



Environmental Aspects of Economic Development in Sub-Saharan Africa

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Abstract

Studies on the economies of Sub-Saharan Africa have generally neglected the links between economic growth and environmental quality. In many such studies, economics and ecology have been treated as mutually exclusive rather than complementary domains. The key to Sub-Saharan Africa's future is to achieve sustainable growth. This calls for replacing the traditional concept of growth based economic output alone with a new approach that stresses development through conservation of Africa's valuable natural resources of soil, water, forests and wildlife.

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“By what economic logic can the amounts required to preserve environmental values ...be considered a "cost", while the impairment of environmental capital that results from failure to make these expenditures is not seen as a cost?...A society which bases its growth on the degradation and using up of its environmental capital will be no more viable than a business enterprise which does not provide an adequate depreciation and amortization account to maintain its capital and productive capacity.”

Maurice Strong,
UN Environmental Program

I. Introduction

Following the 1968-73 drought in the Sahel interest in both the economic development and the ecology of Sub-Saharan Africa has increased enormously. On the one hand, economists have used the word "crisis" with increasing frequency to describe the region's economic predicament. Indeed, statistics amply show that declining per capita agricultural and food production is widespread (see tables 4 and 5) and that many social groups are unable to meet their basic needs (Barker 1984). On the other hand, citing the general conditions in the Sahel, the destruction of tropical forests and dry woodlands, soil depletion and desertification in various parts of Africa, and decreasing populations of some species of wildlife, conservationists have expressed concern over the environmental deterioration. Most ecologists now agree that environmental problems have also reached "crisis" proportions in Africa, which Timberlake (1985) called "a continent on the brink." The seriousness of the situation is evident in the fact that even in the absence of economic growth ever-increasing stresses would be placed on the already fragile environment. As Lewis and Berry (1988) attested, the population expansion into new areas and the rapid urban growth have been aggravating these stresses. Even the normally cautious World Bank (1984) did acknowledge the need for self-sustained development and prevention of further environmental damage.

This paper is not intended to suggest quick and easy solutions for Africa's complex problems. As Djibril Diallo of Senegal, spokesperson of the UN Office for Emergency Operations in Africa, put it, "Africa's problem--Africa's biggest problem--is too many people going around the continent with solutions to problems they don't understand. Many of these solutions are half-baked. But this is not to put all the blame on the North. Some Africans don't understand African problems" (Timberlake 1985). Rather, this study

argues that there is no necessary tradeoff between economic development and environmental maintenance and that separate approaches to either environmental or developmental problems are piecemeal at best. However, as Bartelmus (1986) notes, just such an approach has typically been followed in the past.

To be sure, some attempts were made to combine economics and ecology, as evidenced by the emergence of eco-development literature in the mid-1970s, and the rise of ecological economics in the mid 1980s, which led to the founding of the International Society of Ecological Economists. However, the intimate relationship between the economic crises and the environmental problems has remained largely outside the realm of the mainstream development literature and discussions. In the past two annual conferences organized by the Center for Economic Research on Africa (CERAF) on Sub-Saharan Africa, panel members used the term "environment" only twice in passing.

This basic argument, that accounting for environmental constraints is essential for achieving any chance for self-sustained growth, will be supported by several related themes. Among them are the suggestions that understanding the relationship between the economic and environmental issues calls for a global treatment; that environmental degradation in Africa is often the result of poverty; that the main determinant of environmental affairs is political; and that environmentally sound development requires appreciation of local cultures, active participation of local peoples in development projects, more equitable income distribution, and the choice of appropriate technologies. A number of specific policies, programs, and case studies will be cited to support our arguments.

II. Traditional Views of Economics and Conservation

1. A Critical Look at Traditional Development Economics

Environmental and developmental problems have traditionally been treated separately by policy theorists. On the one hand, "developmental ism" stressed economic growth without much concern for nature and environmental constraints. "Conservationism", on the other hand, has emphasized the risks of growth, and the limits of nature and conservation without adequate concern for either human needs or economic constraints. However, the quality of life can be measured neither on the basis of a cleaner environment nor on the basis of a higher real income alone.

The traditional view that environmental costs of development are unavoidable is best illustrated in the words of a World Bank official, who in a recent interview aired on public television suggested, "Development is going to be an intrusion in the environment

no matter what we would like to think or like to sustain. If you are going to have to have hydroelectric power, then you are going to have to have some kind of dam and that dam is going to flood an area. These are the tradeoffs between the preservation of the environment and the development requirements." The growing international *environmental movement* and ecological economists, however, are refusing to settle for the so-called tradeoffs. They convincingly argue that it is possible to have economic growth and maintain environmental quality simultaneously due to better understanding of ecosystems and increased awareness of their economic value owing to advances in ecological and environmental sciences.

Moreover, the traditional measure of economic growth, per capita real GNP, is being *increasingly questioned*. Ecological economists have accused traditional economists of "mismeasuring development, underestimating the intangible costs of pollution and ignoring society's responsibilities to future generations" (Passell 1990). Riddell (1981) also claimed that GNP per capita is irrelevant as a measure of successful growth of an economic system. Instead, some ecologists are calling for a radical change in economic thinking, which would fit economic activity into ecological systems, rather than the other way around. Hence, the International Society of Ecological Economists is trying to persuade governments to give "the sustainability of natural life support systems priority over conventionally measured economic growth" (Passell 1990).

Currently, efforts are under way to construct new indexes to represent the quality of life, and which would include natural resource depletion in national income accounts. For instance, the Jessie Noyes Foundation in New York is supporting a UN effort to incorporate environmental factors in the measurement of national output. The Russell Sage Foundation and DECD have also been seeking to construct such indexes (Vieria 1985).

It is well-known that in traditional economic theory the right decision--in terms of its efficiency--on how much of the environmental resources to use depends on opportunity costs. But markets, ecological economists maintain, have consistently undervalued environmental resources for various reasons, ranging from the society's value structure to inadequate understanding of the economic value of ecosystems. As Kneese stated, they cannot, therefore, be depended on to weigh, for example, "the cost of damaging a marsh that serves as a breeding ground for birds" (Passell 1990).

Resource depletion, of course, involves questions of intergenerational equity. In economic theory, future benefits and costs of protecting the environment are valued less

(discounted) relative to current benefits and costs. Hence, conservation becomes more difficult the higher the discount rate (Arrow 1976). However, the choice of discount rates is more problematic than traditional economists might admit: "A town council might decide it is worth sacrificing a grove of 300-year-old spruce to save \$100,000 on road construction. But what of future town residents, whose pleasure in seeing very large, very old trees will not be considered?" (Passell 1990).

In Africa, the emphasis on economic growth with very little regard for the environment has significantly contributed to the present crisis. For example, most African governments embraced policies of industrial expansion virtually without any environmental controls. Documented data are extremely limited, though it is known that the overwhelming majority of industrial activity takes place in or around larger urban settlements, particularly capital cities. According to a 1983 ILO report, inadequate regulations and enforcement are resulting in the release of vast quantities of pollutants by modern sector industries. Hence, today in many urban areas the water and air quality resemble "the situation prevalent during the early period of industrialization in Europe" (Lewis and Berry 1988).

Rivers and coastal areas below many African cities are polluted heavily from sewage and industrial wastes. For example, former mangrove swamps around Lagos and coastal areas near Dar es Salaam are much less productive today than they were only a decade ago, thanks to the delivery of industrial pollutants into these areas. People in urban areas are also exposed to ever-increasing air pollution with the rapid growth in the number of motor vehicles and concentration of industry (Lewis and Berry 1988).

It must be kept in mind that Africa remains the least industrialized continent. The real issue is not whether Africa should industrialize, but whether the concentration of industry in the areas of greatest population density or whether the lack of adequate environmental regulations and enforcement of existing regulations are necessary or inevitable components of industrialization.

Too many case studies have conclusively proved that in many cases environmental and even purely economic factors were not of primary concern in determining industrial location or the level of regulation for pollution control. For example, in Nigeria the decisive factor that resulted in the construction of a steel plant in a swamp and mangrove setting within the delta at Aladja was government's policy of economic decentralization. Its output had to be transported over land to the rolling mills at Abeokuta. The result was

high production costs resulting in a final product twice the world price. Consequently, the government had to subsidize its steel industry (Lewis and Berry 1988).

Another example is the World Bank's export-promotion policy in Mauritius. The government created an export processing zone within which firms enjoyed a wide variety of incentives to produce manufactured goods for exports. These incentives included complete exemption of import duty on capital goods, raw materials and manufactured inputs, a 10-to-20 year corporate tax holiday, free repatriation of capital and remittances of profit and dividends, favorable access to loans, a guarantee against nationalization, and a virtual absence of environmental regulations.

Citing the increases in its employment and foreign exchange earnings, Bheenick and Schapiro (1989) have recently mentioned Mauritius as one of the success stories of the World Bank policies. No reference was made to the environmental degradation. Yet, super toxic chemical waste was dumped into the sea since more than 400 factories, mostly textile, have moved in during the early 1980s. Industrial waste, which contaminated drinking water, was also dumped into sewage treatment plant which could process only human waste. Only half a dozen years ago the coast which yielded 50 lbs of fish per day for a fisherman was now yielding 15 lbs at most and many tourists started getting sick from swimming.

The Minister of Housing, Land, Town and Country Planning and the Environment was interviewed on National Public Radio in the US only months after the World Bank evaluation. "We had to think of developing economically," he said, explaining his government's past policies, adding that "when you develop the country economically, at such a stage, you do not give much consideration to environmental matters because you must know where your priorities rest." But the government eventually realized that if it did not protect the environment from the industry, the economy it tried to build would be destroyed. So did the executives of oil, textile and chemical industries, who hired consultants from the Friends of the Earth.

By 1990, Mauritius established one of the most ambitious environmental protection programs in any less developed nation. Ironically, the World Bank helped it obtain \$65 million in loans and grants. "A 'polluter pays' principle will be adapted," continued the Minister, "no pollution is in the interest of the industries themselves, so they will support us. Because without this program, there will be no sustainable development and they will be the losers."

2. A Critical Look at Western Conservationism

Traditionally, some *conservationists* in the West have focused *on* the preservation of African ecosystems and endangered species of wildlife to the neglect of its effect on the socioeconomic conditions, political realities and even the local people. As Timberlake (1985) observed, when these conservationists think of conservation in Africa they think in terms of wildlife alone. An example of this view is Caldwell, "who purports to defend Earth against the un-ecological man" (Bartelmus 1986).

Some attempts have been undertaken to explain this view that puts animals before man (Maunhaum 1980, Anderson and Grove 1987). The problem, these studies conclude, is rooted in the nature of the colonial relationship itself, "which allowed Europeans to impose their image of Africa upon the reality of the African landscape" (Anderson and Grove 1987). The emotional investment in Africa then manifested itself. in a desire to protect the nature of Africa as a special "Eden" for the purposes of the European psyche, not as a complex world in which "people have actually had to live" (Anderson and Grove 1987).

Africa has thus offered the Europeans the opportunity to experience a wild environment which was no longer available in Europe. Carried to an extreme, this conservationism cites the stupidity and ignorance of Africans as the ultimate cause of the destruction of nature. It does not occur to them that economic self-sufficiency is necessary before *conservation can* be meaningful and successful, that wildlife counts but so do people, that nature is destroyed as a consequence of complex economic and political realities. Moreover, this naive apolitical *conservationism is* fatally flawed, "failing to appreciate that, to rural societies of Africa, conservation is a very political issue" (Anderson and Grove 1987). As we shall see below, *managing Africa's* natural resources for conservation and development involves political decisions and direct interventions in the socio-economic and political structures.

Parks are another arena in which the conflict between the interests of the conservationists and the African people is played out. Most Africans have always lived among wildlife: it is part of their heritage. Rural people suffered though from recent efforts to keep African people out of African lands for the benefit of the protected animals and tourist revenue. "It is one thing to keep urban Americans from farming Yellowstone, quite another to keep the Masai herders out of Kenya's Amboseli Reserve," said Walter Lusigi, a Kenyan ecologist (Timberlake 1985). In fact, most serious threats to wildlife come from government policies, or the lack thereof, rather than local people. The

waterfowl habitat in the Djoudj National Park in Senegal is threatened by a dam, *Tanzania's* Mkomazi Game Reserve is being turned into a cattle ranch, and so on.

Fortunately, recent programs such as UNESCO's *International Man and Biosphere Program* (MAB), are trying to integrate people and parks. One successful program has been implemented in Kenya's Amboseli Reserve. For years the Masai herders retreated to the Amboseli during the dry season. In the 1960s some *conservationists* wanted to turn the reserve into a park. Faced with prospect of losing dry season water and grazing, the Masai retaliated by spearing wildlife.

Timberlake (1985) reports that the local rhino population fell in 15 years from 150 down to eight. Government revenues from tourism increased but the Masai were losing to the wildlife. After 10 years of *negotiation* a compromise was found which would benefit both the Masai and the wildlife. Under 1977 plan the government agreed to pay grazing fees to the Masai and help with fences, securing the safety of wildlife on its migration outside the park. Campsites for tourists were moved outside the park, giving the Masai direct tourist revenue and reducing tourist impact on the park by dispersing campsites on their villages. Piped water was provided for the Masai outside the park; they were also given land titles around the park. This program made both economic and environmental sense: as the doubling of the rhino population between 1977 and 1983 shows, since the Masai economically benefit and recognize that the park is theirs they protect wildlife.

Another successful program is being implemented near Zambezi River Valley in Zimbabwe. The government recognized that regulated *hunting* in the woodlands could be worth more than agriculture and last indefinitely. Hunters are happy to pay up to \$1,500 fee to shoot an elephant or \$1,000 for cape buffalo. The meat from the hunt, safari camp fees, and trophy fees are all received by local villagers who were given ownership of the wildlife. People and wildlife are no longer rivals. These examples show how local people support conservation efforts in Africa if they also can benefit from them, i.e., if conservation and economic needs of the people are integrated.

III. Eco-development: Combing Economics and Ecology

It must be noted that the economic crisis and environmental collapse in Africa led to a greater appreciation of the value of the environment in overall development and invoked reappraisal of past policies and practices both inside and outside the continent. Some experts argued that the policies pursued by governments have not only failed to bring about sustained economic growth in most of Africa, they have also been extremely harmful to the environment (Anderson and Grove 1987). In fact, some claimed that many

past economic policies failed precisely because of their detrimental environmental impacts (Timberlake 1980 and Redclift 1984).

This new integrated approach to development and environment, which is based on the premise that programs for the conservation of soil, water, land, forests and even wildlife must be combined with economic development, began to gain more credibility after the UN Conference on the Human Environment in Stockholm in 1972. The Stockholm Conference took up the issues first discussed by the Founex panel, which consisted of 27 experts in developmental and environmental fields, and which met in 1971 in Founex, Switzerland. The Stockholm Conference concluded that environmental factors must be an integral part of development strategies and that the traditional concepts of the basic purposes of growth had to be reconsidered (Vieria 1985).

The Stockholm Conference also acknowledged that environmental degradation in less developed countries was a result of underdevelopment itself. In fact, as Strong (1980) suggested, the basis for participation of the less developed countries in the Conference was the recognition that "underdevelopment and poverty are the most acute threat to the environment." If people are desperately poor, they will turn to whatever is around them to try to make a living: land or forests and other natural resources. Environmental destruction in turn exacerbates poverty. The recurrence of the famine in the Sahel itself suggests a breakdown in the relationship between people and the environment and the urgency for the need to break this vicious circle. When Newsweek in 1985 asked the head of Ethiopia's Relief and Rehabilitation Commission what his nation could do to avoid "suffering from continued drought," he mentioned neither rain nor food relief. "We have to start over again with the forestation program. We have to start irrigation, soil and water conservation projects" (Timberlake 1985).

Following the Stockholm Conference there was a significant growth of national and international environmental agencies and organizations. The Conference itself launched the United Nations Environmental Program (UNEP), with headquarters located in Nairobi. UNEP advocates the concept of "ecodevelopment," defined as "development consistent with the potentials of the area involved, with attention given to the adequate and rational use of the natural resources, and to applications of technological styles" (Bartelmus 1986). The ecodevelopment approach seeks to exploit the traditional knowledge of the indigenous peoples about local bioproductive systems. In the words of Strong (1980) of UNEP, "The marriage of ecology and economics, which I call 'ecodevelopment,' would be designed to assure that the precious natural resources of soil, forests, water, and plant and animal life in the less developed countries are exploited in

ways which make the best possible use of their own skills and labor, and harmonize with their own culture and value systems."

In the meantime, virtually all African nations established some kind of environmental agency in the last two decades. On a global scale, already by 1980, 102 developing nations had an environmental agency, compared to 11 in 1972. Unfortunately, in Africa the ecological education of many governments came from such bitter experiences as the Sahelian drought of the early 1970s, the urban floods in Lagos and Ibadan in Nigeria or blowout of oil wells and oil spillage in the Niger Delta (Areola 1987). While countries like Gabon, Burkina Faso and Cote d'Ivoire created fully-fledged environmental ministries, in most others environmental agencies were embodied by a department or a board (Vieria 1985).

Numerous non-governmental organizations (NGOs) and private groups also became actively involved in relating environmental problems with problems of underdevelopment. Globally, a number of UN agencies such as UNDP, FAO, ILO, UNESCO, WHO, and UNIDO are especially active in underdeveloped regions. For example, UNIDO gives technical assistance in the analysis of the environmental aspects of industrialization: UNDP supports projects which are environmentally sound: and WHO is involved with the health aspects of pollution.

In addition to the Stockholm Conference several other international attempts at linking development to environment were made. Among them are the World Conservation Strategy, a document prepared by the International Union for Conservation of Nature and Natural Resources (IUCN), and the Brandt Committee Report, which recommended conservation for sustainable development and highlighted the connection between the destruction of the natural environment and the creation of rural poverty (Redclift 1984).

IV. Development and the Environment: The Global Issues

As the Brandt Report of 1980 indicated, the environmental problems in underdeveloped regions cannot be fully understood unless they are treated in a global context. For economic relations between the developed and the less developed countries have contributed to the severity of environmental degradation in the latter. Thus, a successful reversal of the trend towards environmental bankruptcy calls for a reorganization in the global relationships. Moreover, the destruction of even local ecosystems often has grave implications for the entire globe. In this section we look at the nature of environmental problems in the developed and the less developed countries and

discuss the responsibility of the industrialized nations in combating environmental degradation in the developing regions.

Today environmental problems exist worldwide since they stem both from being economically developed and from activities induced by lack of development. However, in addition to the differences in the nature of these problems, there is a notable difference in their impacts as "wealthy countries face a deterioration of the quality of life, but life itself may be at stake in developing nations when their natural resource base is destroyed" (Bartelmus 1986).

In less developed countries serious problems involve soil erosion and depletion, desertification, deforestation, freshwater shortage, floods and drought, impacts of fuelwood consumption, loss of arable and grazing land, diseases, and problems associated with rapid urbanization. In industrialized countries air pollution, inland and marine water pollution, overflowing landfills and acid rain constitute the major problems. Furthermore, some problems are increasingly recognized to be global: increases in carbon dioxide concentration in the atmosphere caused by the combustion of fossil fuels and deforestation that result in global warming, ozone depletion caused by the release of chlorofluorocarbons (CFCs) from refrigeration equipment and aerosol cans, and marine environment pollution caused by oil, sewage and chemicals are some of the more publicized examples.

As a radical solution to the growing environmental problems in the West, zero growth of the economy and the population was postulated. Some conservationists, for example, Schumacher (1973), have even suggested that all nations should consider zero growth or use alternative technologies which could lead to development back to a "beautiful smallness." The view that modern industrial society should "give way to a hunter-gatherer way of life, which is the only economy compatible with a healthy land" would, according to Commoner (1990), represent a defeat for humanity. For having more than life's necessities is better than having less, or as one of the well-known dictums of economic theory goes "more is preferred to less."

The more acceptable view emerging now insists that we do not have to sacrifice all the comforts of modern life to end the assault on the environment. So the war between nature and humans calls for a negotiated peace that takes into account both nature's need for self-sustenance and the human need to increase the present material level of human welfare (Commoner 1990). Strong (1980), while demanding that the developed countries reduce the pressures they exert on the environment and on the resources, argue that this

requires a more responsible production and consumption choices and would lead ultimately to a higher standard of living. He then suggests the concept of a "new-growth" society as an alternative to no-growth society, a concept consistent with principles of ecodevelopment.

New-growth society acknowledges the fact that the "environment is both a contributor and a product of growth," and it attempts "to make environmental concern and economics allies." Moreover, newgrowth society requires that cooperation take place among all the nations of the world. The recent adaption of a treaty to phase out the 10 worst ozone-depleting chemicals is an example of how international cooperation can pay off both in economic and environmental terms in the future (Doniger and Miller 1990).

What, then, are the responsibilities of the industrialized nations in preventing further environmental damage in Africa and in other underdeveloped areas? One such responsibility involves the nature of foreign aid. In Africa the Western aid went to "white elephant" projects in the cities, instead of in the grassroots, community-participation rural development so badly needed (Timberlake 1985). According to Timberlake, of the 1.97 billion dollars of aid to the Sahel in 1981, only 4 percent went to growing rainfed crops, 1.5 percent went to ecological projects such as tree planting, soil, water and range conservation.

Unfortunately, for reasons that will be discussed below, many of these projects have failed, including those in rural conservation. In 1985, the World Bank reviewed the results of large number of the projects it had funded. The failure rates for agriculture projects of 33 percent in West Africa and 50 percent in East Africa-were the worst of any other region in the world (World Resources Institute 1990).

More importantly, many multinational corporations transfer their activities southwards in an attempt to find both lower internal and lower external costs of operation (Goldberg 1980). For example, Viera (1985) mentions the EEC suggestion that European polluting industries be transferred to less developed countries--mainly in Africa--since the developed countries generally impose more severe restrictions on industrial pollution. Also, worldwide exploitation of wood and mineral resources by companies from the US, Japan and Europe is often cited as a major factor contributing to environmental problems in the less developed areas.

Estimates vary, but some experts claim that by the year 2010 the rainforest will disappear from most of its present location. Huge timber concessions have been granted

in Papua New Guinea to a Japanese firm (Gupta 1988); in Central America and in the Amazon Basin beef cattle are raised for US consumption on pastures derived from the rainforest (Ehrlich and Ehrlich 1988). In 1981 one-third of Costa Rican land was under ranching, primarily for export of beef to the US, and according to Gupta (1988), similar cattle ranching has been taking place in parts of Africa in response to the demands of the EEC. This large stress placed by the industrialized nations on the resources vital for the sound development of less developed areas, however, goes largely unnoticed in the mainstream literature (Bartelmus 1986).

Some more radical environmentalists have criticized the consumption pattern in the industrialized nations, indicating that wasteful and meaningless consumption, and hence production, are responsible for the worldwide pollution and resource depletion. Perhaps consumption is not in itself objectionable, but as Riddell (1981) points out, when local resources are supplemented by resources abstracted from other nations, especially the less developed ones, the situation becomes unacceptable. Everyone would agree, in fact, that each individual in industrial society makes larger demands on the world resources compared to each individual in underdeveloped world. Thus, "it is intellectually dishonest to attribute the global resource crisis to the population explosion in the less developed countries, without acknowledging that the share of resources consumed by poor people in these countries is much smaller per capita than it is in a country like Britain" (Riddell 1981).

V. Population Growth and the Environment

In Africa virtually every aspect of environmental deterioration is made more acute by the rapid population growth. In many countries over 40 percent of the population is under 15 years of age and in Kenya and Côte d'Ivoire average *annual growth* rates of population exceed 4 percent (see table 1). Even though populations of the Central African countries are growing less rapidly than those of East and West Africa, as a whole, Africa's population growth rate exceeds that of any other continent (Lipton 1985).

According to one estimate, food production must nearly double in the next decade to sustain this growth at current living standards (Hamilton 1982). As Strong (1980) observed, even in the absence of population growth additional pressure on the environment would be placed by the general rise in material expectations and the drive of the poor to improve their living standards. One direct outcome of population growth is migration to urban areas which reinforces the imbalance between overcrowded cities and coastal areas and under-populated interior regions. Industrial urban areas, which are

growing at rates 3 to 7 percent a year put greater pressure on the food, energy and water resources and on the rural sector in general.

To meet the needs of a growing population new lands are being cleared for agriculture, existing lands are more intensively farmed, fallow periods are being reduced, and large-scale irrigation, fertilization and mechanization are being incorporated in agriculture. These practices have increased output initially but have led to environmental degradation and declines in long-term yields in most cases. Even in the areas that are naturally fertile, such as the highlands of East Africa, population pressure has resulted in serious soil erosion (Gupta 1988). Indeed, the process of desertification has been shown to accelerate as a consequence of increasing man-to-land ratios (Riddell 1981).

The rapid population growth is largely a result of declining infant mortality and death rates due to increased spending in the public health sector. Many experts agree that nations which pursue such health programs concerned with curative and preventive medicine compound their population problems. Nearly all recommend policies such as access to contraception services, education and cheaper or free abortion services that are designed to reduce the birth rate, which in Africa is well above the world average (see table 2). However, reducing the birth rate is a more complex problem than it might seem. One cannot just tell people to have fewer children. At the macro level it makes sense to reduce the birth rate, but not at the family level, where having more children often makes more economic sense under current conditions. Furthermore, having many children is usually a necessary and important social function of a woman; a woman in many areas is considered a woman if she can conceive and bear large families, which are viewed as "signs of power, prosperity and holy blessing" (Timberlake 1985).

Improved health care is increasing population growth rates, but what are the African governments thus doing about family planning? Only Kenya, Ghana and Mauritius among the 19 African *nations associated* with the International Planned Parenthood Federation (IPPF) have, until recently, a specific goal of reducing annual population growth. According to Timberlake (1985), by the mid-1980s not a single Sahelian government had established any kind of birth control program. In Senegal, contraception was forbidden until 1980 and sterilization has been illegal in Rwanda and Cote d'Ivoire (Timberlake 1985). Zimbabwe, however, has one of the best population control programs.

Coercion, which in the past has proven to be ineffective, is out of the question: the key element of the program is education. Every community has its own family planning

worker, a familiar and trusted figure, playing the role traditionally associated with the grandmother. Indeed, with about 38 percent of couples using contraception the average annual rate of population growth has declined in the 1980s (see tables 1 and 2). Unfortunately, for Africa as a whole, the best contraceptive is economic development itself. For the desperate and starving villagers of the Sahel, who have very little command over economic resources, children are the only resource they can rely on to maintain their difficult existence.

VI. Development and the Environment: Some Further Observations

1. Rural Development and Environment

With the exception of a few mineral-exporting countries, agriculture dominates the Sub-Saharan economies. The pastoral way of life in drier areas where cultivation is difficult and emphasis on cultivation in higher rainfall regions constitute a significant proportion of the economic activity. The share of the labor force in agriculture, while declining, was still two-thirds or more in 1980 in many of the Sub-Saharan nations (see table 3). Agricultural products are a major source of foreign exchange earnings, with shares in total exports of over 70 percent in countries like Ethiopia, Madagascar, Malawi, Uganda, Mali, Somalia, Tanzania and Chad.

It is not surprising, therefore, to find Lateef's (1980) observation that "the Sahel's struggle to achieve a radical economic transformation is apt to be won or lost in the countryside," or Barker's (1984) assertion that "for the countries of tropical Africa it is impossible to imagine a durable improving trend in the basic standard of living without consistent growth in agricultural production."

The ecodevelopment view too argues that rural development is necessary to eliminate poverty. But most government policies in Africa favor the urban elite. Food prices are kept low, income from cash crop schemes go to urban-based businessmen, and most public expenditure in health and education is undertaken in urban centers. These policies often divert expertise, personnel and funds away from the central problem of agriculture (Faber and Green 1985). Only in a few Sahelian countries, all dominated by rural economies, does agriculture receive as much as 30 percent of the total new investment for growth.

The development strategy which stresses industrialization at the expense of agriculture--which eventually would be pulled into modernization by a dynamic manufacturing sector--does have its adherents. However, policies used to implement this strategy, including cheap urban food prices, concentration of public sector investment in

urban centers, subsidization of credit to large industries and emphasis on heavy industry and large-scale projects have led to intolerable social, political, environmental and economic situations (Lateef 1980). The most serious problem facing rural Africa is the process of desertification. Overgrazing, overcultivation, deforestation, emphasis on cash crop production and large-scale irrigation all have contributed to activating previously stable sand dunes which are destroying the arable land. The World Resources Institute (1990) estimates that 25 percent of the earth's surface is at risk from desertification.

Africa is the continent most at risk. More than 750 million hectares--more than one quarter of Sub-Saharan Africa--is moderately to very severely desertified, i.e., lost biological productivity (World Resources Institute 1990). Almost half of the world's people at risk from desertification live in the Sahel (Timberlake 1985). UNEP's reassessment in 1981 found that nowhere is the situation improving in Africa and concluded that "governments do not see desertification as a high priority item ...There seems to be little appreciation that a major goal of many developing nations, that of food self-sufficiency, cannot be attained if soil and plant resources are allowed to deteriorate" (Timberlake 1985).

Can the Sub-Saharan Africa increase yields and prevent further deterioration in the environment? The potential may be there. A number of studies, including one by FAO, suggested that even the Sahel could be transformed into a greenhouse, that efficient agriculture could produce 24 million cereal tons of grain per year compared to the annual production of 5 to 6 million tons during the 1980s (Lateef 1980). But such a transformation first involves soil and water conservation.

It is hard to imagine Africa achieving self-sustained growth and reducing poverty and hunger without soil conservation, for there is no resource more important to Africa than its soil. But Africa's soils are overused, rendered sterile or contaminated with toxic chemicals. In ecodevelopment view, utilizing practices appropriate for an area's precipitation, morphology, and soil properties is indispensable for soil conservation.

Recent studies cited by Lewis and Berry (1988) lend further support to the notion of soil conservation: First, in a study at the International Institute of Tropical Agriculture, yields of corn, soil erosion and runoff were related to various farming practices in tropical Africa. It was concluded that the traditional method of clearing the land resulted in the lowest soil erosion, the lowest runoff (i.e., the greatest soil moisture infiltration), but the lowest yields. Mechanical clearing of the land led to greater runoff and higher soil erosion rate. The findings suggested manual clearing and "no tillage" methods as the best

long-term alternative since they resulted in higher yields than the traditional method and lower erosion rate than the mechanical clearing method. A second study in Cote d'Ivoire concluded, however, that "no tillage" management in this savanna environment encouraged erosion. Plowing here brings gravels from the subsoil to the surface, thereby lowering the erosional impact of rain splash. In addition, plowing helps to lower erosion by reducing runoff.

Currently, many African nations are dependent on just one crop for over 50 percent of their income: Burundi, Rwanda, Ethiopia, Uganda and Kenya depend heavily on coffee, Senegal, Guinea Bissau and Gambia on peanuts, Mauritius on sugar, while Chad, Mali and Sudan derive most of their income from cotton. Other cash crops, important especially in West Africa, are cocoa, bananas, tobacco, tea and rubber. Government policies, such as involvement in largescale agricultural schemes, encourage farmers to grow export crops to help raise foreign currency.

This emphasis on export crops has led to a paradoxical situation in many countries. They export agricultural products and then use the major part of the foreign exchange to finance the import of foodstuffs. In fact, with the exception of Cote d'Ivoire, Cameroon, Kenya and Zimbabwe, African countries are net imports of foodstuffs (Lewis and Berry 1988). Moreover, cash crops produced less and less cash in the late 1970s and the 1980s, primarily because of international price movements and because growing them requires more and more hard currency for imported pesticides, fertilizers, energy and equipment. According to Timberlake (1985), in 1984, no African country with an economy based on cash crops had a favorable balance of trade. In the words of Sen (1981), "Compared with the farmer ...who lives on what he grows and is thus vulnerable only to variations in his own output,...the grower of cash crops... is vulnerable both to output fluctuations and to shifts in marketability of commodities in exchange rates." Timberlake (1985) argues that African governments feel the need to grow more cash crops in the same way people feel the need to have more children: if children are dying, more children are needed, and if crop prices are declining, more cash crops are needed.

Cash crop cultivation is almost universally cited as a major cause of desertification. This practice leads to monocultures not well-suited for the realities of Africa's soil and climate. In West Africa and the Sahel, the best lands are used to grow cash crops and this practice often displaces the rural population and forces them onto more marginal lands, thereby leading to soil degradation and declining food crop yields. In Senegal, years of peanut cultivation has led to such soil degradation that in some places the land is now completely unusable (Timberlake 1985).

The importance of fresh water in all bioproductive systems and the need for irrigation in dryland agriculture make efficient water management essential for economic growth and environmental maintenance. This is especially true in Africa, much of which suffers from a serious shortage of water. Water management involves slowing down the loss of water (conservation) and diverting it from its path to feed dry areas (irrigation).

Africa has a great need for efficient irrigation. Given that a relatively large number of major river basins are shared by many countries, it has a great potential. But currently it has less land under irrigation than any continent except Australia. Only 6 percent of the cropland in Africa is irrigated (including Egypt with 100 percent), compared to the world average of 15 percent (see table 3). The traditional forms of irrigation, including flood irrigation and carrying water from wells to fields, admittedly had their environmental problems. However, modern irrigation has involved much more comprehensive modification of the environment. Large-scale irrigation schemes required the building of large dams, which have produced major environmental and economic problems. Such large projects are a difficult undertaking anywhere, requiring major environmental impact assessment, careful planning, surveying, and design.

Money and expertise are needed not only to build irrigation systems but also to maintain them. In the drylands modern irrigation has resulted in salinization, silting of reservoirs, waterlogging, lowering of silt levels in downstream areas, spread of waterborne diseases, spread of waterweeds, water pollution from agricultural chemicals and often displacement of thousands of people with undesirable environmental and economic consequences (Lewis and Berry 1988). Other problems with large water projects include disruptions to fisheries, loss of forests and wildlife and excessive water loss due to evaporation. Usually big irrigation projects fail in technical or social terms as well, with canals leaking or breaking open or upstream farmers using too much water, thereby depriving their neighbors downstream. According to Timberlake (1985), in the Sahel during the 1970s and early 1980s, 5,000 new hectares of land were coming under irrigation every year, while another 5,000 hectares of irrigated land were going out of production due to waterlogging and salinization. He also points out that in 1979 Senegal had 5,000 ha and Mali about 17,000 ha of irrigated land in need of rehabilitation.

Perhaps with the exception of the Aswan High Dam in Egypt, almost all irrigation dams are becoming known as classic examples of development failures in Africa. But people now recognize that these detrimental effects are not a necessary tradeoff--particularly when these projects fail in purely "economic" sense. There are many

examples. Take the dam on River Sokoto at Bakolori in Northern Nigeria. According to Adams (1987), one can criticize this project for its total ignorance of the environment and its downstream impact, its ignorance of local socio-economic conditions including problems pertaining to land tenure and land occupancy, its ineffective communications and coercive relations with local farmers related to the scale and speed of operations and, finally, its unrealistic economic appraisal. Moreover, the office du Niger in Mali and the Gezira in Sudan both failed to increase productivity because of waterlogging; also in Sudan the reservoir at Kashm el Girba on the river Atbara was estimated to be 40 percent full of sediment in 1980 after only 10 years of operation (Lewis and Berry 1988).

There are other problems associated with huge water projects. For example, The Akosombo decreased the Volta River's silt load, so that ocean currents washing Togo's shores carry less silt to replace shorelines washed away by waves. The resulting coastal erosion has been so rapid that the coastal road had to be rebuilt twice (Timberlake 1985). Another example is the Volta hydroscheme, which by flooding some of the best land in Ghana and cutting all north-south communication in the nation, arguably has cost much more than it has produced (Riddell 1981). The construction of the Gezira removed previous pasture lands and caused overgrazing of the remaining areas and "initiated major soil erosion in Sudan" (Lewis and Berry 1988).

Large-scale irrigation often displaces large numbers of villagers with serious social and environmental consequences. The Akosombo project uprooted about one percent of the national population and Lake Kainji in Nigeria and Kariba project both displaced about 50,000 people. The effects of such large displacements can be far-reaching. The Talata-Mafara dam and the irrigation project in Nigeria, as Dinham and Hines (1983) reports, displaced 60,000 peasants during three years of construction with no compensation. On a number of occasions, displaced farmers are forced onto more marginal lands which they overcultivate and accelerate the desertification process. There is no doubt that irrigation is necessary, but "the way large-scale irrigation is often carried out in Africa can contribute to the environmental bankruptcy" (Timberlake 1985).

Big dams are built not necessarily for their economic feasibility but because the project becomes a political showpiece (Gupta 1988). The dams needed in Africa are often small ones, not because "small is beautiful," but because small is more manageable. For instance, South Africa's agriculture is based on more than half a million small dams, although several larger ones do exist. Many experts now believe small projects such as micro-catchments, contour-damming and water spreading, irrigation from sand rivers and ground water are more appropriate for Africa's realities. Unlike large projects these

micro-irrigation systems are not bureaucratically-managed and farmers can directly control, manage and run them (Lipton 1985).

All these arguments point out that there is more to efficient water management than building dams. The needs of the farmers must be taken into account; the hydrology of the soil must be studied and understood; the planning should go beyond engineering feasibility study and examine the possible impact on the environment, people, wildlife and the society as a whole. Large projects then must articulate what Riddell (1981) has called the "Equartet," or the four big E's; Economics (including energy economics), Equity (social balance), Engineering (design) and the Environment (conservation). Given the current economic and political realities of Africa, however, difficulties involved in the attainment of these goals more often than not make microirrigation techniques much more feasible and realistic.

2. Deforestation

One dilemma facing Africa is whether to view the forests as an invaluable part of the environment or to use them for short-term economic gains. On the one hand, not only does the destruction of forests provide land for cultivation and revenue from timber exports, it also supplies fuelwood, the major source of energy in most of Africa. On the other hand, forests play a vital role in the overall health of ecosystems and constitute a major economic resource of which the destruction could seriously limit future options available to African nations. Currently, rich speculators and poor peasants alike are clearing forests for agriculture, timber and industry, engaging in a short-term use of the land with no long-term benefits. But a full understanding of this process requires the acknowledgment that peasants who cut trees does so for an immediate and pressing need, not out of neglect or disrespect of the environment.

In addition, forests provide habitat for a multitude of species of plants and animals. Although the valuation of this genetic resource is not easy, surprises in the usefulness of wild plants and animals have been experienced in many fields from medicine and food to pest control (Bartelmus 1986). Tropical forests, for instance, supply a number of invaluable raw materials for the pharmaceutical industries. Plant species from the forest have been used in the hybridization of cereals during the Green Revolution (Gupta 1988).

The illegal felling of trees and the overexploitation of forests have been widespread in most African nations (see table 6 and Areola 1987). According to a FAO/UNEP study in 1981, Africa was losing forests at the rate of 1, 300, 000 ha per year (Timberlake 1985). The Zaire basin still remains largely untouched, but the tropical forests have mostly

disappeared in West Africa where the pressure for cash crop cultivation has been the strongest. Some estimates suggest that by the end of the century the forests of West Africa will have completely disappeared. In the drylands forests are cleared to make way for cash crops.

In the 1980s in Senegal about 50,000 ha of woodlands were being cleared each year, while Burkina Faso was losing 85,000 ha per year and Guinea Bissau about 25,000 ha. In Ghana nearly 50,000 ha per year were being lost to rice cultivation and in Benin no natural forest was left (Timberlake 1985). The deforestation of dry woodlands in the savanna will also continue to impact the economic activity and the standard of living. In Ethiopia it has become difficult to find wood for fuel near large urban centers like Addis Ababa: in Burkina Faso, firewood and charcoal are in short supply; in Sudan the distance of transport of wood to Khartoum is estimated to have increased from 5-10 km to 100-200 km in the past 20 years (Lewis and Berry 1988). According to UN estimates, Uganda will have to import timber soon unless measures are taken to protect the remaining woodlands (Hamilton 1982). Kenya banned charcoal exports in the late 1970s, finally recognizing the long-term consequences of deforestation (Hughes 1987).

However, timber continues to be an important source of revenue for most West African countries. Liberia and Cameroon each earned close to \$100 million in 1980 from exports of timber. The biggest exporter was Côte d'Ivoire, which earned about \$300 million in the same year, where its forested area declined by two-thirds in 20 years between 1965-77.

In addition to forest clearing for agriculture, a major cause of deforestation is the lack of alternative energy sources. The biggest single use of wood in many countries, especially in Ethiopia, Kenya and Nigeria, is for fuel (see table 7). The entire continent has the largest per capita annual consumption of firewood with an average of 1.18 cubic meter in the underdeveloped world. Wood is burned directly for cooking, for heat or is transformed into charcoal, which has less heating value than the original material but is easier to transport. Much of the charcoal is produced for urban consumption. Fuelwood and charcoal are estimated to meet at least 80 percent of total energy consumption in countries like Kenya, Uganda and Tanzania. What is really disturbing is the fact that this sphere of activity is effectively unregulated and hardly any attempt is being made to ensure the future of the forests.

Especially in the Sahel, the destruction of vegetation has resulted in the increase in the time required to procure fuelwood. This seriously disrupts family stability and

shortens the time for other productive and necessary activities, including household production (Redclift 1984). As a FAO study in 1978 found, fuelwood had become so scarce in Gambia that it took 360 woman days per year per family to gather enough amount.

The ecodevelopment view argues for the soft energy options, such as "harnessing solar power," small-scale hydropower projects, and even "vegetable alcohol production" (Riddell 1981). Some concrete steps are already taken in this direction. For example, since the late 1970s, in Senegal Institut de Physique Meteorologique (IPM) and the Ecole Polytechnique de Thies began investigating ways to pump water using solar and wind energy; also experimental solar collectors, photovoltaic systems, and windmills have been installed (Lateef 1980).

Of course, in the present economic context Africa cannot afford to conserve all of its forests. Clearing for agriculture, cutting for fuelwood or construction, logging for export all consume forests for human benefit. But Africa "can afford even less to squander the economic and social benefits which proper forest and woodland management can bring"; for mismanagement forecloses on the larger benefits forests can offer and results in "wastelands unable to produce timber, fuelwood or crops" (Timberlake 1985).

3. The Question of Appropriate Technology

Another topic of controversy in Africa is the choice of appropriate technology. The challenge facing many African nations is to adapt technologies that would lead to elimination or reduction of pollution and prevention of further desertification without at the same time resulting in a reduction in their ability to produce necessary goods and services. The history of science and technology, Commoner (1990) asserts, "shows that it can be done, but now the transformation will require a new motivation and ethic." Environmentalists are critical of the sale of oldfashioned technology from the rich industrialized nations to less developed countries under the rationale that the environment of the latter has a greater capacity to absorb pollution. The Commission of the European Communities in its 1977-81 program, for instance, proposed such a transfer of technology (Vieria 1985).

Ecodevelopment instead suggests softer and indigenous technologies which would be more appropriate for the social and physical environments of the less developed nations. In part because these countries are suspicious that this is a new device to keep them backward, capital-intensive heavy technology has often been preferred. Once again it must be emphasized that appropriate technology does not imply "small is beautiful:" it is

not a prescription for primitive and cheap technology for primitive people. Instead, it calls for "scientifically sound methods and materials that are socially acceptable in a particular context: if anything it calls for the highest scientific perceptiveness" (Ambroggi 1980). As Riddell (1981) put it, "technologies that are economically, socially and environmentally appropriate are so because they are financially profitable, socially rewarding and ecologically adaptive."

The key concept of appropriate technology consistent with ecodevelopment viewpoint is that what is appropriate in economic and environmental terms to Northern nations is not necessarily mirrored in the South (Riddell 1981). Technology developed in the North is adapted to conditions there, i.e., labor that is scarce and expensive, capital and energy that are plentiful and relatively cheap, management that is capable of *fine-tuning operations*, and infrastructure that is extensive and flexible, none of which exist in Africa (Lateef 1980). Furthermore, the product of advanced technology is the outcome of a string of technical linkages (Redclift 1984). This implies that the technological package has to be accepted or rejected as a whole--it is indivisible.

In Sub-Saharan Africa the problems of soil deterioration and the failure to increase yields are admittedly quite complex, but the effects of this "temperate bias" is claimed to hold back African development more than "colonialism, war and world trade patterns put together" (Timberlake 1985). Many advisers and decision-makers involved in Africa's agricultural development are trained in temperate Northern nations with very different soil and climatic characteristics. Thus, practices they propose, such as the cultivation of a single crop, the use of artificial fertilizers and pesticides, and large-scale irrigation, result in topsoil erosion, contaminated water and food supplies and a host of other environmental problems. Moreover, they yield a poor return on capital employed. Large mechanized farms and construction of huge dams for irrigation, for example, which are promoted by external bodies, require skilled labor, skilled management, fuel, and large amount of capital expenditures and are import-intensive.

Many case studies showing how the policies with temperate bias resulted in economic and environmental disaster can be found in Timberlake (1985). They range from the rice cultivation program on the banks of the Niger in Mali which brought financial disaster to more than 70,000 peasants in the mid-1980s due to flooding, to Canadian wheat project in Tanzania which led to water erosion and replaced corn production, a staple for eight out of ten Tanzanians.

In the Sahel the disastrous impacts of mechanization show what happens when Northern technology is introduced to regions which cannot possibly sustain them (Lateef 1980). Lewis and Berry (1988) show how mechanization in the savanna has actually contributed to poorer farming conditions, how it has encouraged economizing on human labor, for which the need is by no means crucial, and how it has required imported fuel. In agriculture, as Blaikie (1985) states, the purpose of mechanization is to increase output of one crop rather than to enhance the farm system as a whole. For modern technology has a big farmer bias: it favors planting crops in pure stands against intercropping techniques. However, such monocultures are more vulnerable to pests, result in soil deterioration, and are not sustainable for long periods.

It must be emphasized that successful development calls not only for the soundness of the conservation techniques, i.e., the mechanical or agronomic method used, but also for the viability of the conservation program or policy. That is, policies have components other than which technique will be used, such as where these techniques will be used, what the means of implementation will be, and who will lose and who will benefit. For instance, consider the pilot projects undertaken by FAO that involve a small number of farmers. These projects are transitional phases between a research station and the real world. But in their more general applications these projects run into various problems, such as political opposition of the local people, inadequacies of the agrarian extension workers and support staff, and so on. That is, replication in the real world often becomes more difficult when social and political factors are ignored (Blaikie 1985). In a case study, Eckholm (1976) recounts a project in Ethiopia where peasants, who were forced to supply their labor in a reforestation program, planted the seedlings upside-down as a protest against oppressive land tenure conditions. The latter included short leases, planting trees on someone else's land, and uncertainty of compensation of tenants by landlords.

4. Politics, Government and the Environment

As was noted above, some conservationists in the West and most of the mainstream social scientists downplay the political aspects of Africa's current predicament and consider the African lazy, ignorant, backward and irrational. The corollary of this view is to suggest that "the stupid peasant must be educated not to cut down trees," which in itself is ignorant and narrow-minded (Timberlake 1985). The issue is political and does not begin and end with the local peoples. As Redclift (1984) put it, "so many causes of the environmental crisis are structural, with roots in social institutions and economic relationships, that anything other than a political treatment of the environment lacks credibility." The lack of economic means for the provision of even the most basic needs, the past economic policies, the population pressure and the nature of economic

relationship with the industrialized countries all could explain some of the environmental degradation in Africa, though the main determinant of environmental affairs is political. For any policy directly or indirectly involving the protection of the environment will reflect the ideology of the government and the values of a particular culture, and the social adjustments that any reform calls for will naturally make conservation a very political issue. The political dimension of Africa's problems is especially emphasized by Blaikie (1985), who believes problems such as soil erosion are not purely environmental but rather complex socioeconomic problems.

Governments in Africa then will have to assume the role of leadership in fight against poverty and environmental degradation, even though some decisions will inevitably be politically unpopular among certain groups. They will have to change through public policy the system of incentives and penalties in order to ensure the successful "marriage of economics and ecology." As Strong (1980) argued, governments are capable of making it profitable to carry out those activities which are environmentally sound and socially desirable, and unprofitable those activities which impair environmental quality and involve irrational use of resources. Such an approach, "far from being negative to the economy ...would unleash new forces and would stimulate creativity, innovation and economic activity" (Strong 1980).

In fact, the technological basis is largely available for transforming current methods of production and consumption activities into ecologically sound ones. So if the necessary technology does exist, what is required to activate it? The answer, according to Commoner (1990), even in the industrialized nations, is the market power of government purchases and a revised system of incentives and penalties for the private sector.

Governments must also realize that some of their past policies have actually accelerated the process of environmental degradation, particularly of overgrazing and desertification. For example, because pastoralists are hard to tax and educate and they move across national boundaries, the African governments have pursued a policy of sedentarization. This policy made no economic sense by eliminating a valuable area from effective utilization. For animal-based economies of pastoralists require large areas of rangeland and mobility to be efficient and appear to be an effective and rational adaptation to environments having water deficiencies. Nor did it make environmental sense by inducing deep well-drilling and dam building, which have adversely affected the resource base of the Sahelian countries "with unexpected negative results" (Lewis and Berry 1988).

As Timberlake (1985) argued, "sedentarization can be the most environmentally damaging process." Timberlake cites the governments' efforts to urge pastoralists to settle via the UNESCO Integrated Project on Arid Land (IPAL) in the late 1970s. The project included permanent settlements, veterinary aid and well-digging services. The result was severe overgrazing of the land around settlements and wells. IPAL's conclusion was that "it will only be possible to increase ...welfare of pastoralists and to stop desertification if the mobility and dispersion of livestock can again be increased considerably, and if overall numbers of livestock can be better controlled through a greatly improved marketing system." Well-digging has failed in part because wells encourage pastoralists to stay around them rather than move from one well to another. Thus, the balance between water supplies and grazing has been disturbed by newly dug deep wells, which, unlike traditionally shallow wells, are relatively free from fluctuations in seasonal rainfall. Well-digging has failed too because most are dug without fitting the new wells into pastoralist routes and without consulting pastoralists themselves.

The past experience has shown that African countries have been poorly served by ideologies and political systems imported from the northern industrialized nations. For example, Marxism in Tanzania, capitalism in Kenya and socialism in Angola have all failed to improve the standards of living of the majority of the people in these countries. Furthermore, development strategies based on the experience of western capitalist or eastern socialist countries are likely to take "an unacceptable toll on the environment" (Redclift 1984). Some ecologists, for example Croall and Rankin (1981), have argued that capitalism is anti-ecology, though socialism is not necessarily pro-ecology. Indeed, the prevalent view in most environmentalist, conservationist and socialist literature suggests that the pursuit of individual profit and mass production and consumption lead to overexploitation of nature. For instance, a number of authors cited by Vieria (1985) see "waste as an integral part of the capitalist world and identify the obsolescence of goods as the essence of capitalism and, as an inevitable consequence, a high pressure put on natural resources." There is much truth in such propositions.

The historical evidence shows that in Africa and elsewhere in the world, resource exploitation and quantitative growth without much regard for the environment have been carried out in socialist countries with at least as much force as they have been under capitalist regimes. If anything, even some radicals concede, socialist countries have a worse environmental record because technology used was developed in capitalist countries, where their design was governed by profit-maximization, to the exclusion of environmental concerns, and because environmentalists have not been free to comment, let alone influence government decisions (Commoner 1990). The fact is that many factors

could lead either to a capitalist government more willing and able to protect the environment or to a socialist government more conducive to the destruction of the environment. Thus, one can state that "environmentalism is itself a political ideology, neither right nor left-wing" (Vieria 1985).

5. Equity and The Environment

Resource misuse and depletion entail questions of income distribution patterns and equity which are rarely considered in the mainstream analyses. Poverty and inequality result in uneconomic exploitation of natural resources and environmental degradation. Poor people degrade the environment unintentionally by dwelling in slums surrounded by their own waste or by soil exhaustion and erosion through intensive use of small plots of land and clearing of forests and vegetation (Vieria 1985). As Riddell (1981) argued, "the avoidance of extremes of poverty and excesses of wealth will greatly strengthen ecodevelopment policy." Moreover, the principal cause of famine in the Sahel might be the inadequate demand for food among particularly vulnerable groups, rather than failures in the supply of food; "changes in income distribution and lower absolute income levels can provoke widespread famines even when harvests are average" (Sen 1981). Furthermore, poorer and less powerful groups almost always have less access to better technology, credit and other opportunities and can only generate weak market signals to institutions involved in upgrading the environment (Blaikie 1985). In fact, a problem inherent in technology transfer to the Sahel is that it widens the gap between the rich and the poor since the new technology is adapted first by farmers who have adequate acreage of land and access to capital.

Blaikie (1985) cites an evaluation of an AID project in Senegal, namely the Senegal Cereal Production Project (SCP), which came to the following conclusion: "Preliminary investigations indicate that ...a disproportionate share of project benefits are earned by large income farmers." Or as Timberlake (1985), referring to a cash crop project in Senegal, asked, "who benefits, a Senegalese peasant, whose land was taken away to make way for an irrigation project to grow rice which only city people could afford to buy?"

6. Local Participation

One of the themes of this paper, namely that participation at various levels of the community is crucial for successful design and implementation of various programs and policies, deserves more attention. Case studies and past experience indicate strongly that a given program's chances of achieving its goal of a healthier environment that can sustain a relatively prosperous life is much higher when people are involved in decision-making (Gupta 1988). As Riddell (1981) maintained, "ecodevelopment works

best as a grassroots endeavor." Self-reliance and local participation are essential components of any meaningful development, especially since rural people are--understandably--suspicious of the new ideas and policies which might undermine their already difficult existence. Whether communities choose agriculture, industry, small- or large-scale schemes or hard or soft technology, they must be involved in the choice (Gupta 1988). Unfortunately, there are many instances in which local conservation efforts are discouraged or neglected, and worse yet, are replaced by those initiated by governments (Blaikie 1985).

The issue of local involvement in programs has three important aspects that must be mentioned. First, achievement of community participation requires a more equal pattern of land ownership: "cooperation is rarely found to succeed amongst those who are unequal in material terms since it becomes difficult both to ensure an equal distribution of costs and benefits" (Blaikie 1985). Secondly, too often local people not only do not participate but actually resist conservation programs. For they see these programs as an imposition when government measures exclude them from resources long since used by them. Riots, formation of armed resistance and political dissent in eastern Africa against the British administration is a case in point. So is the recent friction between the Masai and the government in Kenya. And finally, many examples have proved that as people become better informed about the causes and consequences of problems like pollution, soil erosion or deforestation, they begin to participate in the debate and are prepared to take action. In fact, since 1976 UNEP has been working with UNESCO to implement pilot projects in Africa aimed at education and staff training (Vieria 1985).

Many conservation efforts have failed in Africa because the project's aim did not coincide with the objectives of the villagers. In 1982, for instance, CARE organized a program to keep sand dunes from swallowing up a stream bed in Nijer. The village was not interested in the project. It did not organize any volunteer guards or donate millet stalks: in fact, CARE was forced to buy them at high prices. CARE's money eventually ran out and the project could not be completed. Timberlake (1985) explains that "because the villagers' existence was so marginal, they grew so little and could market so little of their output that they saw no logical reason for involving themselves in the hard labor." It was easier to move elsewhere. A similar CARE project worked in the same valley in a village closer to the main road and to markets and 15 percent increase in yields were converted into a yearly cash increase of about \$108,000.

Now, increasing herd size is a factor in overgrazing especially as the availability of grazing land is declining. It is commonly thought that because animals are a source of

income, herders maximize herd size, which eventually reduces the land to desert. In many parts of Africa though cattle are looked upon as a store of wealth, not just as a source of income. In fact, "the objective function of cattle owners is to accumulate cattle assets which confer security, prestige and status" (Blaikie 1985). Therefore, many policies, based on the assumption that pastoralists would wish to reduce stocking densities, since the same or even greater incomes could be generated by fewer cattle per owner, have failed to produce the intended results.

Also most attempts to plant trees for fuelwood failed, "because it is like presenting a solution to a problem which people do not see they have" (Timberlake 1985). It is now understood that villagers often participate in planting trees because they want them for fruit, timber and shade rather than for fuel. Moreover, in many cases they do not have permanent possession of the land which destroys the incentive for growing trees. These examples illustrate the importance of local participation in conservation efforts.

VII. Conclusion

To some extent, Africa's failure to achieve self-sustained economic growth has been due to the fact that environmental and developmental programs have been almost exclusively designed by specialists--biologists for the protection of plant species, zoologists for the survival of animal species, geographers for the study of soils, economists for growth, and anthropologists for the appreciation of cultures. Hence, the objectives of the programs have reflected these narrowly conceived academic preoccupations of these specialists (Anderson and Grove 1987). The lack of coordination and cooperation among these branches manifest itself in political practice by the fact that wide-ranging issues are usually dealt with by separate ministries (Blaikie 1985). Collaboration between social and natural scientists is one of the indispensable components of environmentally sound economic growth. Concerning agriculture "a strong argument can be made in support of the proposition that the problems of rural development will not be solved until agriculture has achieved a more compatible marriage than now persists with the social sciences" (Lateef 1980). Similar argument can be made for any scheme to improve pastoralism: "government officials with responsibility for livestock management, well-digging, veterinary services, arable farming and forestry will have to start communicating with one another" (Timberlake 1985):

In June 1992 the UN Conference on Environment and Development will convene in Brazil. It is expected to be the largest meeting on the environment in history. The conference will offer the opportunity to strengthen the bond between economics and

ecology and to adopt agreements on important global issues ranging from limitation of greenhouse emissions and ozone depleting CFCs to protection of tropical forests. As Peter Berle (1991) observed, hopefully it will also help defeat the belief that has enslaved us for decades, the belief that economic development, environmental protection and limiting human population growth are separable concepts. Finally, it will perhaps help some Western conservationists realize that "it is not sensible to go from a previous conception of people on top of the universe with nature to serving them to a new one where nature becomes an untouchable diety and humans a malefic appendix" (Vieria 1985).

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Table 1
Population in Africa

	Population Growth Rates		Population under 15
	(percent) (1965-70)	(percent) (1985-90)	(percent) (1990)
Angola	1.52	2.70	44.9
Botswana	2.54	3.51	48.5
Burkina Faso	2.14	2.67	43.8
Burundi	1.45	2.88	45.6
Cameroon	2.11	2.60	43.5
Chad	1.82	2.47	42.8
Cote d'Ivoire	4.05	4.12	49.4
Ethiopia	2.41	2.01	44.9
Gabon	0.36	3.45	32.3
Gambia, The	2.77	2.83	44.0
Ghana	1.91	3.14	45.4
Guinea	1.95	2.48	43.7
Guinea-Bissau	0.06	2.08	41.3
Kenya	3.30	4.22	52.1
Liberia	2.85	3.18	45.7
Malawi	2.56	3.31	46.1
Mali	2.15	2.94	46.6
Mauritania	2.17	2.73	44.6
Mauritius	1.83	1.25	28.4
Niger	2.08	3.01	47.3
Nigeria	3.24	3.43	48.4
Rwanda	3.16	3.40	48.9
Senegal	2.89	2.69	44.5
Sierra Leone	1.79	2.49	44.5
Somalia	2.31	3.32	47.6
Sudan	2.29	2.88	45.3
Tanzania	3.08	3.67	49.1
Uganda	3.96	3.49	48.5
Zaire	2.11	3.17	46.2
Zambia	2.96	3.76	49.1
Zimbabwe	3.28	3.15	44.8
Africa			44.8
World			32.4

Source: World Resources Institute (1990).

Notes: Population Growth Rate = average annual percentage change in population. Population Under 15 = percentage of population between ages 0-14.

Table 2
Population Dynamics

	Contraception 1980-87	Crude Birth Rate 1985-90	Urban Population	
			1975	1990
Angola	na	20	17.8	28.3
Botswana	27.8	12	12.0	23.6
Burkina Faso	na	19	6.3	9.0
Burundi	8.7	17	3.0	7.3
Cameroon	2.4	16	26.9	49.4
Chad	na	20	15.2	33.3
Cote d'Ivoire	2.9	14	32.2	46.6
Ethiopia	na	24	9.5	12.9
Gabon	na	16	30.6	45.7
Gambia, The	na	21	16.6	22.5
Ghana	9.5	13	29.8	33.0
Guinea	na	22	16.3	25.6
Guinea-Bissau	na	20	20.8	30.8
Kenya	17.0	12	12.9	23.6
Liberia	6.5	13	30.4	44.0
Malawi	7.0	20	7.7	14.8
Mali	5.0	21	16.2	19.2
Mauritania	0.8	19	19.6	42.1
Mauritius	75.4	5	43.6	42.3
Niger	na	21	10.6	19.5
Nigeria	4.8	16	23.4	35.2
Rwanda	10.1	17	4.0	7.7
Senegal	11.7	19	34.2	38.4
Sierra Leone	na	23	21.1	32.2
Somalia	na	20	25.6	36.4
Sudan	4.6	16	18.9	22.0
Tanzania	na	14	10.1	32.8
Uganda	na	15	8.3	10.4
Zaire	na	14	32.2	39.5
Zambia	na	14	36.3	55.6
Zimbabwe	38.4	10	19.4	27.6
Africa		15	25.3	34.5
World		10	38.5	42.7

Source: World Resources Institute (1990).

Notes: Contraception = percentage of couples using contraception. Crude Birth Rate = 1,000 multiplied by number of live births in a given year divided by the midyear population. Urban Population = urban population as a percentage of total.

Table 3
Agricultural Indicators

	Agriculture/GDP 1987	Labor 1960	Force 1980	Irrigation 1985-87
Angola	na	69	74	na
Botswana	3	92	70	0
Burkina Faso	38	92	87	0
Burundi	59	90	93	5
Cameroon	24	87	70	0
Chad	43	95	83	0
Côte d'Ivoire	36	89	65	2
Ethiopia	42	88	80	1
Gabon	11	85	75	na
Gambia, The	na	89	84	7
Ghana	51	64	56	0
Guinea	na	88	81	4
Guinea-Bissau	na	87	82	na
Kenya	31	86	81	2
Liberia	37	80	74	1
Malaw	37	92	83	1
Mali	54	94	86	9
Mauritania	37	91	69	6
Mauritius	15	40	28	16
Niger	34	95	91	1
Nigeria	30	71	68	3
Rwanda	37	95	93	0
Senegal	22	84	81	3
Sierra Leone	45	78	70	2
Somalia	65	88	76	12
Sudan	37	86	71	15
Tanzania	61	89	86	3
Uganda	76	89	86	0
Zaire	32	83	72	0
Zambia	12	79	73	0
Zimbabwe	11	69	73	7
Africa		78	69	6
World		60	51	15

Source: World Resources Institute (1990)

Notes: Agriculture/GDP = percentage share of agriculture in Gross Domestic Product. Labor Force = percentage of total labor force employed in agriculture. Irrigation = irrigated land as a percentage of total cropland.

Table 4
Agricultural Productivity
(1979-81=100)

	Total		Per Capita	
	1976-78	1986-88	1976-78	1986-88
Angola	103	102	114	85
Botswana	110	93	123	73
Burkina Faso	90	144	97	121
Burundi	93	122	99	100
Cameroon	98	116	106	96
Chad	98	121	104	103
Cote d'Ivoire	85	122	97	91
Ethiopia	89	105	95	92
Gabon	91	110	105	84
Gambia, The	114	121	125	99
Ghana	97	134	103	105
Guinea	98	109	105	93
Guinea-Bissau	95	152	110	132
Kenya	100	127	112	96
Liberia	94	117	103	93
Malawi	95	106	104	85
Mali	91	125	97	103
Mauritania	90	110	97	91
Mauritius	109	117	116	105
Niger	86	109	93	88
Nigeria	89	126	99	100
Rwanda	86	103	95	82
Senegal	110	134	122	113
Sierra Leone	99	110	106	93
Somalia	96	127	112	99
Sudan	93	113	102	91
Tanzania	91	116	101	89
Uganda	111	105	123	83
Zaire	96	120	105	96
Zambia	116	118	129	89
Zimbabwe	103	119	113	96
Africa	95	116	103	94
World	94	116	99	102

Source: World Resources Institute (1990).

Notes: Index of agricultural production portrays the disposable output (after deduction for seed and feed) of a country's agriculture sector relative to the base period 1979-81. The index includes all crop and livestock products.

Table 5
Food Productivity:
Index of Food Production
 (1979-81=100)

	Total		Per Capita	
	1976-78	1986-88	1976-78	1986-88
Angola	98	104	109	87
Botswana	93	123	73	33
Burkina Faso	91	141	98	118
Burundi	98	123	104	101
Cameroon	99	116	108	96
Chad	94	120	100	102
Cote d'Ivoire	85	127	96	95
Ethiopia	88	106	94	94
Gabon	91	110	110	105
Gambia, The	115	123	127	100
Ghana	97	135	103	106
Guinea	98	109	105	93
Guinea-Bissau	95	152	110	132
Kenya	103	123	115	92
Liberia	94	120	103	96
Malaw	95	103	104	83
Mal	91	124	97	102
Mauritania	90	110	97	91
Mauritius	111	117	117	105
Niger	86	109	93	88
Nigeria	88	127	98	100
Rwanda	86	99	95	79
Senegal	110	135	122	113
Sierra Leone	101	110	108	93
Somalia	96	127	112	99
Sudan	90	112	100	90
Tanzania	90	116	99	90
Uganda	111	104	122	82
Zaire	95	119	105	96
Zambia	117	118	130	89
Zimbabwe	107	110	118	90
Africa	94	116	103	95
World	94	116	99	102

Source: World Resources Institute (1990).

Notes: The Index of Food Production portrays the disposable output of a country's agriculture sector relative to the base period 197981. The index covers all edible agricultural products that contain nutrients. Coffee and tea have no nutritive value and are excluded.

Table 6
Forest Resources

	Forests 1980s	Deforestation 1980s	Reforestation 1980s
Angola	53,600	94	4
Botswana	32,560	20	na
Burkina Faso	4,735	80	3
Burundi	41	1	3
Cameroon	23,300	190	2
Chad	13,500	80	0
Côte d'Ivoire	9,834	510	8
Ethiopia	27,150	88	13
Gabon	20,575	15	1
Gambia, The	215	5	0
Ghana	8,693	72	2
Guinea	10,650	86	0
Guinea-Bissau	2,105	57	0
Kenya	2,360	39	13
Liberia	2,040	46	3
Malaw	4,271	15	1
Mali	7,250	36	1
Mauritania	554	13	0
Mauritius	3	0	0
Niger	2,550	67	3
Nigeria	14,750	400	32
Rwanda	230	5	4
Senegal	11,045	50	4
Sierra Leone	2,055	6	0
Somalia	9,050	14	2
Sudan	47,650	504	17
Tanzania	42,040	130	11
Uganda	6,015	50	2
Zaire	77,590	370	1
Zambia	29,510	70	3
Zimbabwe	19,820	80	6
Africa	684,402	3,822	355

Source: World Resources Institute (1984).

Notes: Forests = extent of total forest and woodland, in thousands of hectares. Deforestation = average annual deforestation of total forest and woodland, in thousands of hectares. Reforestation = average annual reforestation, in thousands of hectares.

Table 7
Timber Harvest Rates
Roundwood Production
 (1985-87)

	Total	Fuel and Charcoal	Industrial
Angola	5,020	4,006	1,013
Botswana	1,255	1,149	76
Burkina Faso	6,931	6,618	314
Burundi	3,742	3,697	45
Cameroon	12,165	9,391	2,774
Chad	3,655	3,139	517
Cote d'Ivoire	11,870	8,255	3,615
Ethiopia	38,927	37,114	1,813
Gabon	3,873	2,573	1,300
Gambia, The	856	835	21
Ghana	9,590	8,496	1,094
Guinea	4,351	3,737	614
Guinea-Bissau	561	422	139
Kenya	33,784	32,195	1,589
Liberia	5,131	4,405	726
Malawi	6,725	6,414	311
Mali	5,052	4,733	319
Mauritania	12	7	5
Mauritius	25	17	8
Niger	4,041	3,791	249
Nigeria	98,603	90,735	7,868
Rwanda	5,842	5,602	240
Senegal	4,099	3,539	560
Sierra Leone	7,922	7,781	141
Somalia	4,531	4,463	68
Sudan	20,099	18,206	1,893
Tanzania	23,892	22,398	1,495
Uganda	12,935	11,247	1,688
Zaire	31,381	28,843	2,539
Zambia	9,946	9,418	528
Zimbabwe	7,391	6,003	1,388
Africa	449,503	396,196	53,307
World	3,255,039	1,680,540	1,574,499

Source: World Resources Institute (1990).

Notes: Total Roundwood Production refers to all wood in the rough, destined for industrial or fuelwood uses. Fuel and charcoal production covers all rough wood used for cooking, heating, and power production. Industrial roundwood production includes all roundwood products other than fuelwood and charcoal, such as sawlogs, pulpwood and veneer logs.

Table 8
Wildlife Harvest Rates

CITES-Reported Trade in Wildlife and Wildlife Products

	Cat Skins(1986)		Raw Ivory(1988)		Live Parrots(1986)	
	M	X	M	X	M	X
Angola	na	na	na	na	0	5
Botswana	449	32	38	0	1,083	0
Burkina Faso	na	na	na	na	1	1
Burundi	0	2	na	na	0	34
Cameroon	3	6	0	2,538	2	10,320
Chad	na	na	na	na	0	0
Cote d'Ivoire	na	na	201	476	4	1,705
Ethiopia	0	1	0	2,160	na	na
Gabon	na	na	0	13,542	1	4
Gambia, The	na	0	na	na	0	0
Ghana	0	2	na	na	0	6,561
Guinea	0	33	na	na	0	1,990
Guinea-Bissau	na	na	na	na	0	2
Kenya	1	20	na	na	2	26
Liberia	0	2	na	na	1	9,368
Malawi	0	2	38	782	0	0
Mali	0	500	na	na	21	3,144
Mauritania	na	na	na	na	na	na
Mauritius	na	na	na	na	1,060	0
Niger	0	0	na	na	1	7
Nigeria	0	42	na	na	0	39
Rwanda	na	na	na	na	0	3
Senegal	na	na	22	0	12	28,430
Sierra Leone	0	1	na	na	0	0
Somalia	na	na	0	22,638	na	na
Sudan	0	4	na	na	54	1
Tanzania	0	342	0	22,581	0	84,228
Uganda	0	2	na	na	1	1
Zaire	0	3	0	11,009	27	108
Zambia	0	47	0	1,622	0	0
Zimbabwe	6	93	3	6,983	66	450
Africa	753	2,272	2,254	130,391	14,255	169,238

Source: World Resources Institute (1990).

Notes: Includes trade reported by members of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Cat Skins = skins of all species of Felidae, in number. Raw Ivory = trade in African elephant ivory, in kilograms. Live Parrots = captive-bred and wild-caught individuals of psittacine species except the bugarigar and the cockatiel, in number.

Table 9
Wildlife Habitat Loss
(1980s)

	Forests	Savanna	Wetlands/Marsh	Mangroves
Angola	45	17	na	50
Botswana	62	53	10	0
Burkina Faso	80	70	0	0
Burundi	88	80	na	0
Cameroon	59	72	80	40
Chad	80	72	90	0
Cote d'Ivoire	78	0	na	60
Ethiopia	86	61	0	0
Gabon	35	0	0	50
Gambia, The	91	0	0	70
Ghana	80	0	na	70
Guinea	69	0	na	60
Guinea-Bissau	80	0	0	70
Kenya	71	43	0	70
Liberia	87	0	na	70
Malaw	56	0	60	0
Mali	78	80	na	0
Mauritania	90	88	0	0
Mauritius	na	na	na	na
Niger	80	75	80	0
Nigeria	76	70	80	50
Rwanda	80	90	na	0
Senegal	82	80	na	40
Sierra Leone	88	0	0	50
Somalia	67	40	0	70
Sudan	74	68	na	0
Tanzania	40	49	na	60
Uganda	79	71	na	0
Zaire	57	30	50	50
Zambia	30	18	10	0
Zimbabwe	56	0	0	0

Source: World Resources Institute (1990).

Notes: Forests = percentage of all forests (dry and moist) lost.

Savanna=percentage of all savanna and grasslands lost.

Wetlands/Marsh = percentage of wetlands and marshes lost.

Mangroves = percentage of mangrove forests or swamps lost.