The Significance of Environmental Issues for Sustainable Development

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1) Introduction

Environmental issues in any country depend largely upon the basic character of the natural resources, on the level of economic and technological development and on the perception of the magnitude and significance of environmental problems. Developed market economies (DMEs) and less developed countries (LDCs) are characterised by very different degrees of development of their resource bases, by different types and levels of economic activity, and therefore by different environmental problems and implications (including types and levels of pollution).[1] DMEs also have considerably more sophisticated systems than LDCs for regulating the environmental implications of development. This paper will attempt to outline the range of environmental issues which are perceived in Ghana at the end of the 20th century and the beginning of the 21st century, to identify the most significant of these issues, and to discuss some of the policy responses.

Differences between the environmental 'footprints' and the socio-economic characteristics of countries have a fundamental effect on the appropriate policy responses to environmental issues. Thus, similar environmental issues in different countries are likely to evoke different policy responses. For example, the issue of soil degradation would usually require different policy responses in countries or regions with significantly different land tenure systems. In addition, within LDCs there is likely to a contrast between the nature of environmental issues and policy responses associated with the 'modern' sector on the one hand in comparison with the 'traditional' sector of the economy on the other hand. For example, the policy and method for improving sanitation systems will differ depending on whether a water-borne technology is widely used. In this paper, we recognise that environmental issues and responses occur in specific spatial and socio-economic contexts even though they increasingly have wider global implications. Policy options related to specific environmental issues are discussed in the context of the search for sustainable development.

On an *a priori* basis it is to be expected that the issues outlined in Chart 1 would be major concerns in Ghana. Section 4 of this paper will then attempt to outline the Ghanaian dimension of these issues, and to provide a basis for their prioritisation.

The second section of the paper discusses some of the background to the nature and changes in environmental issues and policies in the context of development. The third section then focuses on the relationship between the environment and the concept sustainable development, in the context of LDCs and of Ghana in particular. The fourth section outlines the current breadth and nature of environmental issues in Ghana in some detail. The fifth section discusses the broad context of policy towards the environment before focusing particularly on Ghanaian policy towards environmental issues in section six. The seventh section draws together the conclusions of the paper.

Chart 1 – Major Environmental Issues in Ghana's Development

Land degradation	Soil erosion and fertility loss Bushfires Loss of foodstuffs production Loss of agricultural raw materials production Loss of agricultural exports production
Deforestation	Soil erosion and fertility loss Loss of 'long cycle' hardwoods / export potential Fuelwood crisis
Mineral depletion	Loss of domestic mineral resource Loss of exportable mineral base
Water and Sanitation	Potential deterioration of potable water base Potential deterioration of domestic water base Marginal water resources for cultivation and livestock Marginal water resources for manufacturing production Potential deteriorating sanitation
Energy utilisation	Potential deteriorating Hydro-Electric Power capacity Increasingly marginal fuelwood situation Depletion of domestic carboniferous fuels Increased dependence on imported energy base
Pollution	Pollution of water resources – poor sanitation, waste disposal, mineral xxx
Health	
Global Warming and Climate Change	
Loss of Biodiversity	

2) Transitions in Environmental Issues and Policies

The type and character of environmental issues in any country depend on the overall environmental circumstances of the country, and on the level, structure, and technological nature of economic activity. The character of environmental policy depends on the environmental issues and on the socio-economic characteristics of the particular country concerned. For example, the 'journey to work' issue with all of its environmental ramifications is not a priority issue in an economy based largely on smallholder agricultural production. Equally, desertification is not a priority issue in an economy based largely on urban manufacturing production. The economic implications of environmental policy depend on the nature of the environmental issues addressed by policy, and on the nature of the solution which has been selected (which may be of a preventive or curative nature).

This important structural distinction lies at the centre of the arguments put forward in a recent chapter published by Auty and Tribe (1997) on pollution patterns and manufacturing development. In their chapter the logic developed by Syrquin and Chenery (1989) relating to international patterns of industrial development is extended to patterns of pollution, so that at different relative levels of manufacturing activity different types of industries predominate with different types of pollution and other environmental impacts. A typology based on early, middle and late industrialisers was suggested, involving different types of environmental problems and, by implication, different types of environmental policy responses (Auty and Tribe, 1997:243). The Auty/Tribe arguments can be extended from industrial/manufacturing development to societies and economies as a whole, so that different national socio-economic structures are associated with different environmental issues or 'problems' and with different policy responses.

Thus, similar environmental issues in different countries may lead to different policy responses depending upon the socio-economic structure of the country concerned. For example, the particular type of environmental degradation associated with soil erosion in the agricultural sector is likely to lead to different policy responses in the Prairies of North America on the one hand, and in the Savannah regions of West Africa on the other hand. It is on these grounds that a distinction is made

in this paper between environmental issues in DMEs and those in LDCs. Within each group of countries there is also considerable diversity, so that the DME category includes countries such as Greece and Australia, while the LDC category includes Mali and Malaysia. However, there is sufficient common ground within each category to make the classification meaningful.

For example, one of the principal sources for the phenomenon of 'global warming' has been the utilisation of chloro-fluoro-carbons (CFCs), and their escape into the atmosphere, whence they rise to the stratosphere with the effect of depleting the ozone layer. Table 1 shows the breakdown of global CFC utilisation in 1986 with as much as 70 per cent accounted for by the United States and other DMEs and only 16 per cent accounted for by the LDCs. A similar asymmetrical pattern of environmental impact between DMEs and LDCs would certainly be evident for energy utilisation, and for the utilisation of non-renewable minerals.

Table 1 - Global CFC Use by Region (%) in 1986

Country or Group of Countries	% of world total
USA	29
Other industrial countries	41
USSR & Eastern European countries	14
China and India	2
Other Less Developed Countries	14

Source: Hogendorn (1996); Table 16.2, page 574 cited from C.P. Shea, Protecting the Ozone Layer in L.R. Brown et al ***State of the World 1989***; Norton, New York, 1989 page 87.

Environmental issues, as we know them, principally arise due to human settlement and economic activity. *Economic level and economic structure* are two distinct factors leading to environmental impact. The *economic level* refers to per capita income or consumption which determine the levels of resource use and of pollution generation. The e*conomic structure* refers to the balance between the production sectors of the economy – agriculture, industry and services – and the organisational (ownership, management, registration, taxation etc.) and technological (energy sources and uses, capital intensity, scale, technological sophistication etc.) characteristics of the production system. Differences between countries in relation to these economic issues determine both the nature of and the response to environmental problems.

3) The Environment, Development and Sustainability

The concept of 'sustainability' is related to the inter-relationship between the environment, growth and development. The Brundtland Commission defined 'sustainable development' in 1987 as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987: 43) using the same words employed by the International Union for the Conservation of Nature in 1980 (IUCN, 1980). 'Sustainable development' therefore requires equitable development both within generations (intra-generational sustainability) and between generations (inter-generational sustainability). In comprehensively discussing the concept of sustainable development Pearce, Barbier and Markandya (1990: Chapter 1) make the important point that intergenerational equity implies conservation of 'natural capital' by present generations in order to secure the resource base for future generations.

There is also a debate about whether LDCs should give a priority to concern for the environment in their bid for economic growth. Some would argue that because LDCs have low levels of industrialisation they have fewer problems with pollution and other environmental issues. The argument would continue in terms that because LDCs have limited resources the priority should be to allocate them to investment and growth in the first instance rather than to the environment. However, there is an increasing consensus that LDCs depend on the exploitation of natural resources and hence must give some priority to environmental issues relating to, inter alia, energy, water, sanitation,

deforestation, soil erosion and pollution from mining. Furthermore, it is now widely agreed that growth, development and sound environmental quality go hand in hand. It is argued that any country that pays attention to these three aspects of overall development can achieve a 'win-win' situation in terms of sustainable development. The 'win-win' concept is explained in more detail in section 5 below, and essentially amounts to the simultaneous achievement of positive environmental quality ***and*** economic growth rather sacrificing one in order to achieve the other.

More explicit specification of the definition of "sustainable development" is possible, as the following points should demonstrate:

a) economic growth involves environmental external diseconomies which have a value which is equal to or less than that of the environmental external economies, so that there is either a neutral or positive economic impact on balance;

   For example, economic growth has been associated with the depletion of forest resources, both in the long-term (reduction of hardwood species) and short-term (fuelwood exploitation). However, one of the effects of economic growth might be the development of alternative technologies which reduce demands for hardwoods (e.g. veneers and plastic replacements on chipboard {long-term}, or commercial cropping of coppiced species for fuelwood {short-term and long-term}) which offset such depletion.

b) the marginal economic cost of preventing, or of correcting for, negative environmental external diseconomies associated with an economic activity is equal to or less than the marginal economic benefit;

   For example, the establishment of an irrigation project stabilises soil fertility in an area (increasing and stabilising crop yields) but also introduces the possibility of encouraging the development of water-borne diseases. As long as the economic value of the improvement to soil fertility exceeds the costs associated with water-borne diseases the development is, ceteris paribus, sustainable.

c) the positive contributions of economic growth to enhancing the 'natural capital stock' are equal to or greater than the negative contributions.

   For example, the rate of technical change associated with dissemination of improved agricultural cultivation more than compensates for factors giving rise to soil degradation.

This interpretation largely follows the approach of Pearce and Turner (1990:52-58) and has been adopted in most of the attempts to extend environmental analysis to national income accounting such as that applied to Ghana by Convery and Tutu (1991).[2] Each attempt at such 'environmental accounting' needs to assemble information across a large number of elements of the environment and the discussion which follows in Section 4 attempts to outline some of these elements.

4) The Ghanaian Dimension of Specific Environmental Issues

An attempt has been made in this section to identify a number of environmental areas which are of particular significance for Ghana, and in doing so to place them in an order of priority.

A – Land Degradation: Agriculture contributes substantially to the GDP and is also the source of employment in many developing countries. The implications of land degradation are clearly of paramount significance in Ghana for food production, production of agricultural raw materials, and for production of agricultural exports. Some indication of this significance are given by the data in Table 2 below. The environmental problems associated with agriculture in these countries (vegetation loss, erosion and loss of soil fertility) result from poor farming practices such as slash and burn and the use of fire in land clearing. By way of contrast, in the DMEs wind erosion, chemical residues, water pollution and recent problems with genetic engineering are the major issues. Even in the LDCs there are differences between smallholder traditional agriculture and the commercial agricultural sector. The policy instruments which might be used for effective erosion control/soil conservation for smallholder agriculture in LDCs on the one hand and large-scale commercial agriculture on the other hand are likely to differ considerably due to the differing socio-economic characteristics of the two sub-sectors. This is one example of the importance of the distinction for environmental policy

purposes between what might loosely be described as the 'traditional' and 'modern' sectors of the economy in LDCs.

Table 2 – Agriculture in the Ghanaian Economy

Year	Agricultural Value Added as % of GDP	% of Exports Originating in Agriculture Sector	% of Economically Active Population Working in Agriculture
1975	47.6		
1980	57.9		66.4M / 56.8F
1985	44.9	43.5	
1990	44.8	29.1	64.0M / 54.8F
1995	38.8		

Source: World Development Indicators (1999); ISSER (1998) Tables 5.1 and 5.2 page 86.
Note: For the Economically Active Population M=Male and F=Female

Table 2 sets out some basic statistics relating to the importance of agriculture to the Ghanaian economy. Over the last 20 to 25 years agriculture has contributed between 40 and 60 per cent of the Gross Domestic Product, and something in the order of 30 to 45 per cent of the value of exports.[3] Agriculture employs about 65 per cent of the males, and about 55 per cent of the females, in the economically active labour force. To these characteristics should be added the critical importance of agriculture in providing foodstuffs which are essential for the welfare of the Ghanaian population and in providing agricultural inputs to manufacturing processes. Continuation of this economic role is particularly dependent upon the maintenance of the fertility of the soil. Environmental degradation, particularly top-soil erosion, which adversely affects the sustained production capacity of agriculture is therefore of very considerable economic and social significance in Ghana's development. Land is degraded in Ghana principally as a result of poor agricultural practices, fire, logging, fuelwood gathering, overgrazing by livestock and mining and quarrying. The ISSER report on ***The State of the Ghanaian Economy in 1992*** is clear in ascribing about 90 per cent of agricultural land degradation in Ghana to crop production rather than to the grazing of livestock (1993:143).

Box 1: The Suhum Cocoa Rehabilitation Project

Ghana depends on primary production (gold, cocoa and timber products) for a large share of foreign exchange earnings. This type of production is also degrading of the environment especially the forests. The example of the Suhum Cocoa Rehabilitation Project typifies the environmental effects of converting forests into mono-crop agriculture.

The government of Ghana established the Suhum Cocoa Rehabilitation Project in the Eastern region to rehabilitate old cocoa farms and provide cocoa seedlings and extension services to cocoa farmers to help the district and surrounding areas obtain the high cocoa output characteristic of the area. The extension exercise was to cover a farm area of 20-30,000 hectares. The government subsidised the spraying machines and pesticides used in the spraying of the farms to control the capsid disease. Between the 1984 and 1992 crop years, an average 187,999 litres of chlorinated hydrocarbons and organochlorides of various types were distributed to farmers every year for spraying. A total of 6,310 spraying machines were distributed. The project itself used an average of 54,913 litres of pesticides per annum to spray its demonstration farms in the area.

Due to these incentives as well as the favourable price for cocoa, the acreage of cultivable land devoted to the crop quadrupled. This expansion made it impossible for the project to adequately monitor spraying times and quantities of pesticides used. A majority of farmers (about 3,000 small scale farmers) began to equate the number of times they sprayed the farms to the output of cocoa - spraying four times a year instead of twice every year as recommended by the Project.

Though cocoa cultivation does little harm to the environment compared to field crops such as sorghum or maize as the recent literature suggests (World Bank, 1994), it is important to state that the naturally diversified biological character of the rainforest is sharply reduced to a mono-crop system of pure stands which is constantly protected against new strains of pests and diseases by volumes of chemical sprays. The toxicity of these chemicals has proved dangerous to fish in the Suhum river. Combined with the effects of by-products of local soap making (a small scale activity employing many women) which are dumped into the river, fish populations have been greatly reduced affecting an important source of protein in the diet. Government has since privatised the procurement and distribution of farm inputs as part of the adjustment programme. The prices of these chemicals have gone up in the open market limiting their widespread usage on cocoa farms. But this does not solve the pest problem. Neither does it address the environmental effects of slash and burn agriculture. (Kendie, 1995).

Environmental degradation arising from agriculture comes from annual crops such as vegetables, grains and tubers. Tree crops, such as cocoa, coffee and rubber have some environmental benefits because of their vegetative cover. However, the primary process of converting forests into tree crops is a first step degradation (see Box 1). The farming practice of slash and burn exposes the soil to the full intensity of wind and rain leading to soil erosion. The consequence is soil and nutrient loss and finally productivity loss. Soil erosion also causes siltation of facilities such as dams, lakes and streams. The total estimated gross costs of environmental degradation in Ghana was 41,305,000 cedis (US$127 million) in 1989. Soil erosion and other forms of land degradation accounted for 70% of the gross environmental damage costs for that year (Convery and Tutu, 1991; Convery, 1995 Chapter 8).

Table 3 - Comparison of Areas of Soil Erosion Hazard on Regional Basis (sq kms)

Region	Sheet erosion	Gully Erosion	Severe sheet and gully erosion	Total area of region	Percent of region (severe sheet and gully erosion)
Northern	23,310	19,062	23,330	70,384	33.1
Upper East	4,574	3,774	964	8,842	10.9
Upper West	7,288	4,470	7,148	18,476	38.7
Brong Ahafo	10,697	20,932	5,214	39,557	13.2
Volta	6,613	7,376	2,901	20,570	14.1
Ashanti	7,115	11,826	6,017	24,389	24.6
Greater Accra	3,005	101	85	3,245	2.6
Eastern	3,090	11,015	2,852	19,323	14.7
Central	2,002	7,780	521	9,826	5.3
Western	2,745	16,913	3,675	23,921	15.3
Total	70,439	103,249	54,712	238,533	22.9

Source: Soil Research Institute (1971)

Table 3 presents data on the extent of top soil erosion for 1971. More recent data are not available but with the high rate of population growth and reliance on primary production, the trend is generally towards more land degradation. The situation is particularly troubling in the Western region where agriculture, logging and large and small scale surface mining have resulted in extensive vegetation loss and degraded lands. Some large scale gold mines are currently closing their underground operations due to the falling price of gold in the world market to concentrate on surface mining (Benneh et al, 1998).

B – Deforestation: The environmental impact of deforestation on the economy is also diverse. Perhaps the most obvious is through the commercial extraction of large hardwood trees for export, where the replacement of the stock of trees thus lost will take several decades. The loss of part of the tree stock also has a potential impact on soil erosion and on the carbon dioxide sink effect of forests. The displacement of forests by savannah through widespread felling of trees can have effects on 'micro-climates', as well as on fauna and flora in general. Softwoods regenerate faster than hardwoods, but if trees and shrubs are extracted (for example as firewood) but not replaced there may be similar long term negative effects on the total stock of wood, on erosion, and on flora and fauna. Household, community and institutional efforts in planting woodlots in Ghana have been reported by Ghartey (1993) and Seidu (1996), but these are not on a scale sufficient to balance the rate of vegetation loss. The long term implications of deforestation are potentially of very great significance for an economy such as Ghana's.

Table 4 – Exports of Timber (000 m^3)

Year	Volume of Timber Exports
1984	148
1985	247
1990	373
1995	191
1997	172

Source: Tutu (1999) Table 6 page 10 and ISSER (1998) Table 4.6 page 69

At the turn of the 20th century, Ghana had nearly 40% of her land area forested. However, human activities over the years have reduced this forest cover to no more than 12% and much of this is in forest reserves (Benneh et al 1998). Deforestation is occurring from the practices outlined above. The extent of forests destroyed through agriculture and logging is estimated by the Forestry Department to range from 86,000 to 250,000 ha a year. This is speculative and other estimates are more conservative. In ***Sub-Saharan Africa: From Crisis to Sustainable Growth*** (World Bank, 1989:280) average annual loss is estimated at 72,000 ha but other estimates are as low as 45,000 ha. The major effect of deforestation is wind and water erosion which cause soil degradation. The estimate of land degradation arising from agriculture was 63% of total gross environmental degradation in 1988. Logging was second with 26% of the total costs. Another major source of deforestation is fuelwood consumption. The 1986 consumption of fuelwood (47% charcoal, 53% fuelwood) is estimated at 13.9 million cubic metres and is estimated to reach 20.71 million by the year 2000.

C – Mineral Extraction: Mineral extraction is of environmental, and therefore of economic, significance for a number of reasons. Perhaps the most obvious is the fact that mineral resources are non-renewable, so that once extracted, processed and sold for export they are lost to the economy. The issue of the appropriate rate of exploitation of mineral resources is therefore an important one and is the subject of a significant amount of economic literature. The issue of the economically optimum rate of exploitation of mineral resources - the 'theory of mine' - is discussed by Kula (1992, Chapter 4) and Cleeve has also discussed this issue in the context of the Sierra Leone economy (1997, Chapter 2).

Table 5 - Estimated Lifetimes of Global Resources in Years

Type of Mineral	Current consumption rates		Consumption rates in 2030(c)	
Resource	Reserves(a)	Resources(b)	Reserves(a)	Resources(b)
Aluminium	256	805	124	407
Copper	41	277	4	26
Cobalt	109	429	10	40
Molybdenum	67	256	8	33
Nickel	66	163	7	16
Platinum	225	413	21	39
Coal	206	3226	29	457
Petroleum	35	83	3	7

Notes: (a) Quantities that can profitably be extracted with current technology
(b) Total quantities thought to exist
(c) Assuming a population of 10 billion people will consume at current US rates

Source: Hogendorn (1992); Table 16.4 page 616 cited from ***The Economist***, September 16 1989 drawing on information in ***Scientific American.***

Table 5 above gives global information on the anticipated lifetimes of some mineral resources at current rates of consumption and at expected 2030 consumption rates. The economic principles behind the 'theory of mine' are of obvious relevance to the determination of the appropriate rate of exploitation of any country's mineral resources.

Table 6 – Index Numbers of Mineral Production (1983=100)

Minerals	Gold	Diamonds	Bauxite	Manganese	All Mining
Year					
1984	103.8	102.3	69.1	165.8	109.7
1985	108.4	187.9	241.7	182.5	113.0
1990	180.2	44.3	545.2	210.6	184.9
1995	408.5	192.0	731.8	118.7	463.9
1997	426.2	189.5	714.4	192.9	507.0

Source: Tutu (1999) and derived from Republic of Ghana; ***Quarterly Digest of Statistics***; June 1993 and March 1998.

Further, there have been issues of land degradation where residual deposits are abandoned in the vicinity of mines and such spoil-heaps sometimes contain dangerous minerals which may be washed into rivers thus adding to water pollution. Small-scale gold prospecting has had particularly undesirable effects on the landscape and on soil degradation as mentioned above, and chemicals used for the separation of gold can be hazardous to humans as well as to wildlife. Mining work itself also has potentially harmful effects on the health of the immediate and peripheral labour force and associated populations, shortening lifespan and reducing labour productivity as well as damaging the quality of life.

D – Water and Sanitation: This is another sector which has major environmental and economic ramifications. At the level of agricultural production water is obviously a major resource due to its irrigation potential. Poor irrigation water management has contributed to the acidification and salination of irrigated land in many countries. For industrial production, particularly in the agro-industrial sub-sector, water has a key role in the production process. In the context of human settlement, water has a considerable role for direct consumption and for cleaning and sanitation purposes. However, water also has a potentially negative role as a carrier of diseases, and in the context of disease control sanitation is clearly of great significance. Liquid, gaseous and solid waste disposal is also an important environmental concern in the directly productive agricultural and industrial sectors of the economy. The environmental role of the sector is therefore manifest in terms of direct production, direct human consumption, and disease control.

The main media of pollution in the Ghanaian context are water and air. They are also closely related to sanitation. Sanitation management is closely linked to potable water supply, and is also an important facet of the household environment, with important health implications (Esrey and Habicht, 1986). In Ghana, only the Tema metropolitan area is completely served by a water-borne sewage system with a high proportion of households having flush toilets. In a survey of the Greater Accra Metropolitan Area (GAMA) about 35% of households were found to have flush toilet facilities, with about 40% relying on pit latrines including the KVIP (Kumasi Ventilated Improved Pit-latrine) model which is being promoted as an alternative to bucket or pan latrines (Benneh et al, 1993). In Ghana's second largest city (Kumasi, with a 1990 population of 575,000), Bartone (1998:91) reports that "the system of human waste management is inadequate, most of the waste removed from public and bucket latrines end up in nearby streams and in vacant lots within the city limits creating an environment prone to the spread of disease". Overall, about 27% of the population of Ghana has access to adequate sanitation which is largely urban based (African Development Bank, 1997).

Another major cause of insanitary conditions in Ghana with special reference to the urban areas and cities is solid waste accumulation. These block drains causing a lot of health problems. Residential domestic waste forms the bulk of all sources of solid waste produced in Ghanaian urban areas. The problem of solid waste disposal is one of the most intractable management problems in the Greater Accra Metropolitan Area (GAMA) with the Waste Management Department only capable of collecting about 60% of the total refuse generated in the metropolitan area.

The proportion of the Ghanaian population with access to potable water increased from 35% in 1975 to 56% in 1985 but access is much higher in the urban areas than the rural areas (Tutu, et. al., 1996). The Ghana Living Standards Survey (GLSS) for 1991-1992 found that only about 12% of the rural households had access to potable water compared to 75% of the urban households and the lack of potable water supply was listed among four priority problems in the rural areas (Ghana, 1996). The survey in GAMA showed that only 35% of households had indoor piping with private standpipes and water vending accounting for 24% and 28% respectively of the sample of households interviewed (Benneh et. al., 1993). An adequate supply of accessible, potable water is central to household welfare and is a prerequisite for good hygiene and sanitation (Songsore, 1992, p 5). Many health problems are linked to water quality, availability, ease of access and provisions for disposal (Hardoy et al, 1992; Cairncross, 1990).

E – Energy Utilisation: This issue is particularly important in the context of non-renewable energy sources, and also for global warming through the burning of fossil fuels and the destruction of forest resources. Petroleum (crude oil) reserves, on which a large part of the world's industrial output depends, are expected to be exhausted within a comparatively brief time horizon given current rates of consumption, but there is a marked variation in fossil fuel conservation among countries depending on the level of technological development. Introduction of special taxes on leaded fuel and installation of catalytic converters in automobiles may influence consumption and reduce ground level ozone, but these issues have hardly been touched in a serious manner in the DMEs, especially the USA, where the price of petrol is low. A large proportion of the population in the LDCs depend on biomass for their energy needs, the issues of fossil fuel pricing and efficiency of use are still relevant in macro-economic policy in these countries given the large proportion of foreign exchange earnings spent by non oil producing countries on the importation of petroleum products.

Check – and references

The principal energy needs of Ghana are satisfied from bio-fuels (wood, charcoal), hydro-electric power (HEP) generated at Akosombo and Kpong and through the importation of petroleum products. HEP which provides a substantial proportion of industrial energy is renewable energy. However, the extent of renewability depends on the reliability of rainfall in the catchment area of the Volta river, and in turn the reliability of rainfall depends on a complex of factors including the source, direction and flow of air masses, topography and vegetation cover. Droughts such as occurred in 1983 and 1998 lowered the water level of the lake and the electric generating capacity of the dams. Given the importance of HEP in Ghana's industrial development, the management of the lake environment and river flow is imperative to reduce vegetation loss and siltation. Other issues of concern in relation to HEP are the destruction of fertile agricultural land through the flooding of valleys and displacement of people, flora and fauna.

Issue of gas-fired generation of electricity

For domestic cooking, a major energy use, the burning of charcoal contributes to the fuelwood problem and to global warming, and is only renewable in the sense of replanting strategies (Ghartey, 1993; Nsiah-Gyabaah, 1996); the use of kerosene contributes to global warming and is non-renewable; the use of electricity has already been mentioned; and solar power is in the early stages of development and is expensive. Another major consumer of energy is the transport sector, where the alternatives of road, rail and water involve different levels of efficiency in resource use, and also have other environmental impacts (land use for example). It is clear that this is a major area where the environmental and economic implications of future development in Ghana merits significant research effort.

F – Pollution – sanitation, water, air, noise: It is perhaps noticeable to international travellers that populations in most less industrialised countries have greater tolerance of noise than those in developed market economies. Noise reduction or control can be quite costly, so that higher levels of tolerance involve lower control costs so that it may be possible to sustain the argument that extensive noise control is a luxury that less industrialised countries cannot afford. Air pollution is a factor which is closely associated with industrialisation and urbanisation (Auty and Tribe, 1997), and particularly with concentrations of industrial activity or human settlement requiring heating or cooling, or concentrations of traffic. Water pollution is a factor which affects both urban and rural populations, but in different ways and requiring different types of technical solutions with differing economic implications.

Water pollution results from industry and domestic effluent dumping. Studies carried out by the Environmental Protection Agency (EPA) in 1996 found that industries discharge nearly 22 million cubic metres of untreated effluents into rivers and other water bodies (Kobla, 1998). In the rural areas many small scale alcohol and oil processing manufacturing occurs near streams because of the availability of water and the ease with which effluents are easily disposed (Kendie and de Graft

Johnson, 1998). The Densu river is typical of the nature and level of pollution of Ghanaian rivers and streams especially those flowing through population centres. Waste dumping by communities along the course of the river has considerably polluted this water body which is also a source of drinking water for the villages as well as the western parts of Accra. For instance, "in October 1985 sediment load as high as 128 tonnes per day (and) nitrate and orthophosphate concentrations of 5.1 and 1.2 mg/l respectively were recorded (from water samples taken at Nsawam)" (Akuffo, 1998:93). Nitrates occur as end product of biodegradation of animal and human excreta and garbage. Nitrate concentration above 10 milligrams per litre in water, as nitrate nitrogen is suspect. It has been found out that nitrates higher than this level in drinking water have minimal effects in adults. In children, concentrations below the WHO level of 10mg/l can cause methemoglobinemia. The direct discharge of household and industrial wastes into streams results from the lack of waste treatment facilities in Ghanaian communities.

Air pollution can be from the household or from the ambient air quality in the environment. In Ghana as a result of the low level of industrialisation, the major source of air pollution is from the household in terms of cooking and insect control. Air pollution from the exhaust pipes of vehicles is also important. As indicated above a greater proportion of households use fuelwood for cooking. The 1991/92 Ghana Living Standards Survey showed that even for Accra less than 10% of households use electricity or gas for cooking.

Cooking with charcoal and firewood, and especially the latter, gives rise to potentially damaging levels of pollution exposure. In the GAMA survey, there were circumstances where crowding led to cooking indoors in small poorly ventilated rooms. In households where cooking was always done indoors, both women's and children's respiratory problems were more common, and children's respiratory problems were also more common when they were often present during cooking (Benneh et. al., 1993).

Another source of air pollution is the numerous small scale industries operating mostly in the informal sector of the economy. Small scale fish smoking, oil processing, pito brewing and local food manufacture take place at home and depend on inefficient fuels such as firewood as energy source. A study in the Cape Coast Municipal Area (CCMA) found upper respiratory infection the second most prevalent disease accounting for about 11% and 8% of all new OPD cases in 1994 and 1995 respectively and this results from exposure to smoke associated with fish smoking and oil processing (Kendie, 1998).

G – Health: There are many diseases that can be traced directly to poor housing and ventilation, dirty surroundings, poor drinking water, stagnant waters, poor drainage system and lack of proper waste disposal. These diseases include diarrhoea, typhoid fever, tuberculosis, whooping cough, measles, malaria, yaws, bilharzia, intestinal worms, upper respiratory infection, pneumonia, diseases of the skin and onchocerciasis. For the daily reported illness in Ghana for 1987 and 1988, environmentally related ones formed 72% and 70% respectively. Malaria was the commonest making 43% of all cases followed by diarrhoea, upper respiratory infection, skin diseases and intestinal worms (Convery and Tutu, 1991).

Poor health imposes a number of costs on society: the pain and anguish experienced by patients and their families, additional health services (drugs, nursing and hospitalisation), productivity losses from work and days worked at lower productivity. The estimated health cost was ¢1.7 billion or 4% of GDP in 1988 (Convery and Tutu, 1991).

Industrialisation is at a very low level in Ghana and the expected pollution and consequent health impacts is minimal. Mining activity has increased significantly during the Economic Recovery Programme period. The negative environmental effects which include water and air pollution, land degradation and lack of sustainability of the activity are expected to be substantial, though no reliable estimates of the costs are available.

H – Global Warming and Climate Change: This arises mainly due to factors which i) reduce the extent to which there is a protective shield in the upper atmosphere which reduces the intensity of the sun's rays hitting the earth's surface thus lowering heat gain; and ii) increase the insulating effect of the earth's atmosphere reducing the extent to which heat can escape thus lowering heat loss. Forms of environmental pollution which affect these are i) the emission of gases such as CFCs which deplete the ozone layer, ii) the burning of fossil fuels (such as coal, gas and oil) and iii) the destruction of plant matter (such as forests) which uses carbon dioxide and creates oxygen through the process of photosynthesis. The specific concerns are firstly about the extent to which Ghana contributes to the phenomenon of global warming, and secondly about the extent to which Ghana is likely to suffer from the effects of global warming. It is surely the case that Ghana does not at present contribute significantly to global warming because of the low industrial base and the relatively low level of consumption per head. In the longer run this is an issue which will give greater cause for concern. This is especially so in relation to the high rates of deforestation and the continuing importation of equipment containing CFCs.

I – Biodiversity: Biodiversity is the vast array of non-human organisms that share occupation with Homo sapiens on the planet. It is a library of millions of different species and billions of genetically distinct populations on the earth. It is the... "composite of genetic information, species, and ecosystems which supplies the raw material that may assist human communities to adapt to future and unforeseen environmental stresses" (World Bank, 1992:59). Humanity derives direct economic values from biodiversity including all of its food and many of its medicines and industrial products. Biodiversity is therefore the basis of the survival of humanity. This gives it the imperative of its sound management for a mutually rewarding relationship to coexist.

The potential of nature's genetic library for providing more food and drugs is enormous. Wheat, rice and corn (maize) were scruffy wild grasses before they were borrowed from the library and developed by selective breeding into productive crops that now feed humanity. For instance, Anyane (1963) indicates that the Akans and Guans who were the first to migrate to Ghana (then Gold Coast) from northern Africa started to domesticate wild crops such as oil palm, cowpeas, millet, yam, digitaria, cola, coffee and malegueta pepper. Some of these have become traditional crops.

Table 7 - Estimated Value of the Stock of Ghana's Bio-Diversity

Sector	$ million
Forestry	1,313.0
Agricultural Resources	2,682.0
Aquatic, marine	351.6
Mineral Resources	220.6
Total	4,567.2

Source: Baah-Nuakoh et al (1995)

Biodiversity has use and non-use value to humanity. The use values can be direct or indirect while the non-use values are option or existence values. The direct use values are those that human beings get and which can most easily be measured in money terms. The value of biodiversity is very significant to the Ghanaian economy. In an attempt to estimate the value of biodiversity to Ghana Baah-Nuakoh et al (1995) used supply and demand techniques in the analysis of biodiversity as biological resources and produced a classification based on (i) Forestry Resources; (ii) Agricultural Resources and Water, (iii) Aquatic and Marine Resources; and (iv) Mineral Resources.

Forestry Resources include timber, firewood and charcoal, food, fruits and fodder, medicine, basketry, poles, game and wildlife, chewing sticks, etc. Agricultural Resources comprise micro-organisms that fertilise the earth and a range of agricultural products. Water, Aquatic and Marine Resources comprise water for human use, fishes and non-use water for fauna. Mineral Resources include gold, diamonds, bauxite, manganese, sand and stone. Depending mainly on the use-value of these resources, the value of Ghana's biodiversity was estimated by Baah-Nuakoh et al. (1995) to be $4.6 billion as shown in Table 7.

5) The Broad Context of Policy Towards Environmental Issues

The relationship between the economy and the environment has been represented as being akin to that between inflation and unemployment (the 'Phillips Curve' – Agenor and Monteil, 1996: 537-8). An economic 'trade-off' is postulated between the two for DMEs, so that lower levels of unemployment are associated with higher rates of inflation. Within the environmental sphere the parallel is that higher rates of economic growth have been thought to be associated with higher rates of environmental degradation. This implies that there is a 'trade-off' between economic growth and the integrity of the environment, so that achieving better results in one area leads logically to worse results in the other. This approach means that it is necessary to establish priorities between economic growth and the environment, and in the context of LDCs the argument can also be expressed in the form that it is necessary to achieve higher levels of income (i.e. more economic growth) before it is possible to provide the resources which can be applied to environmental protection and to the redressing of environmental degradation.

In LDCs the point is often made that poor farmers will only invest in soil conservation measures after significant increases in income have been achieved. Indeed, Indira Gandhi once held the view that "extremely poor people and countries must make an explicit trade-off, accepting long term environmental degradation to meet their immediate needs for food and shelter" (cited in Leonard 1989: 4). It is important to alleviate poverty, but it should also be recognised that policies to reduce the environmental effects of poverty are themselves poverty alleviating. For instance, poverty forces people to cultivate marginal lands and to engage in land degrading farming practises such as slash and burn that, in turn, entrench poverty. Investments to improve soil fertility can thereby be beneficial to the poor. This represents a 'win-win' situation in which both poverty alleviation and economic growth on the one hand and environmental protection on the other occur simultaneously rather than within a trade-off situation. Poverty alleviation strategies can at the same time achieve a reduction in environmental degradation, measures that contribute to a reversal of environmental decline can also help the poor and two are complementary rather than being in a 'trade-off' situation (Leonard, 1989; Reardon & Vosti, 1995). The term 'win-win' therefore refers to the absence of a 'trade-off', and rather than being in an 'either-or' situation it is possible to achieve two targets simultaneously.

Barrett (1990) suggests that in LDCs, if enough incentives were provided through government investment in building up and improving soil fertility, farmers might be more responsive to conservation measures. For these economies therefore there is a role for government in setting the standards, rules and regulations and generally leading the way in conservation. This type of government activity is particularly important because of the low incomes and short planning horizons of many producers (e.g. peasant farmers and small or micro-scale manufacturers in both rural and urban areas) and, in some cases, inadequate awareness of the environmental effects of production.

In Ghana, environmental degradation is manifested in vegetation loss, erosion and declining soil fertility, pollution and siltation of water bodies. Within the built environment poor sanitation and inadequate water supplies are major issues. The causes of these problems derive from both poverty itself and from the nature of the policy environment. At the micro-level property rights and access to natural resources such as land have implications for household income. Where a tenant farmer only receives one-third to one-half of their production through share-cropping (depending on the nature of the contract with the landowner) as occurs in the cocoa producing regions, that farmer may not have the incentive to engage in long-term conservation. Therefore, the design of land tenure policy to achieve both development and environmental protection goals must be regarded as one element of policy towards the environment which is at the same time part of policy towards poverty reduction.

Renewability / Non-Renewability: The environmental issue of renewability / non-renewability of resources has already been touched upon in the context of energy, deforestation and mining. To some extent this issue might be better described as that of 'reversibility / non-reversibility', particularly in an economic context. This requires some explanation.

Non-renewability implies that when resources have been used once they are no longer available for use again. This clearly applies to fossil fuels, but for many minerals (as well as plastics originating from fossil fuel resources) it is possible to re-cycle. Recycling implies a reversibility, and an 'opportunity cost' which is not permanent. Therefore 'non-renewability', is a relative concept rather than an absolute concept. Recycling or 'renewing' resources involves economic costs, but is part of a continuum rather than of a dichotomy - some recycling is more expensive than others, and some resource use is more irreversible than others.

This line of argument may be extended to some pollution issues as well. The extent to which waste and other forms of effluent are bio-degradable varies from one environment to another, and the time profile of this process affects the economic costs of recycling and regenerating growth. If significant pollution of water (e.g. the Chorale and Kpeshie Lagoons: Laing, 1994:29) has occurred over a long period the introduction of effective implementation of control measures might enable a recovery within a comparatively short period. In this respect the 'law of diminishing returns' has much to recommend it. A further implication of this line of argument is that for countries such as Ghana any argument that the prospective economic implications of having an environmental policy are that it cannot be afforded until a higher level of economic activity has been reached is clearly false. Some environmental effects are so serious and long-lasting that it is inaction and the lack of corrective or mitigating policy measures which cannot be afforded, rather than the opposite. It is necessary to distinguish between undesirable environmental effects which are more or less difficult and costly to reverse, and those which have more or less serious and long-lasting impacts. Policy towards sustainability in this respect needs to be selective.

6) Environmental Issues and Policy in Ghana

The literature on environmental management makes distinctions among various policy options. The major options are the market mechanisms (subsidies, taxes) and 'command and control' instruments (permits, licenses) (see for example Turner, Pearce and Bateman, 1994: Chap 10). In making this distinction it should be recognised that even 'command and control' measures have economic impacts which are transmitted through market mechanisms. Policy responses to the environmental effects of production and consumption depend on the nature of the economy (its level and structure) so that in LDCs where the economy is characterised by primary production and low consumption, the discussion has shifted to a focus on the search for a balance between economic growth and environmental protection. Economic growth is imperative if the basic needs of a significant proportion of the population are to be met. However, development and growth in LDCs imposes severe strains on environmental and ecological systems so that conservation measures and other forms of environmental protection become essential in sustaining development. Even in recent years LDC development plans and national investment programmes did not incorporate environmental protection goals.

We have indicated that the maintenance of sound environmental conditions are conducive to sustainable economic growth and development provided that the right policies are embarked upon. These policies must recognise the intricate interrelationship between improvements in the quality of the natural resource base and economic growth. Ghana as a low income country is less industrialised and so the huge problems of pollution emanating from industry is not present. Nevertheless, the problem of rapid depletion of forests and minerals is a major issue. Some of these problems result in issues of irreversibility discussed above. For instance, the mineral resources are depletable and when they are exhausted they are gone forever. This calls for policy of reaping maximum benefits from the resource and investing it profitably enough to justify its exploitation. Also, although the forests can be replanted, when they are deforested beyond some threshold even replanting them will not recover the rich biodiversity that natural forests contain.

Design of Policy: Policy measures for the control of the environment are conventionally seen as falling into three broad categories: i) command and control measures, ii) market based incentives and

iii) government production or expenditure (Eskeland and Jimenez, 1992:146). All three are intended to lead to the observance of regulations and practices which reduce environmental degradation of all kinds (i.e. the depletion of the natural capital stock). Command and control measures rely on the setting of standards and enforcement through systems of inspection and penalties. Market-based systems rely particularly on the use of taxes and subsidies as incentives to achieve environmental (and long term economic) objectives. Government production and expenditure systems rely on the public sector having the necessary resources to take effective action, and on the identification of activities which are likely to have appropriate impacts. Standards and regulations need to be appropriate to the circumstances of the country concerned, so that the wholesale importation of standards from developed market economies to Ghana may be quite inappropriate for two reasons. First, the technical conditions applying in Ghana are different to those in many developed market economies (for example different climates and different soil conditions), and second, it may not be possible to achieve the same environmental standards in Ghana as in DMEs due to limitations imposed by economic constraints. The World Bank's ***World Development: Report 1992*** concluded that it is "better to have fewer and more realistic standards that are truly implemented." (World Bank, 1992:13).

The concept of the optimum level of pollution, and the obverse which is the concept of the optimum level of pollution abatement, are relevant to this discussion (Pearce and Turner, 1990, Chap 6; Weiss, 1994, p 2-4). Tribe outlines some of the issues associated with the application of these concepts to less developed countries in his 1996 ***Project Appraisal*** article (Tribe, 1996:17-18). Figure 1 applies the simple concept of diminishing marginal returns to this issue. Successively higher levels of pollution abatement are progressively more expensive to achieve (the 'marginal costs' line rising from left to right). The higher levels of pollution abatement give rise to progressively lower values for additional environmental benefits (the marginal benefits' line falling from left to right). At the point where the two lines cross the marginal cost equals the marginal benefit - the non-zero optimum level of pollution. To the left the marginal benefit exceeds the marginal cost, and to the right the marginal cost exceeds the marginal benefit. In a practical policy sense the interesting question is how these concepts might be 'operationalised' in the context of a country such as Ghana. The combination of different technical and socio-economic conditions in Ghana means that experience from DMEs cannot be transferred uncritically, even if sophisticated environmental policy analysis had been conducted in DMEs.

Unfortunately the literature gives little guidance on the design of appropriate economic instruments for environmental policy in less developed countries. One of the most obvious sources is the World Bank, and here the review article published by Eskeland and Jimenez in 1992 (albeit restricted to the pollution element of environmental policy only) is an obvious starting point. For example: "The rules of policy intervention generally assume that markets are competitive. But often that assumption is untenable. In industrial countries, utilities are prime examples of monopolies; they are often subject to controls on both pricing and emissions. In developing countries, many markets may be small; entry barriers, tariffs, and transportation costs high; and access to credit, technology and law enforcement limited." (p160)..... and "In developing countries, small firms in the informal sector are often major polluters. Restructuring and concentration in an industry could lower the costs of monitoring and enforcement, but using flexible instruments such as taxes and regulation of inputs may also save on those costs. This may be a way to curb emissions from small firms without forcing them underground or out of business."(p 161).

It is possible to relate these two quotations from the Eskeland and Jimenez article to the Ghanaian circumstances that are the prime concern of this chapter. First, one of the main limiting factors in the area of environmental policy is that the types of effective controls which are exercised over pricing and emissions from utilities (which are largely monopolies in DMEs) simply do not exist in LDCs such as Ghana. The fact that the article omitted this point is fundamental. Second, to suggest that small firms in the informal sector might be subject to restructuring and concentration simply indicates a remarkable level of ignorance about the socio-economic dynamics of LDCs. In this respect, the Eskeland and Jimenez article might have been better advised to focus on a review of policy

instruments in DMEs to the exclusion of LDCs. In summary, it may be concluded that the article is indicative of the level of ignorance, rather than of the level of knowledge, which exists in this policy area. This said, all such discussions have to start somewhere.

In addition to the traditional discussion of environmental policy in the context of control through command and through market-based systems there are other issues of policy which are of economic significance and which deserve attention.

Turner, Pearce and Bateman (1994, Chapter 23) place particular emphasis on the question of property rights and tenure in the context of environmental policy in less developed countries. The Ghana Environmental Action Plan echoes this emphasis: - "It is one of the axioms of economics that, if resources are not owned, economic efficiency will not be maximised; the incentives encourage over-use, and ultimately destruction of the resource..... Ownership can be exercised equally by the private and the public sector, by individual or group." (Environmental Protection Council, 1991, p 6) This concern might be extended to include the general issue of authority systems, legitimacy and political responsibility and their influence on the economic effectiveness of environmental controls, For example, if the people in a particular locality in Ghana respect and follow the example of traditional leaders the most effective method of achieving lower rates of soil degradation would probably be to convince these leaders to change the cultivation methods, so that others will follow. Alternative, more 'sophisticated', policy measures based on experience in developed market economies might be quite ineffective. These issues are also emphasised in Chapter 4 of the World Bank's ***World Development Report 1992*** which focused on 'the environment and development'. The report stresses the importance of involving local people in natural resources management (World Bank, 1992:93). The issue of land tenure is also related to the time horizon, so that individual time preference rates and the incidence of costs and benefits are also relevant. Attempts to achieve the environmental integrity of land where the costs of conservation fall on one individual and the benefits on another are hardly likely to meet with much success. The design of environmental control measures has to be consistent with a particular country's socio-economic characteristics.

In his 1996 ***Project Appraisal*** article Tribe gives some examples of differences between developed market economies and less developed countries relating to systems and instruments for resource recycling which are directly relevant to Ghanaian experience:

Box 2 – Recycling in LDCs

Let us take as an illustrative example the recycling of non-renewable (or even of renewable) resources ... In most DMEs public collection points have been established at which consumers can dispose of glass bottles and other household disposables which are recyclable. Bottles are then collected, re-melted and made into new glass products, saving new raw materials and energy inputs for the glass industry ... In many LDCs used glass bottles often have high use values as containers for a range of commodities produced within the small-scale manufacturing sector, and so have an intrinsic market value in themselves as containers rather than as recycled raw materials for the glass industry, so that self-employed collectors are productively occupied in this activity. While in DMEs refillable glass containers have been supplanted by tinplate, and later aluminium and plastic, containers to a large extent, in many LDCs even large-scale industries still recover and re-use glass containers after cleaning rather than adopting the alternative packaging technologies which are used in DMEs. Thus, the demand for re-circulation of glass containers comes from both the 'formal' and the 'informal' sector. One reason for this difference is that high levels of unemployment and underemployment in many LDCs give rise to a comparatively low opportunity cost of labour, leading to the recycling of materials as a natural market phenomenon. Other examples of such recycling are a) the re-use of tin cans for the manufacture of paraffin / kerosene lamps, b) the re-use of sheet metal (e.g. motor-cars) as materials for the manufacture of charcoal stoves and other household equipment, and c) the repair and re-use of equipment (e.g. vehicle exhausts) which would be discarded and scrapped in DMEs. All of these examples are relevant to the inter-relationship between manufacturing industry and the environment in LDCs. It is significant that governments and private sector economic institutions do not have to design special policies for the re-cycling of materials if the market provides a solution spontaneously without intervention. (Tribe, 1996:22-23).

The issue of transactions costs associated with policy towards the environment is one which has arguably been given too little attention by economists. The economic literature on the environment is quite strong on the issues of the theory and empirical practice of market-based incentive systems, but is much less strong on the associated question of the economic impact of the transactions costs of all aspects of policy towards the environment. The technical papers of the Ghana Environmental Action Plan give a good basis for considering this issue more fully. In the Action Plan there is a clear distinction between the following activities of environmental policy: i) data gathering and research; ii) standard setting; iii) legislative enactment; iv) legislative enforcement; v) execution of environmental projects and programmes (Laing, 1994:60) . Each of these activities involves the use of resources in order to meet objectives, and since resources are scarce it is necessary to specify priorities in order to ensure that the most pressing issues are tackled first.

In Ghana the need for concerted action starts with the first of the five points from the Action Plan, namely data gathering and research. The Mining, Industry and Hazardous Chemicals chapters of the Plan, for example, make this clear from the outset: "there is a general paucity of information in Ghana on studies and/or monitoring of factors affecting the environment due to industrial activities and the use of hazardous chemicals" (Laing, 1994:28) . Again, "industrial development in Ghana has increased significantly since independence; unfortunately there are no laws to regulate pollution from the manufacturing industry. No laws exist for controlling industrial pollution. Waste water is discharged either into rivers or into open drains which in effect serve as sewers. Air emissions are uncontrolled. Disposal of solids, and effluents from industry including toxic and hazardous wastes is similarly uncontrolled."(Laing, 1994:47). Regulations have been passed in recent years, especially since the enactment of the EPA law in 1994, to control the use of hazardous chemicals and industrial emissions. However, laboratory facilities to support data collection for the effective monitoring of industrial emissions are inadequate in Ghana making the control of industrial pollution very difficult.

However as in almost all countries the effectiveness of the introduction of economic or command and control instruments to manage the environment is important. The factors to be considered include cost effectiveness, flexibility, dynamic efficiency, ease of introduction, monitoring and enforcement, equity and acceptability. In Ghana, economic instruments that are used are mainly user charges such as for the use of water, electricity and dumping of household wastes. The importation of vehicles more than 5 years old attracts a penalty due to their more environmentally damaging characteristics. There are also taxes and charges in the mineral and forestry sector but the problem with these are that they are too low to have the intended impact. Furthermore, avoidance costs are low because monitoring is poor so that producers can ignore regulations without much cost.

There have been command and control instruments such as licenses and permits in the productive and service sectors for agents to begin activity. However, it is in recent times that environmental Impact Assessments are demanded for entrepreneurs intending to establish any industrial activity. Also the legislation to manage hazardous chemicals is being considered. The area that needs action is the design of policies to manage industrial and mineral pollution. The issue of monitoring and enforcement is also urgent and this calls for more human and material resources at the EPA to undertake the daunting task ahead.

7) Conclusions

The type and character of environmental issues and policy will depend upon the level, structure and technological nature of economic activity. These then give rise to different environmental problems and solutions to different countries; whether industrialised or not. While there are global issues, such as global warming and ozone depletion, the more pressing local Ghanaian issues are land degradation and forest depletion, air and water pollution, sanitation, mineral extraction and its sustainability. Both command and control and market-based policies may be used in an effort to direct agents to behave in an environmentally responsible manner. Competitive royalty fees in the forestry sector, more efficient processing in the mineral and forestry sectors, productive investment of net returns from the mineral sector, increased investment and improved technology in the agricultural sector and incentives for the

private sector to help city officials cope with disposal of solid wastes are some of the measures which can reduce the negative environmental consequences within the economic resource constraints which exist in Ghana.

Footnotes

1. A simple dichotomy has been established here between DMEs and LDCs – while in reality it must be recognised that there is considerable diversity within each category. In addition the circumstances of the 'transitional' economies of Eastern and Central Europe may be contrasted with both DMEs and LDCs.

2. The concept of 'sustainable development' is carefully explored in Turner, Pearce and Bateman (1994, Chapter 4).

3. The variations in the agricultural contribution to exports are accounted for largely by fluctuations in the international prices of cocoa and gold – Ghana's two main export products. The same factor, to some extent, accounts for fluctuations in the agricultural contribution to GDP. Price fluctuations are compounded by variations in production due to weather conditions and other natural conditions.

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