

A Contribution to the Ecological Critique of Political Economy

by

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Statement

This thesis contains no material which has been accepted for the award of any other higher degree or graduate diploma in any university and to the best of the author's knowledge and belief the thesis contains no copy or paraphrase of material previously published or written by other persons except where due reference is made in the text of the thesis.

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ABSTRACT

Marx's nineteenth century critique of political economy was developed in an era when natural resources were abundant. Nature was not considered a central feature in the production of economic surplus value. To classical political economy, the vital factor contributing to economic development was the way labour was organised in extended production.

The main objective of this thesis is to shift the role of nature into a more prominent position in political economy. It is an attempt to integrate biophysical economics into Marx's historical materialism. This allows a fuller account of capitalist development and the ecological crisis inherent in this mode of production. The ecological crisis it is argued is a crisis of production.

The biophysical orientation adopted in this thesis implies that the classical political economic notion that labour alone creates surplus value is inadequate to account for the physical basis of production. The thesis argues that labour combines with nature to create surplus value. It follows that the imperatives of growth-oriented production for overcoming poverty in Eastern bloc socialism and the accumulation of private capital in capitalism depend on the generation of surplus value founded on the dual exploitation of labour and nature. From this perspective the ecological crisis is a direct outcome of growth-oriented production.

If nature and labour both constitute surplus value then it is inferred that environmental movements and labour movements are different aspects of the capitalist exploitation process, which is inherently growth-oriented and therefore anti-ecological. It is further argued that Marx's failure to account fully for the dynamics of capitalist development lies in his failure to incorporate nature in the "Labour Theory of Value". The problem for

Marx was that he could not foresee the constraints on production from both the physical limits of natural resources and the environmental limits of pollution. The impediment to capitalist growth is no longer the rising power of the proletariat but the looming ecological crisis. Marx also failed to predict capitalist restructuring that led to the diminishing role of labour in the production of surplus value. As a result he could not foresee the diminishing political power of the working class and the mitigation of the class conflict as a consequence of this restructuring process.

This thesis concludes that the industrial working class will not be the decisive factor in social development of the future. The broader contradiction of capitalism with nature will be the vital factor determining the future of this mode of production.

1. INTRODUCTION

The aim of this thesis is to integrate political economy and environment, so that "nature" may become a central factor in the theories of political and economic development. In essence I argue that the present paradigm of political economy is inadequate in providing a theoretical explanation of the environmental crisis and as a consequence fails to provide a viable solution to the crisis. The environmental crisis is a crisis of production. It is a crisis arising out of the world's political and economic systems which have developed without due regard to the natural environment, which is the basis of all social production processes.

All societies depend on nature for survival. However there is a major difference in the way tribal and modern industrial societies relate to nature. The former is "production oriented", where social production forms the basis for the livelihood of the inhabitants. There is little tendency towards creation of surplus or profit maximisation. The latter on the other hand is "accumulation oriented". Modern societies founded on Western institutional and property rights operate to maximise economic surplus and accumulation.

Production in both societies affects the natural environment and contributes to the ecological crisis in varying ways. In "production oriented" societies, production for need and not for profit can become ecologically unsustainable if the population of these societies exceeds the environment's carrying capacity. Even at low per capita production and consumption the cumulative effects of production may eventually assume unsustainable levels. Meanwhile in "accumulation oriented" societies, it is assumed that nature can be transformed into monetary capital and accumulated without limit. Per capita production to generate economic surplus can be very high even at low levels of population, so that such accumulation may attain crisis proportions.

The imperatives of surplus accumulation and production for the needs of the growing population of the world has resulted in increasingly high levels of production activity. This has contributed to the contemporary global environmental crisis. This crisis can be seen as the antithesis of the "progress" that mankind has made to date. It is now evident that the present path of global development is likely to lead to disaster.

The *Global 2000 Report* to the President of the United States warns that:

If present trends continue, the world in 2000 will be more crowded, more polluted, less stable ecologically, and more vulnerable to disruption than the world we live in now. Serious stresses involving population, resources, and environment are clearly visible ahead. Despite greater material output, the world's people will be poorer in many ways than they are today.

According to the report, the predicament that awaits humanity as it advances into the twenty-first century is attributed predominantly to the increasing human population which is expected to reach 6.35 billion in the year 2000. One has to admit that a population growth of this magnitude would certainly place a far greater stress on the earth's natural environment than is the case at present. But is population growth in the poor nations, as emphasised in the *Global 2000 Report*, the most important factor contributing to the crisis that humanity is facing today? What does a president of a country to whom this report is responsible make of the fact that 'the U.S. with 6 percent of world's population consumes approximately 30 percent of the total energy production of the world'² and is world's number one polluter?

The report recognises that 'few if any of the problems addressed in the Global 2000 Study are amenable to quick technological or policy fixes; rather, they are inextricably mixed with the world's most perplexing social and economic problems'.³ But it comes as no real surprise that the *Global 2000 Report* (like many other global reports) treats the issue of environmental crisis as peripheral to the economic and political factors of the world. As Michael Redclift has observed, the:

environmental crisis in the South is looked upon as a policy problem or, in popular imagination, it is seen as an Act of God. In neither case is it seen as a political issue, and that such a response would, inevitably, favour some interests over the others in global economy. The environment has not, in fact, been interpreted within the framework of global economic relations. It has not been part of the political dialogue about development and the analysis of under development.⁴

The failure to comprehend the interrelationship of the natural environment to political and economic development and the resulting ecological crisis stemming from structural and social factors is evident when one considers the inability of the conventional approach to find a solution to the crisis. Thus the United Nations Environment Programme report *The World Environment (1972-1982)*, which reviewed the state of the world environment in the decade after the Stockholm Conference of 1972, observed that since the 'Stockholm Conference, CO₂ concentration in the atmosphere continued to rise, concern about acid rain grew, and fears about man's impact on stratospheric ozone remained ... The volume and number of chemicals reaching the environment increased enormously: in 1975 industrial production stood at 1.4 times the 1965 level and during the 1970s at least 30,000 substances were in use and the figure was increasing by 1,000 to 2,000 a year'.⁵

Redclift argues that the concern for conservation and ecological sustainability expressed at the international level by the developed countries in such programs as UNESCO's "Man and the Biosphere" and the "World Conservation Strategy", launched in 1971 and 1980 respectively, are inappropriate in providing an adequate framework for understanding the environmental problems of the South. This is because at the level of international policy, issues regarding conservation or ecologically sustainable development are 'rarely linked to demands for structural change in the international economy, and frequently ignored the political interests in resource development'.⁶ Redclift observes that the policies that were implemented in the Stockholm meeting of 1971 by UNESCO in its "Man and Biosphere" program, after ten years:

revealed the failure of international action on almost every count. Human population had increased in the decade by almost 800 million; the disparity between rich and poor nations had increased too. The world's

expenditure on arms had soared to over 500 billion United States dollars annually. The number and intensity of known toxins in the food chain had increased ... Superficially, at least, international conservation efforts had done⁷ little to combat the environmental crisis in the developing countries.

Redclift argues that the resource crisis in the South is also a development crisis based on the interests and experiences of the Western capitalist nations, and other writers, such as Bahro and Enzensberger⁸, have similarly argued that ecological degradation in the South is linked to capitalist accumulation in the North. Counter to the popular view then, there is also a widely held view that it is capitalist development and growth that leads to unsustainable exploitation and the destruction of the natural resources of the South.

This work is an ecological critique of political economy. The context in which political economy is used in this thesis is principally derived from a Marxist approach which 'locates economic analysis within specific social formations, and explains development processes in terms of the benefits and costs they carry for different social classes'.⁹ The thesis attempts to provide an explanation for the ecological crisis. It seeks to demonstrate that the ecological crisis is a crisis of growth-oriented production, and thus is an issue central to political economy.

Both capitalism and socialism are based on productivist ideology that is derived from the classical political/economic notion that only labour creates surplus value. Surplus value is normally defined as the difference between the value of material input as subsistence into human labour and the value of labour's product. Increasing productivity depended on the way in which labour was organised in extended production. The efficient organisation of labour was the central feature contributing to economic growth, which was and is seen as the measure of humanity's progress.

Why growth-oriented economy contributes to an ecological crisis is thus not understood within this paradigm. From a biophysical perspective it can be seen that labour alone

cannot create surplus value. The realisation of surplus value in production is based on the transformation of energy and matter (furnished by nature) by labour. Thus nature, like labour, is a central factor governing the production of surplus value. Growth-oriented production relies on the dual exploitation of labour and nature to create surplus value.

This centrality of nature in social production processes has been overlooked in political economy. Ecological crisis is thus not interpreted as a crisis of production - a crisis that is central to political economy. It is therefore important to integrate environmental issues within the framework of global political and economic relations.

There are several plausible reasons for integrating environmental concerns into a society's political and economic development. The first and foremost is that the economic development of nations based on Gross National Product (GNP) bears a consistently positive relationship with energy consumption - although the relationship is not absolute or uniform - and these relationships exhibit marked inequities between rich and poor nations. Commercial energy consumption figures show that low income countries with GNP per capita in US dollars of range 100 to 370 consume 10 to 200 kg of coal equivalent of energy per capita, while industrialised countries with GNP per capita of range US\$3,500 to US\$10,000 consume 3,000 to 8,000 kg of coal equivalent of energy per capita.¹⁰ This huge disparity in energy use between the poor and the rich industrialised nations is also reflected in the amount of pollution contributed by the developing nations and the rich industrialised nations. As noted by Fred Pearce, the 'average American contributes twenty times more to the greenhouse effect than the average Indian'.¹¹ Apart from inequalities in the consumption of energy and the production of pollution between these nations, there exists severe inequality in annual food consumption patterns. Annual grain consumption data show that in 1975, the United States (the world's largest grain consumer) had an annual per capita grain consumption of 708 kg, while Nigeria (the world's twentieth largest grain consumer) had a corresponding consumption of only 92 kg.¹² It is thus apparent that different nations of the world,

regardless of their demographic characteristics, place differential demands on the earth's resources and make differential contributions to its pollution, and this broadly commensurates with the level of economic development or activity as measured by the GNP statistics. Barry Commoner argues that the present environmental and energy crisis is a consequence of intensive use of energy to increase productivity and economic growth for short term gain in private profit. Commoner thus observes that 'our crisis is a symptom of a deep and dangerous fault in the economic system'.¹³

For England and Bluestone, the environmental crisis warrants a complete re-examination of political economy. They argue that market-based reform is seriously inadequate since 'it ignores several ecological irrationalities of capitalist production and consumption that directly contribute to the present and future environmental crisis. Only a broader analysis that looks at the structure of production, consumption and the distribution of political and economic power can fully comprehend the crisis. Marginal changes alone will not save us from ecological Armageddon'.¹⁴ Inequities are, furthermore, not merely a question of the relationship between the First and the Third Worlds. England and Bluestone emphasise the disparities in income and wealth within the United States and the greater effects of environmental pollution on the underprivileged sectors of that society. They highlight the class dimension of social costs and benefits associated with pollution and the regressive nature of pollution taxes and market-based reforms. Moreover, Redclift shows that environmentalism in the Third World also has a class aspect, in that its consequences bear disproportionately upon the poor. He argues that what is characterised as environmental conflicts in the South are in reality social, economic and political struggles against the capitalist appropriation of the natural environment.¹⁵ These struggles are now simultaneously recognised as ecological struggles.

Apart from the political/economic aspects which constitute the environmental crisis, it is also true that ecological *reforms* have economic and political implications. As Hugh Stretton notes, environmentalists need to be politically aligned to be effective. He argues

that apart from 'being less or more effective in technical ways environmental reform will usually also have to be Right, Left or otherwise contentious in a social way ... To be effective a program of environmental reform has to be part of a program of more general social change'.¹⁶ It is now obvious that to forestall ecological disaster it is necessary to limit the level of human economic activity which has until now proceeded without much regard to material limits of the planet. This limitation has important implications for the poor, the underdeveloped and the working classes. Any limits to economic growth may prolong their poverty. This is where distributive and social justice issues come to the forefront in ecological politics. As social justice issues have traditionally been a concern of socialism, several writers such as Bell, Williams, and Redclift have argued that there is a common ground between socialism and ecology.¹⁷ This realisation has led to a considerable amount of work and development in ecological Marxism or eco-socialism.

However this new ecological version of Marxism or socialism is radically different from orthodox Marxism which was based on an ideology of unlimited growth of material production. This has become necessary with the realisation that growth-oriented socialist production similar to the capitalist mode of production assumes a distinctively destructive character towards the natural environment. Therefore there is a need for theoretical reconstruction, in which orthodox Marxism's optimistic view of the possibilities for unlimited material production and the "domination of nature" need to be discarded. However, Marxism remains important for its materialist account of social development. Following Marx, this thesis adopts a materialist analysis of environmental politics as opposed to utopian socialism or the idealistic orientation of radical ecology. One of the vital characteristic of materialist analysis is that it does not separate environmental issues from the social and economic mode of production.

The view adopted in this thesis is that capitalism as the dominant mode of production in the world today exploits both labour and nature in its appropriation of surplus value. While Marx brilliantly accounted the social character of capitalist development in

historical materialism, he underplayed the natural or biophysical basis of capitalist development. In doing so, he overlooked the importance of natural resources in the dialectic that governs the extraction of surplus value.

Marx's critique of bourgeois ideology was created in an era when there was little cause to question the belief that material progress was limitless. Therefore Marx like other political economists of his time did not consider it important to include nature in the central theoretical structure of his thesis. Marx regarded nature as a passive, invariant backdrop against which social production processes took place. Consequently, he could treat it as a factor external to production.

Perhaps more importantly, Marx was vehemently opposed to the idea of natural determinism of political and economic processes. He was keenly aware of the fact that natural determinism - as in the French physiocratic notion of nature as the source of all material wealth and the argument that economic processes operate according to "Natural Laws" and forces - served as a powerful ideological weapon that could legitimise feudal and bourgeois production processes.¹⁸ Similarly, he was in strong opposition to scarcity theorists such as Malthus and Ricardo who argued respectively that population growth and diminishing returns from land were naturally-determined conditions of existence. This implied that food crisis and the state of the poor was solely caused by natural conditions and was devoid of any social content. Marx opposed the natural determinism of Malthus and Ricardo, arguing that resource scarcity and population problems were due, not to natural causes, but to social and economic ones that are inherent in the capitalist mode of production. He correctly emphasised that these problems were social and structural and therefore should not be treated in isolation to the socio-economic mode of production.

Perhaps ideological limitations contained Marx's formulation within social dimensions. The dialectic governing the class struggle and the extraction of surplus value is devoid of

any natural or physical determinism. To Marx, the limits of capitalist development lay in social relations and not in physical or natural constraints. Jean Paul Deleage notes that:

Marx focused his analysis on the capital/Labor relation. The path opened by the concept of a society/nature totality, which could lead to a fruitful reflection on the interplay of social and natural determinants was thus lost. This potentiality of Marx's Marxism remained unexplained.¹⁹

This thesis attempts to incorporate a biophysical dimension into the predominantly social character of historical materialism. It is a broad reformulation of Marx's thesis in which the class-contradictions and materialist analysis remain fundamental. It is an eco-Marxist critique of political economy. In accordance with Marx's concern for social justice, it is a critique of capitalism, and it complements social justice with a concern for natural viability. The thesis aims to explain theoretically the cause of ecological crises and the significance of social movements in stalling the further development of the capitalist mode of production.

This reformulation of historical materialism begins with Marx's concept of value. Although Marx stated that 'labour is not the only source of material wealth',²⁰ he gave only a use-value status to nature. Nature furnished materials of useful attributes and qualities having a use-value to labour. According to Marx, surplus value created by labour is converted through the generalised commodity exchange into its monetary equivalent - exchange-value. He claimed that nature only helped to create use-values without contributing to the formation of exchange-value. The realm of exchange value was accorded to labour alone, so that nature played no part in exchange value or surplus value. It is at this fundamental level in Marx's work that a breakdown in the distinction between use and exchange value is required, to widen the horizon of historical materialism into the natural domain of social production processes. As James O'Connor observes, Marx's notion of labour as the sole creator of exchange value does not adequately explain the ecological cost of both capitalist and socialist modes of production, which are each

based on energy flows and transformations of the natural environment. He thus states that:

Here we find a clear-cut distinction between classical Marxism and present-day eco-Marxist and other scholars who want to fundamentally revise value theory in ways which would include some concept of ecological cost in the exchange value of the commodity - a project which may or may not ripen into a new theory of value.²¹

For present-day neoclassical economists, value is synonymous with a utility that is based on the method of marginal subjective analysis. Within this paradigm, the atomistic individual subject becomes the focus of price determination, within the interaction of supply and demand factors.²² The utility theory of value, by focusing its theoretical inquiry on the exchange and demand-side factors of production, overlooks the significance of supply-side factors of production. Paul Christensen notes that 'production received little attention in this approach since it did not readily fit the paradigm. When it was taken up it was reformulated along the lines of utility analysis'.²³ Christensen argues that:

Neoclassicals consider production to proceed from the combination of ... primary factors of production ... which are each individually regarded as capable of making an independent and therefore separable contribution to production albeit one subject to diminishing returns. But this assumption, which underlies the basic price and quantity relations of the theory (and the theory of market equilibrium via flexible prices), clearly violates the laws of thermodynamics. Any physical transformation requires the use of energy to do work and results in other changes in the system (the Second Law). And more output cannot be obtained, for any given technology in place, without corresponding material and energy inputs (First Law). The neglect of material and energy resources or their presumed aggregation within the primary factors constitutes a central weakness in neoclassical theory. This difficulty will not, moreover, be simply overcome, by addition of new inputs and production relations to existing theory. The theory must be substantially reformulated.²⁴

According to Christensen, classical-type models are more appropriate to the study of ecological relationships to economic processes. However, he observes that the modern revival of classical models based on Smith, Ricardo and Marx, whilst having that necessary orientation to production, still neglects the connection of nature to economic systems. He thus states that:

They all assume the ability of an economy to reproduce itself through time on the basis of production in previous periods. They lack any specification of the flow of low-entropy energy and material which are a necessary condition of economic activity.²⁵

The establishment of a biophysical basis for production has long been a concern of ecological economists (otherwise known as "biophysical economists"). The organising principles of this field of economics include the First and Second Laws of Thermodynamics, that govern any matter-energy transformation (such as in economic processes). Some biophysical economists such as Odum and Costanza²⁶ have argued for an "Energy Theory of Value", however this has not been readily accepted by others within the discipline.

I argue - as perhaps Marx would have done - that although biophysical analysis is necessary to explain the physical aspect of production, economic processes cannot be wholly translated to physical determinants such as the "Energy Theory of Value". Since production processes are socially mediated, their explanation requires a social theory. Thus the social aspects of production such as labour, the relations of production and the dialectic of class struggle are important and inherent factors in production and the generation of surplus value. The biophysical economists, in emphasising the physical determinants of production, have generally disregarded its social character, which was so overwhelmingly the concern of Marx. It is therefore necessary to incorporate social factors in the biophysical theory of value of the ecological economists. Herman Daly has argued that a satisfactory theory of value must incorporate both low-entropy and labour, so that a theory of value that ignores any one of these two factors would be unsatisfactory.²⁷ Bearing this in mind, it becomes necessary to relate biophysical economics to historical materialism and the "Labour Theory of Value" upon which Marx's work is constructed. I have thus tried to inject into labour theory of value a physical dimension that incorporates low-entropy. The entropy of a thermodynamic system is a measure of disorder in the system. Low-entropy systems represent ordered systems containing useful available energy. Energy becomes unavailable for use if it is dispersed

as high-entropy heat throughout a thermodynamic system. This new low-entropy factor does not replace labour, but complements it so that the dialectic which governs the extractions of surplus value also provides a physical dimension to the social production processes. This is important since it is a common tendency within the positivist paradigm to separate the social and physical processes in such a way as to misjudge the totality of economic processes.

It is worth mentioning at this point that in the 1880s, there was an attempt by Sergei Podolinsky to express the labour theory of value in biophysical terms and to make it consistent with physical laws. Podolinsky's energy analysis verified the notion that labour contributes to surplus value, but his analysis also implied that labour could not be the only source of surplus value.²⁸ However, when Podolinsky relayed his work to the founders of socialism, it was dismissed on the grounds that energy analysis was so complex that to express economic relations in physical magnitudes was impossible. Thus the opportunity that was presented to Marx and Engels to develop their theories in accordance to biophysical laws was lost. However the complexity of biophysical economics does not render null its relation or its applicability to social production processes. The integration of biophysical economics and Marxist economics is necessary if we are to fully account for the ecological dimension of capitalist development which Marx overlooked. Indeed it was Podolinsky's work which implied - and what Marx did not foresee - that the 'limits to growth of the economy were not to be sought only in the shackles of old relations of production but also, perhaps mainly, in the physical and biological facts of earthly life under the sun'.²⁹

An attempt now to assimilate biophysical analysis within the Marxist schema presents several difficulties - particularly the distinction between use-value and exchange-value which, I shall argue, is a false distinction. In Marx, this distinction is representative of his historical conceptualisation between generalised commodity exchange and the pre-capitalist mode of production. It is vital to break down this distinction of use and

exchange value, for it poses a theoretical obstacle to the integration of nature within the central analysis of Marxist political economy.

However rudimentary my attempt to add a biophysical dimension to Marx's historical materialism, it yields some interesting implications for the development of the capitalist mode of production in the materially finite world in which we live. By incorporating nature into the dialectic of surplus value, I have analysed the class struggle and the capitalist mode of production within the context of new and altered conditions of production - as a result of declining natural resource quality and ecological reforms that have an overall effect of increasing the cost of production.

By theorising that both labour and nature forms surplus value - which is distinctly different from Marx, to whom only labour created surplus value - I have argued that the labour movement and the environment movement are different aspects of the same capitalist exploitation process, so that the labour movement is the movement to protect the rights of labour, that is, the social realm of production, while the environment movement serves the interests of the natural realm of capitalist exploitation. This implies that the capitalist mode of production not only has a contradiction in the social relations of production, but also a broader contradiction with nature. I also try to explain that the working class has lost its revolutionary potential as a result of capitalist restructuring via more developed factors of production that, while reducing the role of labour in production, nevertheless accelerates the destruction of nature.

In this thesis I have undertaken what may seem a superficial reformulation of Marx's great work. Firstly the thesis contains no quantitative analysis of value theory and the rigorous mathematical determination that accompanies such an undertaking. This departs radically from the positivist paradigm which seeks to comprehend value theory only in physical magnitudes so that those aspects which are not easily quantifiable are likely to be disregarded among the constituents of value. My proposition of a "Labour/Nature Theory

of Value" does not specifically state the magnitudes of labour and nature that constitute the overall value of a commodity. Rather it is a broad definition in which the two aspects of value are not static but variable, depending on what specific social and natural factors are at play in the creation of surplus value in any one instance. In many cases it would be quite difficult to clearly identify the labour and nature components of commodities which relate to exchange or surplus value.

Secondly, my view of surplus value itself transcends the realm of capital or generalised commodity exchange in the form of money. Surplus value, I argue, also constitutes natural produce such as grains in agrarian societies, or barter goods in pre-capitalist exchange relations, that may be accumulated. With the advent of money these forms of surplus are transformed into monetary capital that may be accumulated without limit. Monetary capital, then is "transformed" nature. Though in essence a human creation, monetary capital has such a paramount status in capitalist and Marxist political economy that it has sometimes become an end in itself. It is from these precepts that I intend to present my thesis.

The thesis is organised in the following way. The first chapter is an exposition of the concept of nature in political economy. It is an examination of the philosophies of the patriarch of political economy of the Left, Karl Marx, and of the Right, Adam Smith. This is because our use and abuse of nature depends to a large extent on our concept of what nature is (the Western concept of nature based on Judeo-Christian values has a humankind-nature relationship that is distinctly different from the paganism of the tribal societies, or the values of Buddhist and Hindu societies).³⁰ Attitudes towards the exploitation of nature would certainly be different if it was considered to be other than the machine of Cartesian science that works according to physical laws that can be mastered and manipulated. It is found that early political economy's orientation towards nature was strongly influenced by developments in modern science, both in the way it conceives nature and also in its application of scientific rationality in the theoretical explication of

economic phenomena. From its early days the science of political economy treated nature as an external factor; as a limiting boundary to politico-economic development rather than as a central variable in economic theory. The most vital contribution to economic development was attributed to the way in which labour was organised in extended production, and the primacy accorded to labour relegated nature to an external factor of production. Although the methodology and the emphasis of economic theory has changed substantially from classical political economy to the present neoclassical paradigm, the treatment of nature as an external factor in the development of mainstream economic theory has been a consistent feature of economic thought. The chapter is titled "The Ideology of Nature in Political Economy" since the construction of the concept of nature has been evolving in a political context in which nature was often visualised in ways that justified a certain political orientation. As we have seen, Marx was opposed to the natural determinism theories of political economists of his time on the grounds that naturalism served an important ideological function. This was a valid position and it remains valid today, for biological determinism plays a vital role in neo-Malthusian rhetoric.

The second chapter is a critique of political economy and neoclassical economic theory from a biophysical perspective. In this chapter, the growth-oriented capitalist and socialist modes of production are criticised and emphasis is placed on the biophysical basis of production processes (which is independent of ideology). Starting from fundamental biophysical laws, namely the First and Second Laws of Thermodynamics, the chapter outlines the way in which nature interacts with labour to create surplus value. It becomes evident in the chapter that Marx's notion, whereby labour alone creates surplus value, does not adequately explain the ecological costs of production. Similarly it is shown that standard neoclassical economic theories overlook the biophysical aspects of social production processes. The chapter argues that both labour and nature constitute surplus value. This notion of a dual constituent to surplus value is fundamentally different from the Marxist notion which attributes only a labour component to surplus value. In this

inquiry into the relationship of nature to production processes, the "Labour Theory of Value" is reformulated to incorporate a natural dimension to the concept of value.

The chapter is titled "The Social Production of Nature", which intends to imply that the commodities realised in production are transformed nature. Whether via agricultural surplus, industrial commodity or a peasant's produce, natural materials are transformed by labour into artificial forms that eventually assume the form of capital.

Following a reformulation of the "Labour Theory of Value" to include a natural component to value, it becomes necessary to investigate the new dynamic that historical materialism assumes as a result of this change. The addition of a biophysical dimension to the dialectic that governs surplus value means that a biophysical factor also determines the development of capitalism - apart from the social factors described by Marx. The third chapter is thus a theoretical investigation of the main features of historical materialism in the light of a new theory of value which incorporates both labour and nature. This integration of a biophysical dimension into Marxist schema explains more adequately the capitalist development and the ecological crisis inherent to this mode of production. This biophysical factor, it is argued, will be the main factor forestalling the advance of capitalism. The chapter is an explanation of the failure of Marx's synthesis on the revolutionary potential of the working class and the dialectic of capitalist development. The theoretical scope is broadened to provide an explanation of the ecological crisis and the associated social movements in the core and at the periphery of capitalist development. One theoretical inference from this synthesis is that the labour movement and the environmental movement are different social and natural responses to the process of capitalist exploitation.

From this perspective I critically evaluate the role of the liberal and radical political ecology strands in environmentalism and their role in providing a solution to the ecological crisis. I conclude that liberal political ecology operates within the capitalist mode of

production and thus serves the interests of capital. Only eco-socialism and the social movements at the capitalist periphery contradict the dominant, inherently anti-ecological mode of production. In close connection with the above conclusion, I explain why the Marxist hope of a working class revolution is futile. This class will not be the decisive factor in the social and economic development of the future.

Endnotes:

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- ⁵ UNEP (1982), *The World Environment 1972-1982*, M.W. Holdgate, M. Kassas and G.F. White (eds.), United Nations Environment Programme, Tycooly International Publishing Ltd., Dublin, p. 14.
- ⁶ Redclift (1984), *op. cit.*, p. 4.
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- ⁹ Redclift (1984), *op. cit.*, p. 5.
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2. THE IDEOLOGY OF NATURE IN POLITICAL ECONOMY

The political/economic traditions of both the liberal Right and Left lack a systematic description of nature in social production processes. This chapter aims to demonstrate this exclusion of nature from the central theoretical structure of political economy. To classical political economy the vital factor that contributed to economic progress was seen as residing in the way in which labour was organised in extended production. To Adam Smith, labour was the prime source of value and the wealth of a nation, while Marx asserted that surplus value was created by labour alone. To Marx, nature only had "use value", which augmented labour in the production of exchange value. To each of these most influential economic thinkers, labour was the sole factor that created value and wealth and thus contributed to human progress. Nature was seen as a peripheral factor in economic processes and was thus dealt in abstraction from the social production process.

It is argued in this chapter, that this abstraction of nature from the central theoretical structure of political economy is due to the strong influence of Newtonian science that has dominated the entire era of (Western) political/economic development. The mechanistic concept of nature in science portrays nature as external to the social realm. This orientation towards nature as external, and being systematically and infinitely capable of manipulation for production, led to the quest to control and "dominate" nature to facilitate the social production process. Thus our conception of nature is dominated by the fact that the natural environment is increasingly being transformed by human productive activity. "The "domination of nature" is a generally accepted reality whether it is viewed in a measure of human progress or in fear as a tragic warning of imminent disaster'.¹

A Dual Concept of Nature

The Western world's conception of nature is essentially one of dualism in which nature is "external", a domain apart from the human realm, an objectified existence outside human

social processes, whilst at the same time "universal", with humans and all their activities but a subset among many species in the totality of nature.

A transformation in the intellectualisation of nature from wild, hostile and repugnant to a softer and more appreciative attitude - that which associated nature with a spiritual path to God - is attributed to Romanticism in the early eighteenth and nineteenth centuries, though 'the change in attitude began with the breakthrough of European astronomy and physics that marked the beginning of the Enlightenment'.² The Scientific Revolution beginning with Nicolas Copernicus revealed a universe that was at once vast, complex and harmonious. It strengthened the belief that the universe, (the solar system and nature) was a majestic and marvellous divine creation. The concept of sublime, spiritual and theistic nature gained momentum in the eighteenth century. Nineteenth century American transcendentalists such as Muir, Thoreau and Emerson shared this vision of nature in a 'romantic tradition ... and it is with this tradition that the universality of nature rather than the externality of nature is most apparent'.³

The purpose of the scientific quest of the Enlightenment was radically changed from trying to understand the natural order and living in harmony with "the creation of God" to one of "mastery and conquest of nature" advocated in the work of Francis Bacon. 'Since Bacon the goal of science has been the use of knowledge that can be used to dominate and control nature'.⁴

The Baconian quest and the prevailing concept of nature in science was influential in the development of an attitude to nature in the social science and political economy of the Enlightenment. A further development on a changing view of nature was the application of the rationalist foundationalism of Rene Descartes whose philosophy contributed the analytical method of reasoning to science. The Cartesian philosophy led to a desire to describe nature in mathematical terms. Descartes asserted a division between mind and matter and for him 'the material universe was a machine ... there was no purpose, life, or

spirituality in matter. Nature worked according to mechanical laws, and everything in the material world could be explained in terms of the arrangement and movement of its parts'.⁵

In this conception nature is portrayed as explicitly external to human society. It is a domain that may be mastered and dominated. In Bacon's and Descartes' image nature is mechanical rather than organic. A mechanical concept of nature in science resulted in a treatment of nature as external and in absolute abstraction from social activity.

It was Newton who unified the empirical, inductive method of Bacon and the rational, deductive method represented by Descartes to describe the fundamental laws of motion. The Newtonian mechanics reduced all physical phenomena to the motion of material particles caused by the interaction of gravity. In the Newtonian view the universe was like a machine, governed by immutable laws. This mechanistic view of nature was thus closely related to a rigorous determinism. A mechanistic nature which operated according to laws that could be described mathematically implied an external physical domain that was governed by divine laws. Physical nature was not thought to be divine in any sense. Capra notes that the:

philosophical basis of this secularisation of nature was the Cartesian division between spirit and matter. As a consequence of this division the world was believed to be a mechanical system that could be described objectively, without ever mentioning the human observer, and such an objective description of nature became the ideal of all science.⁶

The mechanistic concept of nature has dominated the entire fabric of Western society and is largely responsible for the predominant vision of nature in political economy. The "production epistemology" of both traditional and bourgeois economics shares a similar view of the essential controllability of nature. Modern scientific production was adopted as a necessary condition for the generation of wealth, the decrease in poverty and the extension of the human domain over nature. This attitude towards nature implied a metaphor of conquest. Human progress was seen in the transformation of nature by human labour in production processes. Marx described it, for example, as the:

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great civilising influence of capital; its production of a stage of society in comparison to which all earlier ones appear as mere local developments of humanity and as nature-idolatry. For the first time, nature becomes purely an object for humankind, purely a matter of utility; ceases to be recognised as a power for itself; and the theoretical discovery of its autonomous laws appears merely as a ruse so as to subjugate it under human needs, whether as an object of consumption or as a means of production.

Similarly it is suggested that this shift in orientation towards nature was vital to the social and economic development of nation-states. For example, Rostow, in *The Stages of Economic Growth*, distinguishes five categories of economic development: the traditional society, the preconditions for take off, the take off, the drive to maturity and the age of mass-consumption. In Rostow's analysis:

The traditional society is one whose structure is developed within limited production functions, based on pre-Newton science and technology and a pre-Newton attitude towards the physical world. Newton here is used as a symbol for that watershed in history when men came widely to believe that the external world was subject to a few knowable laws, and was systematically capable of production manipulation ... The second stage of growth embraces societies in the process ... when ... the preconditions for take off were initially developed ... in Western Europe of the late seventeenth and early eighteenth centuries as the insights of modern science began to translate into new production functions in both agriculture and industry, in a setting given dynamism by the lateral expansion of world markets and the international competition for them.⁸

The positing of nature as an external object in production processes and science is apparent. Nature is treated as external object to be transformed into commodities by labour. In political economy the functional role of science was to develop "mechanical arts" in order to increase the productivity of the labour process. Political economy shares with Bacon, Descartes and Newton the assumptions of external nature objectified in theory and practice in the labour process.

It is vital to state at this point that, in the scientific and political economy tradition, nature is not only external but - and this is only apparently paradoxical - it is simultaneously universal. Bacon, Descartes and Newton shared a tradition that began from religious precepts. The source of the unity of nature and its universality was religious. The universality of Newton's laws of motion had a physical interpretation of a universal nature

entirely determinable by physical laws that was an omnipresent manifestation of the divine. Scientific knowledge and activity thus justified the position that God's original intention for mankind was to understand and dominate nature.

Furthermore, the philosophy of John Locke, which was influential during the Enlightenment and had a strong impact on the development of modern economic and political thought, was guided by the belief that Newton's laws could be applied to social phenomena as well.⁹ Locke viewed society as consisting of atomistic individuals who were governed by natural laws. These natural laws followed certain natural rights - including individual liberty and the right to private property. Lockean thought emphasised the ideals of individualism and private property rights that were to become the cornerstones of the liberal political ideology and the American Constitution. Susan Leeson observes that Locke's philosophy:

legitimised virtually endless accumulation of material goods; helped equate the process of accumulation with liberty and the pursuit of happiness; ... and helped instil the notion that the "commons" is served best through each man's pursuit of private gain, because there will always be enough for all who are willing to work. In short, Lockean philosophy led to a strong ideology of man's relationship to man and the earth, in which autonomous individuals seek comfort and enjoyment through hard work and material acquisitions.¹⁰

Given that the concept of nature harbours an essential dualism it must be recognised that externalised, abstracted nature provides a legitimacy to a language of domination. External nature becomes an object, 'a mechanism subject to analysis and pursued rather than perused, a nature which mattered not for its meaning but for its laws'.¹¹ The apparent hostility of external nature justifies its domination. It is a common practice to denote extreme events such as droughts, earthquakes, floods and hurricanes as "natural disasters" with hostile connotations. Nature's hostility and the fact that nature is external is reason enough for its subjugation.

Moreover a universal concept of nature does not guarantee its emancipation. Most importantly the universal concept of nature today serves an ideological function in that 'certain social processes are deemed to be natural events by which is meant that these behaviours and characteristics are normal'.¹² For example nature is made responsible for competition, war and survival, so that human activity that transforms nature is justified on the basis that the process is natural, necessary and dignified.

If the externalisation of nature is a means to its domination, and if a universal nature provides a justification for the social behaviour of humankind in its relation with nature, then this dualism serves a clear social and political function. This is the ideology of nature in Western society and in the contemporary and traditional political economy.

Given this depiction of nature it is not unexpected that nature was dealt with in abstraction in the eighteenth century political economic tradition. I now intend to relate the tradition of modern science as a vital factor in the development of political economic thought and particularly the concept of nature in the work of the most influential political economists, namely Adam Smith, who provided the framework for the economic model for the liberal Right, and Karl Marx, whose transformative history served as the ideology of the Left.

Nature in Adam Smith

The libertarian doctrine of Adam Smith, as advanced in his influential work *The Wealth of Nations* in 1776, epitomises that view of political economy upon which the institutions of contemporary open societies are based.¹³ Smith argued for a *laissez-faire* competitive market system of economics, and it was his philosophy that prevailed in the first Industrial Revolution and the development of modern capitalism. His arguments sanctified the self-interested pursuit of gain in a competitive market that led to a promotion of the common good by the "invisible hand" of the market.

Prasch notes that 'Smith as a philosopher of the Scottish Enlightenment ... felt that government should establish a realm of "natural liberty" to rule the people' and that the end and the historical purpose of economic progress and increased wealth was "natural liberty" which 'would be well ordered and harmonious under the regime of the "invisible hand". This invisible hand represented a force of reason that provided an intrinsic and natural logic to the social order, much as Newton's laws demonstrate an organising principle for the natural order'.¹⁴

Skinner notes in his introduction to the *Wealth of Nations* that the School of Scottish philosophy to which Smith belonged possessed a theme owing much to Bacon and Newton. He states:

Bacon was almost as much admired as Montesquieu in Scottish Intellectual circles, but unquestionably the main debt, in respect to method, was due to Sir Isaac Newton. Newton ... had explicitly suggested that the "experimental method" which he used in natural philosophy could be profitably applied to moral philosophy.¹⁵

Smith, probably employing the prevailing "experimental method", objectified nature (and thus abstracted from it) in his analysis of political economy. In his labour theory of value the priority of agriculture and with it nature was denied. From this labour theory of value the political economy tradition has located nature not as its central element but at the periphery of mainstream economic theory. Nature is viewed more as an external limiting factor in the economic development process rather than a primary structure of the process. It is in Smith's work that labour asserts itself as the source of value and the division of labour is seen as the source of increased productivity.

Smith forcefully asserted the importance of labour, capital accumulation and the growth of an economy. The fact that there exists a relation between nature and the growing economic processes was given least attention in his work. He states that:

The annual labour of every nation is the fund which generally supplies it with all the necessities and conveniences

of life which it annually consumes, and which consists either in the immediate produce of that labour or in what is purchased with that produced from other nations ... Whatever the soil, climate, or extent of territory of any particular nation, the abundance or scantiness of its annual supply must ... depend upon ... the dexterity and judgement with which its labour is applied ...¹⁶

Labour to Smith was the prime source of value and the wealth of a nation. He describes the importance of labour thus:

Labour therefore it appears evidently is the only universal as well as the only accurate measure of value, or the only standard by which we can compare the values of different commodities at all times and at all places.¹⁷

Smith stressed the increased productivity as a result of division of labour that accounts for capital accumulation and economic growth. The need for sustained economic growth is explicit when he states that, for a nation:

The increase of revenue and stock is the increase of national wealth ... it is not the actual greatness of national wealth, but its continual increase which occasions a rise in the wages of labour. It is not accordingly in the richest countries, but the most thriving, or in those which are growing rich the fastest, that the wages of labour are highest ... the liberal reward of labour¹⁸ is the natural symptom of increasing national wealth.

In short, increases in productivity follow from increases in the scale of production, which lead to accumulation of capital: 'in modern terms Smith's account of the process of growth can be represented in terms of a movement along an aggregate production function which exhibits increasing returns to scale'.¹⁹

In light of the ecological crisis this attitude towards a growth economy and its effects on nature is questionable. Andre Gorz, in discussing the crisis of capitalism states, that "all production is also destruction" and that this fact can be overlooked so long as resources appear inexhaustible in a production process.²⁰ The destructive character of growth-oriented production is becoming more evident as capital encounters material limits to its expansion. Given current rates of resource depletion and the changes in both terrestrial and

marine environments caused by human activities and production processes, it is no longer apparent that Smith's view remains tenable. Smith developed his work in an era in which there was little cause to question the general belief in the abundance of resources. Thus it is understandable that nature was not posited as an issue in his work; however nature externalised in this manner has remained a tradition within political economy.

Along with the attitude towards growth outlined above, Smith also developed the idea of a stationary state towards which an economy must progress. His words, 'a country which had acquired a full complement of riches which the nature of its soil and climate, and its situation with respect to other countries, allow it to acquire',²¹ so that it could advance no further, shows that Smith did recognise a country's natural potential as one of the limitations to economic growth, though he does not elaborate on this matter of natural limits to economic growth.

An economy in this state, said Smith, is one of deprivation and misery. Under such conditions the labour force cannot reproduce itself. Prasch, in discussing the stationary state condition in *Wealth of Nations*, contends that the stationary state according to Smith was a necessary and inevitable phase of the economy, that is, a logic of accumulation, but could also be a result of human mismanagement of the economy.²²

Prasch also notes that, although Smith realised that any natural limit to agriculture and its products from foreign trade must be understood to be the limit to the potential growth of the economy, he 'did not view this limit as being very imminent. Perhaps, with the continuing explorations of the American landmass, he was confident that, the extensive margin of production was very distant'.²³

The political economic tradition of the liberal Right lacks a systematic description of nature in social production processes. However, where references are made, the external concept of nature in bourgeois economics has much in common with the objectification and

abstraction of nature in the Enlightenment era and the progressivism of seventeenth and eighteenth century British natural philosophy. From the beginning it treated nature as unlimited and external to the production process. Similarly, the positivist paradigm has dominated both classical and contemporary political economy.

Nature in Karl Marx

The ideology of the Left provided by Karl Marx is a critique of the political economy of his time. It was a result of his concern for the exploitation and alienation of the unpropertied labouring masses of Europe by the bourgeoisie as the class in control of the means of production. His theory, a historical account of the way capitalism functions with a focus on the structures such a society creates for sustaining its material existence, has become known as historical materialism.

Marx provided no systematic theory of nature. He focused his analysis on the capital-labour relation, emphasising valuation, distributive and welfare issues, such that the concept of society-nature interplay in production processes was underplayed. He insisted upon the unity of nature and history, suggesting that 'a nature [which] preceded human history ... no longer exists anywhere (except for a few Australian coral islands of recent origin)'.²⁴ Historically and practically therefore, nature is central to human activity, since humans rely on nature for all fundamental needs. To Marx therefore, conceiving nature as separate from society is a false abstraction. He thus observed that in nineteenth century political economy 'the relation of man to nature is excluded from history and hence the antithesis of nature and history is created'.²⁵ Man's concept of nature - including that pertaining within contemporary society - is, to Marx, a function of the structure of a particular society. Burgess states this explicitly:

... in Marx nature is never, as in Hegel, left behind: man's interaction with nature is a constant factor in the development of humanity, and from the point of view of nature is in itself developmental. Moreover, changes in the way in which man interacts with nature (ie., changes in the mode of production)

are rationalised and expressed as changes in the concept of nature.²⁶

It is in this context that Marx addresses nature in his work. A discussion of nature remains fragmented and never more than implicit, and it is necessary to draw from a variety of places in his work to reconstruct a general concept of nature that can be claimed to be Marx's. This task has been achieved by Alfred Schmidt in his work *The Concept of Nature in Marx*.²⁷ While Schmidt's work has been uncritically received by Marxists, Smith, in his critique of Schmidt's work, observes what he believes to be a misinterpretation of Marx, asserting that 'Schmidt's excellent philosophical pedantry is a vision of nature quite opposite to the spirit and practical intent of Marx's later work'.²⁸

According to Schmidt, 'Marx considered nature to be the "primary source of all instruments and objects of labour" (Critique of Gotha Programme), that is, he saw nature from the beginning in relation to human activity',²⁹ thus asserting the historical relation and the human dependence on nature. Following Hegel, who described "first nature" as the world of things outside man, and "second nature" as the world of men (in form of state, law, society, economy, reason and spirit), Schmidt points out that Marx differed from Hegel in that second nature was to be viewed as first, since nature was mediated by human labour and transformed for human consciousness. This mediation between nature and society was a metabolic interaction in which the labour process acted as the motive force while nature provided labour with both its subject (the labourer) and its object (materials to be transformed). In labour 'men incorporate their own essential forces into natural objects [and] natural things gain a new social quality as use-values',³⁰ hence the "naturalisation of man and humanisation of nature". While second nature is both an element of human practice and the totality of everything that exists, because it is in a historical sense external, first nature assumed priority since it was prior to man.

Thus Schmidt identifies the "pre-bourgeois period" when men are absolutely identical to nature - the object or external nature dominates the subject, that is, labour - and the

"bourgeois period" when men succeeded in mastering and dominating nature - the subject now dominates the object. Whether this concept of two natures - one as external to human activity (first nature) and another as the totality of everything that exists (second nature) - is an accurate representation of Marx's concept of nature is, according to Smith and O'Keefe doubtful.³¹

However, Smith and O'Keefe admit that the absence of a systematic theory of nature and the often ambiguous references to nature in Marx's work led to Schmidt's articulation of a dual conception of nature in Marx. They contend that while Schmidt justifiably read a dual conception that is implicit in Marx he failed to comprehend the political intent of Marx's work. According to Smith and O'Keefe, it is the unity of nature (but not the identity of nature) with history that underlies Marx's work and which contradicts the dual conception of nature. This, they argue, becomes apparent only when it is seen in relation to Marx's larger project.

While Schmidt affirms the unity of nature with history and society, his observation of a dual concept of nature in Marxist thought has some justification. As Clark notes:

Marx's hopes for an end to the opposition between nature and history, his recognition of the teleological nature of phenomena, and his dialectical methodology with its emphasis on development, internal relations, and organic wholes do point the way toward a truly ecological dialectic. Yet, in his anthropocentrism, his instrumentalist view of nature, and his problematic of liberation through technical domination he fails to³² overcome the fatal non ecological dualisms of the Western tradition.

Marx often referred to the non-human world as "external nature". In the *Economic and Philosophic Manuscripts of 1844*, he notes that 'the worker can create nothing without nature, without the *sensuous external world*'.³³ He further states that the:

universality of man appears in practice precisely in the universality which makes all nature his *inorganic body* - both inasmuch as nature is (1) his direct means of life, and (2) the material, the object, and the instrument of his life activity. Nature is man's *inorganic body* - a 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.³⁴

In the social production of nature both man and nature participate in the labour process. According to Marx, man 'opposes himself to nature as one of her own forces, setting into motion arms and legs, head and hands, the natural forces of his body, in order to appropriate nature's productions in a form adapted to his own wants'.³⁵ The social production of nature for useful commodities is thus an eternal nature-imposed necessity.

Nature thus becomes a material embodiment of useful attributes and qualities - having a "use value" - which is altered by productive labour, and which incorporates into it an "exchange value". Nature thus becomes the material substratum of commodities having exchange value provided by labour. Marx however, abstracts from the discussion of use values, focussing on exchange value. There is no explicit formulation provided by Marx in his equation of nature with use values.

Margaret Fitzimmons, in *The Matter of Nature*, writes that Marx, while providing hints of social production of nature, 'often slips into a language which implies that nature is external'.³⁶ Furthermore she notes that:

Marx's materialism at times seems contaminated by an almost Darwinian struggle for survival, where the historical role of capitalism is finally to overcome the grubby realm of material necessity which until then has ruled human life.³⁷

In a similar tone, Bookchin argues that Marxism converges with Enlightenment bourgeois ideology in that they share a scientific conception of reality. Thus he argues that for Marx the 'personification of economic categories, the bearer of particular class interest ... were turned into the objects of social law'.³⁸ The significance of such a reality, Bookchin argues is the subservience of the dialectic in a way in which domination is elevated to the status of a natural fact. Therefore Marx's concept of social development according to Bookchin is a:

drama of the extrication of humanity from animality into society, the "disembeddedness" of humanity from cyclic "eternality" of nature into linear temporality of history ... humanity is socialised only to the degree that "men" acquire the technical equipment and institutional structures to achieve the "conquest" of nature.³⁹

Thus the social production of nature and its transformation leads to nature becoming simply an object for humankind, a matter of utility, and it thus ceases to be recognised in its own right.

Bookchin also brings to attention the scientific bias of Marx's formulation by citing his intention in *Capital* to "lay bare the economic law of motion of modern society", arguing that it constitutes an objective basis for social development that is characteristic of the Enlightenment's approach to reality.

While Marx has been called "the true heir of the Enlightenment", his concept of reality remains unresolved, though Smith and O'Keefe argue that Marx's dialectic differs from the formal logic of positivist science and that it is the narrow-mindedness of the adherents of the positivist paradigm who implicate determinant inevitability in Marxian dialectic.⁴⁰ They argue that since society, according to Marx, is always in transition, social laws are not like laws of physics. Rather the laws that govern society, and thus Marx's dialectic, are constantly changing under circumstances transmitted from history.

Eckersley notes, nevertheless, that Marx's approach was scientific and non-ethical in content. She states that:

Marx fully absorbed the Victorian faith in industry, science and progress ... The existing means of production (ie. machines, technologies and human labour) were welcomed as facilitating the transition from the "kingdom of Necessity" to the "kingdom of Freedom" ... indeed Marx urged the Baconian quest ... of "enlargement of human empire" ... that is the potential of nature to be converted into use value.⁴¹

For Marx the exploitation and deprivation of the working class eclipsed any concern for the non-human world. The expropriation of the means of production by the working class and the transformation of nature to their own ends was, to Marx, humanity's emancipation. Nature thus became an object for humankind in its quest for emancipation, a matter of utility stripped of any intrinsic value.

Marx viewed industrialisation as a progressive force that reduced dependence on agriculture. The environment was transformed through the application of capital. In *Capital* he wrote:

[The] capitalist mode of production ... transforms agriculture from a mere empirical and mechanical self-perpetuating process employed by the least developed part of the society,⁴² into the conscious scientific application of agronomy.

Thus Capitalism developed through more efficient production and appropriation of surplus value in which nature performed an enabling function, but all value was derived from labour. The barrier to the full realisation of the productive forces of the society existed in property relations, legal obligations and the political and economic structures of society rather than in natural or resource endowments.⁴³

Furthermore (Marx argued) at a certain stage of capitalist development the productive forces of society would come into conflict with the existing relations of production and herein lies the internal contradiction of capitalism, inherent in its structure. Marx could not foresee that prior to this stage its advance would be questioned on the grounds of ecological constraints.

It becomes evident that modern science with its roots in British natural philosophy laid down the framework for the positivist paradigm and facilitated the control, manipulation and mastery of nature.⁴⁴ The common Left/Right interpretation of nature within political economy, as holding the potential to augment the productivity of human labour, was and is

the central social reality of the industrialising societies. For the liberal Right as in Adam Smith and the Left as in Karl Marx, humankind has been 'perceived as possessing labour power, that extraordinary capacity which allowed him in the eyes of these economic thinkers, to add new wealth to the world. Work was considered to be a productive force. Endowed with this capacity, man no longer had to confine himself to the skilful appropriation of the given riches of the world; rather he could accumulate additional wealth and create infinite progress'.⁴⁵

Thus political economy assumed an external, objective position with regards to nature. Nature became more of a limiting factor in the politico-economic development of society. It was given a utilitarian status of "natural resources" and the issue shifted to the availability of resources for the production processes. The emphasis of political economy increasingly took the form of maximising utility, subject to the constraints of given and scarce resources. Economics became 'the study of how men and society choose to employ scarce resources'.⁴⁶ Political economy's main concern was whether nature was abundant enough to facilitate sustained economic growth. This gave rise to the concept of natural resource scarcity that so occupied the work of nineteenth century political economists such as Malthus and Ricardo and their critic, Marx.

Abundance and Scarcity

Marx treated resource scarcity in relation to the mode of production. In opposition to the scarcity theorists (who argued that scarcity was an inevitable condition of production and due to the "niggardliness of nature"), Marx maintained that nature was abundant enough to facilitate unlimited production. He argued that scarcity was inherent in capitalism.

For Malthus and Ricardo, the concept of scarcity was synonymous with a shortage of food. Malthus' essay, *A Summary view of the Principle of Population*, published in 1830, argued that population growth, coupled with the inability to maintain similar rates of growth in agricultural production, defeated the promise of economic growth and social reform.⁴⁷ He

postulated that population, when unchecked, increased in a geometrical ratio while food production increased in an arithmetic ratio, so that population growth would outrun food supply and thus terminate economic growth. Similarly Ricardo, who focused upon the diminishing returns resulting from increased demands on agricultural land, argued that as population grew, inferior land would be increasingly used. This, according to Ricardo, would result in the lowering of productivity.⁴⁸ To Ricardo, the availability of food and raw materials constituted a major constraint on the generation of profits and capital accumulation. He stated that 'scarcity and the consequent high value of food and other raw produce ... are the only obstacles to increasing wealth and population for the indefinite future'.⁴⁹

Marx rejected the Malthusian population law, arguing that population pressure was not an unvarying, universal principle, but that capitalism created the appearance of a redundant population. Marx's position was that every stage of economic development had its own law of population, and that it was the surplus population of unemployed in the capitalist system that led to the appearance of overpopulation. It was this surplus population within the capitalist structure that led to resource scarcity for large underprivileged sectors of the population rather than the growth of population *per se* or any lack of technical capacity to increase food production. As an example Marx cited British agriculture in the 1800s, showing that there was a simultaneous increase in production and a decrease in the number of labourers employed.⁵⁰

Marx also rejected Ricardo's thesis on diminishing returns, stating that the increasing natural resource costs - frequently seen as the indicator of the operation of the law of diminishing returns - were evidence of the barrier posed by capitalist social relations which prevented a society from taking full advantage of its natural resource potential.⁵¹ He maintained that rising costs of resources were not the operation of the law of diminishing returns but, rather, that capitalist growth contributed to a rapid demand for resources, thereby creating scarcity, which contributes to the increase in costs of resources. Marx

argued that scarcity will disappear when the necessity to create commodities in order to realise profit no longer exists. For Marx, the "creation of super-abundance" would follow as a result of the "abolition of want" that he observed in capitalism.

If one considers the food crisis facing the world today, it is apparent that food scarcity, far from being a natural condition, is politically maintained by powerful food-producing nations in order to manipulate world price mechanisms to maximise profit. Often this is achieved by underproducing or dumping surplus food produce to maintain a demand that exceeds supply. In this context Marx's analysis of scarcity induced by capitalist social structures has more appeal than the Malthusian or Ricardian position. Nevertheless the Malthusian argument persists in the twentieth century in the works of theorists such as Hardin, Ehrlich, and the Club of Rome-MIT Report, *The Limits to Growth*, and *The Ecologist Report, Blueprint for Survival*.⁵² These work reiterate the scarcity of natural resources in the light of increasing population in a finite world.

On the other hand the cornucopian vision of resource availability, increased productivity and economic growth (a characteristic of neoclassical and post-Keynesian growth models) presents an opposition to the scarcity and Neo-Malthusian perspective. Works of economists such as Beckerman, Barnett and Morse, Cole *et.al.*, and Nordhaus reflect the cornucopian perspective.⁵³ A parallel however cannot be drawn between Marx's critique of the scarcity theorists of his time and the neoclassical growth-oriented perspective in the present day debate on the issue. Marx envisaged a communist utopia which would abolish scarcity and create abundance as a result of a breakdown of the capitalist mode of production. In contrast the neoclassical perspective adheres to the capitalist growth ideology, arguing that economic growth is a positive means of overcoming resource scarcity.

While the debate between the believers in cornucopian faith/technological optimism and scarcity theorists is an on going one, the neoclassical economic approach to theorising

about resources has come under considerable criticism in light of the environmental crisis. The virtues of the market and its ability to ensure an optimum allocation of resources and the fact that nature is but an example of a commodity in a system of generalised commodity function in political and economic perspective is far removed from an ecological perspective. For this reason most environmentalists doubt the efficacy of a market solution to the ecological crisis.

This schism between the ecological and economic perspectives is some indication of how the society/nature interplay is misunderstood. Political economy, with its emphasis on labour, has missed the significance of the ecological costs involved in production processes. To comprehend the ecological crisis and its relation to social production processes, it is vital to look at production more as a biophysical process.

The following chapter describes the way in which nature interacts with social production processes to create surplus value. From a biophysical perspective it will be argued that nature, like labour, is a central factor governing the extraction of surplus value, such that surplus value has both labour and nature components. This is fundamentally different from the classical political/economic and Marxist notion that labour alone creates surplus value. The starting point of economic activity in this chapter is thus not confined to labour activity in extended production, but is broadened to include the biophysical aspects of social production processes.

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3. THE SOCIAL PRODUCTION OF NATURE: AN ECOLOGICAL CRITIQUE

This chapter aims to describe the relationship of nature to social production processes. To understand the ecological crisis one must examine the biophysical basis of production regardless of whether it is capitalist or socialist. It is in the production process that labour interacts with nature to create economic surplus value.

It has been noted in the previous chapter that political economy, with its emphasis on the role of labour, overlooked nature's role in production. Nature was seen as an external factor in the production of surplus value. As the inquiry proceeds it will become obvious that the classical political economy notion that labour is the sole creator of surplus value is inadequate. From a biophysical perspective it will be argued that labour is not the sole creator of value, rather it combines with nature to create value. Much of this chapter is devoted to an inquiry into the concept of value in political economy. The "Labour Theory of Value" is reformulated to incorporate a natural dimension to value. The discussion of value is predominantly confined to classical political/economic concepts of value, which focus on the supply-side factors of production. In contrast the neoclassical paradigm emphasises the demand-side factors of production being synonymous with subjective utility. It is more difficult to integrate an ecological criterion to value within the neoclassical paradigm. This chapter is thus a critique of classical and standard neoclassical economic theories of production from a biophysical perspective.

It is now widely recognised by environmentalists that the capitalist and growth-oriented socialist modes of production and consumption are responsible in large part for the ecological crisis. However this fundamental recognition of the anti-ecological character of growth-oriented economic orders is only perceived at quite a superficial level in the wider

society, so that the environmental crisis is rarely perceived as a crisis of human social production or a resource crisis arising from our economic and political system.

Apart from the perspectives of ecological Marxism and biophysical economics, each of which has taken the initiative to analyse political economy from a physical or ecological orientation, most of the domains of ecology, political economy and social science still regard ecological crises as trivial outcomes of an inefficient market. The alleviation of crisis thus lies in the "internalization" of the "externalities" of the human system of production and consumption, with adequate adjustments by means of fiscal remedies.

Ecological crisis is thus seen as a peripheral disorder of the market. The growth-oriented paradigm adopts the view that in a perfectly functioning market economy, increasing production will not affect the natural environment in an adverse way. Consequently, market based solutions dominate the agenda of environmental reform, and as market rationality assumes the upper hand in providing solutions to the environmental crisis, it has been the cause of apprehension and great difficulty for environmentalists to theoretically argue against this emerging paradigm. In the new trend one witnesses the "capitalisation of nature". As O'Connor describes the process, it 'signifies a deepening political control over all aspects of social life through a maturation and generalisation of the social institutions by which exchange value is instituted as a mode of coding and controlling social relations. It is an attempt to treat all of terrestrial life in the same way as produced commodities, controlled and subordinated to the finalities of capital'.¹ However O'Connor notes that there are:

sources of contradictions inherent in the process of the capitalisation of nature, which furnishes the linchpin justifying a shift from an industrial to an ecological Marxist perspective on production, the "eventual" and "inevitable" collapse of capitalism, and the conditions for socialism. The first is the fact that the planet is materially finite which creates biophysical limits to the accumulation process. The second, which is synergetic with the first, is the fact that capital *does not* and *cannot* control the reproduction and modification of the "natural" conditions of production in the same way it purports to regulate industrial commodity production.²

The first source of contradiction highlighted by O'Connor which concerns the biophysical aspect of social production process is an issue that should be central to political economy. It is at this point that the ecological crisis relates to the accumulation process and the rationale of growth-oriented production which contributes to the modern concept of national economic development.

Growth-Oriented Production

Present day economic development policies of all nations which are part of the international economic system are based on Keynesian-neoclassical economic syntheses. This form of economic policy seeks to maximise the Gross National Product (GNP), which is an index of the quantity flow of annual production output. Economic growth is defined as increase over time in the level of GNP per capita of a nation.

The most important function of growth in GNP is the maintenance of full employment for the national workforce. Employment provision preoccupies the policy deliberations of the governments of the advanced nations. Continued growth in productivity via investments conduces to higher employment while technological innovation and industrial efficiency in terms of industrial output per labour unit or labour-time contributes to increased goods and services within any economy.

Growth-oriented production is not only a vital part of capitalist but also of socialist economies. In the case of capitalist production it is the role of private profit realisation - in an atmosphere created by an increase in the income of consumers and aggregate demand for mass-produced commodities - that provides the impetus for economic growth. The socialist imperative for growth in production is normally justified on the grounds of abolition of poverty, which is the absolute economic priority.

The criterion of production in modern society, instead of being a simple quantitative exercise based on human needs, is rather based on the desire for consumption and

appropriation. Raymond Williams points out that the consumption pattern of the modern consumer society leads to a notion of production in which:

You can never really ask: 'do we have to accept certain losses, certain local damage, because we need this production?' You cannot ask whether we need this or that production because of need or beauty. Production becomes insensibly an end in itself, as in ordinary capitalist thinking, but also within this strain of socialist thinking - weak socialist thinking³ - in which it is seen as in itself and as such the answer to poverty.

There are however contradictions in the modern capitalist production that now dominates the world economy. There is an underlying problem for economic strategies which propose a steady increase in economic growth to maintain full employment. The consequences of higher productivity in a capital intensive growth economy are demonstrated by Porritt who states that 'higher productivity without growth in demand and output means mass unemployment; higher productivity with growth in demand and output means ecological catastrophe. Capitalism can indeed survive only through permanent expansion - which in turn means the accelerating contraction of our life-support systems'.⁴ This double edged crisis is an integral part of the problem facing those who are trying to find a path to an ecologically sustainable development without relinquishing the growth oriented economic paradigm. Gorz describes the problem succinctly:

Growth-oriented capitalism is dead. Growth-oriented socialism which, closely resembles it, reflects the distorted image of our past, not our future ... Economic growth, which was supposed to ensure the affluence and well-being of everyone, has created needs more quickly than it could satisfy them, and has led to a series of dead ends which are not solely economic in character: capitalist growth is in crisis not only because it is capitalist but also because it is encountering physical limits.⁵

The biophysical dimension of the crisis facing capitalism which has been noted by Gorz in the above statement is in contrast to the Marxist premise that capitalism's ultimate demise will be social in content. Marxists in their critique of capitalism readily point out the anti-ecological character of the capitalist mode of production, but their own analysis is based on the flawed premise that the ecological crisis is a manifestation of a mere contradiction of

capitalism in its social relations of production: where labour-produced surplus is plundered away by the capitalist. While it is true that the ecological crisis is unavoidable within the capitalist mode of production, the Marxist belief that the ecological crisis will cease to exist if the relations of production are changed (that is, in an adoption of the alternative socialist mode of production - where the means of production are communalised) apparently is a false one.

Social production processes, that is, production founded upon the social division of labour and the use of industrial technique have developed through the use of energy provided by fossil fuels, which is a finite resource. This resource, the life-blood of modern industrial production, was formed in a process of trapping solar energy that spanned an era representing several millions of years. In the last two hundred years or so, industrial technology has not only used fossil fuels (and the natural resources) at rates that exceed their regeneration, but also has impaired the natural environment by the production of toxic waste materials in quantities that destroy and exceed the environment's waste assimilative capacity. In doing so humanity now finds itself in a position where social production assumes a character that endangers social welfare and encounters physical limits that it has to learn to obey in order to exist sustainably.

At this point 'productive processes reveal another aspect which till now was always concealed, and reveal themselves to be destructive forces'.⁶ Existing forms of social production depend on forces of production that destroy the natural environment and thus threaten the basis of their own and human existence. The destructive character of social production manifests also as the built-in obsolescence of capitalist consumerism and the colossal manufacture and stockpiling of military and nuclear weapons. The role of social production in the depletion of nature and the demand it places on resources is well described by Gorz, who observes that "all production is destruction", emphasising that the destructive aspect of production is overlooked if it does not irreversibly deplete natural resources, and thus resources may thereby appear inexhaustible.⁷ Indeed this destructive

potential of production has been underplayed even in the light of the present ecological crisis. In most industrial processes the natural resource input is normally not of local origin so that the production and consumption of commodities takes place within a geography that is separated from the geography that provided primary inputs for the commodities. The real material demands of the industrial production process are thus not perceived by the people who produce and consume commodities. The negative aspects of social production that dominate the environmental agenda of advanced industrial nations are the issues of pollution, the local "environmental friendliness" of consumer products and the welfare of workers with respect to the safety of industrial systems. The fact that industrial productivity contributes to the destruction of the natural environment in other parts of the world is not normally registered because of this spatial separation.

The Biophysical Basis of Production

The interaction of the natural environment with the production process is the focus of study within biophysical economics. Its modern roots can be found in the work of Nicholas Georgescu-Roegen, whose *The Entropy Law and the Economic Process* can be seen as a conceptual reorientation in economics.⁸ Georgescu-Roegen's work involved the incorporation of certain physical laws which classical and neoclassical economics neglected in their treatise of economic theory. In his polemic *Energy and Economic Myths* he argues that the mechanistic analogy dominated the orientation of the founders of neoclassical economics. As a consequence economic processes are viewed 'as a mechanical analogue consisting - as all mechanical analogues do - of a principle of conservation (transformation) and a maximisation rule. The economic science itself is thus reduced to a timeless kinematics'.⁹ He correctly points out the fault of standard economics in its portrayal of economic process as a closed system - a process in which there is a self sustaining circular flow between production and consumption. The crucial point missed by standard economics is that, instead of being an isolated, self sustaining process, the economic process is in fact an open system in which there is a continuous exchange of energy and matter with the natural environment. These exchanges necessarily alter the natural

environment in a cumulative way, which in turn, influenced by these alterations, affect the economic process itself. Georgescu-Roegen's work was instrumental in heralding the field of biophysical economics which examines the physical aspect of social production process from the viewpoint of the First and Second Laws of Thermodynamics, which governs any energy and matter transformation processes.

The nineteenth century economic theory was based on a simple, closed production-consumption model of Leon Walras - later extended by Gustav Cassell - who showed that a stable equilibrium exists for a closed system under special conditions. The standard Walras-Cassell model is the subject of criticism by Ayres and Nair, who describe the fundamental inconsistency of the model with the First Law of Thermodynamics.¹⁰ A closed system such as the Walras-Cassell model is thermodynamically inert and passive, with no flow of matter or energy into or out of the system. Production processes, however, require input to the system in the form of capital goods and raw materials which embody both matter and energy. A part of these inputs is converted into final goods while the other part is waste residues. However, final goods also ultimately enter the waste stream and are thus discharged into the ambient environment. The economic system therefore cannot be a closed system. This point is also expressed by Georgescu-Roegen who observes that standard economics 'portrays the economic process as a self-sustaining, circular flow between "production" and "consumption". But even money does not circulate back and forth within the economic process; for both bullion and paper money ultimately become worn out and their stocks must be replenished from external sources'.¹¹

Perhaps the most startling revelation of biophysical energy economic analysis was the discovery that modern agriculture is less energy efficient than traditional peasant agriculture. It showed that the increased productivity per hectare of land or per human labour in modern agriculture is only possible with increased amounts of energy intensive technology that contribute to energy utilisation that is inferior to a more labour intensive agricultural system of traditional farming.¹² Energy analysis of economic processes

illustrates the shortcomings of the monetary criterion for representing gains in productivity and economic development, such that the viability of most of our production activities are probably questionable from a biophysical perspective.

Furthermore, the narrow scope of neoclassical economic theory - one starting from production to exchange, to maximising utility - fails to relate itself to the wider scope of its dependence on the ecological system of which it is a subset. As a consequence the limitations imposed by the natural regenerative and assimilative capacity of the planet and the physical laws that govern the production processes have been overlooked. Paul Christensen notes that:

The neglect of material and energy resources or their presumed aggregation within the primary factors constitute a central weakness in neoclassical production theory ... The chief current alternatives to the neoclassical perspective are models which share a classical (Smith - Ricardo - Marx) orientation to production ... Leontief's input-output system, Sraffa's *Production of Commodities by Means of Commodities* ... Post-Keynesian models of accumulation and income distribution ... and various Marxian models. It is, however readily apparent that all of these models also display a striking neglect of the multiple connections of economic activity with natural systems.¹³

Similarly, Christensen observes Marx's abstraction from the consideration of nature in his treatise of political economy. He states:

Marx's own starting point in *Capital* is not production as physical process but the commodity considered from two points of view (as use-values and exchange-values). While this provides his analysis with the potential of interactions between physical and social structures, he provides no systematic analysis of production processes in physical terms. There is also a systematic subordination of nature and physical artefacts to labor. Labor activity is, for Marx, the starting point of economic activity. Physical consideration are taken up only as they bear on labor. There is no general treatment of production.¹⁴

Nevertheless, the theoretical potential for an understanding of the social production of nature exists in Marx, through his analysis of the labour process. Although in rudimentary forms only, Marx's work is much better developed as an analysis of social interaction with nature. In fact an integration of the biophysical dimension in the dialectic governing the

production of surplus value as described by Marx yields quite interesting implications for political economy and the environmental movement. The marriage of the biophysical perspective (which emphasises the natural dimension of human existence) with the Marxist critique of capitalism and its concern for the welfare and distributive aspects of political economy has much in common with the concerns of the environmental movement. Michael Redclift makes this point when he states that there 'is a common ground between historical materialism and the environment',¹⁵ observing that the liberating aspect of economic growth as the concern of early political economy did away with environmental concerns in the construction of development theory.

Marx regarded nature as a passive backdrop in which all productive processes took place. Nature was thus an all pervading, limitless and invariable factor which could hardly be altered by production processes. He states that all things which 'labour merely separates from immediate connexion with their environment, are subjects of labour spontaneously provided by nature. Such are the fish we catch, ... water, timber ... and ores'.¹⁶ It is thus possible to understand why Marx externalised nature from production processes. As Marx saw it, an economic system is an open system depending on nature's providence and supposedly nature also functioned as a perfect assimilator of waste and pollution. Nature in its infinity - as Marx perceived it - would be minimally affected by social production processes. It is important to note at this point that, if nature is infinite in its bounty then it does not matter if an economic system within it is an open system or a closed system. For Marx, the economic system was an open system with respect to an infinite nature. It could thus be externalised since the effects of production are negligible and cancel out in the totality of the process.

In an open system such as all economic processes into which matter and energy flow as inputs from the natural environment, these inputs must eventually flow out as waste in exactly equal quantities. This is a consequence of the First Law of Thermodynamics which

states that matter or energy can neither be created nor destroyed but can only be transformed into different forms.

The commodity normally enters the waste stream after a considerable delay so that in real time the waste flow is not strictly proportional to the productive activity; nevertheless there is a positive relationship between resource input, production index and pollution or waste generation. This implies that greater GNP necessarily means greater extraction of energy and matter from the natural environment and, as a consequence a greater aggregate quantity of waste residues will be generated.

The next most immediate consequence of economic processes is explicable by reference to the Second Law of Thermodynamics which states that in any transformation process the entropy of its matter and energy inputs in their totality are always of a lower value than the entropy of the totality of its matter and energy outputs.¹⁷ Any matter and energy transformation process always results in a net increase of the global entropy, so that there is a general tendency of the universe to move toward greater entropy or disorder. Human labour opposes this tendency in the production process by fabricating raw materials into highly ordered forms of commodity, however this local decrease in the entropy of the commodity is only possible with the expenditure of low entropy energy. This low entropy energy is dissipated as high entropy heat which is less useful since it is entropically degraded. Thus the production processes utilise low entropy energy and produce high entropy, less useful heat and waste. Pollution and waste are the dispersed, high entropy states of low entropy fuel and energy inputs to production processes.

Pollution and waste are inevitable consequences of production processes, and for this reason recycling of wastes from production processes is only a partial solution to the waste problem. The Second Law dictates that the degraded materials cannot be transformed to input materials for a production process without expenditure of additional low entropy available energy which must be obtained from the natural environment and also the

creation of additional pollution and dispersed heat in this resource transformation process.

One eminent economist, Solow, recognises this. He observes that:

... the natural resource is not reproducible, so that the size of the existing stock can never increase through time. It can only decrease ... This is true even of recyclable material; the laws of thermodynamics and life guarantee that we will never recover a whole pound of secondary copper from a pound of primary copper in use; or a whole pound of tertiary copper from a pound of secondary copper in use. There is a leakage at every round ... There is less ultimate copper left than there was last year, less by the amount dissipated beyond recovery during the year. So copper remains an exhaustible resource, despite the possibility of partial recycling.¹⁸

In *practice* this statement is true, though strictly speaking it is not, since entropy does not preclude total material recyclability provided enough energy is available. While materials can be perfectly recycled, however, energy cannot be recycled at all. So once useful low entropy is dissipated after use as high entropy less useful heat, it has zero potential for recycling its usefulness. Daly observes that, were 'it not for the entropy law, nothing would ever wear out; we could burn the same gallon of gasoline over and over, and our economic system could be closed with respect to the rest of the natural world'.¹⁹

In his polemic against the growth-oriented orthodox economists, Daly states that low entropy 'is the common denominator of all useful things and is scarce in an absolute sense. The stock of terrestrial low entropy is limited in total amount, while the flow of solar low entropy is limited in its rate of arrival'.²⁰ Like Georgescu-Roegen, who demonstrated the reversible mechanical analogy of mainstream economics to be its weakness since entropic phenomena are irreversible, and Ayres and Nair, who showed the inconsistency between the circular flow, Walras-Cassell model and the First Law of Thermodynamics, Daly emphasised that the circular flow of money in the economic processes is coupled with a unidirectional flow of matter and energy. This linear flow of matter and energy starts with the depletion of low entropy natural resources and ends up as the dispersal of high entropy wastes into the environment.

From this perspective, Daly regards low entropy as the physical coordinate of value, but resists the temptation to proclaim an "Entropy Theory of Value". He points out that although low entropy is a necessary condition, it is not a sufficient one to explain the value of one commodity relative to another, asserting that, 'an entropy theory of value would be no more satisfactory than a labour theory of value. On the other hand, a theory of value that ignores entropy is no more satisfactory than one that ignores labour'.²¹

Theories of Surplus Value

Daly's assertion that the labour theory of value is no more satisfactory than an entropy theory of value warrants an inquiry into the assignment of value in political economy. In fact, it becomes more necessary than ever to investigate value theory, since a biophysical orientation came at a much later stage in the formulation of value theory in political economy, which, as we have seen, has been noted for its downplaying of the value of nature.

Marx clearly stated that:

The bodies of commodities are combinations of two elements - matter and labour. If we take away the useful labour expended upon them, a material substratum is always left, which is furnished by Nature without help of man. The latter can work only as Nature does, that is by changing the form of matter. Nay more, in his work of changing the form he is constantly helped by Natural forces.²² We see then, that labour is not the only source of material wealth ...

However Marx's remark confers only a use value status to nature, and not exchange (surplus) value. To Marx:

The value of a commodity is determined by the socially necessary labour time contained in it. So for instance the price of uncultivated land is imaginary since land is without value, because no human labour has been incorporated in it. Also goods like air may be useful, but have no value since they embody no labour.²³

Thus to Marx, only labour creates exchange value. A distinctive feature of present day Eco-Marxist and biophysical economic thought is that they recognise the inadequacy of

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Marx's constituency of value so that they want 'to fundamentally revise value theory in ways which would include some concept of ecological cost in the exchange value of the commodity'.²⁴

Unlike contemporary economists who associate value with utility and seek to derive an explanation of exchange value from atomistic, micro-analysis of individual consumers, Marx followed the thought of Adam Smith and David Ricardo in his formulation of value theory. Smith treated the value of any commodity as being determined by the sum of the various costs involved in its production, in a general framework of supply and demand. This developed into what became known as the "Cost of Production Theory of Value". The realisation of profit, or the surplus value, according to Ricardo depended exclusively on wages, in the sense of being the difference between the value of labour's product and the value of wages paid to labour. Marx adopted Ricardo's thesis on surplus value and incorporated a crucial historical and institutional dimension, the *appropriation* of surplus value. This surplus value, according to Marx, was appropriated by the owners of the means of production or other forms of property such as land. This was possible with the existence of a proletariat that was dispossessed of land and property and hence completely dependent on the labour wage for their livelihood.

Marx spoke of the creation of surplus value as the difference between the value of material input as subsistence into human labour and the value of the commodity produced by labour. This surplus was appropriated by the capitalist and the dialectic between the capitalist and labour determined the production of surplus value. 'Both capital and labour are produced within the economy, and so the dialectic governing the extraction of surplus value described by Marxist economists is confined within the economy'.²⁵ Marx's belief in an infinite nature allowed him to externalise nature from the dialectic that governs the production of surplus value, so that only capital and labour become important factors in the production process.

The sixteenth century French physiocratic tradition regarded nature as the source of all material wealth. To them economic processes were subject to objective laws which they called "Natural Laws" that were independent of any social processes. The central argument of the physiocrats was that only agricultural labour was productive and therefore only agriculture produces surplus. The land rent, in the physiocrats' view, was the only form of surplus value.²⁶

The possibility of surplus value, according to the physiocrats, is 'present in agricultural labour. It appears ... as a *gift of Nature*, a productive power of nature'.²⁷ This surplus value, a "gift of Nature", is appropriated by the owner of the fundamental condition of labour - nature, that is, the land in form of land rent. The worker in the industrial sector, according to the physiocrats, did not increase the material substance in industrial production; rather he merely changed the form of the material input. Furthermore, the value labour adds to the material was not through the worker's labour as such, but came through the production cost of labour; through the sum of the means of subsistence which the labourer consumes in the course of his labour, provided by agriculture. This subsistence is equivalent to his wage.

The physiocrats thus argued that if one ignores a nation's foreign trade, then the number of workers employed in industry and other sectors of the economy, and completely released from agriculture, would be determined by the nation's agricultural productivity. The same point is made by Rostow, who highlights the importance of the agricultural sector in the transition of a traditional economy to an industrial one in his *Stages of Economic Growth*. Rostow observes that the early growth of a nation hinges on the amount of food supply so that 'the rate of increase in output in agriculture may set the limit within which the transition to modernisation proceeds'.²⁸

The next important point made by the physiocrats was the dependence of surplus value upon the degree of development of the forces of production. They argued that if the

productivity of labour was developed to the extent that a human's labour time was only sufficient to produce his own means of subsistence then there would be no surplus value. This would mean that there would be absolutely no difference between the value of labour power and the value created by its use. Thus the development of factors of production, rather than labour itself, dictates the level of productivity and thus surplus value.

Marx was opposed to the physiocrat position on a number of grounds. Perhaps most importantly, he opposed it on ideological grounds. Because Marx championed the cause of industrial labour, he strongly reacted against the notion that industrial labour was "sterile" in a productive sense. He pointed out that the physiocrats, in conceiving land rent as the only form of surplus value, entirely missed the significance of industrial sector profits derived from the circulation of capital. He also criticised the physiocratic notion that economic process was purely a physical phenomenon, arguing that the social form of value was overlooked in capitalist production by the physiocrats.

Marx saw physiocratic thought as giving a certain legitimacy to feudalism as the precursor of the bourgeois mode of production, such that feudalism was seen as a necessary factor in the development of capital - and a natural one too. Thus Marx observes that:

The system has more the character of a bourgeois reproduction of the feudal system, the domination of landed property, and the industrial spheres, within which capital first develops independently, are depicted rather as "unproductive" branches of labour, mere appendages of agriculture. The first condition for the development of capital is the separation of ownership of land from labour - so that land ... emerges as an independent force in the hands of a separate class, over against the free labour. In the physiocrat account, therefore the owner of land appears as the true capitalist, that is, as the appropriator of surplus value. Feudalism, ²⁸ thus reproduced and explained in the guise of bourgeois production.

For Turgot (a physiocrat, 1760s), the surplus value was possible because a producer sells a product that he has not bought.³⁰ This unbought element is for Turgot the "pure gift of Nature". On this point I agree with Turgot's position. In simple reproduction such as in subsistence reproduction a peasant appropriates surplus; for example, grains which he sells

in the market for money in exchange. If we extend into a more historical barter system (prior to money as the medium of exchange) he would get an equivalent product in exchange so that money or capital is just another aspect of surplus in the form of grains or goods appropriated from nature. It is worth noting that this surplus appropriated by the peasant would decrease if he had to pay wages, let us say, to draft animals who laboured with him. The surplus is diminished further were he to pay for all the materials he took from nature; if, let us suppose "nature" demanded compensation. It is because he does not pay the draft animals and nature and compensate for all the disturbances created by his activity that there exists this possibility of a surplus. In any case, when land becomes private property owned by the landlord, and is handed over to a landless peasant by "the Lord of the Land", then part of the surplus the peasant appropriates from nature is paid to the landlord in form of land rent. This surplus does not really belong to the landlord; it is a "debt to nature", but it is given to the landlord because he has assumed the ownership of that part of nature on which the peasant works. This gives rise to the relations of production that necessarily occur when a propertied class and a dispossessed unpropertied class are created. After paying the landlord his rent the peasant may be left with a surplus after he has consumed the necessary amount for subsistence.

For both agricultural and industrial sectors, if there exist two classes in which the fruits of production are forwarded to the landlord or industrial capitalist, the realisation of surplus value would be affected and in most cases would be hardly possible if we paid nature in full for the amount of natural resources that we derive from it. This includes the amount we owe for air, water, and the labour of the draft animals; for the pollution of the atmosphere; for the "money" that we do not pump back into an oil well when oil is extracted from it ... and so on. This point is also expressed by William Kapp, who believes that when the cost of environmental externalities is included in total business costs, in some cases the cost of production exceeds the total benefits. In his critique of the business enterprise system he notes that the profits and the social efficiency of private

investment are largely illusory. He thus questions the capability of the present form of private enterprise to "pay the debt to nature" already incurred by the ecological crisis.³¹

Marx apparently had little disagreement with Turgot's position. He observed that the total product is still appropriated by the worker from nature. However the total product now has two parts; the first forms the wages of the worker so that he is presented with that part of the product which is necessary for the reproduction of his labour power, while the second part, which is the excess over the wage, is the gift of Nature which form the surplus value that is appropriated by the landowner. He thus states:

This "pure gift of Nature" is now, however already defined as a gift which she makes "to him who cultivates it" and therefore as a gift which she makes to labour; as the productive power of labour, applied to the land, a productive power which labour possesses through using the productive power of Nature, and this labour creates out of the land, but only creates out of the land as labour. In the hand of the landowner, therefore, the surplus³² no longer appears as the "gift of Nature", but as an appropriation.

While the implication here is that nature and labour both create value, Marx then overlooks the contribution of nature and attributes the surplus value to labour alone; stating that from the point of view of the landowner, it is an appropriation of labour of the agricultural worker in excess of the wage of the worker. When expressed in labour time, Marx states that 'this surplus of products, however, is only the embodiment of the amount of time which he works gratis for the landowner, in addition to the time he works for the reproduction of his own wage'.³³ Marx's conceptual definition of surplus value in the form of labour time thus obscures the importance of nature in the realisation of surplus value.

Indeed, Marx experiences difficulty when he encounters the question of surplus value in subsistence production - as in the case of independent craftsmen or peasants who work with their own means of production. He states that:

... these producers working with their own means of production not only reproduce their labour power but create surplus value since their position makes it possible to appropriate their own surplus labour or a part of it ... And here we come up against a peculiarity ... In the same way as the capitalist mode of production the independent peasant or handicraftsman is sundered into two persons. As owner of means of production he is capitalist, he therefore pays himself his wages and draws his profit from his capital; that is to say he exploits himself as wage worker and pays himself, with the surplus value, the tribute that labour owes to capital.³⁴ Perhaps he also pays himself a third part as landowner (rent) ...

Thus Marx puts the issue of simple reproduction on a procrustean bed, adding further that:

... the producer - the worker - is the possessor, owner, of his means of production. They are therefore not capital, any more than in relation to them he is a wage worker. Nevertheless they are thought of as capital, and he himself is split in two, so that as capitalist he employs himself as wage worker. In fact this way of presenting it, however irrational it may seem at first sight, is nevertheless correct in so far as the producer in such a case actually creates his own surplus ... That he is able to appropriate to himself the whole product of his own labour, and that the excess of the value of his product over the average price of his day's labour - which does not distinguish him from other³⁵ workers - but to his ownership of the means of production.

From Turgot's position it is clear that the surplus value is appropriated from nature as a gift of nature, so that the contradiction that Marx points out in simple reproduction does not exist. This difficulty necessarily arises when surplus value is regarded as having been created solely by labour so that surplus, instead of being an appropriation from nature - as in Turgot's position - is an appropriation from labour. In simple reproduction therefore the peasant does not - as Marx puts it - exploit himself by appropriating his own surplus; rather he appropriates the surplus from nature, which is nature's gift for his labour.

Furthermore, Marx's claim that the 'sum total of the mass of subsistence which the worker consumes from one year to another, or the mass of material substance that he consumes, is smaller than the sum total of the means of subsistence that he produces',³⁶ is not a physical possibility since it violates the First and Second Laws of Thermodynamics. In fact, the subsistence the worker consumes does not transform into what he produces; rather it changes into excreta. This is the entropically degraded form of subsistence matter. The

energy from the subsistence matter becomes available as labour power, and is incorporated into materials which are obtained from nature and not created by labour, and which thereby become final commodities. Labour itself cannot just subsist and produce commodities as Marx's phrase would tend to suggest. In this context, Jean-Paul Deleage asks: 'can a parallel not be established between ... the hidden mechanism by which surplus-value is formed, and another, unsuspected by Marx, the hidden cost of things subtracted from ecological systems? ... Should the theoretical status of this concept of ecological cost not be ranked on a par with that of surplus-value?'³⁷

A Revised Labour Theory of Value

In 1883, a Ukrainian socialist named Podolinsky attempted to make the labour theory of value consistent with a thermodynamic analysis of the economic processes.³⁸ Podolinsky found that the yields per area and the energy surpluses in ecosystems in which human labour was subsidised were greater relative to unsubsidised natural forest ecosystems. His conclusion was that the energy viewpoint was compatible with the view that labour creates value. In his review of Podolinsky's work - in which Podolinsky tried to correlate modes of production and the "accumulation" of energy through human labour - Engels denied that it was possible to draw any interesting economic conclusions from energy accounting. Engels believed that calculus of energy ratios and costs was possible only in the most primitive sectors of production. In agriculture such calculus was very difficult, while in industrial economy the calculus was impossible. In his letter to Marx (December 1882) he wrote that the 'energy value, according to their cost of production, of a hammer, a screw, a needle, is a quantity which cannot be calculated'.³⁹ Thus Marx and Engels did not believe it was necessary to integrate into their work the biophysical dimension that Podolinsky sought to achieve.

Similarly, in the early twentieth century, Frederick Soddy argued that solar energy empowered all life processes⁴⁰, whilst in the 1970s, Odum argued that energy was the source of economic value, and empirical support for Odum's work came from Costanza,⁴¹

who used his empirical argument to propose an "Embodied Energy Theory of Economic Value" which expressed the value of any good or service in relation to the quantity of energy directly and indirectly used in its production. The energy theory of value provided by Odum and the embodied energy theory of value of Costanza have been criticised by many economists - including biophysical economists.

Ecological analysis has been alien to political economy until recently. Whatever opportunity there was of integrating ecological analysis into Marxism was lost when Marx and Engels rejected Podolinsky's findings. As a consequence it has become increasingly difficult to overcome the 'epistemological obstacles (the use of categories from political economy) and ideological obstacles (the vision of a two stage transition to communist equality)',⁴² to modify value theory in light of ecological considerations. Marx himself intensified this difficulty by creating a distinction between exchange values and use values.

This problem is highlighted by Bennholdt-Thomsen in her consideration of the relationship between subsistence reproduction and extended reproduction.⁴³ She correctly argues that the distinction between use and exchange values is a false one. According to Bennholdt-Thomsen, Marx's value theory is confined only to extended production. In Marx, exchange values prevail in extended reproduction or in capitalist production while the sphere of use values is confined to pre-capitalist subsistence reproduction. Thus the definitions of use and exchange values are partly based on the historical development of the mode of production.

Bennholdt-Thomsen thus correctly notes that:

... it would be false to consider the production of use-values as not belonging to the capitalist mode of production, only because it at first sight, does not seem to be integrated into generalised exchange relations ... Extended reproduction is based upon subsistence reproduction. Products coming from the latter are introduced into the former. Under capitalist conditions use-value always has its counterparts in exchange-value. They are the two faces of the same coin.⁴⁴

As it has been discussed (in the second chapter), the identification of "first nature" (the pre-bourgeois period) and "second nature" (bourgeois period) implicit in historical materialism, is representative of the historical development of mode of production in Marxist political economy. This distinction between pre-capitalist and capitalist modes of production relates to the realm of use-values and exchange-values respectively. This distinction, however, breaks down as nature is treated as a commodity in extended reproduction - subordinated to capital, that is, the realm of exchange-values, hence "the capitalisation of nature". In a similar argument, Smith and O'Keefe observe that under the capitalist mode of production not only "second nature" but also "first nature" is produced, so that 'the second nature is no longer produced out of the first nature, but rather the first is produced by and within the confines of the second'; with the result that 'the relation with nature is a use-value relation only in the most subordinate sense. Before anything else it is an exchange-value relation'.⁴⁵

The breakdown of the distinction between use and exchange values is necessary if an ecological factor is to be incorporated into value theory. Furthermore, overcoming the separation enables the analysis of value to transcend the historical dimension of pre-capitalist and the present capitalist and socialist modes of production. Thus the theory of value does not need to be confined within the sphere of generalised commodity exchange only. This point does not imply that the sphere of generalised commodity exchange and the social relations of production is not vital in the analysis of value; on the contrary, the social relations of production and labour are vital components of value and must not be isolated from the theory of value.

The tendency of biophysical analysis has, however, been to wholly replace existing value theories derived from social orientations with a physical parameter such as energy; as a consequence biophysical economists have devoted little attention to the social factors of value. This has contributed to the schism that exists between biophysical economists and

Marxist and neoclassical economists. The consequential difficulties are expressed thus by Alier and Naredo:

The alternative is not to adopt an energy theory of value (although some people have done this). Nor is to fall back on a theory of value=prices, since prices do not reflect energy costs now, nor can they reflect energy availability in time since this is not known⁴⁶. The alternative is perhaps, to do without a general theory of value.

Starting from the beginning of political economy analysis of value we find that, for the physiocrats, nature is the source of all value and only agricultural labour is productive, whereas to Adam Smith and Marx all forms of labour were productive and the source of surplus value. From the biophysical orientation of Daly, the theory of value should incorporate both labour and entropy, and any value theory which fails to consider both would be unsatisfactory. Twentieth century biophysical economists assert that matter and energy provided by nature and the sun have been the source of value for both traditional and modern economic processes. Meanwhile, Podolinsky analytically verified labour productivity with energy analysis, thus justifying the notion that labour contributes to surplus value. But he also realised that all energy and materials used by man (such as food, clothing, tools, and warmth) came from nature, so that nature was the source of value for human beings and their economic processes.

In short, the theory of value should incorporate the physical aspects of matter, energy and entropy; all of which can be summarised as entities of nature; and the social aspect of production residing in labour. Thus the revised theory of value should be based on the contributions of both labour and nature together. Marx's treatise that labour was the sole creator of surplus value excludes the importance of natural resources by subordinating it to a use value status so that nature formed no part of the surplus value. In doing so he foregoes a theory of surplus value - in terms of labour productivity realised by the use of technology and the quality of natural resources - based on the dual exploitation of both labour and nature. He thus only perceived the social relations of production as a primary factor governing the production of surplus. The theory of surplus value however, should

be able to account for the exploitation of nature under the present social modes of production, and also exploitation of labour in the social relations of production. The theory of surplus value should be able to provide an explanation for the fact that social production processes are not only constrained by social factors but also by natural factors. Therefore there is a need to reformulate the labour theory of value in a form that exhibits both these factors, such as, for example, "The Labour/Nature Theory Of Value", which has the possibility of providing an explanation for the social dynamics of the environmental conflict and the natural or biophysical conditions of social and economic development.

Endnotes:

- ¹ M. O'Connor, *op. cit.*, pp. 33-57.
- ² *ibid.*, p. 36.
- ³ Williams, *op. cit.*, pp. 9-10.
- ⁴ J. Porritt (1984), *Seeing Green: The Politics of Ecology Explained*, Basil Blackwell, Oxford, pp. 224-225.
- ⁵ Gorz, *op. cit.*, p. 11.
- ⁶ Enzensberger, *op. cit.*, pp. 3-32.
- ⁷ Gorz, *op. cit.*, p. 20.
- ⁸ N. Georgescu-Roegen (1971), *The Entropy Law and Economic Process*, Harvard University Press, Cambridge (Ma.).
- ⁹ N. Georgescu-Roegen (1975), "Energy and Economic Myths", *The Ecologist*, 5, pp. 164-174.
- ¹⁰ R. Ayres and I. Nair (1984), "Thermodynamics and Economics", *Physics Today*, 25, pp. 62-71.
- ¹¹ Georgescu-Roegen (1975), *op. cit.*, pp. 164-165.
- ¹² Alier and Schlupmann, *op. cit.*, p. 3.
- ¹³ Christensen, *op. cit.*, pp. 75-89.
- ¹⁴ *ibid.*, p. 79.
- ¹⁵ Redclift (1984), *op. cit.*, pp. 5-6.
- ¹⁶ K. Marx (1867 ed.), *Capital*, quoted in R. Kaufmann (1987), "Biophysical and Marxist Economics: Learning from Each Other", *Ecological Modelling*, 38, pp. 91-105.
- ¹⁷ Some references in the now abundant literature on the topic include Daly (1977), *op. cit.*; Georgescu-Roegen (1975), *op. cit.*; Commoner, *op. cit.*
- ¹⁸ R.M. Solow (1974), "The Economics of Resources or the Resources of Economics", *American Economic Review*, 64:2, pp. 1-14.
- ¹⁹ Daly (1977), *op. cit.*, p. 16.
- ²⁰ *ibid.*, pp. 41-42.
- ²¹ *ibid.*, p. 26.
- ²² K. Marx quoted in Freedman, *op. cit.*, p. 34.
- ²³ *ibid.*, p. 30.
- ²⁴ J. O'Connor (1989a), *op. cit.*, p. 5-14.
- ²⁵ Kaufmann, *op. cit.*, pp. 91-105.
- ²⁶ Marx (1951 ed.), *op. cit.*, p. 51.

- ²⁷ *ibid.*, p. 51.
- ²⁸ Rostow, *op. cit.*, p. 23.
- ²⁹ Marx (1951 ed.), *op. cit.*, p. 50.
- ³⁰ Turgot's notion of surplus value has been discussed at length by Marx in *ibid.*
- ³¹ K.W. Kapp (1963), *Social Costs of Business Enterprise*, Asia Publishing House, Bombay.
- ³² Marx (1951 ed.), *op. cit.*, p. 62.
- ³³ *ibid.*, p. 62.
- ³⁴ *ibid.*, p. 192.
- ³⁵ *ibid.*, p. 193.
- ³⁶ *ibid.*, p. 46.
- ³⁷ Deleage, *op. cit.*, pp. 15-31.
- ³⁸ Alier and Naredo, *op. cit.*, pp. 207-224.
- ³⁹ F. Engel's Letter to K. Marx (December 1882), quoted in *ibid.*, p. 218.
- ⁴⁰ H.E. Daly (1980), "The Economic Thought of Frederick Soddy", *History of Political Economy*, 12:4, pp. 469-488.
- ⁴¹ Odum, *op. cit.*; R. Costanza (1980), "Embodied Energy and Economic Valuation", *Science*, 210, pp. 1219-1224; Costanza (1981), *op. cit.*, pp. 119-146.
- ⁴² Alier and Naredo, *op. cit.*, p. 219.
- ⁴³ V. Bennholdt-Thomsen (1982), "Subsistence Production and Extended Reproduction: A Contribution to the Discussion About Modes of Production", *The Journal of Peasant Studies*, 9, pp. 240-253.
- ⁴⁴ *ibid.*, p. 244.
- ⁴⁵ Smith and O' Keefe, *op. cit.*, p. 35.
- ⁴⁶ Alier and Naredo, *op. cit.*, p. 219.

4. CAPITALISM, SOCIALISM AND NATURE

If - as has been argued in this thesis - labour and nature constitute surplus value, then the realisation of surplus value in social production processes not only exploits labour power but is inevitably environmentally exploitative as well. In fact all social production processes - whether traditional pre-capitalist or modern industrial - impinge on the natural environment in one way or another. This dual exploitation of labour and nature in the realisation of surplus value, varies in the degree of its impact on the environment from one society to another. It assumes a more destructive character when the rationality of production is governed by unlimited capital accumulation.

Marx's description of the accumulative tendency of capitalism and its consequent exploitative character towards labour, started from the notion that only labour creates surplus value. The dialectic governing the extraction of surplus value was thus confined to social relations of production only. To Marx, the contradiction in the social relations of production was the main factor that would eventually stall capitalist advance. He thus did not foresee the present ecological constraints that are bringing into question the "progress" of the capitalist mode of production.

The adding of a biophysical dimension to surplus value implies that the predominantly social character of historical materialism described by Marx contains an ecological dimension. This chapter is an investigation of the biophysical dimension overlooked in the Marxist explanation. The analysis complements the Marxist position, whilst extending it to incorporate the ecological factors associated with production. It is argued that the ecological crisis is a consequence of growth-oriented production, and is inevitable in an inherently expansive, capitalist mode of production.

The biophysical extension of Marx's dialectical explanation of social development suggests that the Labour movement and the Green movement are different aspects - the social and biophysical aspects respectively - of the exploitative capitalist process.

Capitalist development thus proceeds in contradiction to these two interacting factors. It will be shown in this chapter that, as a consequence of capitalist restructuring, labour's role has been reduced in production, thereby increasing nature's role in the dialectic governing the extraction of surplus value. This restructuring, it is argued, though making capitalism more resource-intensive, has effectively neutralised industrial labour as the agent of revolution, such that the industrial working class today has been co-opted into the capitalist structure.

The description of the relationship between the Labour and Green movements provides a theoretical platform from which to critically evaluate the various political perspectives within the ecological movement and their prescriptions of social change. A substantial part of this chapter is thus devoted to an appraisal of political ecology from an eco-Marxist perspective.

The truth is, that the social production process is more destructive to nature than it is to labour. Nature not only constitutes the productive factors; fuels, machinery, and tools which augment labour, but it is, unlike labour, substantially transformed into immediate commodities. Furthermore, the by-products of production processes in the form of waste and pollution have a debilitating effect on natural systems. While wages compensate labour for its physical or mental depreciation in the labour process, there does not exist a similar fund for nature, so that nature, once transformed by human activity, is rarely restored back to its original form. It may be argued of course that nature cannot be paid and that, in any case, nature is self renewing. However, this being the case, it is imperative that we have the knowledge to operate within the confines of natural regeneration processes. If we cannot compensate nature then it is prudent to minimise human productive activity that

bears on the environment. The ecological crisis is a consequence of social productive activity that has neglected the ecological realities of our existence.

For this reason, any economic production process that relies on incessant growth in productivity is bound to be ecologically destructive. Viewed in this way both the capitalist mode of production and growth-oriented socialism, in their deification of increasing Gross National Product as a measure of economic progress, represent environmentally destructive modes of production. Both advanced capitalism and the form of "socialism" that existed in the former USSR and Eastern bloc countries have shared a similar attitude to the feasibility and desirability of unlimited growth of material production, and the means to achieve it. As far as the realisation of surplus value is concerned, both modes of production have resorted to industrialisation and increasing productivity to create surplus value. In this regard, both economic modes are no different from each other in their relationship with nature. Everything else being the same, changing the nature of the relations of production and the features of distribution of the surplus value realised in the production process will hardly change its relationship with nature. This is why it is inaccurate to relate ecological crisis to capitalism alone and its contradiction in the relations of production. Jean-Paul Deleage argues similarly:

In fact, their [Eastern bloc socialist nation's] productive system displays too little difference from the standpoint of its methods and goals, compared with that of developed capitalist countries ... Whether guided by private capitalists or the imperatives of the state capital, industrialisation and the accumulation and concentration of capital which industrialisation implies, have a logic of their own, identical in both cases, formally unique and independent of any theory or ideology ... State ownership of the means of production provides no theoretical guarantee against the waste of resources generated by the anarchy of the capitalist mode of production.¹

Historical experience also suggests that there have been similar forms of environmental degradation in the industrial capitalist and "socialist" nations. Many economists and environmentalists therefore conclude that it is not capitalism and socialism that deserve the onus for environmental degradation. Rather they attribute blame to "industrialization",

"urbanization", "technology", "bureaucracy" and a "production at all costs" mentality - all of which appear to be common in both capitalist and socialist worlds'.²

The socialist mode is claimed to be radically different from the capitalist mode of production with respect to its socio-political structure, in that the control of production activity is (theoretically) exercised by the whole society. However as John Kenneth Galbraith points out, any society that adopts industrial technology will necessarily have a similar structure, with an autonomous, power-exercising body presiding over the whole society. He thus observes that:

... there is considerable distress over how little difference nationalisation of an industry means. If an intelligent observer from Mars or Venus could come and examine all large contemporary industrial concerns - private or public - as working enterprises, he would notice, I suspect, only their overwhelming sameness. The technostucture in the case of public and private ownership assumes similar powers and uses of the same group methods of arriving at decisions.³

It is apparent therefore that attaining a more ecologically benign society would mean a break from social production processes that rely on industrial technology of the sort that advanced industrial nations have employed in their economic development. Thus Roszak argues for a social transformation to 'a world less urbanised, less dominated by the compulsions of industrial productivity, more characterised by small-scaled localised operation by personal and participative relationships in government and the economy'.⁴

Similarly Timothy Luke argues for the deconstruction of the colossus of industrial society:

... deconstructionism puts personal emancipation and communal self-determination first on a revolutionary agenda for dismantling the hierarchies, large-scales, complexities, super-centres and uniformities of corporate capitalism ... This alternative can be summarised in the utopian constructs of ecotechnics, democommunitarianism and rurbanism ...⁵

For many people, this trend towards deconstruction of industrial society and the new environmental consciousness is expected to, in some way, transcend the politics of traditional Left and Right and evolve into a new economic order. This new trend adopts

an apolitical stance, dismissing the contemporary politics of class struggle and relying on individual consciousness for liberation from the imminent catastrophe that faces mankind. This depoliticised position adopted by a large part of environmentalism has been criticised by eco-socialists for its political simplicity and idealism.

Appraising Political Ecology: A Materialist Perspective

The basic shortcoming of a political ecology which relies on voluntarist, individual consciousness as the means of change is that there is a tendency to see the ecological crisis as a unifying issue in which environmental concern is so universal in its value that it can override all other social issues and vested interests. This approach views ecological politics as a positive-sum issue with no disagreeable consequences. Transition to an ecologically responsible society can be attained in a peaceful, liberal manner devoid of any harm to interests or privileges and thus demands no changes to the present social and economic structure of the society. But this depoliticised strategy really offers very little by way of a solution to the transition to an ecologically benign society. David Pepper is one who recognises its shortcomings:

... as our environmental problems do increase there will be an increasing need to pool and share equally all resources, and to restrain profit-motivated production. Can anyone imagine that such sharing and restraint will be readily accomplished by appealing to individual values and without some kind of struggle between the owners and the controllers of the means of production (such as the multinationals) and the rest of us? It seems unlikely.⁶

According to Pepper, within the environmental movement, 'the so called "new" green perspective is substantially a subtle means of perpetuating the political *status quo*, assisted by some very politically naive people. It will become a formidable force for true political change only when it adopts a more materialist analysis of social processes'.⁷ Pepper concludes that only eco-socialists, because of their materialist analysis, offer a solution that has more relevance to the mass of people. Eco-socialists, unlike non-political ecologists, do not separate social and environmental reform from the need to change the socio-economic mode of production. Raymond Williams argues that non-political ecology is an

inadequate position since ecological reform programs advocated by the environmental movement involve substantial social and economic dislocations. Thus he asserts that:

There would ... be major disturbances in any serious programme for resource saving, resource management and above all in the diminution of radical poverty in the poorest parts of the world. This is not an argument against the programmes, but if it is the case we must say so openly, and see what positive forces can be assembled to support them. And it is here⁸ that we come ... to the relation with socialism, which I see as crucial.

What the apolitical stance of popular ecology grossly overlooks is that severe inequalities exist between the power of groups and societies to command scarce resources; that there are wealthy and poor nations, classes and individuals. These inequalities are part of the entire social fabric; it is thus not surprising that no popular consciousness and voluntarist commitments have hitherto brought about the ideal sought by apolitical ecology.

For this reason there is common ground between environmentalist concern for natural viability, which raises critical distributive issues, and socialism's concern for social justice.

As Stephen Bell states:

... ecology must come to grips with socialist class analysis and with socialism's emphasis on social justice. On the other hand ... ultimately socialism must confront the problem of ecological constraints on growth, and face the implications this poses for its materialist, productivist ideology.⁹

As opposed to depoliticised popular ecology, the eco-socialist perspective is an essentially materialist analysis rather than an idealist one. A materialist conception, following Marx:

... sees change and development stemming substantially from material factors, and particularly from the way that human societies organise themselves and their labour to gain their material subsistence through production - that is, their mode of production. It holds that the predominant ideas which influence social change are not autonomously¹⁰ derived from abstract thinking and reasoning processes.

In this regard Marx's materialist account of the development of capitalism still provides the most fertile ground for the incorporation of an ecological dimension in order to explain the

dynamics of political ecology. For Marx, the contradiction in the capitalist mode of production is conceived only in its social dimensions, that is, between the relations of production - capitalist and labour. He did not assimilate the natural or biophysical aspect in the dialectic of surplus production, so that the broader contradiction of capitalism in its relation with the natural environment was overlooked. In fact, Marx, in downplaying the role of nature, grossly underestimated capitalism's ability to restructure itself in light of the crises it encounters in its development. James O'Connor argues similarly:

While Marx and Engels were master theoreticians of the social havoc caused by capitalist development, neither put ecological destruction at the centre of their theory of capital. They underestimated the degree to which the historical progression of capitalism is based on the exhaustion of resources and depletion of nature.¹¹

O'Connor also points out that Marx and Engels could not foresee the importance of social movements within liberal democratic political systems in preventing the damage to the natural environment wrought by capitalism.

Furthermore, Marxist economic theory about the conditions of the working class has not been accurate. Working-class wages have not been driven to subsistence; rather, in advanced capitalist nations, they have remained generally constant and have maintained a share of continually increasing surplus value. Moreover, in advanced industrial nations, the welfare state has permitted the increasing wealth produced by capitalists to be shared amongst all major elements of the population. This inadequacy of Marxist economic theory to fully account for the ecological and social dynamics associated with capitalist development can be traced to Marx's notion that only labour creates surplus value.

What Marx knew but did not state elaborately - maybe for ideological reasons - was that labour power alone is limited in its capacity to produce surplus value, so that increasing labour productivity is only possible with progressive development of factors of production which constitute the natural forces in the extraction of surplus value. Apart from the fact that a commodity is a natural element transformed in the production process by labour

rather than created by it, Marx obscured nature's role in the realisation of surplus value by broadly categorising natural elements such as resources, fuels, tools, and machinery under capital goods.

Given that surplus value is derived from a dual exploitation of nature and labour, it becomes possible for capitalism to reduce the exploitation of labour by increasing the exploitation of nature. This is possible by means of labour displacing technology which maintains production capacity with less employed labour. While no social production process can exist without both labour and nature, it is possible to reduce dependence upon one by increased exploitation of the other in the extraction of surplus value. Therefore production may be labour-intensive, which exploits labour but is ecologically less harmful; or capital-intensive, which largely exploits nature. Jean-Paul Deleage recognises this character of capitalist economic growth, which owes its development to capital embodied in both labour and nature, when he states that, in the advanced capitalist nations:

... as limits to the rate of exploitation of labour power are found, the ultimate recourse is often a frenzied destruction of the capital embodied in nature. Economic growth located at the surface of social development is in fact only a Pyrrhic victory as it is obtained only at the price of the destruction of the environment and the degradation of the human habitat.¹²

It follows that the assimilation of a value theory that includes both labour and nature into the macro-analysis of historical materialism yields a new ecological dynamic to the development of the capitalist mode of production. It possesses the capacity to explain the political ecologies of the advanced industrial nations of the North (the core of capitalist development) and the developing nations of the South (The periphery of the capitalist mode of production). The inclusion of nature in the dialectic that governs surplus value explains why the working class has waned in its revolutionary capacity to transcend capitalism.

Capitalist economic systems within liberal democratic states are inherently anti-ecological. Liberal democratic capitalism combines high levels of socio-economic inequality with

representational political democracy. In such a structure, economic growth is a substitute for redistribution of wealth. This inequality in the socio-economic structure is concealed by a growth economy presenting greater gains to the whole society - although disproportionately greater - which mutes the public discontent by ensuring everybody some growth in general wealth. With a cessation of growth in the economy, there is an increase in distributive inequality, and a substantial number of people lose their livelihood, thus giving rise to tensions which threaten the structure of liberal democratic state.¹³

Moreover, the capitalist expansive thrust derives from the logic of capital accumulation. Progressive capital accumulation is paramount to the capitalist mode of production since the competitive nature of production compels an enterprise to constantly extend its capital in order to survive. To maintain a competitive edge an enterprise in advance capitalism becomes increasingly capital-intensive to be more productive and efficient. However, Marx demonstrated that as an enterprise becomes increasingly capital-intensive, the average rate of profit declines so that ultimately it faces a "crisis of over-accumulation". To avoid this crisis capitalists are constantly forced to increase the rate of profit. Advanced capitalism can avoid a falling rate of profit by an increase in production, in price and in the sophistication of the commodity. It may also resort to what is termed planned obsolescence, a means of quality control to limit the life-span of its product and thereby increase the circulation rate of capital.

Along with the production of goods there exists considerable effort to ensure their use by elaborate strategies of advertising, sales and marketing. Services sector growth may claim to be less resource-intensive and non-polluting than the industrial sector, but is nevertheless environmentally destructive. This is noted by Singh:

... it may seem, even a 'service' trade without any evident effluent to worry about, may be easily seen to have a very severe environmental impact. 'Sales promotion' which causes newspapers and magazines to get heavier and heavier, particularly in the rich countries, is one such. *The New York Times* alone, for example, uses up to six hectares of Canadian forest every day except on Sundays when the area involved

is fifteen to twenty hectares. In causing an excessive production and consumption of publicity material like paper, the 'advertising industry' probably does more damage than many other pursuits.¹⁴

Similarly Anthony Harris argues that the level of non-price competition in the form of advertising, packaging and model changes leads to much more rapid depletion of natural resources than the economic need would suggest. He further states that:

The so called "corporate economy" promotes the need for private individual consumption patterns and derides the possibility of alternative social forms of consumption by adopting a set of pricing rules which¹⁵ make public provision unprofitable and therefore uneconomic.

One example of this, is the increasing importance of the private transport system over the deteriorating and inadequate public transport facilities in various large cities. Though cars may well be an environmentally destructive transport alternative, they nevertheless represent the most economical and convenient mode of transport, serving the cause of a profitable car industry and other industries associated with it.

Capitalist economies are based on a commodity form of need satisfaction and a wage form of labour. James O'Connor describes capitalist economies as "demand-constrained" economies which emphasise personal consumption and are more wasteful and resource intensive 'through advertising, packaging, style changes, model changes, product differentiation, and credit buying which are needed to keep the system afloat'.¹⁶ Capitalist economies are subject to the rule of progressive accumulation and growth to increase the absolute shares of the different sectors within any society (due to their unequal economic structure) and are therefore inherently growth-oriented and, as a consequence, anti-ecological.

On the other hand however, O'Connor argues, socialist economies are based on collective consumption such as mass transit and collective recreational facilities, medical services and accommodation. Described as "resource-constrained", 'socialist economies use and waste

fewer resources than capitalist economies and personal consumption creates less pollution'.¹⁷

Why, then, were the "socialist" economies of Eastern Europe such environmental disasters? To the degree that the former East European socialist nations adopted systems of production based on industrial technology similar to the West, the nature of ecological degradation in the East and the West are the same. Furthermore, the Eastern bloc countries were also a part of the global economic system, hence the need to adopt a growth-oriented economy to maintain labour productivity and national productivity at levels that would match the productivity of the capitalist nations in the world market. It was necessary to avoid the adverse economic effects as a result of lower productivity in a free market economy.

Because the property and production relations of socialist economies are different from capitalist economies, the pattern of consumption and the principle of production - for use instead of profit - in socialist economies has the possibility of being rationalised and thus less environmentally destructive. The factors that govern the capitalist mode of production's expansive dynamic are not inherent in socialist economies. In practice, however, socialist countries have not demonstrated a democratic socialised production based on human needs. Instead they are characterised by an authoritarian central planning body that assumes control of the production and accumulation of surplus on behalf of the state.

If economic growth is an absolute necessity for the survival of the capitalist mode of production then it becomes apparent that capitalism cannot be ecologically viable in a materially finite world. The same applies to growth-oriented socialism for that matter. Stated in this manner, any ecological policy that seeks to restrict or reverse the economic growth trend places itself in direct contradiction with capitalism's expansive thrust. It is for this reason that any ecological reforms that are compatible with the capitalist mode of

production, such as the market-based incentives in pollution-abatement and resource use legislation, are not ecologically benign in the long-term. Minor ecological reforms within the capitalist mode of production only buy time for the short-term interest of capital against the long-term interest of nature and mankind. From this perspective, advocates of these types of reform within the capitalist structure are said to serve the interests of capitalism and fail to recognise the basic contradiction between its development and ecological viability.

It is precisely for this reason that a serious environmentalist position would have to be anti-capitalist. Capitalism, as it is structurally bound to continued economic growth, would have to be transcended in the interest of the natural environment. The environment movement, in this sense, is a subversive movement, since its themes run against the present growth paradigm of the world economic order.

If capitalism as an economic order has to be transcended, at issue then is the politics of transcending capitalism and its policy constraints to a more ecologically benign society. Furthermore, a slow or no-growth ecologically viable economy would certainly have to confront distributive issues to be socially just as well.

As far as environmental management and protection policies are concerned, there are doubts as to whether the state administrative apparatus has the capacity or the will to enforce environmental legislation effectively. In a liberal democracy there is an interdependent relationship between capital and the state. Environmental legislation which involves increased state intervention into the practices of capitalist enterprises will not be acceptable to those enterprises, as Stephen Bell notes:

Thorough-going ecological policies would require detailed economic regulation and planning pertaining to areas such as the investment process, controls over technology and environmental impact, a reorientation of consumption patterns and so on. This implies a level of state interventionism which would seriously undermine private economic autonomy and control ... This suggests that efforts to push

state interventionism to what would necessarily be historically unprecedented levels would be hotly resisted by capital.¹⁸

Bell highlights the Reagan administration's subversion of the United States' environmental legislation of the 1970s to reduce business costs and boost capital investment in order to promote economic growth. The relaxation of environmental legislation by governments is, in fact, a common practice in an economic recession when concerns for employment, business investments and economic productivity override environmental concerns.

Despite the structural dependence of the state on capitalist enterprises, there is a need to balance the interests of the other social classes from which it derives legitimacy. The state, while providing full employment and services via investments and economic growth, also has to ensure that the natural environment receives some protection if it is to retain legitimacy. This places the state in an uncomfortable position where it must reconcile conflicting pressures. This dilemma is expressed by Walker, who observes:

... an inherent conflict in the role of the State. On the one hand, it is expected to create and maintain economic growth, and on the other to meet expectations that it will maintain the viability of the productive system as a whole: entailing conservation of the natural environment and husbanding of resources. The resolution of this conflict has frequently been imbalanced: the political institutions of modern States are inadequate and insensitive to the needs of human and of natural ecology, and long-term well-being is often sacrificed to short-term goals.¹⁹

It is important to note that the liberal state in both structure and function has evolved within the capitalist mode of production and precedes the environmental movement. Consequently, ecological initiatives by the movement within the state apparatus must be congruent with existing functional characteristics of the capitalist state. This is evident in the case of environmental legislation in liberal democratic states that adopt a market rationality as the basis for environmental protection. Nature, under liberal political ecology, thus becomes a mere commodity subordinated to the laws of market; protected from the commons and reserved by the market for an elite group of people possessing the capital resources to gain access to it. Wherever the market justifies the circumstances,

nature is expropriated from the poor, whose livelihood depends on it, to satisfy the non-essential wants of the affluent. Liberal political ecology from this perspective, in adopting the market as a means of environmental protection, has thus become one of its instruments, providing justification for capitalist appropriation of nature in the unbridled production of surplus value.

Because surplus value realised in production processes represents the appropriation of nature and the exploitation of labour power, when unlimited private profit or capital accumulation becomes the imperative of production, this appropriation assumes an exploitative character. The reference to money as petro-dollars, phosphate-dollars and where forest resources are concerned, green-gold, is not a mere coincidence; rather the capital accumulated as profits in banks represents the capital form of natural resources and labour power. The larger the accumulation of capital, the larger is the transformation of nature and labour power into the artificial form of money.

As capitalism advances its exploitative appropriation of labour and nature in its insatiable thirst for profit, social movements arise to protect the interest of these entities from total subordination to capital. What is rarely recognised is that the two most powerful social movements of the twentieth century - Labour and the Green movement - are dual aspects of the same capitalist exploitation process. Both labour and nature are used in the production of surplus value and profit. While the Labour movement represents the interest of the working class against capitalist exploitation, the Green movement represents the interest of nature. Because there is this intimate relationship between labour and nature in the production process, any reform sought by the Green movement has a direct bearing on the working class. Several factors conspire to mask this common origin, so that, in the political arena there is an apparent hostility between the representatives of the two movements. For example, in Germany, there is an ideological division between Die Grunen and the Social Democrats; in Britain, it is between the Labour Party and the Green Party; in Australia, between the Green and environment groups and the Labor Party.

One of the reasons for this division lies in the fact that, in liberal democratic states, the environment movement basically serves a reformatory function within the capitalist state structure so that its agenda may affect the well-being and the livelihood of the working-class in employment. In the capitalist mode of production the "alienation of labour" from the means of production implies that wage labour is the only form of livelihood for the working class and thus any reform that contributes to unemployment will face opposition from labour. The Green movement, while operating within the structure of the capitalist state, avoids welfare and distributive issues and thus fails to incorporate the interests of labour who are the initial victims of capitalist exploitation and who would be the first to suffer the consequences of slow or zero growth. As long as alienated labour exists, the Green movement's agenda of ecological reform which results in loss of employment will conflict with the interest of the working class, whose only means of livelihood is wage labour provided by capitalist enterprises. It therefore does not come as a surprise that the Labour movement and many socialists see the typical environmentalist as 'a middle-class, elitist, romantic nature worshipper who has turned his or her back on the bread and butter issues facing the working class and the poor ...'²⁰

It is worth noting that environmentalism in advanced industrial nations takes on a different character than it does in the developing countries. As Michael Redclift observes, in 'those countries which have achieved a significant degree of industrial growth there is abundant evidence that environmental activity follows class lines, dictated by participation of different groups in the country's development'.²¹ He argues that issues such as pollution, industrial blight and wilderness preservation, which constitute the environmental agenda of the developed nations, are the concerns of middle-class society.

Meanwhile in the developing nations, ecological movements are a simultaneously economic and political struggle against poverty and misery. The "internationalisation of the environment" enables capitalism to exploit the natural resources of the peripheral nations

of the South which act as primary resource-suppliers to the industrialised nations in the core of capitalist development. Whenever the capitalist demand for resources conflicts with the demands of local people whose livelihood depends on these natural resources, it is then a struggle against exploitation of people and their resources which constitutes the environmentalism of the South. As Redclift observes:

As nature is transformed under capitalist development and "natural resources" are created, social struggles are initiated which resist the incorporation of nature in wider spheres of accumulation. The concern of these movements with the distribution of resources is usually linked to ideas about the alternative uses to which they can be put. The struggle to create the conditions of existence necessary for social and biological reproduction, outside the spheres of capitalist accumulation and market-oriented resource use, is a struggle to effect profound environmental objectives.²²

Some examples of these include the Chipko movement in India, the Green Belt movement in Kenya and the ecological movements in Latin America.

In so far as the environment movement of the advanced industrial nations fails to realise that the environmental crisis is a crisis of the capitalist mode of production, it will fail to comprehend its relationship with the broader struggles of the Labour movement and of the poor South.

The Failure of the Proletarian Revolution

Capitalism has been fortunate that surplus value can be extracted from two sources - labour and nature. This gives it increased flexibility and the ability to restructure itself whenever it encounters limits to the exploitation of one of these factors. It is here that Marx overlooked the fact that capitalism can restructure in such a way as to decrease the importance of labour in the extraction of surplus value by resorting to increased exploitation of nature. At the expense of nature, the exploitation of labour may be reduced, thus decreasing the intensity of the contradiction in the relations of production and, as a consequence, the possibility of class struggle. While the basic contradiction between labour and capitalism remains in capitalist appropriation of the surplus in the

production process, the intensity of this contradiction is significantly reduced if the surplus is not entirely labour's but also nature's. Thus labour does not experience exploitation to the extent Marx predicted. In fact, in the developed nations, increased industrial productivity made possible by the use of modern industrial production has contributed substantially to increased labour wages. This explains the lessened need for struggle and revolution.

The capitalist restructuring of labour-intensive production, as a response to increased labour costs, has been a characteristic of modern capitalist development. The changing nature of the reproduction patterns in the developed capitalist nations based on increased exploitation of nature is expressed thus by Frank Beckenbach:

... it is possible for capitalist firms to increase their rate of profit by (in relation to sales volume) making use of these reproduction patterns. However this requires investment spending (in the use of chemical processes, electronic control media, the energy system, and roads, for example). Hence, the exploitation of human beings is manifested as an increase in the means of production, raw materials, and energy, for a given quantity of commodities, while the corresponding quantity of labour decreases ... This intensified exploitation of nature (outside the individual production process) and labour (inside the individual production process) is accompanied simultaneously by environmental pollution and unemployment.²³

In the developed countries there is a general tendency for technical innovation to replace labour with large requirements of non-human power. This labour-saving bias of capitalist development has led to labour being predominantly replaced by non-living energy sources. For example, 'labor did less than 1% of the work, as measured by horsepower-hours, done by the U.S. economy in 1980'.²⁴ Empirical analysis within the U.S. manufacturing sector between 1909 and 1981 shows that there is a close relationship between total energy use per worker-hour and labour productivity. A similar relationship between labour productivity and energy use per worker has been observed internationally.²⁵ From a biophysical perspective, Kaufmann observes that:

As non-living fuels become the predominant source of energy, the quantity of net energy available to an economy increased rapidly.

This allowed owners to subsidise human muscle with more energy. This increased labour productivity and increased the surplus value that could be produced from a day's work. Similarly as the supply of energy increased, energy was available to increase the length of the working day. From a biophysical perspective, fossil fuels do the large amounts of work needed to extract surplus value from workers.²⁶

Therefore the extraction of surplus value is a function of both labour and the non-human factors of production that augment labour in its productive activity. This relationship of surplus value and natural factors of production was highlighted by the French physiocrats, who regarded surplus value as a *gift of nature, a productive power of nature*. They argued that:

All surplus value ... depends on a given productivity of labour. If the productivity of labour were only developed to such a degree that a man's labour time was only sufficient to keep him alive to produce and reproduce his own means of subsistence, then there would be no surplus labour and no surplus value, and there would be absolutely no difference between the value of labour power and the value created by its use. The possibility of surplus is conditioned therefore by a certain degree of productivity, a productivity which enables labour power to reproduce more than its own value,²⁷ to produce in excess of the necessities required by its life processes.

From this perspective it becomes apparent that natural resources and non-human factors along with human labour govern the production of surplus value. Capitalist production in becoming more resource-intensive thus reduced its dependence upon labour in the extraction of surplus value. While labour cannot be totally replaced, new labour displacing technology such as artificial intelligence, robotics and computer automation will result in a still further reduced role for labour in production processes. Capitalism thus will be able to employ few workers with high wage levels, while still maintaining its productivity and profit margin. With a highly paid but reduced work-force in the production process the capitalist is thus able to mitigate the class conflict.

However a resource-intensive capitalist development only accelerates the depletion of high quality natural resources whilst its wastes damage ecological functions, which in turn affects the profit margin. This broader contradiction of capitalism with the natural

environment, which overshadows the contradiction in its relations of production is, as we have seen, overlooked in Marxist analysis of capitalism. In fact it is quite hard to contemplate the demise of capitalism as a result of a struggle between its relations of production if capitalism is deemed to have no material or environmental constraints. If it were not for the ecological crisis it would seem that capitalism had overcome the restrictions imposed on it by the contradictions in its relations of production.

As resource-intensive capitalism encounters material limits and degrades the environment, this implies that changing resource quality should affect the dialectic that governs the extraction of surplus value and therefore the dynamics of class struggle. Kaufmann observes this when he highlights the effects of changes in fuel quality on the intensity of class struggle in the United States. He states that:

Until the late 1960's and early 1970's, the energy input to the U.S. economy increased faster than the work-force. This enabled owners to subsidise each worker with more energy, increasing worker productivity. This permitted the socially defined minimum wage to rise along with production of surplus value. The ability to get a bigger slice from a growing pie tended to reduce the intensity of class struggle ... Over the last 15 years, the energy input to the U.S. economy stagnated, while the labour force continued to grow. This reduced the amount of energy available to subsidise each worker and therefore output per worker declined. Such declines tend to intensify class struggle because an increase in surplus value is possible only by reducing wage goods. The decline in real wages during the last 15 years may reflect redirections caused by declining resource quality.²⁸

Marx, by excluding nature from the dialectic process in the production of surplus value, did not express class struggle from this biophysical perspective. He thus did not anticipate capitalist restructuring whereby labour would lose its revolutionary momentum and the fact that the major capitalist contradiction would be in its relationship to nature and not labour. He also could not foresee the significance of social movements such as the Green movement in the advanced industrial core nations and the social struggles in the periphery that are far removed from the side-effects of industrial pollution, but nevertheless a factor in the global capitalist mode of production and exploitation. These social movements today pose a greater problem to capitalist advance than Marx's working class. In fact the

struggles of the working class in industrial societies for job protection tend to reinforce the central position of capitalist enterprises and industrial structures in modern society.

Thus the historic mission of the working class is - although not totally obsolete - certainly not central to the transition from capitalism to socialism. It is now evident that the working class alone possesses neither the revolutionary capacity nor the will to bring about the demise of capitalism. It is thus not surprising that prominent socialists such as Gorz and Bahro have lost faith in the revolutionary power of the working class.

This, however, does not imply that the working class has no role in the politics of post-capitalist transition. There will be increased industrial unrest as capitalism restructures to accommodate ecological reforms and, as a consequence, switches to the exploitation of labour. Ecological reforms under the liberal political ecology will have a direct bearing on the working class in the form of lost jobs and therefore will not only contribute to the division between the Labour movement and the Green movement, but also create tension in industrial relations. Capitalist restructuring under a far-reaching politics of ecological reform would cause mayhem in the labour sector. As Elkington states:

...in many cases, environmental controls result in lost profits, lost jobs and plant closures. A recent survey of 4000 U.S. chemical companies, for example, estimated that if they adopted the best practicable technology it would cost \$139 million, cutting profitability by about nine percent, causing four plant closures and destroying 251 jobs. If on the other hand, these companies were forced to go for the ultimate, in the form of best available technology, the cost would be around \$677 million, profits would be cut by a third, 20 plants would be forced to close and nearly 10,000 jobs would be lost.²⁹

These trends imply that there is an increased possibility of labour struggles and class conflict in light of the ecological reforms under liberal democratic state which operates within the capitalist mode of production. The social implications of environmental reforms are well expressed by Stretton:

If production is cut by unexpected shortages or by drastic restraints on pollution or high-energy industries, that will make for one range of social troubles; different troubles can be expected if underemployment is spread more evenly over the workforce. If energy-conserving policies turn the clock to more labour-intensive methods of production, the troubles will be different than those expected if new sources of energy are tapped and conservationist effort goes into intensive waste absorption and technical substitution. Any of these directions of change will set citizen against citizen in one way or the other ... To build better equalities into programs of environmental reform the only imaginable³⁰ equalisers and peacemakers are the political parties of the Left.

As capitalism will find it increasingly hard to exploit nature it will resort to practices that exploit labour in the core nations. Wherever this is not possible capitalist enterprises will move to the periphery, that is, to the poor nations of the South, where they can exploit both nature and cheap labour.

The major contradiction of capitalism lies in its relationship to possessors of natural resources that are vital to the production of surplus value. Since there is no one person who owns natural resources, the problem of natural resources will involve entire nation states, and the local populations which collectively own those resources.

Those nation states that have certain key raw materials and natural resources that are vital to the capitalist production will become important to the core capitalist nations. In cases where capitalist exploitation of the natural resources of these nations conflicts with the needs of the local population there will be increased anti-capitalist sentiments. Thus the capitalist demand for resources will create a contradiction between the capitalists and the owners of resources (nation states), the people of the nations in the periphery which supply the core capitalist nations with primary resources. The world economy will thus be dominated by the interests of capitalist nations whose production and consumption patterns depend on maintaining the supply of raw materials from these nations. As Raymond Williams expresses it:

This is shown most dramatically at the moment in the case of oil. But it is true also over a very wide range of necessary metals, of certain strategically important minerals and in certain cases even in food. We

can now reasonably say that the central issues of world history over the next twenty or thirty years are going to be the distribution and use of these resources ... already the struggles over the supply and price of oil, and of other commodities determine not only the functioning of the world economy but the key political relations between states.³¹

As Bahro envisioned it, the principle contradictions of capitalism are not in 'the institutionalised class struggle' within the developed countries; rather the struggle has shifted from the workplace to the world stage. He thus observes that:

We can no longer behave as if the fate of us all depended on the outcome of domestic class struggles over wage levels, or on what party is dominant in the state. The tremendous contradictions on the North-South and East-West axes, which are inseparably bound together, overspill this context.³²

With the end of East-West political rivalry, the only remaining contradiction facing capitalism lies in the North-South divide. As it stands, capitalism will resort to peaceful means of ensuring supply of resources by increased free trade agreements wherever possible. In extreme cases, it will resort to new forms of imperialism, presenting the nations that refuse to cooperate in the international market as enemies of capitalism. As Enzensberger observes:

Imperialism will do everything to incite the population of industrialised countries against such apparent external enemies whose policy will be presented as a direct threat to their standard of living and to their very survival, in order to win their assent to military operations.³³

Almost sixteen years after it was written, this prophetic statement from Enzensberger materialised in the Gulf war - which was an ecological disaster on a massive scale. The so-called "New World Order" to justify this event, viewed from Enzensberger's perspective, only sets a precedent to the new international disorder that is to follow.

Endnotes:

- ¹ Deleage, *op. cit.*, pp. 15-31.
- ² J. O'Connor (1989b), "Political Economy of Ecology of Socialism and Capitalism", *Capital, Nature, Socialism*, 3, pp. 93-107.
- ³ J.K. Galbraith (1967), *The New Industrial State*, Hamish Hamilton/Penguin, Harmondsworth (Eng.), p. 108.
- ⁴ T. Roszak (1981), *Person/Planet: The Creative Disintegration of Industrial Society*, Granada, London, p. 325.
- ⁵ T.W. Luke (1983), "Notes for a De-constructionist Ecology", *New Political Science*, 11, pp. 21-32.
- ⁶ D. Pepper (1985), "Determinism, Idealism and the Politics of Environmentalism - A Viewpoint", *International Journal of Environmental Studies*, 26, pp. 11-19.
- ⁷ *ibid.*, p. 19.
- ⁸ Williams, *op. cit.*, p. 13.
- ⁹ Bell, *op. cit.*, pp. 295-306.
- ¹⁰ Pepper, *op. cit.*, p. 16.
- ¹¹ J. O'Connor (1989a), *op. cit.*, pp. 5-14.
- ¹² Deleage, *op. cit.*, p. 25.
- ¹³ Bell, *op. cit.*, p. 6; Ophuls, *op. cit.*, p. 186; Stretton, *op. cit.*, p. 6.
- ¹⁴ N. Singh (1976), *Economics and the Crisis of Ecology*, Oxford University Press, New Delhi, pp. 26-27.
- ¹⁵ A. Harriss (1983), "Radical Economics and Natural Resources", *International Journal of Environmental Studies*, 21, pp. 45-53.
- ¹⁶ J. O'Connor (1989b), *op. cit.*, p. 102.
- ¹⁷ *ibid.*, p. 103.
- ¹⁸ Bell, *op. cit.*, p. 6.
- ¹⁹ K.J. Walker (1985), "Economic Growth and Environmental Management: The Dilemma of the State", Paper for The 27th Conference of the Australian Political Studies Association, Adelaide, August 28th-30th, pp. 1-14.
- ²⁰ Eckersley, *op. cit.*, pp. 18-25.
- ²¹ Redclift (1984), *op. cit.*, p. 47.
- ²² Redclift (1987), *op. cit.*, p. 159.
- ²³ F. Beckenbach (1989), "Social Costs in Modern Capitalism", *Capitalism, Nature, Socialism*, 3, pp. 72-91.

²⁴ C.A.S. Hall, C.J. Cleveland and R. Kaufmann (1986), *Energy and Resource Quality: The Ecology of Economic Processes*, Wiley-Interscience, New York, p. 577.

²⁵ Kaufmann, *op. cit.*, pp. 91-105.

²⁶ *ibid.*, p. 96.

²⁷ Marx (1951 ed.), *op. cit.*, p. 48.

²⁸ Kaufmann, *op. cit.*, p. 100.

²⁹ J. Elkington (1987), *The Green Capitalists*, Gollancz, London, p. 210.

³⁰ Stretton, *op. cit.*, p. 13.

³¹ Williams, *op. cit.*, p. 17.

³² Bahro, *op. cit.*, p. 20.

³³ Enzensberger, *op. cit.*, pp. 3-32.

5. CONCLUSION

This thesis has argued that nature, like labour, is a central factor in the generation of economic surplus value. This centrality of nature was overlooked not only in classical and Marxist political economies but also in standard neoclassical economic theories. To classical political economy, labour was the sole contributor to surplus value. Labour thus became the focus of economic activity. Human progress was seen as residing in the way in which labour was organised in extended production. Nature featured as an external factor that augmented labour in the economic process.

Thus political economy externalised nature from social production processes. This orientation towards nature as a factor external to social production processes is due to the strong influence of Newtonian science in the development of political economy. Modern scientific production has a mechanistic concept of nature in which, external nature is capable of systematic manipulation. The treatment of nature as a peripheral factor to economic activity has consequently led to a situation where the biophysical aspects of production have been routinely overlooked.

Thus the ecological implications of political/economic developments are not interpreted within the framework of the social mode of production that governs our lives. This thesis has argued that the ecological crisis is a crisis of production; a crisis central to political economy and only amenable to understanding within this context.

This is why it is now impossible to separate political/economic and environmental issues. For example the classical economic concern about the consequences of the Malthusian population law and Ricardian *diminishing returns* on long-run economic growth need to be seen as environmental issues. Similarly, the notion of a steady-state economy proposed by biophysical economists parallels the ideas of classical political economists such as Adam

Smith, David Ricardo and John Stuart Mill, all of whom had argued that society must ultimately settle down to a stationary-state. It was the publication of *The Population bomb* and the Club of Rome Report, *The Limits to Growth* in the early 1970s¹, that essentially rekindled the classical political economic concerns. The reports, however, were not prepared by political economists but by systems analysts and natural scientists who argued that the increasing levels of material well-being experienced by the rich industrial nations would not be possible for all nations in the long-run because of the constraints the natural environment placed on economic growth.

The vital importance of nature to international political economy is bound to become more apparent as the natural environment becomes more and more impoverished under the current capitalist mode of production. Within this mode of production there is an extremely unequal pattern of resource use, such that the industrialised nations with high GNPs consume the majority of the world's resources compared to the less developed nations. Countries with a high standard of living and an industrial infrastructure require the continued availability of resources at high levels to maintain their economies. As resources become scarce or degraded and the newly industrialised nations emulate the traditionally accepted form of economic development based on increasing GNP and industrialisation, they will place an increased demand on world resources. Issues of natural resources are likely then to become potentially explosive, and competition and resource wars may come to dominate the international political arena; the concept of "eco-wars" would then be characteristic of military and national security issues. The threat of war under present ecological realities and its implications for existing concepts of security and defence is described thus by Prins and Stamp:

degradation of the natural environment of which we are a component part and upon which we are wholly dependent, will become a source of conflict in the old fashioned sense, as groups of people fight eco-wars for control of natural resources.²

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Similarly, Myers argues that the notion of national security in the traditional sense of military capability has to be broadened to incorporate key factors of environmental stability on which our material welfare depends. He states that if:

a nation's environmental foundations are depleted, its economy will steadily decline, its social fabric deteriorate, and its political structure become destabilised. The outcome is all too likely to be conflict, whether conflict in the form of disorder and insurrection within the nation, or tension and hostilities with other nations.³

Myers gives instances of intra-national agricultural-based conflicts in nations such as Ethiopia, the Philippines, Bangladesh and Egypt. He further notes that factors such as inequitable distribution of farmland, poor agricultural practices and population growth contribute to the crisis. On a broader international scale Myers illustrates instances of hostilities between nations over fish stocks in North Atlantic Regions, the North-South clash over the Third Law of the Sea as developing nations claim a right to deep sea minerals and over water supplies in the Middle East and famous river basin areas such as the Indus, Ganges, Nile, Mekong, Euphratus/Tigris and Rio de la Plata.

But perhaps the most strategic natural resource, essential to developed industrial capitalist nations, is oil. Barry Commoner argues in *The Poverty of Power* that the world's most dangerous political issue involves the energy crisis 'as it wrenches back into open view the brutality of national competition for resources, the festering issues of economic and social injustice and the tragic absurdity of modern war'.⁴

There are basically three different strands of economic thought that underpin the use of natural resources, as identified by Piers Blaikie.⁵ These are the subjective preference (neo-classical) school, the cost-of-production (neo-Ricardian) school and the abstract Labour (Marxist) school.

In relation to resources the neoclassicals adopt the view that there is no global crisis of capitalism, but mere local crises brought about by natural disasters and inefficient policies

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of national governments. The neoclassical perspective primarily argues that the operation of the free market without government interference and regulation ensures optimum resource use, and that a properly functioning price mechanism would remedy the ecological problems arising as a consequence of inappropriate patterns of economic activity. According to this view, then, ecological problems are not a consequence of economic growth or the level of economic activity *per se*, and they can be eliminated by the use of market based fiscal policies.

From a biophysical perspective however, it is obvious that, while inappropriate patterns of economic activity aggravate the crisis, the main factor that constitutes ecological crisis is the *level* of economic activity. No doubt market-based policies can mitigate the crisis to some extent, but this is only a partial solution. Long-term solutions for ecological crises lie in the cessation of economic growth and a decrease in the overall level of economic activity. In 1969, the economists Ayres and Kneese⁶ drew attention to the *materials balance principle* which states that the mass of resource flows from the environment into the economic system equals the mass of pollution and waste residuals produced in the process as final goods ultimately enter the waste stream after their lifetime and use. In cases of an economy undergoing stock or capital accumulation the production of residuals would be less than the basic inputs by the amount that is accumulated. Thus pollution or 'production of residuals is an inherent part of the production and consumption process'.⁷ This principle is not fully appreciated by the neoclassical school. The belief that the price mechanism can solve pollution and resource degradation, and that the level of economic activity does not have ecological consequences, is thus a delusion. Georgescu-Roegen observes that, given:

the entropic nature of the economic process, waste is an output just as unavoidable as the input of natural resources. "Bigger and better" motorcycles, automobiles, jet planes, refrigerators, etc., necessarily cause not only "bigger and better" depletion of natural resources but also "bigger and better" pollution. But by now, economists can no longer ignore the existence of pollution. They even have suddenly discovered that they "actually have something important to say to the world", namely that if prices are right there is no pollution - which is another facet of the economists' myth about prices.⁸

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The cost-of-production or the neo-Ricardian perspective, in contrast to neoclassical thought, insists that the market is too rigid to allow the less developed nations to achieve sustained economic growth. It suggests that for many less developed countries there is a need for "a critical minimum effort" such as the injection of foreign aid, institutional adjustments to trade and tariffs, promotion of improved technology and capital investments so that development may be achieved. The policies that were adopted at national and international levels after the 1980 Brandt Commission recommendations⁹ are examples of the neo-Ricardian concept of development and crisis elimination. The neo-Ricardian school argue that economic growth in the less developed nations would result in an increased demand for industrial goods produced by the developed nations. The global crisis in the Brandt Commission's view was the failure of demand in the poor nations of the South which contributed to the industrial recession in the developed nations. With hindsight it can be said that the neo-Ricardian approach to global crisis resolution seems to have achieved little success. The social and economic situation since 1980 has worsened, particularly the debt crisis which afflicts the majority of the populations in the impoverished Third World.

This thesis takes the perspective of abstract labour or the Marxist school of thought, which argues that the development of capitalism and the contradictions in its relations of production are the ultimate cause of the world crisis. World capitalism, which manifests itself in the market-driven economies of the advanced industrial nations and which extends into the global periphery through multinational corporations, banks and the foreign policies of neo-imperialist nations, is the cause of the crisis in the South, and the cause of the global ecological crisis.

However this thesis maintains that the ecological crisis cannot be overcome merely by abolishing the contradictions in the relations of production. Though the achievement of socialism would be a major part of the solution, it is not a sufficient one, as the biophysical perspective shows that a growth-oriented socialist production would also be anti-ecological.

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Unlimited growth in production, whether socialist or capitalist, will inevitably encounter material limits and degrade the natural environment.

The integration of biophysical economics and labour theory derived from Marx's historical materialism, shows that economic surplus is constituted by both labour and nature. Capitalism therefore, in appropriating this surplus, appropriates value that is founded upon the exploitation of these two factors. Marx's historical materialism portends the development of capitalism in its social dimensions only. It derives its conclusions from an analysis which accords an exclusively labour component within surplus value. This is the fundamental flaw in Marx's account of capitalist development and accounts for the failure of the proletariat as the agents of revolution. This factor also contributed to Marx's failure to foresee the ecological crisis that threatens the advance of capitalism today.

The basis of capitalist appropriation therefore resides in two factors, labour and nature, both of which it exploits for profit. In labour-intensive production capitalism exploits labour more than nature. Where this exploitation is predominantly of labour, social movements arise to protect the welfare of the working class. As a result, capital restructures to a less labour-intensive, more resource-intensive production as it attempts to reduce the role of labour in production. The increased use of non-human factors of production to maintain the profit margin means that production becomes increasingly resource-intensive and as a consequence anti-ecological as it depletes and pollutes the natural environment. This increased appropriation of nature in capitalist production affects the welfare of society, contributing to the growth of social movements such as environmentalism in the industrial nations and in the South various movements of struggle against the appropriation of land and resources by capitalist development processes. Thus the labour and environment movements are different aspects of capitalist appropriation.

I have argued that capitalism is able to adjust to the demands of labour and nature to maintain its profit margin. This to a large extent has masked its inherent contradictions.

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Consequently, it has been remarkably effective in reducing class-contradiction by reducing the role of labour in production and by introducing labour-saving technologies. Increased productivity without a corresponding increase in labour, results in higher wages, far in excess of bare subsistence, as forecast by Marx. This has the overall effect of mitigating class-conflict. The tendency to labour-saving within the industrial sector has been noted by authors such as John Kenneth Galbraith in *The New Industrial State* and Barry Jones in *Sleepers Awake: Technology and the Future of Work*.¹⁰ It implies that the working class will not be the central factor in the demise of capitalism; rather the capitalist future is most threatened by the availability of natural resources and their accessibility. Already, capitalism views the natural resources existing within national boundaries as global rather than national heritage. For example, Prins and Stamp observe that the United States, the torch-bearer of market capitalism, whilst refusing to change the structure of its own economic system, insists upon:

a principled "right" of access to the world's natural resources at prices of one's own choosing ... It has meant, in 1991 resorting to violence. In the light of the Gulf Crisis of 1990-91, energy policy based upon the "right of access" to other countries' natural resources is very much in people's minds.¹¹

Capitalism's broader contradiction with nature means that it will stalk the planet for natural resources to generate profits. In the process it will face opposition from resource-rich nations or their people who collectively possess the resources which are vital for capitalism's survival.

Although it has been argued that the working class will not be central in capitalism's collapse, this is not to imply that it is obsolete or that there is no contradiction in the relations of production. From the perspective of this thesis it follows that, as liberal political ecology increases the pressure on capitalism to rationalise its abuse of nature, its reforms will bear adversely on labour. Market-based environmental reforms will generally increase the cost of production and thus reduce the profit margin, as pollution control mechanisms and the pricing of traditionally free natural resources make production more

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capital-intensive. This will result in an exploitative rationalisation of labour to maintain profits and the likelihood of industrial tensions.

Thus liberal political ecology operating within the capitalist mode of production will resort to policies that will adversely affect labour welfare. The labour sector will regard the environment movement as its enemy, an unfortunate circumstance as it has been argued that these movements, given the nature of their relationship, should be allies rather than adversaries.

In the capitalist mode of production, the workers are alienated from the factors of production. Their only means of livelihood is their labour which they sell to the capitalists. Therefore in an alienated social structure the workers are solely dependent on the capitalists for employment. Unless there is a substantial change in the present social structure the workers will continue to fiercely resist any tendencies that contribute to unemployment. Liberal political ecology which does not confront the issues of alienation and distributive justice directly contradicts the welfare of the working class. From this perspective the working class in the advanced industrial nations is in the same circumstances as the poor in the South who are afflicted by extreme poverty; that is, the immediate welfare concerning personal livelihood overrides the issues concerning mankind and the planet. To mobilise popular ecological action from the poor requires radical reforms of current social structures. Only an adequate guarantee of just welfare for all sectors of society will provide the basis of an ecologically sensitive popular mass action. The emancipation of nature lies in the emancipation of humanity.

This is why the eco-socialist version of environmentalism is progressive - distributive justice is inherent to its concern. Socialism however must come to terms with the fact that its ideology of unlimited production for overcoming poverty is flawed in a materially finite world. Bell notes that the 'most promising socialist transitional strategy to date offers the possibility of a post-capitalist society but not a post-growth or a post-materialist society' as

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socialism's orthodoxy fails to comprehend the ecological implications of its growth-oriented ideology.¹²

In the post Cold-War world, the capitalist system is enjoying an unprecedented period of expansion throughout the globe. The only viable opposition to this capitalist hegemony will come from the Left and popular struggles of the underprivileged masses in the South. Redclift argues, for example, that environmentalism in the South is a struggle to 'retain control over the natural environment often in the face of opposition from development agencies and governments'.¹³ Similarly Paul Ekins has documented the proliferation of popular organisations and activities which provide an alternative to the Western concept of development.¹⁴ The conclusion about the failure of the industrial working class as a revolutionary agent and the broader contradiction of capitalism in the resource rich South concurs with Herbert Marcuse's observation in *Re-examination of the Concept of Revolution*, in which he argues that the Marxist concept of revolution must be rethought from a global perspective. He states that the:

revolutionary proletariat becomes an agent of change where it still is the human basis of the social process of production, namely, in the predominantly agrarian areas of the Third World, where it provides the popular support for the national liberation fronts ... these areas and forces are not external to the capitalist system. They are an essential part of its global space of exploitation.¹⁵

The environmental crisis, like the food crisis, is a consequence of the political economic structures of the world, and its resolution thus lies in radical changes to these structures that prohibit the mobilisation of the solution to the crisis even where there exists the technical capacity to afford such an undertaking. Under the present mode of production most of the crises are economically and politically sustained. For instance, Erik Eckholm notes that if the world's environment is properly managed it can indefinitely and abundantly provide for the whole of humanity's needs. He points out that 'the persistent undernourishment of some 500 million people today does not stem from a global scarcity of resources: even as tens and

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thousands of babies die each day from diseases exacerbated by malnutrition, over one-third of the world's grain is fed to livestock to supply the meat-rich diet of the affluent'.¹⁶

Furthermore the rich industrial nations of the earth have utilised a large part of their manpower, capital and the world's natural resources in the construction of the Military Industrial Complex which profits from destruction. The military Keynesianism of the present world order drains the world of much needed resources to combat global problems. It is estimated that the diversion of a 'mere 10 percent of the world's military budget into constructive activities' would eliminate many of the problems of our planet.¹⁷

Such global crises as hunger and population are further exacerbated by the unequal distribution of land under the present political/economic system. These crises eventually have environmental implications. The 1960 land census conducted by the FAO reveals that 'a mere 2.5 percent of landowners with holdings of more than 100 hectares control nearly three quarters of all the land in the world - with the top 0.23 percent controlling over half'.¹⁸ These figures on land distribution, the realities of the food crisis, and the resources diverted to military activities reveal to some degree the potential for abundance that is possible for humanity, a potential that cannot be realised under the capitalist mode of production.

The future does not look optimistic as capitalism fatally embraces the world. Tomorrow's world will survive on new forms of exploitation of the Third World, labour and the natural environment. Humanity will live in a constant fear of wars, revolutions and exploitation. The solution was provided by Marx who summarised the choice as - socialism or barbarism.

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Endnotes:

- ¹ Ehrlich, *op. cit.*; Meadows *et. al. op. cit.*
- ² G. Prins and R. Stamp (1991), *Top Guns and Toxic Whales: The Environment and Global Security*, Earthscan Publications Ltd., London, p. 11.
- ³ N. Myers (1986), "The Environmental Dimension to Security Issues", *The Environmentalist*, 6:4, pp. 251-257.
- ⁴ Commoner, *op. cit.*, pp. 4-5.
- ⁵ P. Blaikie (1989), "The Use of Natural Resources in Developing and Developed Countries", in R.J. Johnston and P.J. Taylor (eds.), *A World in Crisis?*, Basil Blackwell, Oxford, pp. 125-150.
- ⁶ R.U. Ayres and A.V. Kneese (1969), "Production, Consumption, and Externalities", *American Economic Review*, 59, pp. 282-297.
- ⁷ *ibid.*, p. 295.
- ⁸ Georgescu-Roegen (1975), *op. cit.*, pp. 164-174.
- ⁹ Brandt Commission (1980), *North-South: A Programme for Survival*, Pan Books, London.
- ¹⁰ Galbraith, *op. cit.*; B. Jones (1982), *Sleepers Awake: Technology and the Future of Work*, Oxford University Press, Melbourne.
- ¹¹ Prins and Stamp, *op. cit.*, p. 84.
- ¹² Bell, *op. cit.*, pp. 295-306.
- ¹³ Redclift (1987), *op. cit.*, p. 170.
- ¹⁴ P. Ekins (1992), *A New World Order: Grassroots Movements for Global Change*, Routledge, London.
- ¹⁵ H. Marcuse (1970), "Re-examination of the Concept of Revolution", in A. Lothstein (ed.), *All We Are Saying The Philosophy of the New Left*, G.P. Putnam's Sons, New York, pp. 273-282.
- ¹⁶ E. Eckholm quoted in N. Myers (1985), *The Gaia Atlas of Planet Management*, Pan Books, London, p. 22.
- ¹⁷ Myers (1985), *op. cit.*, p. 246.
- ¹⁸ Cited in S. George (1976), *How the Other Half Dies: The Real Reasons for World Hunger*, Penguin, Harmondsworth (Eng.), p. 58.

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