POLITICAL ECOLOGICAL ECONOMICS:[1] AN EMERGING TRANSDISCIPLINARY APPROACH TO SUSTAINABILITY

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Abstract
Serious attempts to come to terms with the issues underlying the current environmental crisis is calling into question some very basic assumptions within the mainstream traditions of economics and development. This article explores some of the insights which are arising from a combination of the fields of ecological economics and political ecology. The aim in combining these two fields is to facilitate an inquiry into the political processes and institutions involved in questions of unequal ecological flows and distribution.

INTRODUCTION

> *"You claim that greater prosperity is the best way to improve the environment. On what economy's performance in what millennium do you base this conclusion?...To claim that a massive increase in global production and consumption will be good for the environment is preposterous. The audacity to make such a claim with a straight face accounts for much of the heated opposition to the World Trade Organisation."*
>
> Thilo Bode, Executive Director of Greenpeace[2]

There is a growing consensus that the conventional model of development, based largely on principles from neo-classical economics, is leading humanity down a dangerously unsustainable path. While it has certainly produced some marked successes, such as rapid economic growth, advanced technological progress, and increased levels of consumption, inequality between nations has reached

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[1]This title reflects the combination of the fields of political ecology and ecological economics.

[2] Written in a letter to *The Economists* December 11, 1999, after the formation of the WTO in Seattle. Quoted in Martinez-Alier 2002: 16.

historically unprecedented levels (UNDP 1998). Statistical evidence has shown that poverty, hunger and disease have persisted or got worse in many countries, while the basic needs and rights of women, indigenous people and small farmers are often not being met or, worse yet, are being threatened by development (Shiva 1989, Sachs 1993, Sutcliffe 1995). At the same time, more energy and materials have been consumed during the last half a century than in the whole preceding history of humanity (Altvater 1993). While a few people have attained material abundance through industrialisation and economic growth, resource depletion and environmental degradation now pose an immediate threat to many, and affect the future of us all (Costanza et al. 1997, Rees 1999).

Serious attempts to come to terms with the issues underlying the current environmental crisis is calling into question some very basic assumptions within the mainstream traditions of economics and development. This article will explore some of the insights which are arising from a combination of the fields of ecological economics and political ecology. Ecological economics examines the physical flows of materials and energy that bind the economy and ecosystems.[3] It combines an understanding of thermodynamics with complex systems theory and systems ecology (Costanza et al. 1997). Political ecology, which originates in geography and anthropology, emphasises the structural conflicts between society and the environment. As its name suggests, politics and power dynamics are of central importance (Bryant 1997). The aim in combining the two is to facilitate an inquiry into the political processes and institutions involved in questions of unequal ecological flows and distribution. Before moving into the main focus of the inquiry, the investigation will begin with a brief look at the mainstream approach to solving the environment-development dilemma.

SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL ECONOMICS

Whereas environmental problems were once commonly believed to be solvable in isolation from social issues, the concept of sustainable development introduced a new quest for reconciling environmental and social concerns with economic growth. The concept of sustainable development was popularised in 1987 by the influential Brundtland Report (World Commission on Environment and Development 1987). For the first time, a strong link was made between eradicating poverty and achieving environmental sustainability. In the report, it was pointed

[3]It should be noted that the field of ecological economics is conceptually pluralistic. The perspective presented here is based on the assumption that ecological studies must be grounded in biophysical assessments.

out that poor people are often forced to destroy their immediate environment in order to survive. This is what Martinez-Alier (1990) refers to as the "too poor to be green" perspective. Poverty and pressure of population on resources were consequently pointed to as the main problems related to environmental degradation. Unfortunately, the report did not go so far as to inquire into the political or economic interests which may cause or perpetuate poverty. Nor did it include the fact that many environmental conflicts actually involve poor people defending the environment and their livelihoods against encroaching economic forces (Martinez-Alier 2002). Rather, the view put forward regarded poverty as an "original state of being" and, as such, economic growth was turned to as the main answer to help the poor out of "their" predicament (Bryant 1997: 6).

At the same time, however, the Brundtland report did acknowledge that much economic activity as currently conducted was having negative environmental consequences. The problems identified were basically the same as those previously named by environmental critiques of development, such as in the *Limits to Growth* report (Meadows 1972). Both reports agreed that economic activity was causing pollution, using up scarce resources, disturbing ecosystems and destroying habitats. The point of disagreement, however, was what the ultimate cause of these problems was.

From the perspective of neo-classical economic theory, environmental problems are seen to arise not as a result of economic growth *per se*, but rather due to the fact that many environmental goods are provided for free, and therefore more of them is demanded than if they had to paid for (Pearce in Hayward 1995: 90). The outcome of this overuse results in external environmental or social costs which are imposed on third parties. This is what environmental economists term "externalities". The solution, from an environmental economics perspectives, is to correct prices by calculating the market value or "shadow price" of these environmental costs and benefits, and then bring them back within the market by raising prices of damaging activities through taxes, charges, tradable permits and so on (Jacobs 1997: 371). Using a single measure of monetary value, costs and benefits can then be compared to one another. Then, assuming that prices have been correctly calculated, total environmental damage will be reduced to the point at which marginal costs equal marginal benefits.

While this argument reveals some important deficiencies in conventional economics, some are still not convinced that environmental concerns can be sufficiently addressed through the market mechanism. This is particularly the opinion among many ecological economists (e.g. Altvater 1993, Røpke 1999,

Rees 1998, Martinez-Alier and O'Connor 1996). In addition to critiques concerning practical problems with pricing externalities[4] or more fundamental questions of whether all things can or should be valued in money terms,[5] ecological economists argue from a more scientific nature that mainstream economic approaches have failed to understand the physical dimensions of ecological problems.

THERMODYNAMICS AND THE ECONOMIC PROCESS

Up until the recent rise of ecological economics, the sustainability concept has been largely restricted to economic criteria. By contrast, ecological economics examines the physical aspects of material and energy flows from nature, through the economy, and back to nature in degraded form. These material and energy flows are essential for all production and consumption, and often determine the actual ecological and social impacts resulting from economic activities (Georgescu Roegen 1971, Daly 1996, Rees 1999). Yet these vital flows are completely invisible to conventional economic analysis.

Ecological economics therefore begins with a conceptual model that sees the economy connected to and sustained by a flow of energy, materials and ecosystem services. This is in contrast to conventional economics which views the economy as an isolated and self-sustaining system which remains largely unconstrained by the physical environment (Rees 1999). To help understand the ecological economics perspective, an analogy can be made to the biological concept of metabolism, whereby all living systems maintain themselves by continuously consuming a flow of materials and energy from their environment and discharging the corresponding wastes. In the same way, industrial metabolism and human social systems maintain themselves by converting raw materials into manufactured products and services and discharging the wastes (Fischer-Kowalski et al. 1998).

[4] For example, how does one measure the cost of health impairing pollution? If, for example, it is based on lost earnings from sickness and death, does it make sense to pollute in countries with the lowest wages? How can the cost of things we don't even know about be measured? Consider that it was only relatively recently that the importance of the ozone layer was first recognised. How can an interdependent ecosystem be divided into individual pieces which can be measured in price? (See Rees 1999, Røpke 1999, Jacobs 1997, Martinez-Alier 1994, Mayumi and Gowdy 1999 for further discussion.).

[5] It has been pointed out that if all things are reduced to their market value, then the activities and processes that are not monetised or don't involve cash transactions get undervalued. What is, for example, the value of security, beauty, traditions, or community?

What then becomes evident from a thermodynamic perspective are the unidirectional and irreversible flows which are taking place.

To explain briefly in thermodynamic terms, the First Law of Thermodynamics says that matter and energy can neither be created nor destroyed. This means that in any physical transformation, the quantity of raw materials and energy taken from nature must be equal to the quantity of the waste materials ultimately returned to nature. What this means, in terms of economic processes, is that all resources extracted from the environment must eventually become unwanted wastes and pollutants (Ayres 1998: 190). While recycling helps to reduce waste, it also requires fresh inputs of energy, and in the final end still leaves a residue of unusable waste. Moving on to the Second Law of Thermodynamics, it says that while the quantity of energy will remain constant in an isolated or closed system, the energy will tend to dissipate into less useful forms with every physical action or transformation (Ayres 1998: 190). In other words, while the quantity of energy remains the same before and after a physical transformation, there is a qualitative difference in it. This difference is measured in terms of "entropy". Putting the two laws together, in any physical transformation, energy and matter are transformed from a state of highly concentrated and easily available resources into a state of highly dispersed and non-available wastes. What gets used up are "low entropy" useful materials, such as fossil fuels or high grade metal ores which are dispersed to unusable concentrations over time. What accumulates are other generally harmful materials, such as waste products, mine tailings, or thermal pollution (Rees 1999: 31).

The problem, in terms of sustainability, is that there are limits on the availability of environmental resources and, more significantly, on the absorption capacity of the biosphere. In order for an economy to be ecologically sustainable, when it has reached the systemic limits of the biosphere, flow rates must be held constant (Rees 1999). Signs of stress on the environment, such as loss of top soil, contamination of surface waters and oceans, acid rain, the hole in the ozone layer, and global warming, strongly suggest that this point has already been reached. If this is the case, there must now be a limit on the rate of throughput of energy and matter, and therefore a limit on the rate of material production and consumption in order to achieve sustainable ecological processes (Altvater 1998: 30-31). From this perspective, if the current structure of economic growth is maintained, the existing ecological crises can be expected to get worse.[6]

[6] While many environmental economists and industrial ecologists emphasise the potential for dematerialising the economy through more eco-efficient production processes, this is not actually occurring, despite gains in efficiency. This is because the environmental load of the economy is

This thermodynamic critique has serious implications for the conventional model of development which relies on economic growth, in both the North and South, as the only practical means to alleviate poverty, address material inequalities between countries, and provide resources for addressing environmental problems. It also brings up the question of distribution between countries in a quite different way since, in the face of biophysical limits, the overconsumption of environmental resources and services by one party must necessarily be compensated by the underconsumption by another party, if the world is to maintain some degree of ecological stability (Rees 1999, Sachs 1999). Furthermore, if limited access to resources is a cause of poverty, the environmental overconsumption of the rich has an enormous effect on the potential for the poor to achieve sustainable development. When questions of distribution and access to natural resources and services are linked to social structures and questions of power, ecological economics enters the field of political ecology (Martinez-Alier 2002).

ECOLOGICAL DISTRIBUTION AND UNEQUAL EXCHANGE

An understanding of biophysical limits reveals the importance of reducing the throughput of matter and energy in order to achieve ecological sustainability. However, ecological limits are still only half of the story. This becomes clear when one considers, for example, the fact that the advanced industrialised countries use an enormous amount of non-renewable forms of energy in food systems alone, compared with its use for *all purposes* in poor countries; yet it is only a small proportion of the total amount of non-renewable energy used by rich countries (Martinez-Alier 1987: 247). The 20/80 "rule of thumb" captures, in a nut shell, the huge geographical differences in the use of natural resources and services in the world; that is, 20% of the world's population uses 80% of its resources (Sachs et al. 1998: x). Moreover, at present, the wealthy 25% of humanity living in OECD countries can be seen to require a biologically productive space, to produce the resources it consumes and to absorb the corresponding wastes it generates, equal to the entire biologically productive surface area of the earth (Wackernagel and Rees 1996). This means that whole

determined not only by production but also by consumption, which is not diminishing on a world scale (Martinez-Alier 2002). Moreover, spontaneous efficiency gains in the economy have been shown to increase profits or lower prices, both of which lead to increased consumption and accelerated resource depletion (Rees 1999: 45).

countries survive by appropriating the carrying capacity[7] of an area of land vastly larger than their own physical territories (Ibid.; Rees 1999). As a way of visualising this, Wackernagel and Rees predict that if all people were to live like North Americans, three planets would be required to produce the required resources, absorb the wastes, and otherwise maintain life-support.[8] Such statistics give an idea of both ecological limits and North-South inequalities. Furthermore, they suggest that economic activity is dependent not only on physical materials and energy, but also on social and political organisation in order to acquire and transform these resources.

Various critiques are now suggesting that international trade may be providing the means by which advanced industrialised nations are able to import sustainability from poorer Southern countries (Rees 1992, Satterthwaite 1999, Røpke 1994). This is because if environmentally intensive goods can be imported, then the importing region may be able to improve its local environmental standards at the expense of environmental degradation elsewhere. Muradian and Martinez-Alier (2001) point out that this relationship between free trade and the environment is one of the main areas of disagreement between environmental economics and ecological economics.

One reason for this disagreement can be found in the very different results which are obtained depending on whether monetary or physical units are used for measuring. Recent studies are showing that while trade between two countries may be shown to be balanced in conventional monetary terms, these same trading arrangements can be shown to be very unequal in terms of environmental inputs and outputs (Giljum 2001, Giljum and Hubacek 2001, Muradian et al. 2001b). By thinking in terms of flows of energy and materials rather than national monetary trade statistics, the material realities of North-South relations becomes much more explicit. For example, if monetary units are used to compare imports and exports, the European Union can be shown to have more or less balanced trade relations with the rest of the world. However, if physical units of weight are used to compare the imports and exports, the EU can be clearly shown to be a large net importer of materials and resources (Giljum and Hubacek 2001). Likewise

[7] Carrying capacity can be defined as the maximum rate of resource consumption and waste discharge that can be sustained indefinitely in a given region by a given population (Wackernagel and Rees 1996).

[8] This is based on ecological footprint analysis, which measures the amount of biologically productive space necessary for a given population to produce the resources it consumes and to absorb the corresponding wastes it generates. For a more in depth discussion of the method, see "Forum: The Ecological Footprint" in *Ecological Economics* 32(2000)3.

considering the production of pollution-intensive products, if monetary units are used, the EU can be shown to be a net exporter of pollution-intensive products in some years. However, if physical units are used, the EU always appears as a large net importer of these products (Muradian and Martinez-Alier 2001).

Seen from the perspective of conventional trade theory, this all makes some sense. Going back to conventional trade theory for a moment, a cornerstone of it is the "law" of comparative advantage, which states that a country will have a comparative advantage as long as the commodity which it "produces" requires locally abundant factors and few scarce factors (Muradian and Martinez-Alier 2001). At the core of the theory is the role of specialisation. Typically, the advanced industrialised countries of the North specialise in producing goods for internal consumption and export, while the less industrially developed countries, particularly in Africa and Latin America, specialise in particular extractive exports, and depend on importation of transformed commodities for their own consumption. According to the theory, as long as each country is trading what it can produce at a relatively lower cost to other things, then both sides of the trading arrangement will benefit. The problem however is that not all comparative advantages are equal.

A new theory of ecologically unequal exchange is now emerging which questions the gains from trade for exporters of natural resources. As such, it challenges the wisdom of the export-led development model, which is currently actively promoted by international institutions such as the World Bank and International Monetary Fund. By examining the net flows of energy and materials, new aspects regarding the differential costs and benefits to extractive and productive regions can be shown (Bunker 1985).

Previous arguments put forward in theories of imperialism, dependency, and unequal exchange based on wage or productivity differentials have all recognised primary material export as a defining characteristic of most forms of under development (Emmanuel 1972, Amin 1977). The approach of ecologically unequal exchange, however, extends these theories by taking into consideration the large environmental impact of the specialisation in the exports of natural resources (Sustainable Europe Research Institute 2001, Bunker 1985). Ecologically unequal exchange can be seen to stem from two sources: 1) the fact that local resources are sold cheaply or given away or health damaging substances are tolerated, not because of a lack of awareness but because of a lack of economic and social power in the exporting region; and 2) the fact that primary commodities produced for export from the South frequently take a much longer time to

regenerate than the rapidly manufactured products or services which they are traded for in the North (Martinez-Alier 2002: 214). The concept of ecologically unequal exchange is summed up well in the following:

> *By ecologically unequal exchange we mean the fact of exporting products from poor regions and countries, at prices which do not take into account the local externalities caused by these exports or the exhaustion of natural resources, in exchange for goods and services from richer regions. The concept focuses on the poverty and the lack of political power of the exporting region, to emphasise the idea of lack of alternative options, in terms of exporting other renewable goods with lower local impacts, or in terms of internalising the externalities in the prices of exports, or in terms of applying the precautionary principle to new export items produces with untested technologies.*
>
> (Ibid.: 214)

Seen from this perspective, the exploitation of resources and ecosystems, together with the exploitation of labour and unequal distribution of monetary wealth, must be considered as important factors affecting the potential for long-term regional development.

INTERNAL DYNAMICS OF EXTRACTION AND PRODUCTION

In one of the earliest studies of ecologically unequal exchange, Bunker (1985) emphasised the internal dynamics of extractive and productive social formations in order to demonstrate how extractive economies become impoverished through the export of their resources; while productive economies, which appropriate these resources for their industrial processes, develop economically and increase their power to ensure the continued flow of resources to them.[9] Part of his explanation focussed on the effect of space (Bunker 1985: 22-27). Bunker pointed out how productive enterprises are able to locate close to one another to benefit from shared infrastructure and labour forces. In this way, even when one enterprise collapses, the infrastructure remains for subsequent enterprises. In contrast, extractive processes must locate near the natural resource which they exploit, often far from other enterprises and existing demographic or economic centres. Therefore, they often require the development of new infrastructure for resource removal and transport, labour recruitment, shelter and so on. However, once the resource is depleted or no longer in demand, the infrastructure and labour force

[9] This study focussed on the history of the Brazilian Amazon Basin over 350 years.

established at these sites are no longer of any use. Consequently, social development in extractive regions tends to be discontinuous in time and space.

Another part of his explanation focussed on the dynamics of scale. Bunker pointed out how, in industrial systems, the unit cost of commodity production decreases as the scale of production increases (Ibid. 25). In this way, productive processes benefit from labour saving technology and the use of fossil fuels. In extractive economies, however, the more resource which is extracted, the more difficult and expensive it becomes to extract remaining supplies. Therefore unit cost tends to rise as the scale of extraction increases, and the amount of resource available for further extraction decreases. Eventually the increasing cost of extraction gives new locations or industrial substitutes a competitive advantage, seriously reducing or eliminating the original extractive enterprise.

Bunker also pointed out that extractive processes frequently entail a much lower ratio of both labour and capital to value than do productive processes (Ibid. 23). This means that the majority of value in an extractive economy is in the resource itself, and profit occurs in the exchange itself rather than in the sector. Therefore, while extractive processes may initially produce rapid rises in regional incomes, this may be followed by equally rapid collapses when the depletion of easily accessible resources requires additional inputs of labour and capital without corresponding increases in volume.

From this perspective, it becomes apparent how resources, which may take thousands of years to regenerate (if at all), are extracted and exported with little or none of the extracted materials or energy flowing through the extractive economy to be conserved in durable infrastructure, or embodied in complex social organisation.[10] In productive economies, on the other hand, imported materials and energy flow through the economy and create an accelerated energy flow which permits the development of specialised technical and social organisation, and allows for more powerful means of exploiting the energy in the environment. Bunker concludes that the hierarchies of power and control, associated with these developments, can be seen to have culminated in the present global market system.

[10]This is based on the understanding that matter both stores energy and can be converted to energy. While the conservation of energy and matter into more durable forms is most perceivable as physical infrastructure, at a more abstract level, it may also take the form of learning, complex social organisation, and technology (Bunker 1985: 45). Bunker points out that, while energy and matter cannot in themselves cause these development, they are a necessary prerequisite since none of these development can occur without the conversion of energy and matter (Ibid. 245)

MARKET INSTITUTION AND THE TRANSFER OF WEALTH

The theory of ecologically unequal exchange can go one step further and ask why market prices and the market mechanism have not provided a fair and reciprocal exchange. From the perspective of standard economic theory, the problem is seen to lie in the existence of incomplete markets, and the need for establishing property rights (Martinez-Alier 2002). Bunker and other "political ecological economists", however, emphasise the issue of power. It seems quite evident that those suffering unfavourable rates of exchange are likely to have less power, and that such unfavourable rates of exchange will, in turn, tend to enhance power differentials over time (Bunker 1985: 247).

An interesting approach taken by Hornborg (1998) focuses on how the market institution organises the net transfer of energy and materials to world system centres. He points out that, in order for industrial centres to appropriate the goods and services they require from other regions, it is helpful if such flows are represented as reciprocal exchange (Yoffee, Godelier in Hornborg 1998: 134). One way that this gets represented as reciprocal exchange is through the notion of market prices. Hornborg points out that since industrial processes necessarily entail a degradation of energy, then the sum of products exported from an industrial centre must contain less energy than the sum of its imports. However, in order to stay in business, the finished products will need to be sold for more money than the amount spent on the fuels and raw materials used in their manufacturing. His research reveals that for any given set of fuels and raw materials to be used in manufacturing a particular product, the more that its original energy is dissipated, the higher the finished product will be priced. What this means, in short, is the more resources that flow through an economy, the more money that can be made, and the more new resources that can be purchased.

Once again, this situation makes sense from a standard economic perspective. It is exactly this logic that allows for an expanding cycle of production and keeps industrial production profitable and competitive. However, as Hornborg points out, this logic has also provided industrial sectors the means by which to appropriate accelerating quantities of energy (Ibid. 133). This accelerating appropriation of resources from other countries has not only deprived certain countries from developing sustainably, but it has also led to massive ecological damage.

Such understandings point to the socially contextual nature of neo-classical economics, and emphasise the fact that sustainability is much more than a

technical issue. As Norgaard (1994: 222) comments, "It is not an accident that neo-classical economics addresses the piecemeal correction of resource and inefficiencies through improved markets, largely ignoring the historical role of markets within a broader vision of viable relations between economics and the environment". This is an important point since how systems are understood historically affects not only our actions within those systems but also efforts to re-design them (Toulmin in Ibid. 222).

A NEW LOOK AT "WHO OWES WHOM"

Contrary to the conventional view that environmental degradation in the South is caused by people "too poor to be green", the perspective of ecologically unequal exchange emphasises the way in which resources are appropriated by world industrial centres at prices which do not reflect the many environmental externalities of export production nor their social impacts. In contrast to the fundamental assumption of free trade, which claims that prices in the international trading system always reflect the full costs of production, studies of ecologically unequal exchange show that unrecognised and uncompensated externalities are an inherent part of the world trading system. When countries export commodities at prices which do not take into account the negative local externalities caused by the extraction of resources or the production of pollution-intensive products, then costs get shifted from the importing region to the exporting region (Sustainable Europe Research Institute 2001, Muradian et al. 2001a).

There is now increasing reference to the "ecological debt" which the advanced industrialised countries have to the developing South. Ecologically unequal exchange is one source of this debt, and its beginnings can be traced back to the stripping of resources and loss of life associated with centuries of colonisation. However, this ecological debt continues to accelerate today, with increased pressure for exports from structural adjustment programs, intellectual appropriation of ancestral knowledge, or degradation of the best soils for cash crops.

There is also another, more commonly referred to source of the ecological debt, and that is the historic and current levels of carbon dioxide emissions. This stems from the fact that the advanced industrialised countries produce around three quarters of the total world carbon emissions, but correspond to only one quarter of the world's population (Martinez-Alier 2002: 231). Based on equal emissions per person, the International Panel on Climate Change calculated that the rich countries use around 3 billion tons of carbon more per person per year than what

would otherwise be their fair share (Ibid. 231). The ecological debt can then be calculated according to how much it would cost to reduce these excessive emissions. With an approximate cost of reducing carbon emissions at US $20 per ton, the carbon debt of the advanced industrialised countries can be calculated to be around US $60 billion per year (Ibid. 231).

This puts a new twist on the question of "who owes whom" in the world, since the accumulated Latin American external debt in 1999 of US $700 billion is equivalent to only 12 years of carbon debt (Ibid. 231). From this perspective, not only does the ecological debt make evident the multiple inequalities in the present world market system, it also makes the external debt of third world countries appear illegitimate.[11] It also puts clear responsibility on the North to reduce emissions proportional to their current ecological debt, and to assist other countries in dealing with the effect of climate change who are not responsible historically for its causes. Likewise, it puts a certain obligation on those who have benefited from ecologically unequal exchange to restore or compensate areas in the South which have suffered from the extraction of natural resources and export of monocultures. Furthermore, with the external debt being used as political pressure for the over-exploitation of natural resources, it can be concluded that in order to effectively deal with the current ecological crisis, both the external debt and the ecological debt need to be redressed.

Recognition of the ecological debt could, therefore, have far ranging political and economic consequences. However, making progress on this issue obviously requires a great deal of concerted effort from people, organisations, and governments in the South, as well as people and organisations acting in solidarity in the North. At present, there are several international campaigns which are applying the concept of ecological debt towards progressive ends.[12] The point, however, is that as long as economic theory only investigates connections between countries in terms of monetary relations, the existing ecological asymmetries will

[11] With regards to this point, it is of significance to mention the recent ruling in Argentina on the foreign debt, which established the responsibility of civil servants of the dictatorship that contracted it and co-responsibility of international organisations like the IMF, who approved illegal and fraudulent loans. This legal approach may be the most effective means of establishing the ultimate illegitimacy of foreign debts in many third world countries (Gaona 2001).

[12] See for example "Ecological debt campaign" (http://www.cosmovisiones.com); the Dakar declaration for the total and unconditional cancellation of African and third world debt" (http://www.anotherworldispossible.com/socialforumA_history_dakar.html); or the International Institute for Environment and Development's "World Summit on Sustainable Development" news letter.

remain largely invisible. Therefore, increasing awareness and continuing pressure is necessary to make these ecological arguments into conscious and more widely acknowledged political issues.

CONCLUSION

A political ecological economics approach directly challenges some basic assumptions within conventional theories of economics and development. A thermodynamic understanding of production and consumption challenges the mainstream orthodoxy of economic growth by pointing to the physical limits of all growth, and more profoundly to the entropic nature of all economic activity. With environmental systems already showing signs of stress, attempts to maintain the existing structure of economic growth can only be expected to deepen the current ecological crisis. As Altvater (1993) argues, ecological limits eventually turn into social limits and finally into barriers to the dominant economic rationality.

By considering the net flows of energy and materials between extractive and productive social formations, it becomes evident how specialisation in the export of abundant raw materials and primary commodities in the South, as recommended by the theory of comparative advantage, can lead to short-term "illusory" growth, but that such development tends to be unsustainable in the long-term. In addition, the theory of ecologically unequal exchange helps explain how Northern advanced industrial countries are able to maintain a high level of production and consumption, while improving their local environmental standards, by shifting environmental costs to the South. From this perspective, reliance on the extraction of primary goods as a basis for development can be concluded to be not only economically unsound, but also socially, politically and ecologically detrimental.

The understandings expressed through the theory of ecologically unequal exchange and ecological debt provide fresh insights into the causes of uneven development and new perspectives towards what needs to be done to resolve this imbalance. By focussing on aspects which have largely been neglected in development debates, an approach drawing on ecological economics has the potential to side-step hardening conflicts and access new points of entry into discussions on free trade, economic specialisation and (un)sustainable development. Furthermore, its more accurate and complete understanding of the interaction between human and environmental systems is essential in order to develop appropriate strategies and innovations for achieving both ecological sustainability and a more equitable distribution of resources and wealth.

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