POLICY REFORM AND NATURAL RESOURCE MANAGEMENT IN SUB-SAHARAN AFRICA

edited by

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POLICY REFORM AND NATURAL RESOURCE MANAGEMENT IN SUB-SAHARAN AFRICA: INTRODUCTION

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INTRODUCTION

The broad outlines of Africa's development crisis are well known. While some scholars have described the crisis as environmental, others have concluded that it is largely the result of poor policy decisions on the part of African governments and donor and development agencies. In recent years, thinking and analysis have converged on the realization that those policies so often responsible for economic stagnation and declining agricultural productivity are, simultaneously, major contributors to the environmental crisis and degradation of the natural resources base.

Africa's economic problems are structural, and many have not responded to short-term efforts that focus primarily on single-sector improvements. Thus, a loose consensus has been reached that these problems will be alleviated only through integration across conventional sectors such as agriculture, livestock husbandry, forestry, fisheries, energy production, and rural development. It is also apparent that African countries must restructure their economies and institutions to ensure that economic growth is supported by public and private investment in long-term management of the country's natural resources. Too often, unfortunately, the latter

* The authors would like to thank Steve Siebert and Rhonda Blaine for their efforts in the final preparation of this document.

is needlessly sacrificed in pursuit of the former.

Clearly, the well-being and productivity of Africa's pastoral and agrarian peoples -- and the urban people whose food they provide -- are dependent on the conservation and appropriate use of renewable resource endowments (e.g., agricultural lands, forests, rangelands, wildlife, fisheries, soils, and water). However, in the face of pressures to increase agricultural productivity, assure food security, and provide infrastructure and health services for their burgeoning populations, African nations, like so many other developing countries, find it difficult to allocate the necessary fiscal resources for improvements in the sustainable management of their natural resources. Furthermore, these same pressures are contributing to the deterioration of the natural resource base through such actions as the extension of agriculture onto marginal lands and into forests, over exploitation of the wildlife and fishery resources, and intensification of cultivation of fragile and highly erodible soils.

In order to improve sectoral coordination and foster investment in the sound stewardship of natural resources, a better understanding must be reached concerning both the causes and consequences of environmental mismanagement. The report that follows takes an initial step forward that understanding by investigating the interrelated nature of macroeconomic policy reforms and the use of the natural resource base. Specifically, it presents research findings that identify and document examples of principle linkages between policy reform and natural resource management that donors and African governments can draw upon for assistance in designing, implementing, and evaluating projects and programs with natural resource components.

BACKGROUND

Impact of Macroeconomic Adjustment Programs

Macroeconomic reforms in Africa in the 1980's have shared many common characteristics across countries. Part of this fact is due to the similar nature of the external shocks confronting African governments, such as commodity price declines, high real interest rates, and a sharp decline in available financing from external sources. However, there have also been many common elements to the overall economic strategy for development and growth pursued by many African nations. This, combined with the importance of official development assistance from multilateral organizations, such as the World Bank and the International Monetary Fund, has resulted in the implementation of similar reform programs in a large number of African countries.

IMF stabilization programs in the short-term and longer-term structural adjustment programs promoted by the World Bank (and to an increasing degree by bilateral aid organizations) tend to exhibit some or all of the following characteristics:

1. Macro policy restraint in terms of both monetary policy (decreased expansion of money and credit to achieve a reduction in inflation and external imbalance) and fiscal policy (decreased government spending to bring excess of government expenditures over revenues into line with the increasing restricted availability of foreign credit) in order to achieve expenditure reduction.

2. A package of measures designed to promote an "outward" orientation of economic activity. Among these measures are devaluation, trade, liberalization, and reduction of price interventions to achieve expenditure switching. This is intended to create incentives for increased exports and to reduce expenditures on imports. Such measures are often accompanied by physical investments to remove structural impediments to the proposed changes.

Several aspects of these reforms generate new and in some cases significantly increased pressures on natural resources and the environment in general:

1. The decreased availability of foreign loans together with the high interest rates typically associated with stabilization programs cause a decreased ability to plan investments on the basis of least cost over the long-term. Projects or activities which generate a quick short-run return will tend to be favored more, with a consequent lessened ability to take into account environmental or sustainability issues which may only become apparent over the long-run.
2. Environmental quality has many aspects of a "public good" in that it often is uneconomic for private individuals to make the necessary investments since they cannot themselves recoup the returns generated. In such cases (e.g., forest or wildlife preserves) the government must bear the costs in order for the desired outcome to be achieved. Macro-reforms and their associated austerity measures can vastly decrease government resources available for these purposes as funds are diverted toward what are perceived as more pressing concerns.

3. An increased orientation toward export markets can have particularly important environmental consequences in the predominantly agricultural economies of Sub-Saharan Africa since such a shift implies widespread changes in cropping and marketing patterns across entire countries.

Complementary Policy Reform Options

While an understanding of the processes of environmental degradation on a micro-level is imperative in order to assess the scope of the problem, it is equally important to assess the economic processes which create incentives to engage in such detrimental activities. An analysis of these processes and the mechanisms through which macro-policy reforms affect them are prerequisites for the formulation of complementary policies to achieve a better and more sustainable use of each nation's natural resource base. Given the need for and inevitability of stabilization and adjustment, such complementary policies, as well as "reforms of the reforms," can help promote economic growth on a sustainable long-term basis.

Evaluation of the overall resource effects of a macro-adjustment program must proceed first from an inventory of the changes in economic activity caused by the reforms. These activities must then be evaluated on a technical level to determine which will allow or promote the long-run sustainability of the envisioned "restructured" economy, and which merit further investigation to ensure the most desirable pattern of resource use. Such an overall assessment of the environmental consequences of a given policy package can provide a basis for a ranking of proposed reform programs in terms of their sustainability and consequences for resource use.

Approach

In the fall of 1988, a study group was formed after the Principal Investigators (James P. Lassoie and Steven C. Kyle) learned that their proposal to U.S.A.I.D. to investigate this topic had been funded. This study group was composed of a portion of the team involved in the earlier proposal development stage and interested graduate students primarily from Cornell's Departments of Natural Resources and Agricultural Economics (Table 1). The group met through the fall to discuss the topic, identify specific areas for research that were based on professional strengths of the members, initiate a comprehensive review of the literature and commence literature analysis and writing.

Partial draft manuscripts of the various research topics chosen (see Table 2) were completed in early November. These formed the basis for a workshop held on November 11-12, 1988 on the Cornell Campus. Participants included study group members (Table 1), who presented their initial findings of their research on the second day of the workshop. Other individuals, some of whom were involved in a panel presentation on the first day (see Table 3), were invited to provide input, review, and comment.

Draft manuscripts were completed in February 1989, and circulated to a variety of professionals for their comments. These individuals are acknowledged in the various papers presented in this report. A number of the study group members participated in a conference entitled: "Incentives and Constraints: Macroeconomic Policy Impacts on Natural Resource Utilization," sponsored by the Smithsonian Institute and held in Washington, D.C. on May 11

and 12, 1989 (See Table 1). Final papers were prepared during the spring of 1989 reflecting input obtained from reviewers and during the conference.

PRESENTATION OF STUDY RESULTS

What follows are seven reports addressing the impacts of policy reform on natural resources management in Sub-Saharan Africa (see Table 2). The first two (S. Kyle; A. Cunha and S. Kyle) provide an overview and analysis of the situation from an economic point of view. The third paper discusses various approaches to financing expenditures for environmental concerns (S. Kyle and A. Hawkins). The next four papers address aspects of natural resources management; specifically impacts on wildlife (J. Lassoie, E. W. Wischusen, and R. McNeil), fisheries (B. Wilkins, H. Acquay, and M. Vander Vort), and soil biomass (D. Pimental, B. Floyd, W. Teel, and J. Bourns).

Obviously, a subject of complexity, both geographically as well as ecologically, economically, and socially, demands detailed, site-specific research investigations before specific cause and effect relationships between structural adjustment policies and natural resources management issues can be fully delineated. It is hoped that this report will provide the reader with the necessary background to examine this complex question further and to start to focus on specific areas requiring more in-depth analyses. It is a subject worthy of continued research efforts.

Table 1. Cornell Study Group on Policy Reform and Natural Resources Management in Sub-Saharan Africa.

Name	Title	Affiliation
David J. Allee	Professor of Resource Economics	Dept. of Ag. Economics Cornell University
Herbert K. Acquay [1,2]	Graduate Student	Natural Resources Cornell University
Julie D. Bourns [1]	Visiting Graduate Student	School of Foreign and Envir. Studies, Yale Univ.
Duane Chapman	Professor of Resource Economics	Dept. of Ag. Economics Cornell University
Aercio S. Cunha [1]	Visiting Professor of Resource Economics	University of Brasilia
Beth O. Floyd [1,2,4]	Graduate Student	International Agri. Cornell University
Ann P. Hawkins [1]	Graduate Student	Dept. of Rural Sociology Cornell University
Steven C. Kyle [1,2,3]	Assistant Professor International Dev. Econ.	Dept. of Ag. Economics Cornell University
James P. Lassoie [1,3]	Associate Professor of Natural Resources & Chairman	Dept. of Natural Resources Cornell University
Richard J. McNeil [1,2]	Associate Professor of Natural Resources	Dept. of Natural Resources Cornell University
David Pimentel [1,2]	Professor of Insect Ecology and Ag. Science	Dept. of Entomology Cornell University
Thomas T. Poleman	Professor of International Food Economics	Dept. of Ag. Economics Cornell University
Wayne S. Teel [1]	Graduate Student	Natural Resources Cornell University
Mark Vander Vort [1]	Graduate Student	International Ag. Econ. Cornell University
Bruce T. Wilkins [1]	Professor of Natural Resources	Dept. of Natural Resources Cornell University
E. William Wischusen [1]	Graduate Student	Ecology and Evol. Biology Cornell University

1 Contributing author
2 Attended Smithsonian Conference, May 11-12, 1989
3 Principal Investigator
4 Study Group Research Assistant

Table 2. Specific Research Topics Related to the Study of Policy Reform and Natural Resources Management in Sub-Saharan Africa.

Author(s)	Title
Steven Kyle	Structural Adjustment Agriculture, and Natural Resources in Africa
Aercio Cunha and Steven Kyle	Natural Resources, Structural Adjustment, and Sustainable Growth in Sub-Saharan Africa: A Critique of Policy Recommendations
Steven Kyle and Ann Hawkins	Financing Environmental Expenditures in Africa
James Lassoie and E. William Wischusen	The Impact of Structural Adjustment Programs on Wildlife in Sub-Saharan Africa
Bruce Wilkins, Herbert Acquay and Mark Vander Vort	Structural Adjustment Programs and Fishery Policies in Sub-Saharan Africa
David Pimental, Beth Floyd, Wayne Teel and Julie Bourns	Deforestation, Biomass Depletion, and Land Degradation: Linkages to Policy Reform in Sub-Saharan Africa
Richard J. McNeil	Structural Adjustment and Wildlife Resources

Table 3. Invited Participants and Discussants at the Workshop on Policy Reform and Natural Resource Management in Sub-Saharan Africa, November 11, 1989, Cornell University

Name	Title	Affiliation
Ronnie Coffman	Professor of Plant Breeding & Chairman	Dept. of Plant Breeding and Biometry, Cornell University
Jeffrey Curtis	Financial Manager	International Agriculture Program Cornell University
Lee Hannah	Science and Diplomacy Fellow	Africa Bureau U.S.A.I.D.
James Haldeman	Acting Assoc. Director	International Agriculture Program Cornell University
David Lewis	Associate Professor of Planning & Chairman[1]	Dept. of City and Regional Planning Cornell University
Jeffrey Metzel[2]	Research Economist	Associates for International Resources and Development
Richard Norgaard[3]	Professor of Economics	Energy and Resources Program Univ. of California - Berkeley
Iona Sebastian	Economist	Environmental Department World Bank
Roger Sedjo[4]	Senior Fellow and Director	Forest Economics and Policy Reform Program, Resources for the Future
Lori Ann Thrupp	Post Doctoral Fellow	Energy and Resources Program Univ. of California - Berkeley
Norman T. Uphoff	Professor of Government[5]	Center for International Studies Cornell University
Rees Warne	Graduate Student	Agricultural Economics Cornell University
Armand Van Wambeke	Professor of Soils	Department of Agronomy Cornell University

1 Also Director of the Institute for African Development.
2 Panel Presentation: "Economic Reform Programs and Resource Management in Sub-Saharan Africa."
3 Panel Presentation: "Amazon Rainforest Destruction, Brazil's Environmental Policy, and the World Bank."
4 Panel Presentation: "Property Rights, Deforestation, and Protection of Plant Genetic Resources" followed by discussion of Ronnie Coffman.
5 Also, Chairman of Cornell's Rural Development Committee and Director of International Studies.

STRUCTURAL ADJUSTMENT, AGRICULTURE, AND NATURAL RESOURCES IN AFRICA

Steven Kyle
Cornell University

Introduction

Any attempt to reach general conclusions regarding the effect of structural adjustment (SA) programs and the environment (or, in fact, anything else) must first recognize the heterogeneity of such programs. A recent World Bank compilation of measures implemented under the auspices of SA lending agreements[1] shows that virtually the entire economy and the full range of policy instruments can be included. By the same token, very few of these instruments or economic sectors are always included.

So, general prescriptions for improvement in the sensitivity to environmental concerns shown by SA programs cannot be based on a strict enumeration of policies which must be altered or eliminated but rather must focus on the overall aims of such programs. In this sphere there is in fact a unifying theme, that of opening economies to international markets and this, together with the structure of African economies gives rise to some useful generalizations and some particular recommendations for the future.

The next section will elaborate on the degree to which SA programs provide generalizable effects on natural resources in Africa, with particular emphasis on agriculture and the resource base needed to support it. Most important in any evaluation of agricultural resources is the soil and water used to produce crops. It is here that the most pervasive and the most important effects are to be found. The following section elaborates on the

importance, cost and degree of irreversibility of effects on African soils and waters, together with some projections of current trends. The final section presents conclusions and recommendations for SA programs undertaken in the future.

Common Aspects of SA Programs

A review of the policies common to SA (See Table 1) shows that devaluation of the currency together with removal of trade barriers are one of the sets of policies that most often constitutes a part of such programs. This fact points to the common theme uniting all such programs: to promote a country's comparative advantage by reorienting the economy outward toward world markets rather than inward toward protected domestic markets.

Comparative advantage states that a country will tend to produce those commodities which it can make relatively cheaply compared to its trading partners and will import those which it can make only at a relatively greater cost. This doctrine, well known since the time of David Ricardo in the early 19th century, provides the theoretical underpinnings for a policy of removing distortions (trade taxes, price controls, etc.) which prevent a country from following its comparative advantage.

The empirical case has been elaborated in great detail by Anne Krueger and associates in an exhaustive set of studies sponsored by the National Bureau of Economic Research.[2]

While there is still some debate as to whether the efficiency gains predicted by theory are truly the source of the superiority of outward oriented development strategies, the studies demonstrate that in fact such strategies can produce higher growth rates and higher rates of

growth in employment at least in some countries.[3] This observation, most clearly demonstrated in the cases of East Asian export economies such as Korea and Taiwan, is reinforced by the impact of external shocks on African economies in the decade of the 1980's, where it seems clear that at least some degree of outward reorientation would be beneficial. This statement, however, falls far short of recommending immediate removal of all government interventions in trade and agriculture. Nevertheless, the extreme anti-export bias of macro policy in many SSA countries has clearly been excessive. However, it is important to realize that realignment of prices will not by itself generate the desired reorientation of economies in the African context. Various institutional and infrastructural problems must also be addressed.

The 1980's have witnessed a drying up of foreign capital flows for most developing nations together with higher real interest rates and generally adverse terms of trade shocks. These problems have provided an added incentive to promote the export expansion that outward oriented strategies emphasize, as foreign exchange shortages have become increasingly constraining.

The principal goal of the various policies designed to promote an outward oriented strategy is to achieve a devaluation of the "real exchange rate". The real exchange rate is defined as the relative prices of goods which are internationally traded and those which are produced and consumed only domestically. A devaluation implies an increase in the relative price of tradeables, both exports and imports. An increase in the price of exportables will tend to create an incentive to expand their production while an increase in the price of

importables will create an incentive to decrease their consumption. Both of these effects work to increase the available supply of foreign exchange.

Given that African governments are reorienting (or being induced to do so) toward their "natural" comparative advantage via adjustments in the real exchange rate, the logical next question is to ask where their comparative advantage lies. First we must ask which sectors of the economy comprise the "traded" sector whose production is to be expanded. In Africa, traded goods are primarily agricultural (except for mineral exporters). In addition, agriculture is virtually always the most trade oriented sector of the economy, at least potentially, since the other obvious candidate, manufacturing, is unlikely to provide a substantial contribution to exports within the time frame envisioned by SA programs in Africa.

Another consideration supporting the conclusion that promoting tradeables means promoting agriculture is the fact that many versions of comparative advantage focus on relative abundances of the factors of production. In this respect Africa is, relatively speaking, well endowed with agricultural land and has low wages. The relatively low cost of both of these factors compared to trading partners reinforces the designation of agriculture as the sector most likely to be stimulated by a depreciation of the real exchange rate.

It is important to emphasize that depreciating the real exchange rate is not by itself a strategy for agricultural development. Many non-price aspects of agriculture such as technology institutions, infrastructure and education must be taken into account and the need for them will vary not only according to the physical conditions of agricultural production, but also according to level of development. On both scores, Sub-Saharan Africa exhibits

substantial diversity. Not only are agro-climatic zones very different from country to country, but common measures of the level of development such as per capita GNP vary by a factor of ten or twenty. "Getting prices right" may be good advice but it far from a fully articulated development strategy. The record for African economies in the 1980's demonstrates that growth is dependent on a variety of factors, not limited to those that can be addressed in medium term adjustment programs.

Environmental Effects of Stimulating Agricultural Incentives

The previous section reached the conclusion that SA programs are in general intended to promote a faster pace of agricultural development and within agriculture, a higher level of production of export and import-substituting crops though it questioned the efficiency of the policy packages applied in SSA. What does this mean for the environment?

Before answering this question, it is important to recognize that agricultural development means changing the environment. Growth in agricultural production comes mainly from two sources:

- extension of the area under cultivation
- intensification of cultivation on areas already cropped

Both of these sources of growth necessarily imply changes in the environment in the sense that patterns of land and water use are changed (usually permanently) from what they were

previously. Indeed, this process has been occurring since sedentary agriculture was first practiced millennia ago.

Two propositions related to this observation underlie the remainder of this paper: First, agricultural development and its consequent environmental changes are inevitable in the sense that no country can expect to achieve substantially higher levels of development without agricultural development as described above. Second, the process of agricultural development is desirable in spite of its environmental consequences since the alternative is to consign millions of Africans to a life of poverty and deprivation. The need for intensification becomes especially apparent when account is taken of the projected effects of population growth on the area of arable land per person. (See Table 2).

The pressure for increased intensity of land use becomes still stronger when the composition of growth is biased toward agricultural production. Increased prices for agricultural exports will, according to well known theorems of international trade, increase prices of factors used intensively in their production.[4] This implies that land prices will rise which, in turn, will draw more marginal land into production and require more intensive use of already cultivated land in order to generate an adequate return. This relationship between increased exports, land prices, and intensity of land use has been well documented in various studies.[5]

So, if we accept the inevitability and desirability of accelerated agricultural development together with its unavoidable changes in the environment, the case for environmental concerns due to SA must rest on the sustainability of the new land and water use patterns rather than

Table 2. Actual and Projected Per Capita Arable Land in Selected Countries.

Country	Year	
	1985	2000
	---hectare per person---	
Kenya	0.73	0.42
Malawi	0.48	0.30
Tanzania	2.30	1.44
Cameroon	3.34	2.09
Nigeria	0.71	0.48
Senegal	0.70	0.45

Source: World Bank.

the fact that they alter or destroy previous ecological patterns. This is not at all intended to suggest that we place no value on preservation of valued habitats. It is for precisely these concerns that national parks and preserves are created, and why the need to create such preserves is an important component of any study of the relationship between SA and natural resources. This discussion is directed at agriculturally valuable land which is devoted to crop production.

Sustainability is important in the most basic sense because it is important not to degrade assets which underlie the long run wealth and productivity of the country. Prime among these assets are soil and water which regenerate only very slowly, if at all (see below). However, even if maintenance of long term assets isn't held to be paramount, it makes little sense to undergo a painful restructuring process only to achieve a structure which can't be sustained and will eventually require yet another SA at a later date. For example, it makes little sense to restructure an economy on the basis of an export crop that mines or erodes the soil and so can only be grown for 10 or 20 years.

While there are any number of ways agriculture can be made more environmentally benign or sustainable, one common denominator is the need for investment. That is, it is possible to get impressive short term gains if the need to maintain productive assets is ignored. A more sustainable pattern of growth will forgo such short term gains in order to avoid deterioration. This implies either investment in sounder cultural techniques, investment in machinery or soil fertility, or merely the avoidance of <u>disinvestment</u> in the soil and water

resources inherited from the past. In all of these areas, current knowledge is far short of what is needed for optimal resource use.

A second common denominator is the need for a long time horizon when making development and investment decisions. Individual farmers living at the subsistence level do not have this choice; they must do whatever they can to stay alive and often cannot afford to forgo current consumption in order to promote long run sustainability. It is then up to the government to provide the incentive and the wherewithal to take such a long view. This might mean actually intervening to make investments directly, or to promote increased awareness, or providing services such as credit to allow individuals the time needed to survive while necessary investments gestate.

All of this indicates that SA programs which fail to address the long-term need for investment in human and institutional capacity as well as physical capital in an effort to induce development primarily through price policy and deregulation may well have adverse environmental effects.

Possibilities for Policy Reform

Given the involvement of the World Bank in the formulation, financing and implementation of SA programs it seems clear that it has more options and certainly more power to induce change than do other organizations. While it is certainly the case that a prerequisite for environmentally sound development strategy is the awareness and commitment

of the national government, there is much that can be done from outside to promote that awareness.

This fact is illustrated by the disproportionate amount of investment in African nations which is financed from abroad. In Senegal, to take one example, an average of 75% of government expenditure has been financed by foreign capital flows since the late 1960's.[6] Given that counterpart funds are needed for virtually all development projects it is clear that the Senegalese government has very little scope to engage in activities not promoted by foreign donors or lenders. In this somewhat extreme case (It is common for other African countries to have been funded to the extent of 25 or 30% of government spending[7]) it is necessary for those financing expenditures to attach a high priority to environmental investments if any are to be made at all.

Given the need for World Bank involvement, and the potential for the Bank to have a significant influence, there are a variety of ways to improve performance. Some of these relate to long term effects of SA programs or Bank operations while others are of a short run or transitory nature.

Long-Term Actions

1. Slow-Down - If we accept the premise that the goal is development and within that sustainable agriculture development, positive results will come only gradually. Programs must allow for this and also be evaluated on that basis.

2. Restraint in Privatization - The environment is in many respects a public good in that it is not in the interests of individuals to make needed investments even though on a societal basis such expenditures would be optimal. This implies that the private sector can be depended on not to pursue optimal policies with respect to maintaining environmental quality or sustainability of resource use in most cases. In many areas only the government can enforce such policies, and then only if it has the resources to do so. For example, government intervention to promote good cultural practices or to induce adoption of desired technologies may generate benefits beyond those recouped by the individual farmer. In such situations a good case can be made for retaining some degree of government involvement.

Another example which follows from the Bank predilection to remove all governmental interventions in markets is the standard prescription to eliminate all subsidies on inputs, particularly on fertilizer. While it must be recognized that such subsidies have been far too generous in some places, there are good reasons to promote the use of fertilizers. Africa in many parts has poor or fragile soils and is also the continent which has he lowest fertilizer application per hectare of arable land. (See Table 3) In some situations, such as areas where droughts and total crop loss are a real threat, the consequent risks will lead farmers to use less fertilizer than they otherwise would, leading to possible loss in fertility.[8] A government might rationally want to subsidize the cost and distribution of fertilizer under these circumstances since it is able to take a longer view than an individual farmer. Indeed, this argument holds for other stages in the food production chain such as marketing. In a risky production environment undercapitalized local entrepreneurs may be unable or unwilling to

take on the risk involved, leaving a choice between government provision of inputs and marketing or complete absence of needed services.

3. Provide Money for Investment - Without doubt the most important thing the international and bilateral organizations can do is to provide the funds needed to make investments which will promote environmentally sustainable development. In many cases this will mean simply taking a longer view so that sustainability is not sacrificed to the desire for a quicker return. For example, some tree crops are known to be less damaging to the environment or can promote soil fertility but may require a relatively long period of time to generate an economic return. But in general, it involves investment in the broadest sense; human, institutional and physical.

One problem that has been noted with many development projects funded by both multilateral and bilateral donors has been the inadequacy of funding for recurrent costs. Donors prefer to fund capital investments but are less eager to fund continuing operating expenses or maintenance. This means that it is often difficult for countries to maintain projects as intended and often to meet recurrent expenditures needed for proper operation.

4. Increased Emphasis on Research and Extension - Given the pressures for intensification of land use stemming both from economic growth and the reorientation caused by structural adjustment programs, an increase in research on sustainable cultivation techniques is necessary. This research must be locally based, since results are often nontrans- ferrable. To date, funding for such research has been inadequate, with little research infrastructure, either physical or institutional, built in most of SSA.

Table 3. Fertilizer Use Per Hectare of Arable Land, 1975 and 1985.

Region	Kg. of Nutrient/Ha.	
	1975	1985
Africa	13	20
Latin America	29	41
Oceanic	29	32
Developing Countries	27	58
Asia	37	85
North America	87	85
Western Europe	188	228
World	63	87

Source: FAO, Fertilizer Yearbook, 1986.

It is tempting to propose a massive increase in funding for agricultural research in Sub-Saharan Africa. In fact, the World Bank has proposed exactly this in recent statements on agricultural research in SSA.[9] From a level of $314 mn. over the 1981-86 period, the Bank plans to mobilize $1.5 bn for agricultural research in Africa over the next five years.[10] While this increased emphasis on research is commendable, it is not at all clear that sinking $300 million a year into Sub-Saharan Africa's research centers will yield results that can significantly ameliorate adverse environmental effects of current SA programs. These large sums may well generate improved physical infrastructure for agricultural research, but will not address the binding constraints of weak institutions, human capacity development and links with governments, extension agencies or "consumers" of research: the rural population. In fact, the problem of current costs may well be exacerbated.

These considerations imply that architects of SA programs in Africa must allow more time than is generally needed in other countries at different levels of economic and institutional development. The history of agricultural research in SSA demonstrates that given time, it is likely that high rates of return can be generated from research.[11] Insofar as improved cultural techniques can enhance the sustainability of agricultural production, there will be a need for extension services to educate farmers. It is important that these extension efforts precede or at the least be concurrent with incentives to increase production. To wait for the degradation to become apparent following a reorientation of incentives to favor agricultural production is clearly not the optimal course, especially when degradation is irreversible.

5. Role of Risk and Irreversibility - There is a temptation when implementing large projects such as SA programs to proceed on the assumption that they will succeed. In SSA there is ample reason to question the degree to which SA will generate intended results. To date, economic growth and agricultural production remain stagnant in many countries in spite of several years of adjustment. The possible irreversibility of resource effects of SA together with the uncertainty of the outcome dictates a greater degree of caution in implementation. In particular, projections underlying policy recommendation should include risk explicitly, something often not done in standard project appraisals.

Short Term Actions

The fact that most, if not all, SA programs have a significant element of stabilization policies (or are adopted in conjunction with IMF programs) in addition to adjustment policies means that there can be a variety of short term effects. Most of these arise from the fact that stabilization measures are aimed primarily at reducing the level of aggregate demand in the short run so as to lessen the need for foreign financing of current expenditures. In effect, stabilization in the short run is bought at the expense of a contraction of the economy. Here is must be realized that the "short run" may not be so short. SA programs are implemented over several years, and desired effects may not be evident for quite a while, and in at least some cases have been difficult to find at all.

The contraction in the economy will generate unemployment in the short run. Transitional unemployment can also be caused by the frictions inherent in a major

reorientation of the economy. This is generated by the massive restructuring of incentives which cause broad categories of activities to decline in favor of others. It is virtually impossible for this to occur without some interim dislocation and unemployment. This transitional unemployment can cause increased reliance on subsistence production in agriculture in the short run. As noted above, subsistence producers have little capacity to defer consumption in order to make environmentally sound investments.

Another factor which can cause short run problems is the common policy prescription of decontrolling or raising food prices. In a context of increased unemployment and short term recession such a policy can induce significant numbers to return to a reliance on subsistence production or to retard movements into urban areas that would have otherwise occurred. Clearly, this has positive as well as negative effects.

In some cases, it may be necessary to implement reforms more slowly in order to minimize adverse impacts on vulnerable populations. The reallocation of resources that occurs in response to changes in incentives will take time. In the case of agricultural production, it is bound to take at least the length of the crop cycle, and usually more. Forcing drastic changes in a shorter time frame may be pointless in that it can cause pain without any gain over a slower pace of reform. In some cases, such as the need for improved extension noted above, time will be needed to get supporting policies under way. In general, it is important not to overestimate the degree of flexibility in SSA economies. Resources are not always mobile, and responses to incentives may well be delayed or even nonexistent without complementary investments and time for adjustment.

Short term employment or food rationing programs can go far to alleviate some of these transitional problems. In fact, such programs have been implemented in several countries which have undergone SA programs. However, these programs have sometimes been put in place only after the problems have become apparent, as much as two years after the beginning of implementation of reforms. Environmental concerns add to the case for implementation of these programs as soon as SA policies are put into effect.

Conclusions

This paper has outlined some general effects on natural resources that can be expected to accompany the implementation of SA programs. Given the inevitability and general desirability of reforms to promote growth and to reduce dependence on foreign capital, the paper has outlined several ways for the World Bank to modify or add to its standard policy package to minimize adverse effects. These suggestions are not painless, but they are not at all beyond the capacity of the World Bank to implement. What is needed is recognition of the problem and a will to implement "reforms of the reforms".

One possibility which has not yet been alluded to but which could potentially provide greater benefits than any other measure is that of debt relief. While it is indeed a virtue to repay debts, it makes little sense to damage a country's resource base and hence its future productive capacity in the name of remaining current on foreign debt service. This is especially so since in spite of years of sacrifice and effort most countries have been hard pressed to cover interest payments much less repay principal. So, not only is the resource

base in danger of being sacrificed to maintain current debt service, but this means that eventual repayment of principal becomes less and less likely, since it is that same resource base that is to support future production and repayment. Since sustainable development requires additional investible funds it is difficult to make a case for continuing to transfer these funds abroad to creditors.

Recognition that the debt is unlikely ever to be repaid provides the best argument for forgiving it now. Not to do so risks exacerbating resource degradation in reaching for a target that cannot be attained. Finally, the issue of debt relief has become linked with the idea of "debt for nature" swaps in which external debt of developing countries is exchanged for investments in national parks or environmental preserves. There are a few cases in SSA where this idea could prove useful; however, it is important to realize that debt swaps are no more a substitute for a development strategy than is a policy of merely raising prices. Parks and preserves are important, and debt swaps may prove a useful vehicle for financing them. Nevertheless, the primary reason to forgive debt must be to facilitate growth and development rather than swapping it for nature, attractive though the possibility may sometimes seem. Alleviation of poverty together with development, not financing tricks, will remain the key to relieving pressure on fragile environments.

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DEFORESTATION, BIOMASS DEPLETION, AND LAND DEGRADATION: LINKAGES TO POLICY REFORM IN SUB-SAHARAN AFRICA

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Introduction

This paper analyzes the relationship between policy reform[2] and natural resource degradation in sub-Saharan Africa. Conceptually, natural resources encompass a broad range of assets including wildlife and mineral endowments. However, the scope of this assessment will be limited specifically to soil and biomass resources. In keeping with these parameters, the focus will be on deforestation, biomass depletion, and soil erosion.

As Warford (1987) points out, natural resources are utilized daily through numerous small-scale activities. Although the interventions of large-scale, mechanized farmers, timber concessionaires, and ranchers, can severely degrade soil and forest resources, in most parts of sub-Saharan Africa, the greatest pressure is brought to bear from rapidly increasing populations of rural poor who are struggling to derive their livelihood in increasingly

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[2] The terms "policy reform" and "structural adjustment" will be used interchangeably to refer to those programs supported through multilateral and bilateral non-project assistance designed to effect structural change in the economies of borrower countries.

marginal environments. Therefore, the premise of this paper will be that "linkages" between policy reform and natural resources are primarily manifested in the actions of resource-poor agriculturalists.

The vast majority -- 90% -- of sub-Saharan Africa's poor live and work in rural areas (Lele 1988; Daniel et al. 1985). Income is earned through a variety of cropping, trading, fuelwood harvesting and livestock production strategies. For the sake of simplicity, we will refer to these rural agriculturalists as "farmers" or "smallholders."[3]

A. Policy Reform Overview

In the growing body of literature on policy reform, it is frequently stated at the outset that assessing impacts is difficult given the paucity of reliable micro-level data (Ross et al. 1987; Weideman et al. 1987). Although it is possible to monitor post-reform effects, comparable baseline or pre-reform information simply is not available in most cases. Evaluation problems are further compounded by the fact that certain adjustment measures have been introduced so recently in some countries that any analysis of consequences may be premature.

The difficulty of isolating the effects of a structural adjustment program is also acknowledged. In sub-Saharan Africa it is particularly difficult to separate the impacts of adjustment from the drought which affected much of the continent between 1982 and

[3] Our discussion will focus primarily on cultivators. Although we recognize that livestock herders also play a major role in land degradation, an analysis of overgrazing is beyond the scope of this paper. Likewise, we will be concerned primarily with rainfed agriculture. An assessment of the environmental problems associated with irrigated agriculture is also beyond the scope of this paper.

1984. Furthermore, in a dynamic economy, one policy mechanism can be off-set by another (e.g. removing subsidies to inputs may be off-set by higher producer prices).

The particular mix of structural adjustment measures varies considerably across countries. Nevertheless, most structural adjustment programs in sub-Saharan Africa contain agricultural policy reforms (Lancaster 1987). Policy options might include: raising real producer prices on agricultural output; reducing subsidies on inputs (fertilizer, pesticides, machinery, irrigation, credit); and reducing operating costs or divesting parastatal enterprises. Trade policies can also affect agriculture, chief among these being exchange rate adjustments.

These policies are directed at increasing the agricultural sector's contribution to economic growth. This implies increasing agricultural production, and agriculture, of necessity, impacts upon soil, water and biomass resources.

B. Expansion of Agricultural Production

At least two-thirds of Africa's increased production over the last twenty years has come from expansion in cultivated area (Paulino 1987). Furthermore, the FAO projects that the total cultivated land area will increase by more than 20% by the year 2010 (FAO 1986).

Obviously, most of the increase in cultivated area has been, and will continue to be, in response to population growth. As Binswanger and Pingali (1988) demonstrate, population densities influence farming systems. In low-density African countries, shifting cultivation is the most common system of farming. Fallow periods restore soil fertility.

As population grows, agriculture is extended into forests or onto marginal lands and fallow periods are reduced.

In medium- and high-density areas, the new lands being brought into cultivation are more fragile than previously farmed land (Lewis 1987). This is especially true in highland or transitional (sub-humid to semi-arid) areas where newly cultivated land occupies steep slopes and/or poor soils. The marginal nature of these lands, combined with reductions in fallow periods, contribute to accelerating environmental problems -- soil erosion, declining fertility, degraded vegetation. Most of the regions in sub-Saharan Africa are already affected by natural resource degradation (U.S. Congress/OTA 1988; FAO 1986).

Population growth, though it may be primary, is not the only contributor to extensive agriculture or changes in farming systems. Other factors include marketing facilities and transport infrastructure which determine access to urban or foreign markets. The possibility of marketing a surplus stimulates farmers to grow more. Output is augmented either by using more land -- low-input extensive production -- or adopting more intensive technologies such as chemical fertilizer or low-cost irrigation. The choice of farming system is determined by a host of factors: availability of land; relative cost of labor, capital, and fertilizers; cost and availability of credit; market accessibility; and information and training (Binswanger and Pingali 1988).

C. Policy's Role in Resource Management

Given that increased agricultural production is necessary for meeting future food needs, increased reliance upon land, water, and biomass resources is unavoidable. What

is at issue however, is the sustainability of agriculture, fuelwood gathering or timber harvesting. Preventing the "mining" of renewable resources is as important as increasing cash profit if sustainable development is to occur (Lewis 1987).

Thus, the challenge lies in implementing policies which encourage and complement resource conserving, rather than resource depleting, systems. Policies designed to enhance productivity must be made synonymous -- in the minds of both policy-makers and farmers -- with those designed to foster sound natural resource management.

Policy reforms have focused primarily on stabilization and efficient allocation of resources to promote growth, neglecting attention to natural resources until relatively recently (Hansen 1988). This is particularly short-sighted in sub-Saharan Africa where growth is predominantly dependent upon extraction or utilization of natural resource endowments (soil, forests, minerals, etc.).

A recent World Bank survey of 22 African countries undergoing structural adjustment found that environmental issues were highlighted in only six cases, and only three of these actually received loans which included specific environmental reforms (Sebastian 1988). Of the countries reviewed, only a 1986 Agricultural Sector Adjustment Loan for Somalia observed that minimum support prices for corn and sorghum may lead to cultivation in marginal areas (agricultural expansion in response to price changes will be discussed in detail below).

In the West African countries, tropical timber provides a large portion of foreign exchange earnings. Yet again, attempts to incorporate forest management policies into

structural adjustment programs have been undertaken in only a few countries, notably Cote d'Ivoire and Gabon (World Bank 1988c; World Bank 1985a and 1985b).

In the case of Ghana (which will be discussed in more detail below), policy reforms have led to a rapid increase in timber exports, but have failed to stimulate adequate reforestation and stewardship of existing forest reserves. In order to guarantee the forestry sector's continuing contribution to economic development in West African countries, it would appear that additional reforms are needed which concentrate on land use and reforestation.

D. Study Background

We began our analysis with a general overview of deforestation, biomass depletion and soil erosion in sub-Saharan Africa, detailing some of the causes and costs. This broad assessment facilitated selection of five case study countries--Ghana, Kenya, Senegal, Sudan, and Zambia. Appendix I contains case study background and selection criteria.[4]

The remainder of this paper is divided into two parts. The following section will examine a range of policy instruments, identifying possible natural resource impacts. Specific examples of reform and resource linkages are drawn from the case study countries. Through the examples, we have attempted to portray the most recent policy

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[4] In Appendix II, we present a very general review of deforestation, biomass depletion and soil erosion in sub-Saharan Africa. Appendix III highlights some policy implications for agroforestry.

developments, with the understanding that structural adjustment is a dynamic process, subject to constant alteration.

The paper concludes with recommendations for complementary policy elements that could promote sounder resource management through the structural adjustment process. Data utilized derive from a wide range of secondary sources, including World Bank, and USAID documents. In the Sudan and Kenyan cases, one of the authors has drawn upon personal field experience.

II. POLICY INSTRUMENTS AND NATURAL RESOURCE LINKAGES

Glaring examples of soil or forest degradation which directly implicate policy reform are not readily apparent. Even if reliable baseline environmental measurements were available, it would be difficult to substantiate that environmental degradation is any more severe than it would have been in the absence of a structural adjustment program. Moreover, in some cases, it is probable that the adjustment process has prevented implementation of projects likely to yield negative environmental consequences.

In light of these limitations, we have examined elements of structural adjustment with a view toward identifying potential impacts. Following an outline of the possible effects of specific policy instruments, cases are provided which briefly discuss the situation in particular countries. Although the case assessments are by no means exhaustive, they have

been undertaken to illustrate how resource management problems may be linked to adjustment reforms.

A. Commodity Price and Exchange Rate Adjustments

Many elements of structural adjustment programs are based on "getting the prices right" (Sarris 1987). However, it is generally agreed that getting prices right is a necessary, but not sufficient, condition for enhancing agricultural production. For example, raising producer and consumer prices of food crops or removing fertilizer subsidies, will have negative consequences for the poorest smallholders if access to land, improved technology, and services is severely restricted (Lele 1988).

The effect of increased producer prices on natural resources depends on the price responsiveness of individual farmers. Where climate, environmental, labor or marketing constraints exist, a price increase alone may have little impact on production (Cleaver 1988). In like manner, where non-price constraints are significant, environmental effects of a price increase are uncertain.

Assuming land, labor, and rainfall are relatively abundant, and marketing infrastructure in place, an increase in commodity prices will likely augment the derived demand for agricultural land (Southgate 1988), leading to agricultural expansion. As discussed above, extensive agriculture can be problematic. More land under cultivation generally implies more soil exposed to water and wind erosion, resulting in loss of productivity including soil nutrients.

Although traditional fallow systems have proven an effective means of restoring fertility in areas of low-population density, in the highlands of East Africa and the humid areas of western Africa, fallow periods are declining markedly (Lewis 1987; Reij et al. 1986). In these areas, price increases will most likely encourage continuous cultivation. On fragile soils, monoculture will exhaust soil fertility. Without soil conservation measures and replacement of lost nutrients, decreases in agricultural output invariably result.

It is argued that if farmers receive remunerative payment for their produce, they will have more of an incentive, as well as the means, to invest in soil enhancing and conserving measures. Higher prices, it is posited, result in higher land values and improved land husbandry (Binswanger and Pingali 1988; Southgate 1988).

Yet again, this hypothesis must account for rational behavior in light of various considerations. Farmer assessment of the erosion rate, alternative available investments, future price change expectations, and constraints to the means of production will all figure into the land management decisions (Nelson 1988). For example, land tenure insecurity often creates a strong disincentive for soil conservation and tree planting as farmers are reluctant to invest in such activities on land to which they hold no title (Blaikie, 1985).

Much also depends upon the "policy environment" that creates future price expectations. If the farmer's price security -- degree of confidence in price stability -- is high, conservation investments are more readily made. If farmer price security is low, the logical strategy would lead to mining soil for the quickest possible returns.

Relative crop prices will also influence the particular mixture of crops. High prices for particular commodities may lead to the introduction of new crops. Price changes can sometimes induce switching from soil eroding annual crops, to more stable, soil conserving perennials such as coffee or tea (Repetto 1988; Lele 1988). Exchange rate devaluation can also stimulate production expansion or switching by increasing the terms of trade for export crops, many of which are perennials.

Although it is certainly true that such a switch from annuals to perennials may occur, it is simplistic to assert that this change will alleviate land degradation problems. After all, substitution does not happen overnight. During the time (two to three years depending on the crop) it takes for perennials to establish a closed canopy, soil can be exposed to erosive forces. Also, in the interim, farmers need some means of generating income and/or producing food. Meeting immediate needs might lead to an extension of area devoted to soil depleting row crops.

Moreover, direct substitution of perennials for annuals will seldom result; additional land will almost certainly come under production. In many countries, an expansion of perennial crops occurs at the expense of tropical forests. In Ghana, cocoa, coffee, and rubber are being established in tropical forest areas. In Kenya, tea and coffee plantations are carved out of high moist forest zones. A trade-off between forest and crops is inevitable.

Also, as more land is devoted to perennial cash crops, poor or landless farmers must expand their cultivation of short cycle, (subsistence) crops into marginal land areas or

tropical forests. All these scenarios suggest that substitution of perennials for annuals does not necessarily prevent the land degradation and deforestation associated with extensive agriculture.

A final point should be made regarding exchange rate adjustment and the forestry sector. Just as devaluation increases the terms of trade for export crops, it stimulates timber exports. Timber plays an important role in several West African economies, but rapid expansion of timber industries can lead to overexploitation of remaining forest land and/or pressure to exploit forest reserves on an unsustainable scale.

1. **Ghana.** Since Ghana initiated its Economic Recovery Program (ERP) in 1983, the cedi has been devalued from 2.75 cedi per dollar in 1983 to 176 cedi per dollar by the end of 1987 (USAID 1988a). In addition to providing funding to support the ERP, the World Bank and other donors have financed sectoral loans for rehabilitation of the cocoa and timber industries (World Bank 1987a). Policies related to the development of the gold and timber sectors have exacerbated the ongoing process of deforestation.

At the beginning of the present century, all the southern forest zone (8.2 million hectares) was covered by closed forest. This has been reduced to 1.7 million hectares, primarily from shifting agriculture, agro-conversion to cocoa plantations, and fuelwood harvesting (Deherve 1985; World Bank 1987b; Repetto and Gillis 1988). Higher producer prices have helped stimulate rehabilitation and replanting of old cocoa farms, many of which were destroyed by brush fires during the 1983 drought. New cocoa plantations are also being established in the high-forest zone. Cocoa production has

increased from roughly 158,000 tons in 1983/84 to 218,000 tons in 1986/87 (Hodges 1988; World Bank, 1987c).

The hectarage devoted to grains and other staples has also risen. The 1987 FAO Crop Assessment Team (FAO 1987) reports a general trend of expanding area under cultivation in response to higher prices.

Thus, tropical forests are under pressure from subsistence farmers, cocoa farmers, and most recently, from timber concessionaires. Policies which include exchange rate adjustments, foreign exchange retention facilities, and foreign financing at preferential exchange rates (often deriving from on-lent IDA loans) have greatly stimulated the timber industry. Timber export revenues increased from $12 million in 1982 to $100 million in 1988, and the number of independent logging companies rose from 90 to over 300 between 1985 and 1987 (Anderson 1989; Bentsi-Enchill, 1989).

Unfortunately, there has been very little control over the timber industry. A recent article in West Africa (Bentsi-Enchill, 1989) reports that malpractice includes activities such as: underinvoicing (quoting lower than actual export prices); under-declaration of the quantity of timber exported; down-grading of recorded quality of timber shipped; over-invoicing of imported machinery and parts; and manipulation of foreign exchange retention accounts.

The Ghanaian government has enacted several policies in an effort to curb rampant mismanagement, such as placing an export ban on 18 species (Anderson 1989). Plans also call for rationalization of the concession system and raising forestry fees to more efficiently

convert rent into forest revenue. In an effort to encourage exports of processed timber -- which earn four times as much hard currency per cubic meter of wood -- Ghana has reduced the foreign exchange retention rights on raw logs from 20% to 5%, at the same time increasing to 35% the retention rights for manufactured furniture parts, joints and other products (Hodges 1988).

However, incentives will ultimately matter little if a steady supply of timber is not available. Not enough support has been directed toward improving the performance of processing facilities or to reforesting and managing timber reserves. Ghana is on the verge of losing its potential to export timber altogether. Deherve (1985) reported that Ghana has a sustained yield potential for export of 362,000 cubic meters per year if present forests are preserved and managed for commercial production. Yet current exports are estimated at about 950,000 cubic meters (Hodges 1988) and reforestation efforts have been far below target levels. This is clearly an unsustainable situation.

Initial forestry sector loans to Ghana stressed the need for infrastructural improvements to bring the timber industry back to health, but did not include provisions for protecting or reforesting timber land. However, World Bank plans to finance a revolving reforestation fund to be supported by future timber earnings are encouraging (Hodges 1988; World Bank 1987b). Such policy in support of reforestation and improved management is a must if Ghana's forest sector is to survive.

2. **Kenya.** Kenya's overall environment is in a precarious position. Only 22% of its land is classified as arable (7% of which is prime land) and it is occupied by 80% of

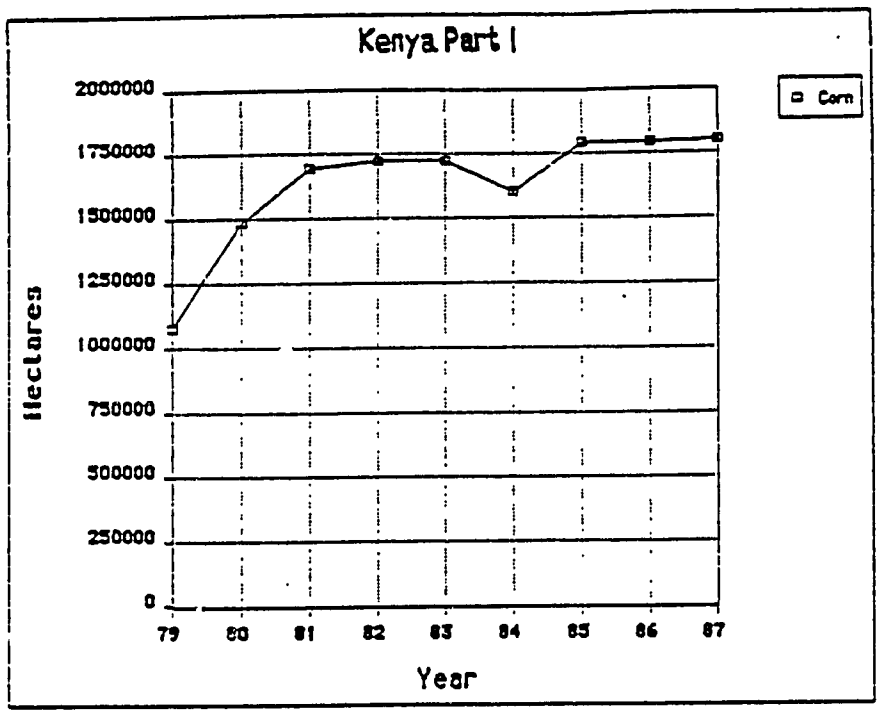
the country's population; a population increasing by over 4% per year. In addition, 80% of Kenya's remaining closed forest is located in the same region (World Bank 1988a).

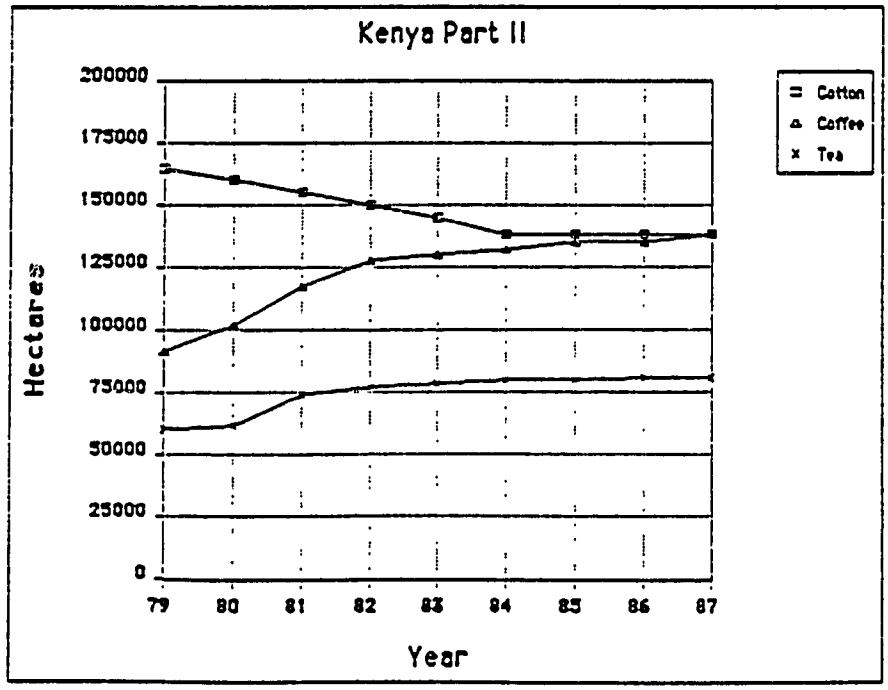
Primary foreign exchange earners are coffee and tea. The hectarage devoted to both these crops has been expanding over the last decade (Figure 1), and expansion is conducted at the expense of forest land and upper watersheds. Although they are more soil conserving by virtue of their root structure and canopy cover, as coffee and tea are expanded into Kenya's prime agricultural land, marginal land areas -- steeper slopes and more arid lands -- are brought under cultivation by poorer farmers planting subsistence crops (Dinham and Hines 1983; Blaikie 1985).

In spite of what is probably sub-Saharan Africa's most extensive soil conservation program (Harrison 1987; Wenner 1983), much of Kenya's productive land suffers from serious levels of soil erosion, especially those areas planted to maize, the principle food crop (Lewis and Berry 1988). Figure 1 demonstrates the rise in hectares planted to maize (with a drop in 1983/84 as the result of the drought). Maize provides soil with precious little protection from raindrop impact. Erosion rates are most severe in Kenya's highland areas where measurements of 12.5 mt/ha/yr are reported on up to 26% of cultivated land (Lewis 1986).

Price adjustments are designed to encourage production of maize, rice, and wheat. Such expansion will exacerbate soil erosion unless soil conservation measures are put in place.

Figure 1. Area Planted to Various Crops: Kenya





Sources: Foreign Production, Supply and Distribution of Agricultural Commodities; FAS/USDA 1988.

FAO Production Yearbook (various years).

World Bank Structural Adjustment Loans I (1980) and II (1982) did call for the development of national land use policies incorporating programs for soil, water, and forest conservation (Sebastian 1988). Under the loans, funds were also targeted for research and extension services for small farmers. However, it remains to be seen whether extension to promote soil conservation can keep pace with expanding production.

3. Senegal. Between 1983 and 1987 nominal prices have increased for groundnuts, rice, maize, cowpeas, millet, and cotton (World Bank 1987d). However, in real terms, prices have stagnated for millet and declined for cotton (Hodges 1988; Ross et al. 1987).

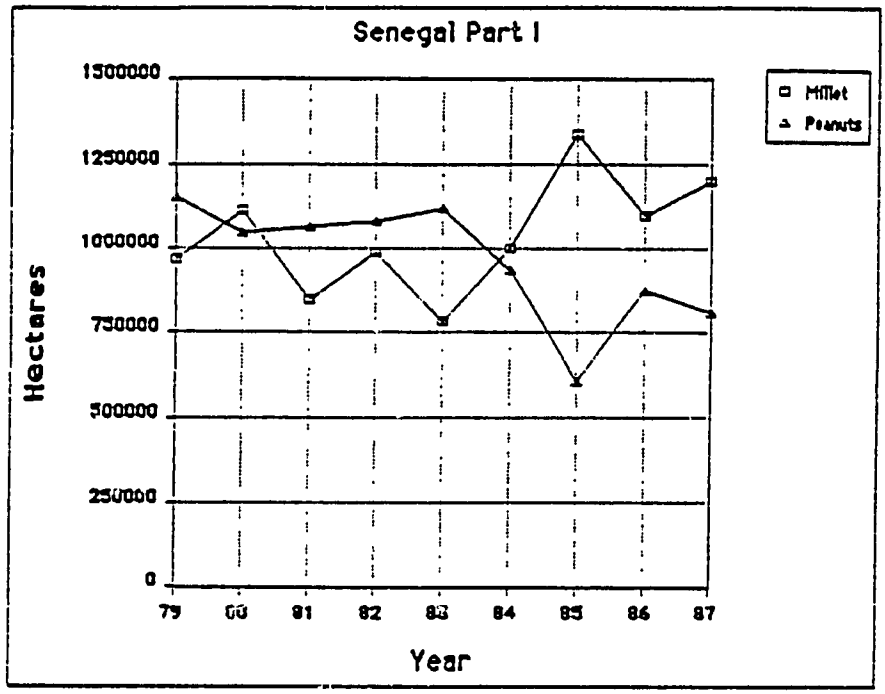
Price policy in Senegal has conflicting objectives. A high, subsidized groundnut price encourages production of groundnuts over millet (as well as adding to the budget deficit). This is at odds with the Cereals Plan[5] which aims to expand and diversify course grain production (Hodges 1988; USAID 1988c).

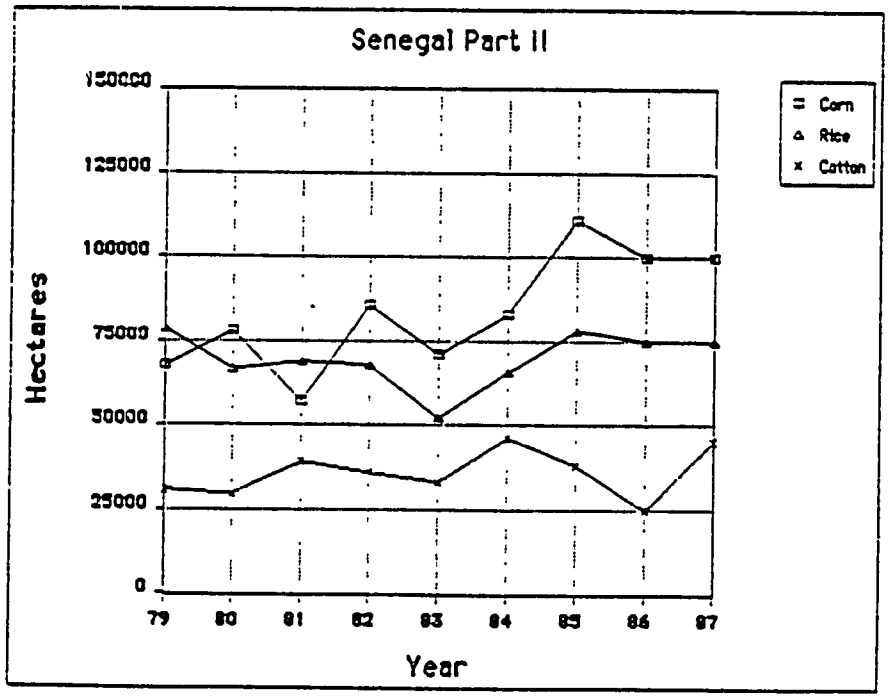
The situation is further compounded by inconsistent input price policies. As illustrated in Figure 2, the land area devoted to groundnuts declined sharply between 1983 and 1985 while millet planting increased. Although this change

reflects farmer concern for food security following the drought, the decline in groundnut hectarage would also appear to be related to the retenue producers were required to pay for groundnut seed and fertilizer during the 1983/84 and 1984/85 campaigns (Ross et al. 1987). Because of this fee, farmers did not receive the official producer price. At the

[5] The Plan aims for 80% cereals self-sufficiency by the year 2000 and depends on increased production and consumption of millet, sorghum, maize, rice and cowpeas.

Figure 2. Area Planted to Various Crops: Senegal





Sources: Foreign Production, Supply and Distribution of Agricultural Commodities; FAS/USDA 1988.

FAO Production Yearbook (various years).

same time, liberalization of the course grain market contributed to the amount of millet and maize planted.

Although groundnuts are well-adapted to the soil and climate of the Sahel, population growth and ill-conceived policy measures have led to monoculture and resulting land degradation (Franke and Chasin 1980; National Research Council 1984). Unfortunately, a number of limitations -- to be discussed in Section B below -- prevent farmers from intensifying production. Fertilization levels are inadequate and population-induced land pressure precludes against sufficient fallow periods.

Millet production also requires land clearing and removal of vegetation, exposing soil to erosion and desertification, however, after harvesting, the stalks of millet are usually left in the ground, providing the soil with some organic matter. When groundnuts are harvested, the soil is left completely bare (Franke and Chasin 1980).

Despite the observation and documentation of high levels of erosion and declining soil fertility in Senegal's groundnut basin for well over thirty years (Pelissier 1952; Porteres 1952; Franke and Chasin 1980), policies and long-range plans continue to stimulate overcultivation. Coercive colonial policies were later followed by national government policies (artificially high guaranteed prices) to maintain production (Franke and Chasin 1980). In Senegal, groundnut prices are still maintained above world market prices (Ross et al. 1987). Meanwhile, the export price (in $US) of groundnut oil fell by half between 1984 and 1987 (Hodges 1988).

Any increase in either course grain or groundnut production will require expansion into less populated rainfed areas in the south and southeast portions of the country (USAID 1988c). Although higher rainfall and soil fertility make this a more productive region, cultivation will inevitably lead to accelerated erosion and loss of soil nutrients unless mitigating, soil conservation and fertility restoration measures are put in place.

Furthermore, this area contains the majority of Senegal's remaining forest (World Bank 1983). Fuelwood shortages in densely populated western Senegal highlight the importance of preserving the wood stocks located here, as well as designing policies to promote agroforestry.

Gorse et al. (1988) maintain that the Senegalese reform program "emphasizes agricultural production and largely ignores protection measures indispensable to preserve the agricultural resource base. In particular, it says little or nothing about the need for better soil conservation and regeneration measures, and desertification control."

4. Sudan. Policy reform in Sudan has been characterized by periodic reversals, overshadowed by civil war, drought, and famine. Because the reform process has been inconsistent, it is difficult to relate structural adjustment measures to natural resources. Nevertheless, Sudan provides a prime example of how government price control has contributed to resource degradation.

Sudan's third most important source of foreign exchange is gum arabic, an exudate of Acacia sengal trees which grow in a 300 mile wide belt across Sudan south of

Khartoum.[6] Sudan produces 85% of the world's supply of gum arabic (World Bank 1986). Pearce (1987) reports export earnings totaling US $84 million in 1983/84 and US $78 million in 1984/85. Some 200,000 smallholders derive income from gum production.

However, gum production has declined by about 40% over the last decade generally due to government stipulated low prices and mismanagement by the parastatal responsible for gum arabic marketing; the producer price is roughly 50% lower than the export price (World Bank 1986; USAID 1988d). Producers have found it more profitable to switch into other activities, converting trees into charcoal or removing gum gardens to plant annual crops. Of the gum produced, approximately half of total production was smuggled into Chad and C.A.R. due to unattractive producer prices (Pearce 1987; Larson 1987).

In 1986, producer prices for gum were raised, almost trebling the official price (Pearce 1987). Higher producer prices for gum arabic are recommendable for environmental, financial and economic reasons. As a leguminous tree, Acacia senegal maintains soil fertility and stability. Price increases provide incentive for tree re-establishment in the northern part of the gum arabic belt.[7] Observations following the 1986 price increase indicate that gum supply is fairly elastic; Acacia senegal plantings have increased (Pearce 1987). Higher producer prices contribute to household income and

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[6] Gum arabic "gardens" have long been an important fallow system. Crops of millet, sorghum, and groundnuts are grown for five years, then the land is planted in gum arabic which begins producing after 5-10 years. Production can be sustained for 20 years. Furthermore, Acacia senegal is nitrogen-fixing and serves to restore fertility.

[7] Tree removal for woodfuels has been most intense here.

ensure that domestic output is directed toward the home industry, enhancing government revenue.

Price policy reform in Sudan has also aimed at stimulating production in the irrigated sector through increased cotton and wheat prices (Sebastian 1988). Although cotton accounted for 36% of export earnings in 1986/87, this was made possible only through substantial multi- and bilateral donor subsidies for capital and input investment.

Reliance on this sector requires continued dependence on imported machinery, fertilizers and pesticides, all of which can have negative environmental and budgetary impacts. World Bank Sectoral Adjustment loans have included technical assistance for studies of pesticide use, assessment of health effects, and evaluation of application methods (Sebastian 1988). Studies concerning pesticide impacts are necessary in light of Sudan's dependence on this sector.

However, the traditional rainfed subsector may prove more important for Sudan's long-term development. Prior to the 1984/85 drought period, it contributed to 55% of foreign exchange earnings and 60% of food production (USAID 1988d). Up to 16 million of Sudan's 25 million people are employed in this sector, primarily on family farm plots. They grow staple grains as well as sesame, groundnuts, and gum arabic.

Further reform measures should be sought which enhance and safeguard the rainfed sector. For example, additional policies could help stimulate gum production such as

reduction of gum export taxes or devaluation of the exchange rate which applies to gum arabic.[8]

5. **Zambia.** Producer price increases for maize were stipulated as part of Zambia's structural adjustment program. Maize is the most important domestic agricultural crop, accounting for about 75% of total marketed agricultural output; 60-70% is produced by smallholders (USAID 1987). Between the 1981/82 and 1985/86 marketing seasons, the producer price of maize increased by 185% and consequently, the amount of maize marketed increased by 65% (Weidemann et al. 1987).

It is reported that small farmers have increased production more rapidly than large farmers. Citing preliminary data from surveys undertaken in the Eastern Province by the International Food Policy Research Institute (IFPRI 1985), Weidemann et al. (1987) indicate that in 1981, only 23% of small farm households cultivated more than three hectares of maize, whereas in 1986, 53% cultivated more than three hectares. Thus, production increases have been realized by extending the margin of cultivated area.

Farmers appear to be responding to price incentives; gains have been achieved via an increase in the rural areas' share of national income. However, there may be a cost associated with this trend toward more extensive agriculture, albeit difficult to assess. Almost two-thirds of Zambia is covered by extensive areas of miombo woodlands. These woodlands have little potential for export, but do ensure a continuous fuel and building

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[8] Gum is subject to a separate exchange rate; although higher than the official rate, it is still below the unofficial rate, thus contributing to high export prices. Lowering the export price could help secure and expand export markets.

material supply if properly managed. "Chitemene agriculture" -- shifting cultivation -- practiced by most small farmers, causes the largest amount of tree removal (Chidumayo 1986). Traditionally, chitemene involved a 25 year rotation, however, there has been an increasing tendency to reduce the fallow period to 12 years or less, a period inadequate to rebuild the nutrient content in the low fertility soils common in Zambia (Chidumayo 1986). If chitemene remains the dominant farming system, it is likely that erosion and loss of soil fertility will ultimately become a problem. Data is available from Zimbabwe on the direct costs of erosion as related to soil nutrients (see Appendix II).

Unless intensification of agriculture is promoted -- with a strong emphasis on fertility maintenance and erosion control -- a gradual decline in productivity will most likely ensue on those sites which are prone to erosion. Permanent agriculture on oxisols (common throughout Zambia) is not possible unless active steps are taken to keep organic matter content high and erosion losses at a minimum.

B. Input Price Adjustments (Tax/Subsidy Adjustments)

Subsidies on agricultural inputs affect farmer resource use and allocation. Artificially lowering the costs of fertilizers, pesticides, credit, irrigation, or machinery can encourage overuse to the detriment of the resource base, the economy and human health (in the case of pesticides). For the purpose of this discussion, we will be primarily concerned with fertilizer, credit, machinery inputs and land rentals.

Fertilizer subsidies entail tremendous fiscal costs. There is also empirical evidence to suggest that subsidies: encourage inefficient fertilizer application; discourage soil erosion

control; induce a substitution from organic to chemical fertilizer (sometimes with negative long-term effects on soil structure and fertility); and are frequently captured by those who do not need them (Repetto 1988b).

However, many of these arguments against fertilizer subsidies are less relevant in the sub-Saharan African context where fertilizer use is lower than in any other region of the world. In 1984/85, Africa's share of fertilizer consumption was 2.7% of the world's total consumption (Vlek et al. 1987). Of that total, 72% was consumed by Algeria, Egypt, Morroco, Nigeria, and South Africa (IFDC 1987). The remaining 27% was divided up between 45 sub-Saharan countries. More than half of these countries use less than 5 kg/ha per year (Harrison 1987).

There is little disagreement that increases in mineral fertilizer applications will be part of the move toward intensive management systems. Even moderate applications of fertilizer can achieve increased yields (U.S. Congress/OTA 1988; FAO 1986), thereby reducing the incentive to extend agriculture's margin. Yet, removal of subsidies depresses demand. Raising producer prices will tend to off-set higher fertilizer costs, but farmers must be given the opportunity to benefit from higher commodity prices before confronting higher input prices. This argues for a phased approach to subsidy removal.

Furthermore, even if smallholders are able to obtain additional income from agricultural product sales, their capital constraints are severe and very often seasonal. These constraints preclude against cash purchases of fertilizer. In many countries, farmers are accustomed to purchase fertilizer on credit. This is the case in Senegal where

elimination of customary credit channels has discouraged fertilizer use. Since fertilizer is primarily reserved for groundnuts, lack of access to credit has discouraged groundnut cultivation (Harsch 1988). Although such a result may be desirable on environmental grounds, credit restrictions also prevent intensive production of alternative crops.

Of course, it is frequently the case that smallholders are unable to derive benefits from subsidized inputs which tend to be captured by larger farmers. This is especially true in the case of rural credit since larger farmers are a better risk from the viewpoint of lending agencies. While sweeping removal of credit subsidies may prevent wealthier farmers from capturing a larger share of the benefits, such an action also precludes against small farmers deriving any benefits at all. This argument highlights the importance of targeting smallholders and ensuring access to these necessary inputs.

Finally, mechanization subsidies are not usually captured by smallholders, however they may be affected if they are displaced. Although mechanization can be important in timing the planting of the crop to take advantage of rainfall at the start of the growing season, large schemes (which generally include subsidies) can also lead to serious land degradation.

In addition, employment opportunities may be depressed, exacerbating rural poverty which reinforces natural resource degradation (see section II.E. below). Farmers who mechanize generally do so to save labor and extend their land. Yield increases rarely occur (Binswanger and Pingali 1988). As discussed below, low fees for machinery and land rentals in Sudan have partly contributed to overexpansion of mechanized farming and

massive depletion of soil and dry forest resources. On the other hand, a real exchange rate depreciation of 80% in Zambia has resulted in a switch away from mechanized production (requiring costly machinery imports) toward labor- and animal-intensive production (Weidemann 1987).

1. **Kenya.** The 1986 Agricultural Sector Adjustment Loan called for: introduction of user fees for livestock services while phasing out subsidies for such services; raising prices for improved seeds; increasing user charges for tractor hire; and revising fertilizer prices based on a benchmark international price (Sebastian 1988).

In light of Kenya's land constraints, promotion of relatively intensive agriculture is paramount and responses to input price changes should be carefully monitored. Small farmers are accustomed to using fertilizers and hybrid seeds (Lele 1988). Although the majority of smallhoders grow local varieties of maize, 50% also grow hybrid maize (D'Silva and Dommen 1986). Price increases could have a negative impact on their use which in turn would hinder intensification of production.

Increasing fees for tractor hire is environmentally and equitably sound. Mechanical plowing often compacts soil, reduces infiltration and leaves larger areas of land exposed and susceptible to erosion. Increased charges for tractor hire may inhibit extensive farming, at the same time lessening subsidies to large farm operators who are less in need of them. Opportunities for additional wage labor may also result.

Lastly, government support for livestock development has included provision of services. It is possible that removal of subsidies will discourage excessive growth of herd sizes.

2. Senegal. Fertilizer subsidies have been eliminated (except where furnished under donor programs) and the government has disengaged from provision and subsidy of groundnut seed. The internal distribution of fertilizer has been privatized and credit is no longer provided by the government.

In 1980, the price of fertilizer was 25 CFA/kg (due to a government subsidy of $18 million) with farmers consuming an estimated 70,000 tons (Ross et al. 1987). By 1987, consumption had decreased to approximately 25,000 tons with an unsubsidized price of 110 CFA/kg.

Of course, redressing soil fertility problems is not simply a matter of encouraging use of mineral fertilizer. Repeated use of chemical fertilizers on fragile and poorly buffered soils has led to nutrient imbalance and acidification in some cases. Technical packages are required which promote some use of mineral fertilizer in combination with organic fertilizer.

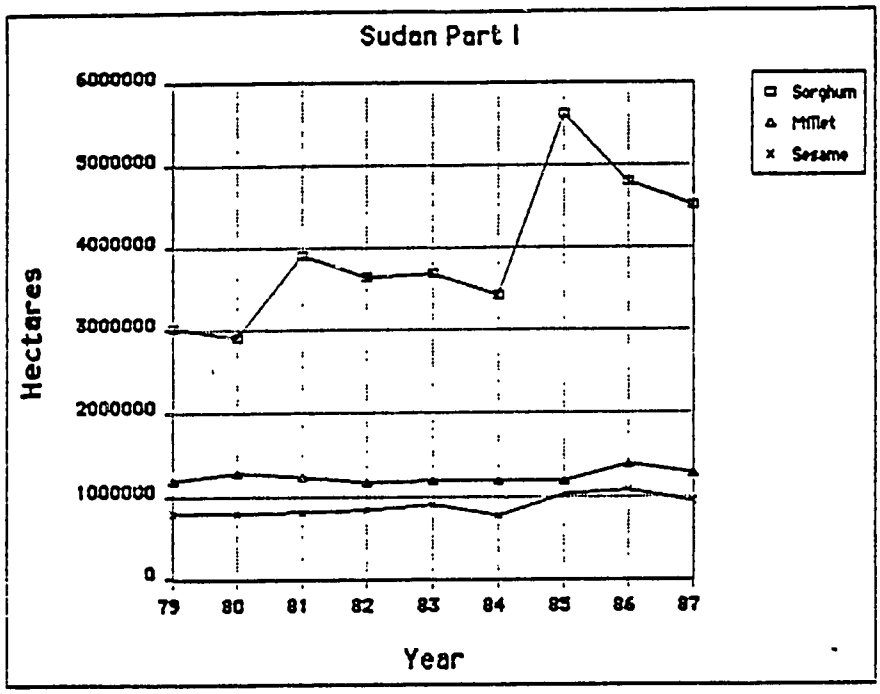
This type of "package" is not new to Senegal. Moore (1983) reports that nearly two decades ago under the Land Improvement Scheme, farmers readily adopted the use of improved seeds and mineral fertilizer for cash crops, but were less interested in incorporating organic matter to improve soil structure. Land tenure and labor conflicts were the chief constraints to this component of the package.

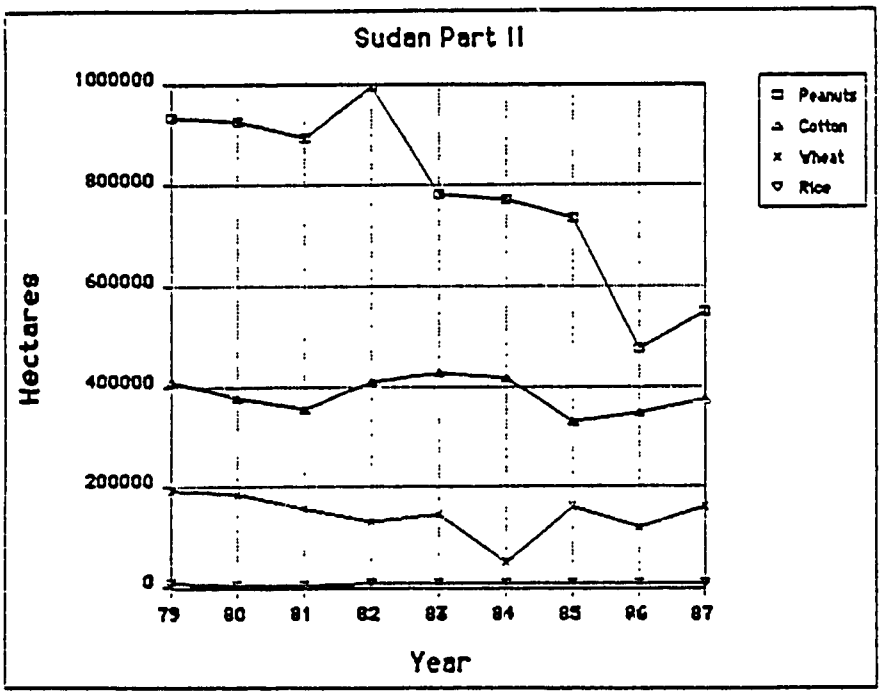
New policy initiatives must be designed which encourage agroforestry practices, use of leguminous crops to raise soil nitrogen levels, and soil management techniques such as minimum tillage. Policy instruments might include land titles in exchange for demonstrated use of conservation practices or credit specified for resource conserving techniques. Of course, such policies will also require adequate extension services.

Lastly, policy reforms in the energy sector include a tax on petroleum products designed to reduce domestic energy consumption. In Senegal, liquified petroleum gas (LPG) is the third most important urban household fuel (behind woodfuels and kerosene). LPG has been substituted for charcoal by the more affluent urban groups, representing 5% of urban household energy consumption (Floor and Gorse 1988). Taxing petroleum products may induce a switch away from bottled gas toward charcoal. Any increased demand for woodfuels will be felt in the areas surrounding cities, already degraded from fuelwood collection.

3. Sudan. Lewis and Berry (1988) report that the introduction of machinery into Sudan's savannah areas has allowed 2 million hectares of previously little-used clay soils to be cultivated, primarily for sorghum production (Figure 3). Although the mechanization scheme succeeded in bringing these hard-to-work (but potentially productive) soils into production and increasing output, environmental costs have been great. The mechanized farming schemes have taken up former forest land, which, after several years of continuous sorghum cropping, has been abandoned (World Bank 1986).

Figure 3. Area Planted to Various Crops: Sudan





Sources: Foreign Production, Supply and Distribution of Agricultural Commodities; FAS/USDA 1988.

FAO Production Yearbook (various years).

Mechanization in Sudan offers a prime example of the negative consequences of extensive monocropping where soil is mined without restoring lost nutrients. Since it costs mechanized farmers less to move on to new (unauthorized) tracts of land when yields begin to decline, fertilizer is never applied (Barnes and Olivares 1988). Similarly, leasing conditions which call for shelterbelts, fallow periods, and crop rotations are ignored, while local/regional governments commonly lease undemarcated land to secure revenue (Pearce 1987).

The incentives used to attract farmers to open these new lands -- 25 year leases at nominally low fees and subsidized machinery rentals -- have encouraged short run profit seeking. Inability to enforce mandated land management policies has also contributed to the problem. Expansion and land clearing have developed faster than the government's institutional ability to enforce proper management. Equity concerns arise in the displacement of smallholders by larger (generally wealthy) mechanized farmers.

The World Bank funded Agricultural Rehabilitation Programs I (1980) and II (1983), call for increased rates for land and machinery rental (Sebastian 1988). Theoretically, increasing rentals will off-set the negative incentives which have led short-term "rent seekers" to engage in the mechanization schemes. However, such policy reform does not address the broader issue concerning enforcement of leasing conditions.

If established, higher land rentals will generate additional revenue. A good portion of the revenue must be diverted to local and regional levels and earmarked for institutional support for agencies responsible for leasing conditions and land management.

C. Institutional Changes

Privatization or dismantling of government-owned enterprises is a common feature of reform programs. However, there is a growing realization that the private sector in sub-Saharan Africa is not as responsive to market and price liberalization as originally presumed (Cleaver 1988; Shepard 1988).

Privatization's success or failure can be related to other reforms. For example, removal of government subsidies and price controls -- the cornerstone of market liberalization -- is supposed to enhance private sector activity. However, in the case of fertilizer, the price increases resulting from subsidy removal, can significantly reduce consumption. Lower demand creates an unfavorable environment for market entry, thus discouraging private sector participation. This has been the case in Senegal where declines in demand have depressed private sector involvement in the fertilizer market (Ross et al. 1987).

A slower approach to privatization can make for a smoother transition. Shepard (1988) reports that preliminary studies of fertilizer privatization in Ghana have recommended a phased approach, beginning at the retail level in one region and expanding to include additional regions and levels if measures prove successful. This slower approach might better ensure involvement of local entrepreneurs.

However, where the private sector assumes responsibility for input and output distribution, there is no guarantee that the poorer smallholders won't be squeezed out.

In Kenya, there is some indication that the private sector firms responsible for fertilizer distribution prefer to sell to plantations or other large-scale buyers (Shepard 1988).

Institutional reform can also involve changing regulations of land use and laws governing land tenure and transfer. However, the analysis of property rights is by no means straight-forward; it often involves trade-offs. For example, in Cote d'Ivoire, policy transfers property rights for cleared land to the cultivator. This has created an incentive for former shifting cultivators to expand the scale of their operations, occasioning forest removal (Gillis 1988; Myers 1985). On the other hand, the positive affect of land registration can be observed in Kenya, where farmers receiving land title have engaged more readily in soil conservation activities (Reij et al. 1986).

1. Kenya. In Kenya, parastatals played a transitional role in input distribution until the level of demand attracted market entry by private firms (Johnson et al. 1988). Fertilizer is now being distributed by 35 private sector firms (USAID 1988).

Although participation by such a large number of companies would appear to indicate efficient and widespread distribution, problems still exist as illustrated by Shepard (1988). He recounts that much of Kenya's fertilizer has been supplied on aid such that donated fertilizer is allocated to firms through a Fertilizer Committee (comprised of various government agency representatives). However, many of the companies receiving allocations have no interest in marketing, instead on-selling to plantations or other large-scale buyers. Establishment of wholesale operations and dealer networks is neglected to the detriment of small farmers (Shepard 1988).

These problems may be overcome with time. Moreover, smallholders should also be encouraged to adopt low-resource technologies -- agroforestry, inter-cropping, mulching -- which optimize use of organic fertilizers. As mentioned above, farmers in Kenya have been more willing to make investments in soil conservation and tree planting as a result of land adjudication and registration (Reij et al. 1986; Harrison 1987).

It is notable that Structural Adjustment Operations I and II (1980 and 1982) included reviews of land policy issues and laws affecting land tenure and transfer (Sebastian 1988). Support for this type of institutional reform should be included in the adjustment process whenever possible, and indeed, would appear to be a prerequisite for other reform measures.

2. **Senegal.** Divestiture and liquidation of parastatal enterprises is underway in Senegal. ONCAD and its successor SONAR -- responsible for agricultural input distribution -- have been liquidated. Similarly, the Rural Development Agencies (RDAs) -- responsible for input credit and marketing -- are being restructured (Ross et al. 1987).

The gap left by the elimination of traditional systems for credit and fertilizer distribution has been only partially filled by cooperatives which are prone to the same problems common among parastatals (Ross et al. 1987). A number of questions remain concerning equitable distribution of inputs under private sector control.

The new "private" cooperative system relies on the village sections and producer groups for distribution of inputs, however, it appears that individuals holding important political or economic positions benefit most (Kelly 1986 as cited by Shepard 1988). To

the extent that smaller, poorer farmers are prevented access to inputs -- and land for that matter -- they will be forced to resort to extensive, soil depleting (e.g. low-input monocropping) production systems.

Lastly, it is interesting to note that the dismantling of parastatals and restriction of cooperative activities appears to have resulted in a larger role for NGOs (Gorse et al. 1988; Ross et al. 1987). Another new development has been the formation of Economic Interest Groups (EIGs) who evolved in response to NGOs' need for counterpart organizations. The NGO/EIG partnerships could serve as catalysts for natural resource management efforts.

D. Expenditure Reduction

It is especially difficult to isolate the effects of expenditure reduction. Nevertheless, there are several ways in which natural resources might be affected, either directly or indirectly.

Expenditure reductions generally include such reforms as: cuts in public sector employee wages, retrenchment of public sector employees, reductions in public sector investments, liberalization of interest rates, and lower budgetary allocations for certain sectors (Hansen 1988).

Cuts in wages and retrenchment of public sector employees may intensify the poverty effect of resource mismanagement (see section II.E. below). Natural resources are affected if there is a poverty-induced return to subsistence farming.

Budgetary allocations for natural resources management are likely to be cut. For example, in Zambia, budget expenditures for "Lands and Natural Resources" from 202.6 million kwacha in 1982 to 81 million kwacha in 1984 (Africa South of the Sahara 1988).

Such cuts include funds for the research and extension services necessary for farmer training, or credit to encourage tree planting or erosion control. On the other hand, public sector investment in activities which may negatively impact the environment -- e.g. road or dam projects -- are also cut (Cook 1988; Repetto 1988a).

Higher interest rates will cause a bias toward the present. Since sustainable resource management requires a longer time commitment -- and often a lower rate of extraction -- higher interest rates lead to short-term rent seeking to the detriment of resource conservation.

1. **Ghana.** COCOBOD (Cocoa Marketing Board) is scheduled to divest 52 of its 92 cocoa and coffee plantations (World Bank 1987c). Reductions in employee levels are already underway. Between 1985 and 1987, approximately 26,000 "ghost workers" were removed from COCOBOD's payroll (World Bank 1987a). In addition to those employees who existed on paper only, actual staff retrenchments have also occurred. Hodges (1988) reports that by the middle of 1988, staff lay-offs from COCOBOD had reached roughly 30,000. Furthermore, as part of a three year program to excise 45,000 jobs from the civil service (USAID 1988).

As divestiture of cocoa plantations occurs, further reductions in the workforce will be seen. As rural plantation workers are laid off, they may have no other recourse than

to return to subsistence agriculture. In the more densely populated areas, it may be necessary for them to cultivate the most marginal lands.[9] On the contrary, the effect of civil service retrenchment in the urban areas has most likely had a negligible impact on natural resources as most of these people have remained in urban areas. However, trends in reverse migration should be monitored.

Measures to reduce the budget deficit have been accompanied by restrictive monetary policy -- high interest rates and credit ceilings. Demand for credit from the Agricultural Development Bank in 1983-87 was 7.9 billion cedis against a supply of 1.6 billion cedis, and the proportion of loans from primary and secondary banks to the agriculture sector (agriculture, forestry, fishing) declined from 39% in 1983 to 18% in 1986 (USAID 1988a). Such a situation seriously constrains sustainable development in the agricultural sector.

2. Kenya. During the period 1980 to 1982, the Beijer Institute of Sweden undertook an exhaustive energy audit of Kenya (O'Keefe et al. 1984). Its conclusion states, "An integrated energy plan must be developed at this point in Kenya's history if serious impending crises are to be avoided....Wood resource requirements will increase from 20.4 million tonnes in 1980 to 49.7 million tonnes by 2000. Shortfalls will reach 11 million tonnes by 1990 and 33 million tonnes by 2000."

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[9] It was not possible to locate data on returns to subsistence farming although anecdotal evidence appears to support this theory.

Recognizing Kenya's heavy dependence on fuelwood, the Ministry of Energy began the Kenya Renewable Energy Development Project (KREDP) with funding from USAID for 3 years (1983-86). The project aimed to establish a system of tree nurseries for fuelwood and agroforestry species throughout the country and was generally regarded as successful and important for Kenya's future energy needs (Harrison 1987).

However, the project encountered considerable financial and administrative difficulties when transferred to the Government of Kenya at the end of the three year period.[10] Because of expenditure reduction, the government was unable to fully assume operational costs.

The KREDP experience suggests that donors -- in this case USAID -- should consider alternatives such as funding for longer project periods, gradual (phased-out) funding reductions, or collaboration (share-funding) with other donors. In all cases, priority should be given to coverage of recurrent costs. These recommendations are especially relevant for agroforestry projects in light of the time required for trees to grow to harvestable size. Such projects should be afforded "protection" under adjustment.

E. Poverty Effect

Over the long term, structural adjustment aims to promote growth and raise incomes. However, in the short and medium term, income growth can be impeded by: transitional

[10] One of the authors worked on community forestry projects in Kenya from 1982 through 1985. He had numerous contacts with the KWEDP people. This section of the report is based on information obtained from Dr. Amare Getahun, the project's head forester.

recession; prolonged economic stagnation; and distributional problems associated with expenditure switching (even with an increase in GNP). Impediments to enhanced welfare, inevitably impact natural resources (see Cunha and Kyle, this volume).

Policy reform is generally constructed with the aim of reorienting rural-urban terms of trade. Those rural poor who are net food producers stand to benefit from higher food and agricultural prices. However, it is important to distinguish increases in agricultural income from changes in net farm family welfare. Increases in the price of agricultural inputs, the rising cost of transportation, and decreased market accessibility will off-set gains from higher commodity prices. To a lesser extent, the rural household's purchasing power declines with price increases for staples (such as edible oils).[11]

For example, Ross et al. (1987) report that cost of living increases for rural Senegalese households have resulted from consumer price hikes (rice, cooking oil, sugar) coupled with input price liberalization. In spite of the fact that producer price increases have contributed to higher agricultural income, the assumption that net rural household welfare is improving may be false.. Citing data from the Institut Senegalais de Recherches Agricoles (ISRA), they contend that farmgate input prices have increased at a faster rate than producer prices in recent years.

The impact of subsidy removals and price increases will be felt most strongly by the chronic poor or landless rural families who lack the means to purchase food regularly.

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[11] It should be noted that the impact of food price increases is generally felt more by the urban poor who are net food consumers.

Their survival strategies may necessitate growing food in extremely marginal areas, or charcoal making to generate income. Poverty shortens time horizons and raises personal discount rates, the consequence being that immediate needs take precedence over distant needs. The inevitable cycle ensues; poverty encourages resource depleting actions and resource depletion reduces income (Pearce 1987).

"To the extent that poverty in many regions of the world is the primary cause for environmental degradation, increased poverty caused by structural adjustment policies can lead to further environmental damage" (Hansen 1988). Although the price effects of adjustment can lead to crop substitution or expansion, the importance of the income effect of adjustment should not be overlooked. In many countries, the income effect may overshadow the price effect in relation to environmental degradation (Repetto, personal communication).

Policy Elements for Resource Management Through the Adjustment Process

There is an emerging body of literature calling for the combination of adjustment policies with poverty-focused measures (Cornia, Jolly, and Stewart 1987). The concept of the "human face" approach to adjustment can, and should, be expanded to incorporate measures for safeguarding natural resources.

Such measures can vary in their nature and scope. They may range from public work schemes designed to rehabilitate degraded lands, to the targeting of inputs and new

technologies aimed at supporting intensive production among smallholders. Some of these measures are described and then discussed in more detail below.

A. Policy Elements

1. Ensure that inputs (i.e. fertilizer, credit, land, water, extension) and resource sustaining technologies are channeled to the rural poor and small farmers through targeted policies.

If it is assumed that conditions contributing to extensive, low-input agriculture are fundamentally responsible for much of the sub-Saharan Africa's resource degradation, then measures which encourage intensive, resource conserving practices are called for. Such measures will also serve to enhance agricultural income.

Zimbabwe is often cited for its "maize miracle," and the production gains achieved from a smallholder emphasis. From 1980 to 1985, communal maize production more than tripled to 1.6 million metric tons; 50% of Zimbabwe's total output (Desmond 1987). In addition, maize yields have increased from 600-700 kg/ha (1970s) to 1200 kg/ha in 1985/86 (Harrison 1987).

These gains were possible due to a number of factors including: considerable government support; use of adapted input packages; effective service delivery systems; increased availability of credit (which led to a higher degree of input use); and higher prices (Desmond 1987; Harrison 1987).

Although one must be careful about recommendations for "replicating" particular policy and institutional changes across countries, this oft-quoted example demonstrates the

productivity and income gains made possible by targeting small farmers. Welfare improvement can be regarded as the first step in natural resource conservation.

Targeting funds to those agencies responsible for natural resource management is also necessary. Because of the "common-property" nature of many natural resource endowments (communal farmlands, rangelands or forests) some degree of regulatory control is unavoidable. Responsibility for regulation falls on government agencies, which, in light of expenditure reductions, are ill-equipped to assume the charge. Under such circumstances, an argument for financial targeting can be made. According to Hansen (1988), "...structural adjustment measures can provide for environmentally sound control in some such cases, but the incidence of costs and the burden could be quite uneven, perhaps unacceptable, unless compensatory measures in the form of targeted grant allocations are simultaneously made."

2. **Combine resource management with special support programs – public works schemes and food subsidies – instated during adjustment for the benefit of low-income groups.**

Under Ghana's Programs of Action to Mitigate the Social Costs of Adjustment (PAMSCAD), rehabilitation of agricultural infrastructure is to be carried out under community initiative and employment generating projects (World Bank 1988c). Through

such programs, schemes could include erosion control measures and reforestation.[12] USAID (1988a) plans to promote natural resource management activities through PAMSCAD.

Public Law 480 provides opportunities for supporting environmental efforts, especially forestry. During the first half of the present decade, more than $80 million worth of Titles I and III local currencies supported forestry activities (Joyce and Burwell 1985). In addition, some $30 million in Title II commodities was applied toward forestry projects. Throughout Africa, the World Food Program has collaborated with recipient government ministries in "Food for Work" (FFW) forestry activities.

The problems associated with FFW projects are well known (e.g. dependency, lack of long-term commitment, mismanagement, logistic difficulties, etc.). However, problems most often arise due to poor program orientation and implementation. Joyce and Burwell (1985) provide a number of guidelines for enhancing FFW schemes.

For example, where possible, responsibility and accountability for distribution should be placed on local committees. Also, projects should be established with profit making goals (e.g. manage nurseries and woodlots to produce marketable wood products) and donated food should be used as start-up capital for income generating schemes. Finally,

[12] However, past efforts have shown that such investments are more likely to be sustained when implemented on privately held land.

technical assistance should be provided as needed by cooperating with government agencies or other support organizations.

3. **Include analysts and policymakers with expertise on natural resources in the national/international group responsible for adjustment decisionmaking.**

Enhancing the participation of natural resource specialists in policy reform dialogue is paramount if sustainable development is to be achieved. As expressed by the World Commission on Environment and Development: "The ability to anticipate and prevent environmental damage requires that the ecological dimensions of policy be considered at the same time as the economic, trade, energy, agricultural, and other dimensions. They should be considered on the same agendas and in the same national and international institutions..." (WDED 1987).

Participation can be achieved at several levels. At the country level, negotiations on structural adjustment are attended primarily by foreign economic consultants and officials from Finance Ministries or Central Banks. In addition to these economic advisors, environmental specialists should be included in the dialogue. Of course, environmental advisors from many of the poorer sub-Saharan African countries may be difficult to come by; this reality argues for inclusion of environmental consultants or PVO staff (see section below on NGOs/PVOs).

An international forum also exists via round-table discussions organized by the United Nations Development Program (UNDP) where African governments and donors discuss policy reforms. Participation of representatives from the United Nations

Development Fund for Women, has led to increased data collection on women's activities and promotion of women's needs (U.S. Congress/OTA 1988).

4. **Coordinate natural resource management efforts with private voluntary organizations (PVOs) and non-governmental organizations (NGOs).**

Experience has shown that multi- and bilateral organizations are not the most appropriate institutions to undertake the long-term investment in human and institutional development required for natural resource management and agricultural productivity. Such a role is better assigned to foundations, voluntary agencies, and/or non-governmental local organizations (Lele 1988).

Increasingly, bilateral organizations are coordinating their activities with such organizations. Under the Natural Resource Management Support Project, USAID is considering support for a coalition of PVOs and NGOs forming a working group on natural resource management (Otto et al. 1988). USAID is establishing "umbrella" co-financed projects for various sectors in a number of countries (Johnson et al. 1988).

Mechanisms are being sought to promote participation of multilaterals as well. The World Bank is also being encouraged to finance umbrella projects. As proposed by Gorse et al. (1988), the umbrella project would link state technical agencies with NGOs and would be staffed by both country and expatriate technicians. The following services are among those which would be provided under the umbrella:

- technical advice on natural resource management;
- access to specialized information on natural resources;

- training for NGO staff and extension agents;
- funding for material support, infrastructure, equipment, and site-specific research activities;
- credit to supplement NGO activities or revolving credit funds;
- representation and advocacy for natural resource management and NGO activities within the context of policy dialogue.

Gorse et al. (1988) propose that the World Bank support these umbrella projects through policy-based lending. Fast dispursing loans would be provided partly to support project activities (including a line of credit). The remainder of the loan would go to recipient governments as funds to support recurrent costs (operating budgets) for public agencies involved in natural resource management. In this way, policy reform would not only be leveraging conservation of natural resources, but would also be supporting donor/government/NGO collaboration.

5. **Make loans and official development assistance conditional upon environmental standards or requirements.**

Although World Bank structural adjustment and sectoral adjustment loans to Africa are beginning to raise environmental concerns, few policy measures have been developed which directly confront environmental problems (Hansen 1988). This is especially true of agriculture and forestry sectoral adjustment loans where prices, taxes, and institutions have been altered without examining implications for micro-level resource management decisions.

Stein Hansen (1988) poses a very relevant question when he asks: "Why should sustainable environmental management not be an integral part of adjustment programs?"

Structural adjustment and sectoral adjustment loans, due to their performance-based disbursements, already include built-in monitoring procedures (Weideman, C.J. 1987). It is not unrealistic to include "environmental performance" in the review process, especially in the context of sectoral adjustment loans. For example, release of a tranche might be made contingent upon reforestation of a specified number of hectares.

Of course, such conditionality would be meaningless without adequate support -- e.g. technical assistance and recurrent cost funding -- for the forestry sector. Moreover, environmental conditionality demands complementarity in policy reform measures and coordination among donors and host country governments.

B. Monitoring and Research

"The swift rise in funding for policy reform has outpaced efforts to evaluate its impacts" (U.S. Congress/OTA 1988).

A better understanding of farmer responsiveness to specific policy changes is essential for development of appropriate -- or resource sustaining -- policy interventions. Particular micro-level adjustments made by individual farmers drive macro-outcomes and simultaneously determine environmental impacts.

Unfortunately, information concerning household (micro-level) responses under structural adjustment in sub-Saharan Africa is limited. This is partly a function of

structural adjustment's recent history, but it is also a reflection of donor preference for policy based lending despite uncertain outcomes.

1. **Surveys.** In many countries undergoing adjustment, surveys are already under way to monitor the relationship between economic policies and living standards. Through the World Bank's Living Standards Measurement Studies (LSMS), microeconomic research has been conducted in Ghana, Cote d'Ivoire, Morocco, Mauritania, and Peru.

The household data collected from the LSMS surveys can provide important information concerning cropping patterns, cultivation practices, and energy consumption. For example, LSMS data from Cote d'Ivoire identifies which income groups grow which crops, and the average number of hectares devoted to each crop (Glewwe and de Tray 1988).

In addition, the Social Dimensions of Adjustment (SDA) program -- supported by the World Bank and various multi- and bilateral agencies -- is being undertaken in a number of sub-Saharan African countries with the aim of integrating social dimensions into adjustment programs. Through the SDA, statistical data bases will be developed.

Longitudinal monitoring can help identify changes in land area devoted to specific crops in response to input and output price changes. Such data can help establish the linkage between prices and resources by tracking resource allocation and utilization. However, complementary monitoring programs must be established which allow for more in-depth evaluation of the environmental components of agricultural production.

2. **Environmental and Low-Resource Agriculture Data Bases.** Quantified data and economic studies of the consequences of environmental degradation are lacking throughout sub-Saharan Africa. Yet, justification for budgetary expenditures on natural resources depends on being able to demonstrate the importance of resource conservation to future agricultural output.

Such data will be vital if economists from donor agencies, and Finance and Economic Planning Ministries are to be convinced that investment in renewable resources is essential for long-term agricultural development. Donors such as the World Bank and USAID can contribute to the development of natural resource data bases.

Secondly, a review of the literature reveals considerable rhetoric about the need to "diversify agricultural production" and the importance of agriculture as "the engine of growth in sub-Saharan Africa." However, if production increases in either food or cash crops are to be obtained, research must be aimed at production techniques and policies which are relevant to small farm conditions. Many technologies have already been developed and tested with positive results (e.g. agroforestry, crop rotations, residue management, soil conserving techniques, energy conserving woodstoves). Donors should continue to support data collection focusing on low-resource agriculture.

Because research and policy are reciprocal in nature, low-resource agricultural research cannot be isolated from policy reform. Although it is rarely the case, research findings should influence policy design.

3. **Research and Human Capital Formation.** The current policy reform paradigm needs to be altered to stimulate broader participation and greater sectoral integration. "Too much emphasis has been put on using leverage and policy dialogue to ensure that government officials make the right decisions...the emphasis should be instead on developing a policy dialogue process that enhances a country's capacity for good policy research and analysis, thereby improving decision-making by a country's own policymakers" (Johnson et al. 1988).

It is noteworthy that responsibility for policy reform design goes primarily to expatriate consultants, who are expensive to hire and often lacking in knowledge about local conditions (U.S. Congress/OTA 1988). These consultant economists are especially unacquainted with natural resource conditions and environmental issues.

Structural adjustment programs must place a higher priority on developing the African capacity to carry out policy analysis and maintain reforms. Although donor support for policy reform has been increasing, support for the training required to increase African participation has not been equally forthcoming (Lancaster 1987). Finally, the integration of natural resources and low-resource agriculture into policy analysis has been neglected for too long. This must be made a priority for both donor and African policy analysts.

Conclusion

In much of sub-Saharan Africa, limits to cultivable area have been reached (U.S. Congress/OTA 1988; Lipton 1985). The challenge lies in making policies more consistent with intensification of agriculture on existing available land. It will be necessary to determine, and invest in, production technologies which are resource-conserving and relevant to the needs of small farmers. Where forestry is an economically important industry, it will be necessary to manage timber harvesting according to maximum sustained yield. Investments must be made in reforestation and agroforestry to help take pressure off existing forest reserves.

Most of the actions recommended in this paper have been suggested before. Prescriptions concerning extension, credit, fertilizers, monitoring, and research are not new. However, by making natural resources the focal point, a different perspective is gained which reemphasizes the importance of policy reform recommendations made in different contexts.

Of course, the recommendations made here are very broad. It is hoped that they will serve as a starting point for refining and developing concrete policy actions. By presenting the actual or potential impacts of an array of structural adjustment instruments, we have attempted to highlight those areas which will need to be monitored throughout the adjustment process in order to avoid deleterious environmental consequences.

In summary, we conclude that sustaining economic growth in sub-Saharan Africa calls for placing natural resources in the forefront of policy planning. The underlying assumption is that increased agricultural productivity and farmer income will, on the whole,

discourage extensive -- soil and biomass depleting --agriculture. Therefor, it is paramount that policies encourage intensive agriculture.

However, intensification will not be possible without: development of institutions and infrastructure; low resource agricultural research; land security; access to inputs; and education and training. Developing these areas can forge positive linkages between policy reform and natural resources. Without them, policy reform will ultimately prove ineffective.

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Appendix I

OVERVIEW: CASE STUDY COUNTRIES

A. Case Background and Selection

The five case study countries -- Ghana, Kenya, Senegal, Sudan, and Zambia -- were selected on the basis of ecological zone, population density, degree of indebtedness, and adjustment status. The agroecological zonation we utilized was taken from USAID's Plan for Supporting Natural Resources Management in Sub-Saharan Africa (1986). Much of the area occupied by Kenya, Senegal, and Sudan is designated arid and semi-arid tropics. Kenya also contains tropical/subtropical highland areas while southern Senegal and south-western Sudan are designated as subhumid tropical uplands. Zambia is entirely located within the subhumid tropical uplands, as is northern Ghana. Southern Ghana is classified as humid lowlands.

Table 1 provides a summary of basic population indicators. However, as a selection criterion we also utilize what Binswanger and Pingali (1988) refer to as "agroclimatic population density." This is defined as the number of people per million calories of production potential. Production potential is based on FAO estimates of potential calorie production at intermediate input technology in a specified agroecological zone. This provides a measure of each country's land endowments and the population it can sustain. Kenya and Senegal are high density countries, Ghana and Sudan are medium density countries, and Zambia is still relatively low density (Table 2).

Table 1. Basic Indicators for Case Study Countries.

	POPULATION (a)	AREA (ha.)	POPULATION DENSITY (b) (people per thousand ha.)	ANNUAL POP. GROWTH 1980 - 1986 (percent)
GHANA	13,200,000	23,900,000	675	3.5
KENYA	21,200,000	58,300,000	428	4.1
SENEGAL	6,800,000	19,600,000	374	2.9
SUDAN	22,600,000	250,600,000	102	2.8
ZAMBIA	6,900,000	75,300,000	103	3.5

a. Population figures from 1986
b. From World Resources 1988/1989; reflects more recent data.

Source: World Development Report 1988; World Resources 1988/1989.

Table 2. Agroclimatic Population Densities, 1987-2025

Climatic Category	Low Density(a)	Medium Density(b)	High Density(c)
Mixed(d)	**Zambia** (2066)	**Ghana** (2036) Sudan (2065)	**Kenya**
Arid or Semi-arid			**Senegal** (2066)

Note: In each climatic category, countries are ranked by projected population density in 2000.

a. Having less than 100 people per million kilocalories of potential production by 2025. Figures in parenthesis denote the year a country is expected to reach a density of 100.
b. Having 100 people per million kilocalories of potential production currently or by 2025. Figures in parenthesis denote the year a country is expected to reach a density of 250.
c. Having 250 people per million kilocalories of potential production currently or by 2025. Figures in parenthesis denote the year a country that has not reached a density of 250 is expected to do so.
d. Includes climates with mostly intermediate rainfall and countries with both high- and low-rainfall zones.

Source: Binswanger and Pingali 1988.

Finally, countries can be classified on the basis of policy reform (Gulhati 1988). Intensity and duration of reforms are strongest in Ghana, Kenya, and Senegal. The reform process in both Zambia and Sudan has undergone numerous reversals. Of the five countries, three -- Kenya, Sudan, and Zambia -- are among sub-Saharan Africa's six largest debtors (Table 3).[1]

Table 3. External Debt of Case Study Countries

	Per Capita GNP 1987 (US$)	Per Capita Debt (US$)	Public Long-Term Debt,end 1987 (US$ mn)	1988 Debt Service([a])/ '87 Exports (percent)
GHANA	390	230	2207	10.8(b)
KENYA	330	269	4482	36.8
SENEGAL	510	528	3068	26.4
SUDAN	330	480	7876	142.3
ZAMBIA	250	889	4354	59.0

a. Scheduled debt service on long-term debt.
b. Figure from 1986 data.

Sources: World Bank 1988f; World Bank 1987e.

[1] In addition to those selected for study, largest debtors include Cote d'Ivoire, Nigeria and Zaire. Both Cote d'Ivoire and Nigeria are considered highly indebted countries (HICs) by the World Bank with total outstanding debt of 14.2 and 30.5 billion respectively. Zaire is the fourth largest debtor nation in SSA.

B. Policy Reform Overviews

1. Ghana.

Ghana's Economic Recovery Program was initiated in 1983 with a stabilization phase (ERP I). The Government of Ghana entered into an agreement with the World Bank's International Development Association (IDA) and successive stand-by arrangements (SBAs) were made available by the IMF. ERP II, the structural adjustment phase, is scheduled to run from 1987 to 1989 with emphasis being placed on private sector, market oriented development (World Bank 1987a; USAID 1988a).

Two aspects of Ghana's ERP are noteworthy. First, in addition to demonstrating a high degree of commitment to the program, the government has succeeded in mobilizing resources in the form of increased levels of foreign assistance. Aid commitments from bilateral and multilateral donors combined rose from $391 million in 1986 to $747 million in 1987, thus allowing a more "expansionary approach to adjustment" (Hodges 1988).

Secondly, Ghana has taken steps to confront the far reaching socioeconomic effects of reform through the "Program to Mitigate the Costs of Adjustment" (PAMSCAD). Conceived in 1987 as a supplement to ERP II, PAMSCAD was organized around a task force with support from the United Nations Children's Fund (UNICEF) and the World Bank. PAMSCAD is comprised of 24 specific project proposals organized into four major categories: community initiatives; employment generation; redeployment; and targeted basic needs (water, health, nutrition, eduction) programs for poorer income groups (USAID 1988a; World Bank 1988e).

A World Bank report acknowledges that the adjustment process is precariously

balanced on the price of cocoa, from which Ghana derives two-thirds of its export earnings. "A decline in cocoa prices would have a serious impact on the structural adjustment program. If cocoa prices dropped 10% below what is currently projected, it would add about $50 million to the financing gap each year" (World Bank 1987a).

2. **Kenya.**

Kenya was one of the first sub-Saharan African countries to receive a structural adjustment loan; SAL I in 1980 followed by SAL II in 1982. Disbursement of the second tranche of SAL II was suspended in 1983 until Kenya liberalized maize marketing in 1984 (Africa South of the Sahara 1988). Most recently, the World Bank has concentrated on sectoral adjustment programs in agriculture (1986) and industry (World Bank 1988d).

USAID and other donors have also supported policy reform through various mechanisms. USAID has utilized Economic Support Funds and PL 480 Title I to promote private sector activity most notably in fertilizer marketing and wheat milling (USAID 1987a).

The overall goals of adjustment include: increasing the efficiency of production in agriculture and industry, stimulating agricultural growth, expansion and diversification of exports, and rationalization of public expenditures.

3. **Senegal.**

The Senegal reform process was initiated in 1979 with IMF, World Bank and bilateral agency support. It should be noted that, per capita, Senegal is one of the world's largest foreign aid recipients; donors pledged $1.8 billion for fiscal years 1987-1990 (Hodges 1988). Of the bilateral donors, USAID and the French have contributed the

largest shares of financial assistance. However, several IMF stand-by arrangements, along with three structural adjustment loans from the World Bank (SAL I,II, and III; 1980, 1986, 1987), have provided the real impetus for policy reform.

Initially, emphasis was placed on stabilization measures, until the announcement of a Medium and Long Term Adjustment Program (PAML) for 1985-92 (Hodges 1988). This program incorporates the New Agricultural Policy which aims to diversify agricultural production away from its narrow production and export reliance on groundnuts; reduce government involvement in the agriculture sector through restructuring of rural development agencies; and privatization of the input distribution, credit, and marketing services previously performed by the parastatals (USAID 1985; U.S. Congress 1986).

USAID has supported Senegal's reform process through its Economic Support Fund, the PL 480 Title I program, and the African Economic Policy Reform Program funds. These resources have been used primarily to leverage reform of the agricultural sector and the tax and tariff system (USAID 1988c). For example, USAID along with the Caisse Centrale de la Cooperation Economique (French aid agency) financed a phase-out subsidy for fertilizer through 1988.

4. **Sudan.**

The single most dominant factor affecting the Sudanese economy has been its civil war. Insofar as policy reform has occurred, it has been characterized by periodic reversals against a backdrop of political instability, drought, famine, and war.

Sudan first signed an agreement with the IMF in 1979 which called for rehabilitation of the irrigated sector and increasing production of export crops (cotton and

groundnuts). Preconditions for this agreement included devaluation of the Sudanese pound; expenditure restraints; credit ceilings; and decreased subsidies on imported food, medicines, and petroleum (Hansohm 1986; Larson 1987).

Due to arrearages and noncompliance with recommended stabilization and recovery measures, the IMF suspended negotiations with Sudan in February 1986 (U.S. Congress 1986). However, by October 1987, a modest reform program was again adopted, sanctioned by the IMF, and financed by World Bank, USAID, and others (USAID 1988d).

The World Bank has continued to operate through specific project lending, as well as through three sectoral adjustment loans for agricultural rehabilitation (Agricultural Rehabilitation Programs I,II,III; 1980, 1983, 1987). Funding has been directed primarily toward the irrigated and mechanized rain-fed sectors (Barnes and Olivares 1988).

USAID is investigating the possibility of converting P.L. 480 Title I debt -- currently at $570 million -- to a grant in exchange for policy changes (USAID 1988d). This measure would apply to subsidy reduction such that when the government of Sudan removes a subsidy, a debt amount in direct proportion to the subsidy would be placed on a repayment moratorium, and eventually converted to a grant (provided the subsidy has not been reintroduced).

In January 1989, a general strike was staged in Khartoum to protest price increases (Time, Jan. 9, 1989). In response, the government revoked reform induced price hikes. It is unclear how this reversal will affect donor lending operations.

5. Zambia.

Although Zambia began relying on IMF credits in 1975, economic reform and

stabilization began in ernest in 1982, with the long run goal of lessening Zambia's dependence on the mineral sector and copper in particular (Africa South of the Sahara 1988). The economic restructuring program includes the following components: liberalization of market structures and prices, increased private sector access to markets, and streamlining of public sector activities (Weidemann et al. 1987). The strategy has been to emphasize agricultural sector led development by providing better incentives for agricultural production.

The World Bank and IMF have taken the lead role in developing and supporting the program, however, following the Consultative Group meeting in 1984, additional donors pledged increased financial support (mostly bilateral disbursements). USAID has supported reforms through the Commodity Import Program, the Zambian Agricultural Marketing and Auction Programs, P.L. 480, and projects in policy analysis, research, and extension.

Since 1986, the Zambian government has reversed several reform measures. In December of that year, removal of the subsidy on refined maize meal resulted in 120% price increase. Riots ensued and the government reinstated the subsidy (Africa South of the Sahara 1988). Following strikes for higher pay in 1987, the government also rescinded on a 70% fuel price increase.

The overall outlook for Zambia's economy is poor given domestic and external financial imbalances (USAID 1987). However, specific agricultural adjustments are beginning to show positive results in terms of enhanced production and a more equitable distribution of income (Weidemann et al. 1987).

Appendix II

DEFORESTATION, BIOMASS DEPLETION, AND LAND DEGRADATION IN SUB-SAHARAN AFRICA:

I. AN OVERVIEW

The deforestation rate in West Africa's productive closed forest has been the world's highest since about 1975 (Repetto and Gillis 1988). Yet even this appalling figure does not expose the extent to which forest is being lost in sub-Saharan Africa. All ecotypes from dense, closed tropical forest, to sahelian semi-desert scrub are threatened with destruction if, to use a well-worn but apt phrase, present trends continue. FAO (1986) estimates that 3.7 million hectares of forest are being cleared annually.

This section will examine forest and woodlands in sub-Saharan Africa's various ecotypes. Though one could specify many more ecotypes, this analysis will be based primarily on the duration and amount of rainfall received and are defined as closed forest, dry woodlands, savanna and open woodlands, and semi-arid scrubland.

Closed forest

Closed forests are those in which a continuous canopy of trees dominate. In sub-Saharan Africa, they are located in the equatorial zone and along the south coast of West Africa from Guinea to Nigeria. In 1850, Africa contained 1,336 million hectares

of closed forest. This dropped by 20% by 1980 and continues to decline at an even faster pace (Repetto and Gillis 1988). Most of the 262 million hectare loss has occurred in West African countries. Central Africa, including Zaire, Congo, Gabon, Equatorial Guinea, and the Central African Republic (C.A.R.) have seen far less depletion of their resources primarily because access to markets is extremely difficult (Repetto 1988b). Deforestation in West Africa can be attributed to various causes depending on the country (Repetto and Gillis 1988). In Cote d'Ivoire, logging for export sales of timber is the primary factor, although once commercially logged, land is converted to agriculture. In Ghana, conversion to arable land by impoverished, landless people has been primarily responsible for loss of closed forest Shifting cultivation is widely practiced in C.A.R., Zaire, and Congo, but land pressures are not as great as in West Africa.

Conversion of forests to agricultural land comes with two major consequences. In the first place, forests are highly diverse ecosystems with a wide range of species diversity whose economic potential is unknown and mostly untapped (Myers 1983). We have already lost many species that may have contributed to human welfare. Secondly, forests cover and protect a deeply weathered, fragile, and relatively infertile soil. Agriculture is possible on these soil types, but only when adequate measures are taken to protect it from erosion and enhance its limited fertility. Often farmers coming into cleared forest land from outside, have neither knowledge nor incentive (e.g. land tenure) to productively manage the land. As a result, massive erosion and decreased fertility

ensues.

Dry Woodlands

Surrounding the closed forest areas of Africa are large belts of seasonally dry woodlands which generally receive between 800 and 1500mm rainfall. In West Africa, this woodland belt extends from Senegal across Ivory Coast, Ghana, Nigeria, C.A.R. and into Southern Sudan and Northern Uganda. Much of it is now in agriculture. Valuable tree species such as Parkia biglobosa and Butyrospermum parkii are kept for their food value and the rest are cleared for crop production (von Maydell 1984). Deforestation here comes mainly from pressure for more farmland, the need for building materials, and especially firewood. A major proportion of Africa's energy needs (80%) are met by woody biomass either as wood or converted to charcoal (Keita 1987).

In southern Africa this type of woodland is even more common but its species composition is quite different. The dominant woodland type is the Brachystegia-Julbernardia or miombo (Chidumayo 1987a) which extends from northern Tanzania, south to Zimbabwe, and west to Angola. Most of the woody biomass of the Southern African Development Coordinating Conference (SADCC) countries are in miombo woodlands. Between 60% and 90% of the total energy used in the nine SADCC countries comes from woody biomass (Beijer Institute 1985). Deforestation to meet woodfuel demands occurs mainly in circles around major population centers such as the copper belt of Zambia (Chidumayo 1987a).

Away from these centers shifting cultivation takes a major toll on the woodlands since this agricultural activity occurs at a rate faster than the trees can regenerate (Chidumayo 1987b). As a result soil erosion and decreasing fertility become problems. If soil degradation continues, and the distance to mature miombo stands becomes too great, natural regeneration may fail resulting in a permanent or semi-permanent open savannah which has inherently lower productivity (Van Wambeke, personal communication).

A special subgroup of this forest type occurs in the highlands of Ethiopia through Kenya and south to Zimbabwe. The Kenyan highland forests could be categorized as closed forest. Ethiopia has lost over 90% of its forest since 1900; soil erosion has become a severe problem and consumption of wood exceeds production by 150% (Anderson and Fishwick 1984). These highland areas are often endowed with deep, fertile soils and are therefore targets for agricultural conversion. Since most of these areas are already in production, newly opened lands tend to be steeper and more prone to erosion and fertility losses (Lewis and Berry 1988).

Savannah

Savannah carries with it the image of open, treeless, grassy plains dotted with wildebeest and other wild game. This image fits in the Serengeti region of Tanzania and some parts of Kenya, but most of the African savannah is utilized for agriculture or livestock. Nor is the Savannah treeless. Acacia, Combretum, and Terminalia species are quite common in this region with between 400 and 1000mm rainfall. These and

other species provide fuelwood, fodder, building material and much more.

In West Africa, the Sudano-Sahelian zone is perhaps the most threatened area in terms of biomass depletion and loss of soil fertility. Explanations for this are many including drought, inappropriate development schemes, poor government management, population increase, overgrazing, and various combinations of these (Harrison 1987).

Semi-arid scrubland

Like the savannah, this ecological area is under severe stress primarily from overgrazing, firewood use and the extraction of charcoal. Because of scarce rainfall, agricultural potential is low. Nomadic and semi-nomadic peoples dominate the area. Their migration patterns in West Africa have been to move north to the edge of the Sahara in the rainy season, then retreat south into the Sudano-Sahelian zone which does support agriculture in drier times. This allows them to take advantage of fodder at its peak and keep away from wetter areas in the rains when cattle diseases are common. Trees often are major providers of fodder for the animals, as well as the source of fuel and building material. Acacia is the most important genus in this zone, though others like Balanites aegyptiaca are quite valuable.

Increased human population and herd sizes, combined with changes in migration patterns when new water sources were provided in the late 1960s, have put extreme pressure on these low rainfall areas (Breman and de Wit 1983). Breman and de Wit also claim that development agencies overestimated the productivity of this rangeland, promoting projects that increased environmental stress and reduced overall productivity.

Niger, a country which ranges from true desert to medium productivity savannah, now has the highest depletion rate of woody biomass reserves in Africa. Over 200% more wood is used than is grown each year (Anderson and Fishwick 1984).

Problems arise when traditional pastoral peoples are denied access into areas that were once dry season grazing areas. The expansion of agriculture -- with conversion of Acacia bush and savannah into cropland -- restricts movement and fodder availability in the period of the year when cattle are most vulnerable. This places ever more stress on the scrubland and may lead to intertribal conflicts (Lamprey and Yussuf 1983).

As can be seen in this brief review of four major African ecotypes the problems are many and quite varied. In all four zones land conversion is probably the most important cause of deforestation. Conversion may be part of a shifting cultivation strategy, the desire to expand cash crop production, the need for animal fodder, or simply the human pressure for more subsistence crops.

II. SOIL EROSION AND CROP PRODUCTIVITY IN AFRICA

Soil erosion is one of the most serious environmental problems in sub-Saharan Africa. It contributes to poverty by significantly reducing the potential for food production. It is insidious and irreversible; five centuries are required to replace one inch of lost soil. This section examines: (i) soil erosion problems in various regions of sub-Saharan Africa; (ii) the impact of different crop culture systems on erosion rates;

and (iii) the ecological effects of erosion on crop productivity.

Erosion Rates in Sub-Saharan African Regions

Wind and rainfall energy cause soil erosion on agricultural and forest lands. Wind erosion occurs most frequently in arid regions whereas water is the erosional agent in the humid and highland areas. Most water erosion occurs during very intense rainfall events (Turner et al. 1984). Raindrops contain considerable energy. When a drop strikes bare soil it loosens or breaks up aggregates causing clay, silt, or sand size particles to scatter. These particles are then free to move if enough rain falls for runoff to occur. The amount of runoff can be enormous. Edmund Barrow measured erosion in Baringo District of Kenya and showed that during one two hour, 60mm rainfall event on bare soil with a 2% slope, up to 12 tons per hectare could be lost (Barrow 1985). This translates to an annual soil loss in this semi-arid region of over 60 metric tons per hectare.

Lal (1989) reports erosion rates ranging from 5 to 600 tons per hectare per year in various regions of sub-Saharan Africa under different land use systems (Table 1).

Crop Culture and Erosion Rates

The primary cause of soil erosion is a lack of vegetative cover on the surface of the land. When soil is exposed to rainfall energy or wind energy, soil particles and organic matter will be moved from the land. The lighter weight organic matter is the first to be washed or blown from the exposed soil. Organic matter is an essential resource in productive soils.

One of the most significant causes of bare soil in sub-Saharan Africa is

overgrazing. In many areas savannah burning is practiced to stimulate growth of new shoots in the dry season which further exposes the soil. The measurements by Barrow (1985) given above were on badly overgrazed soils. In Kondoa District of Tanzania, extensive erosion was almost entirely blamed on overstocking and uncontrolled management of cattle (Ostberg 1986). Uncontrolled grazing contributes to erosion in two ways: first and most obvious is that the animals remove the vegetative cover needed to hold the soil in place. Second, cattle tend to walk on specific paths across slopes, compacting soil in a way that concentrates runoff promoting gully formation.

To illustrate the relationship between vegetative cover and erosion rates in agricultural systems, erosion rates under different vegetation can be compared. Soil erosion on land with a thick cover of grass like Kentucky bluegrass will be only about 0.1 ton per hectare per year. This is on land with about a 5% slope receiving rainfall of about 1,000 mm per year relatively evenly distributed throughout the year.

However, with a crop such as wheat that requires tilling and seeding the soil, the erosion rate will be approximately 10 tons per hectare per year under similar environmental conditions. Most of the erosion will take place immediately after tilling and during the time that the young wheat plants are becoming established -- while the soil lacks vegetative cover.

The most severe erosion occurs under row crops such as corn and soybeans. Under the conventional environmental conditions mentioned above, erosion rates will equal about 20 tons per hectare per year. Obviously, corn and soybean culture provides

Table 1. Measured erosion rates (t/ha/yr) in different ecological regions of Africa

Region	Country	Land Use	Erosion Rate (t/ha/yr)
Sub-Sahelian	Senegal	Cropland	5 - 30
Sub-Sahelian	Bourkina Faso	Cropland	5 - 35
Sub-Sahelian	Niger	Watershed	40
Savanna	Ghana	Bare-fallow	20
Savanna	Ghana	Cropland	5 - 10
Savanna	Nigeria	Cropland	10 - 20
Savanna	Ivory Coast	Cropland	10 - 50
Forest	Ivory Coast	Cropland	10 - 50
Forest	Ivory Coast	Bare-plowed	50 - 600
Forest	Nigeria	Bare-plowed	10 - 320
Forest	Nigeria	Cropland	10 - 50
Forest	Nigeria	Mixed	15
Forest	Ghana	Bare-plowed	100 - 300
Forest	Ghana	Cropland	5 - 20

Source: Lal (1989).

less vegetative cover than either wheat or bluegrass and thus erosion rates are higher.

Erosion control techniques in sub-Saharan Africa are directly related to the degree of vegetative cover as illustrated in Table 2. Note that 6 tons per hectare of straw applied to corn culture reduced the soil erosion rate over 1000-fold.

An important factor which contributes to vegetative cover is fertilizer. Adding fertilizer to a crop increases growth, thereby reducing the soil area exposed to water and wind erosion. If fertilizer (and water) are available, a given crop may be planted more densely to lower erosion rates.

Table 2. Erosion control technologies.

Technology	Treatment	Soil Loss (t/ha/yr)	Slope (%)	Country
Mulch	Corn planted on land with 6 t/ha/yr of rice straw	0.1	5	Nigeria
- - -	Continuous corn	148	5	Nigeria
Grass cover	Grass	0.08	10	Tanzania
- - -	Plowed	3.6	10	Tanzania
No-till	Corn	0.14	15	Nigeria
- - -	conventional corn	24	15	Nigeria

Source: Pimentel et al. (1987).

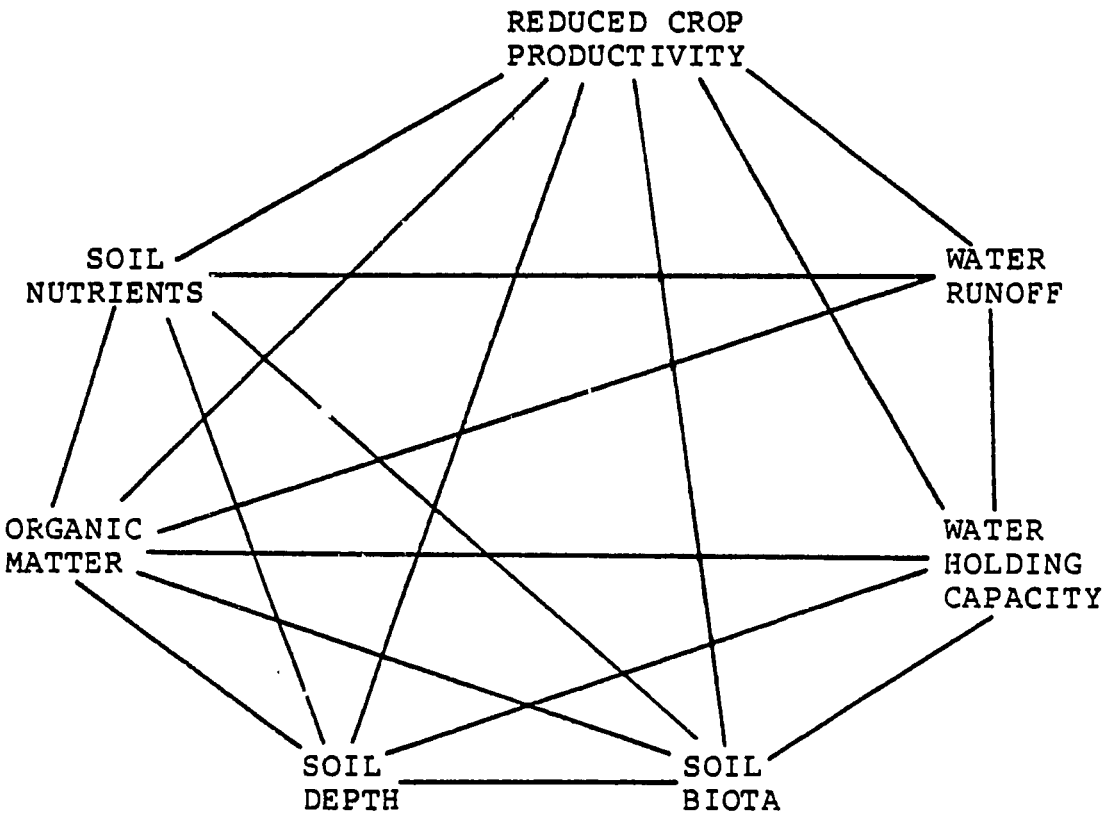
Erosion Effects on Crop Productivity

The ecological effects of erosion on crop productivity are poorly understood and controversial. In large part this is due to the complex of erosion effects associated with reductions in crop productivity (Figure 1). Even when a single erosion factor is investigated, results can lead to controversy. For example, economist Crosson (1985) reported that about $500 million in fertilizer nutrients are lost annually through U.S. soil erosion. However, agronomist Troeh (et al. 1980) reported that about $18 billion in fertilizer nutrients are lost each year; there is a 36-fold difference in their estimates!

Careful study of their papers indicates that different factors were being measured. Crosson was assessing fertilizer nutrients immediately available to the crop during the current year, whereas Troeh et al. were assessing the total fertilizer nutrients that were available now and in the future years after mineralization of the nutrients in the eroded soil.

Often, economists and modelers measure the effect of erosion on crop productivity by measuring the ecological impact of reduced soil depth. This is partly due to the availability of simple, easily understood data that illustrates how reductions in soil depth affect crop productivity. However, reliance on this measurement alone could lead to the conclusion that 20 t/ha/yr of soil erosion has a minimal impact (0.2%) on crop productivity (Table 3). Note that the total impact of erosion on crop productivity is approximately a 15% reduction in yield.

Figure 1.



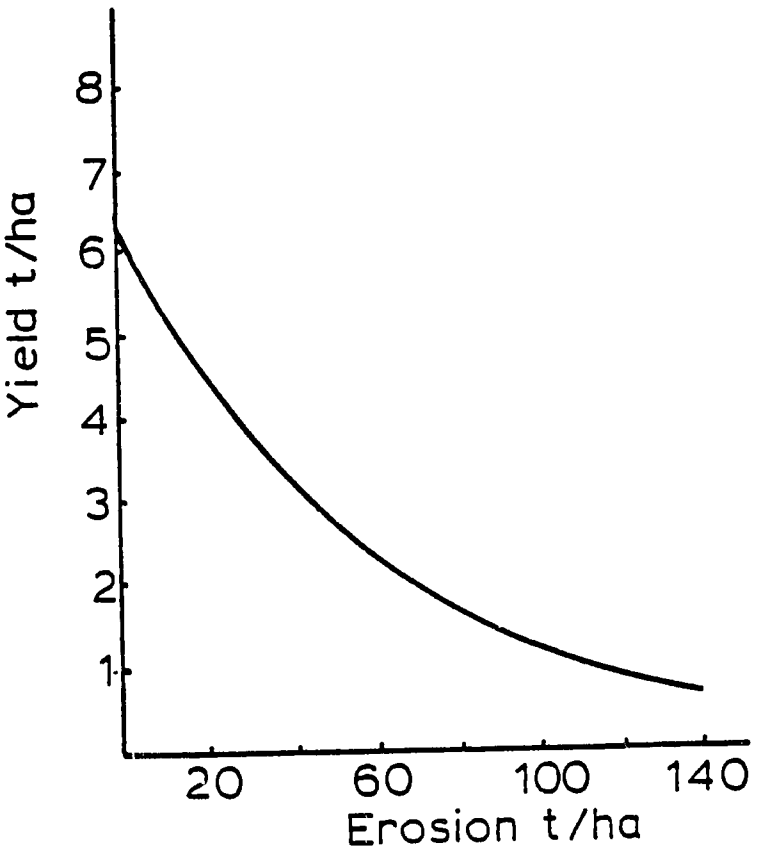
The interrelationship of the ecological complex of factors associated with soil erosion that result in reducing crop productivity.

The cumulative effect of soil erosion on corn productivity in Nigeria is illustrated in Figure 2. As documented in Figure 1, at least six factors related to soil erosion are associated with decreases in crop productivity. The most important factor is usually rapid water runoff and the least important factor is soil depth. It is estimated that water is the prime limiting factor for worldwide crop and natural vegetation production (Pimentel 1986). The impact of water availability on crop production is well illustrated in Figure 3. Note how rapidly productivity declines below 1500 mm of rainfall per year.

After rainfall, soil nutrients represent the next most important requirement for crop productivity. Soil erosion removes topsoil first. In general topsoil contains more nutrients than the underlying soil layers and in many tropical soils fertility may be concentrated in the top centimeter (Lal 1987). Many authors estimate that one ton of rich topsoil contains 4 kg nitrogen, 1 kg phosphorus, and 20 kg potassium, as well as between 1 and 5% organic matter (OM) (Pimentel et al. 1987; Lal 1987).[1] Soil and nutrient losses will vary according to the slope of the land. Lal (1977) reports that bare fallow with 1% slope will lose 58.3 kg total organic carbon/ha/year and 6.2 kg N/ha/year, while a 15% slope with a similar soil type could lose 3073.4 kg organic carbon/ha/year and 225.6 kg N/ha/year.

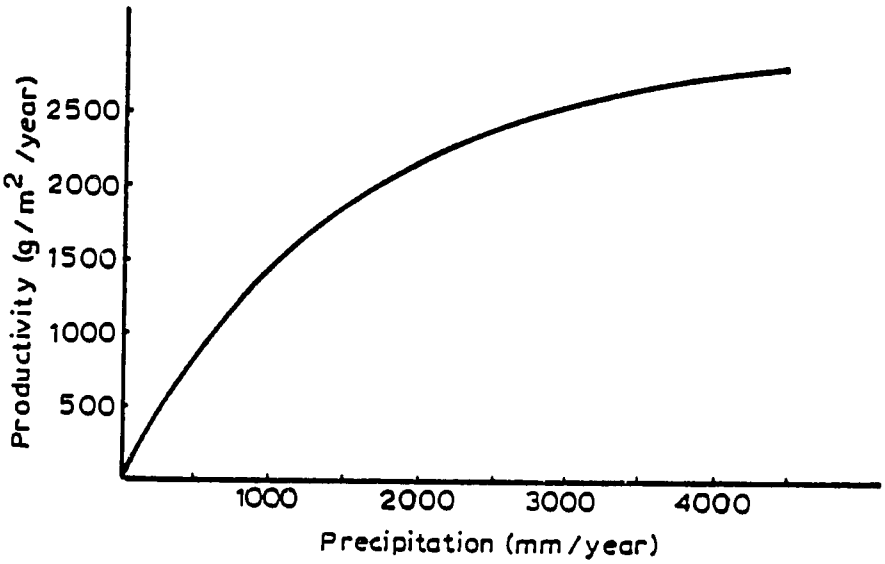
[1] These figures for nutrient content of one ton of soil are given with some trepidation. Soils are highly variable. Some may be quite rich in organic matter, especially in organic soils of closed forest environments, and others may be deficient. It is assumed that this soil was a tropical forest soil which does have a higher nutrient status than most (Lal 1986).

Figure 2. Relationship between maize yield and cumulative soil erosion on an Alfisol on land with 1% slope in southwest Nigeria.



(After Lal 1989).

Figure 3. Net primary activity of natural vegetation related to mean annual precipitation



Source: Pimentel 1986.

Table 3. An estimation of the individual erosion effects on corn roductivity with an erosion rate of about 20 t/ha/yr. Note, all of these factors are interrelated; each of these factors influences most of the others.

% Yield Reduction	Erosion Effects on Corn Productivity
6	Water Runoff
3	Loss of Soil Nutrients
2	Loss of Soil Organic Matter
2	Loss of Water Holding Capacity
2	Loss of Soil Biodiversity
0.2	Reduced Soil Depth
15.2	Total Reduced Crop Productivity

These losses are extreme when you consider that the average African farmer uses only 18kg/ha of fertilizer per year as compared to the European farmer who uses 218kg/ha per year (Sheldon et al. 1984). For most African farmers the nutrient loss due to erosion greatly exceeds the nutrient addition in the form of fertilizer, which for many may be unavailable, unaffordable, or simply out of their sphere of knowledge (Sheldon et al. 1984).

Soils have different tolerance levels to erosion. A deep, nutrient Mollisol in Iowa can tolerate the excessive loss of 5 tons of soil per hectare per year for a longer period

than a shallow soil.[2] An Oxisol in Zambia or a thin Alfisol in Ghana will show an immediate negative impact on yields (Lal 1977). Most African soils, with the notable exception of the deeper soils in the East African highlands, are vulnerable to soil erosion since a majority of the nutrients are located in the top 15 centimeters.

The costs of soil erosion in terms of nutrient loss is staggering. Michael Stocking (1986) analyzed data collected in Zimbabwe from four different soil types during the 1950s and 60s. Three of these soils were alfisols and one an entisol representative of soils in the most productive agricultural region. He estimated the replacement cost of nutrients lost due to erosion on all Zimbabwe's agricultural land during that period in present dollars to be over US $1.5 billion, an amount greater than Zimbabwe's total export income in 1986 (World Bank 1988).

There are more costs of soil erosion than loss of nutrients. A study in Nigeria which artificially desurfaced soil at three different sites showed that substantial increases in bulk density occurred in the newly exposed surface (Mbagwu et al. 1984). Increases in bulk density imply a decrease in soil porosity and therefore a decrease in moisture holding capacity. In this case moisture holding capacity was reduced between 12% and 61% depending on soil type (Mbagwu et al. 1984). Attempts to replace the nutrients lost by desurfacing using standard fertilizers did not result in a restoration of yields to the original level.

Erosion may not need to be completely desurfacing to cause the same level of

[2] The rate of soil formation under agricultural conditions averages about 1 t/ha/yr.

fertility reduction. Stocking further reports that erosive action selectively removes organic carbon and soil nutrients. He found that soil collected from test plots subjected to erosive rainfall events was up to 2.5 times richer in N, P, and organic carbon than the original surface horizon. These data indicate that the calculation of erosional fertility losses from tons of soil lost per hectare may underestimate the actual loss.

Most of the nutrients present in soil are present in soil organic matter (Figure 1). In addition to soil nutrients, soil organic matter is also related to several other factors in the agricultural system. For example, soil organic matter influences water runoff, water holding capacity, and soil biota.

Organic matter -- especially as crop residues -- reduces the rate of water runoff. In addition, soil water holding capacity is dramatically raised with increased amounts of organic matter. The abundance of soil biota increases with organic matter. Increasing soil biota in turn increases water availability to the crop. For instance, in rich agricultural soils, there may be approximately 10,000 earthworm holes per square meter of soil surface. The abundant holes allow rainfall to percolate rapidly into the soil, thus reducing the rate of water runoff and increasing the amount of water held by the soil and available to the crop.

In summary, soil erosion in sub-Saharan Africa is a major factor in reducing crop productivity and is costing several billion dollars annually in lost resources like fertilizer nutrients and water.

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Appendix III

AGROFORESTRY IN SUB-SAHARAN AFRICA: ECONOMIC ASPECTS AND POLICY IMPLICATIONS

Julie Bourns[1]

Structural adjustment programs aimed at encouraging sustainable agricultural growth, and entailing sound environmental and natural resource management, may do well to consider the potential returns from investment in agroforestry. Agroforestry represents one method for intensifying agricultural production, improving fuelwood supplies, and raising returns to livestock management while re-establishing trees on the landscape and achieving the resulting ecological benefits. Furthermore, agroforestry appears to be a relatively low-cost approach to production and conservation, whose prospects may be enhanced by appropriately designed adjustment programs, and which may, in turn, have positive effects on rural income levels.

Certain adjustment measures may enhance and highlight the benefits and relatively low real costs of agroforestry. For example, removal or reduction of subsidies on agricultural and forestry inputs raises their cost to producers. Currency devaluation

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[1] The author, a visiting graduate student from the School of Forestry and Environmental Studies at Yale University, spent the Fall 1988 semester at Cornell where her studies concentrated on agroforestry and tropical resources with a focus on Africa.

can have the same effect. Higher costs could encourage farmers to substitute mulching or intercropping of perennials for purchased inputs. Pricing policies can encourage tree crop establishment if prices for tree products are raised. Finally, public expenditures, in terms of cost per hectare, are generally lower for agroforestry programs than for woodfuel plantation or shelterbelt programs.

If structural adjustment programs can encourage long-term project funding they are likely to improve the prospects for success and the value of returns from agroforestry projects.

Subsidy Removal

During a phased removal of subsidies -- over a two to three year period -- agroforestry could help ease the transition from heavy-input land use systems to less costly, more environmentally sound production systems. Positive impacts by leguminous trees on the yields of crops growing near them has been reported in a number of studies (Dancette and Poulain 1969; Felker 1978; Huxley 1983; Sanchez 1987). Their nutrient and organic matter inputs to the soil can eliminate or substantially decrease fertilizer requirements, and in the case of nitrogen-fixing species, chemical fertilizer applications may actually reduce their nutrient-enhancing effects.

Organic mulches contribute essential micronutrients lacking in synthetic fertilizers. Agroforestry systems, which more closely simulate natural ecological communities, are generally less susceptible than monocultures to disease and pest outbreaks. Thus, they may not require pesticides and fungicides to the extent that tree

or food crop monocultures do. The possible reduction of weed growth in agroforestry systems can reduce the need for herbicides. A lower level of dependence on such imported inputs, impacts positively on project, sectoral, and national budgets.

However, such substitution (from chemical inputs to agroforestry) does not occur immediately and rarely spontaneously. Farmers require time to be convinced of the benefits of agroforestry interventions, especially the productivity enhancing value of soil and water conservation. Adequate extension services are mandatory. Credit availability may also be important to support investments in agroforestry activities during the years before benefits begin to accrue.

The removal or reduction of subsidies for water use may encourage more research to evaluate the effects of agroforestry systems on local water resources and availability. In some instances, trees have been shown to improve the water and moisture regimes of the micro-site as well as larger areas, to the benefit of crops and pasture. In other instances trees may monopolize water resources to the detriment of crops. Therefore, the precise impact of agroforestry on water resources will depend on the particular site and species in question. Experimentation along these lines may be more likely to come about as water is priced more realistically in ecological and economic terms.

Pricing Policies

Pricing policies that affect the market value of tree products can be either beneficial or detrimental to agroforestry systems. For example, when prices for gum

arabic fell in the Sudan, gum producers found that harvesting Acacia senegal trees for fuelwood proved more valuable than gum extraction. As tree stocks decline, production systems break down; local farmers and herders are deprived of animal fodder, as well as the tree's contributions to soil fertility and conservation. Adjustment programs which raise the value of such trees (through pricing policies) will encourage their active cultivation and integration into the prevailing production system.

To the extent that structural adjustment programs encourage the production of food crops with a relatively high erosion propensity, the incorporation of agroforestry practices may help minimize ecological degradation. Integrating woody perennials into such crop producing areas can counteract erosive forces, reducing the costs of resultant environmental externalities. Food crops such as maize, sorghum, millet, cassava, and rice, have been shown to produce well within certain agroforestry systems. Also, tree and shrub crops which yield valuable products themselves (coffee, cocoa, rubber, oil palm, banana, and tea) may be selected for interplanting.

Expenditure Reduction

From the perspective of public expenditures, Anderson and Fishwick (1984) estimate that the costs per hectare of agroforestry programs are approximately one-fifth of those for large-scale public forestry projects (e.g. woodfuel plantations or shelterbelts). This cost estimate includes research, nursery and extension expenses.

A 1983 World Bank review of Bank forestry projects concluded that plantations cost between $800 and $1500 per hectare and yield returns of 10 to 15 percent, while

farm forestry projects cost one-fourth to one-third as much and give returns of 25 to 30 percent (cited in Harrison 1987). Among the factors which the World Bank considers as contributing to these high rates of return are the following:

1) Agroforestry usually requires a lower level of infrastructural investment than plantations, which require access roads, firebreaks, administrative staffing, and fencing;

2) Agroforestry uses low-cost tree establishment techniques and decentralized planting by many small farmers;

3) Prices of wood products from agroforestry (poles, stakes, fuelwood) have been rising generally in real terms at a faster rate than other commodities, due to increasing scarcity (Spears 1987).

Plantation forestry usually requires equipment for land preparation and tree felling, fencing, large quantities of petrol, fertilizers, pesticides, and fungicides. The use of such inputs -- many of which must be imported -- is likely to be much lower or absent in agroforestry systems.

For other than timber purposes, certain agroforestry systems may yield more than traditional plantations. Harrison (1987) argues that closely planted trees in alley cropping systems can yield two-to-three times the amount of wood biomass as conventional forestry plantations covering the same area. This capacity increases productivity per unit area of land over a given time period in comparison with plantation systems.

Income Generation/Rural Employment

Gillis (1988) has remarked that the forestry plantation sector, in spite of its dependence on wage labor, has not been a prolific source of employment. In this sense, it has not contributed significantly to the generation of rural incomes. Agroforestry projects hold a higher potential for improving rural incomes -- albeit gradually and incrementally -- at a lower cost. This potential is bolstered by a propensity for autonomous expansion and self-replication, further encouraging rural market development.

To the extent that agroforestry programs contribute to raising rural incomes and stabilizing rural production systems, they also help to ease pressures on remaining forest lands. The latter may represent significant stores of wealth, in terms of wildlife, timber, and genetic resources. Sustained management of forest lands can contribute significantly to national income. However, the needs of rural populations often forestall revenue generating opportunities. For example, in Cote d'Ivoire between 1966 and 1980, farmers destroyed some 300 million cubic meters of saleable timber, a quantity far exceeding the amount exported during the same period.

Institutional and Policy Aspects of Agroforestry

Policies concerning land and tree tenure, water rights, range management, and restrictions on the use of public lands all influence tree planting. Secure land tenure is crucial; rights to land constitute a major incentive to investment in agroforestry and

protection of trees. Communal areas require special arrangements, such as perhaps giving usufruct and harvest rights to claimants. Louise Fortmann (1985) has discussed land and tree tenures in relation to implementation of agroforestry projects. Her studies highlight the need for identifying prevailing customs and legislation in project areas for incorporation into project design. This is also true for policy reform. There is scope for addressing certain institutional constraints through the structural adjustment process.

Anderson (1987) argues that most African governments (and donors) have accorded low priority in their macroeconomic and investment incentives policies to rural and agricultural development -- including afforestation programs. He cites the period during and after the oil boom in Nigeria, when the value of the naira was high and public expenditure and incentives policies favored investment in urban areas and industrial sectors. In contrast, investment in agriculture -- and particularly agroforestry -- was discouraged.

> "Insofar as this depressed agricultural incomes, it must also have reduced incentives to invest in the efficient use of land, particularly in noncrop, long-term activities such as tree planting. The problems and risks of developing farm forestry are thus at least as great as those of developing agriculture itself, and the success of farm forestry programs will be inseparably tied to the success of agriculture... Furthermore, the lower are incomes, the more the subsistence farmers will be tempted to harvest and sell (without replenishment) existing tree stocks to

augment their income and the slower will be the rate of substitution of commercial fuels for fuelwood in local urban areas" (Anderson 1987).

Grainger (1986) notes that governments and international agencies have allocated only 24% of aid to agriculture and forestry; of these projects, only 40% are rural and only 8% of aid is directed at intensifying rainfed agriculture. He further points out that forestry and environmental rehabilitation projects accounted for only 1.4% of all aid to the Sahel in 1980.

Anderson (1987) suggests that a contributing factor to the neglect by public policies of rural afforestation (and agroforestry) is the compartmentalization of most analyses of agriculture, forestry, and livestock activities. As a result, the economic associations among these is ignored, thereby risking a gross understatement of the benefits which such associations can achieve.

This is compounded by the donor tendency to emphasize short-term funding horizons and cost-effectiveness. Such a bias can lead to premature termination of projects with a forestry component (Otto et al. 1988). This tendency also undervalues "the process-oriented nature of grassroots community action and the experimental state of many natural resource management activities in environmentally degraded zones in Africa" (Otto et al. 1988).

The position is often taken that forestry and agroforestry investments render certain benefits insignificant because of discounting and the long gestation periods

required. Anderson (1987) argues that although the Net Present Values (NPVs) for such investments are calculated at a 10% discount rate, they are usually based on the current values of agricultural productivity and ignore the possibility that this may rise (e.g. as land values rise due to population pressures or with changes in economic policies). It is inconsistent to disregard this possibility while applying a 10% discount rate to such an important sector.

Lastly, administrative concerns arising from financial considerations may work against support for small-scale projects. In the case of Dutch Aid -- currently promoting a range of agroforestry activities at the grass-roots level in Senegal -- the Senegalese mission and field personnel are facing pressure to reduce their supervision costs by increasing project size (Gorse et al. 1988). Project staff are concerned that such growth will impair their efforts to foster a participatory approach.

Smaller projects also incorporate site-specific and experimental approaches important for project success. Moreover, small size can reduce the cost of errors. Yet small projects continually face pressure to consolidate and reduce operation costs.

Conclusion and Recommendations

Forestry and agricultural pricing policies should be examined in light of: (1) incentives which favor production for export at the expense of production for consumption; and (2) incentives which may discourage conservation measures. Policies in all the above-mentioned areas constitute powerful incentives or disincentives for farmer participation in rural development in general and agroforestry in particular.

Technical initiatives should be interdisciplinary so as to better address the complex nature of resource use issues. They will need to integrate approaches to forest, soil, crop, livestock and water management, and must therefore involve the government ministries or departments responsible for these areas. They must also address human resource issues, requiring the presence of social scientists. They should derive from traditional production systems and correspond to the physical, biological, and human carrying capacity of the targeted site (Gorse et al. 1988).

There is also a need to retrain extension agents in participatory and interdisciplinary approaches. Agroforestry projects will be more successful to the extent that they are rooted in local problems and practices. The high degree of variability and complexity among conditions in Africa requires that project design, evaluation, and technology selection involve the rural farmers and pastoralists who are most familiar with prevailing local conditions. Active farmer participation also encourages and reflects farmer commitment which will be crucial to sustainability.

Although minimal, a certain degree of infrastructure is required to support agroforestry. It will be necessary to develop and expand infrastructure services; this will require creation of networks of local nurseries and increased investment in agroforestry research. Anderson (1987) has suggested establishing a West African regional center for agro-silvo-pastoral research, in addition to strengthening existing national research institutions.

Often, local organizations are best equipped to provide the necessary goods and services to farmers. This suggests an important role for grassroots organizations and intermediary non-governmental organizations (NGOs), and locally-based private voluntary organizations (PVOs). Wherever feasible, these groups should forge linkages with government agencies, for in the long-run, governments should be made responsible for maintenance and continuation of program support.

The overall effect of policy reform programs on agroforestry may be evaluated in light of the impact on the real costs and benefits of agroforestry relative to other land use systems. If a supportive institutional and economic environment is established, agroforestry may well appear as one relatively inexpensive option for raising rural productivity and income levels on a sustainable, if incremental, basis.

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NATURAL RESOURCES, STRUCTURAL ADJUSTMENT, AND SUSTAINABLE GROWTH IN SUB-SAHARAN AFRICA: A CRITIQUE OF POLICY RECOMMENDATIONS[1]

Aercio S. Cunha and Steven Kyle[2]

Introduction

1. Growth in a Resource Over-Dependent Economy

Exploitation of natural resources and environmental degradation are unavoidable consequences of human activity. As the law of entropy requires, increased production of any good is tantamount to increased utilization of natural resources of one kind or another. It follows that intensification of resource utilization is inevitable for economic growth and development. "The truth, however unpleasant, is that the most we can do is to prevent any unnecessary depletion of resources and any unnecessary deterioration of the environment..." (Georgescu-Roegen, 1976, p. 21). The difficulty, of course, is to

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determine the precise meaning of "unnecessary." Although no general definition of the term is possible, this is a difficulty that must be dealt with in order to make policy recommendations pertaining to specific resource utilization. In other words, one has to: (i) clearly specify a country's growth objectives (the benefits); and, (ii) figure what loss of resources and level of environmental degradation (the costs) is required to obtain these objectives.

The sub-Saharan African countries draw their means of subsistence mostly from direct exploitation of a few scarce natural resources (as have all countries at a similar stage of economic development and per capita income). Their main activity -- rainfed agriculture -- is heavily dependent upon agricultural land and water. For these countries, inappropriate or overexploitation of natural resources can usually be translated into inappropriate cultivation practices and agricultural expansion into unsuitable lands, forested areas, or wildlife habitats. "Unsuitable" should be understood to mean that the new production activities cannot be sustained for more than a few years before sufficient degradation of the resource base renders this activity no longer viable. Under such conditions, agricultural expansion can hardly be cost effective. By being most damaging to the environment, it is by definition, unsustainable.

Under the pressure of population growth, sustainable cultivation methods (e.g. fallowing and manuring) have become insufficient to feed increased numbers of people. Expansion of cultivated area, food imports, and village crowding have relieved some of the pressure but at the cost of excessive foreign indebtedness, tilling fragile soils, and

endangering wildlife. As resources dwindle and the environment degrades, growth prospects become seriously impaired. As sources of foreign funds dry up, countries must dig ever deeper into their inherited wealth of natural resources.

Most development economists would agree that increased extraction of a slowly renewable resource for a temporary increase in consumption does not make much economic sense. Rather, continuous economic growth should be the objective. For that objective to be achieved, a resource over-dependent economy must: (i) adopt resource-saving technology; (ii) generate an economic surplus, even through extraction of scarce resources; and (iii) reinvest that surplus in ways that will ultimately allow it to do without the resource. Most of the time, this will mean capital accumulation, diversification of the productive structure, and agricultural modernization. If resource depletion is the price of reducing resource dependency and ipso facto for sustainable growth, one may safely argue that the price is worth the objective and make a case for "necessary" depletion.

2. The Questions

To correct sub-Saharan Africa's macroeconomic imbalance between supply and demand, the IMF/World Bank are attempting to induce countries to undergo a set of economic reforms that have come to be known as "structural adjustment."[3] The bottom line of the reforms is to, first, reduce aggregate demand so that macroeconomic

[3] Although the World Bank and IMF operate independently, it is often the case that both organizations are involved in policy conditionality in countries undergoing structural adjustment programs.

equilibrium is restored, and second, to divert resources from the domestic to the traded goods sector, so that contractual obligations with foreign creditors can be met. The underlying presumption is that these policies will set the countries on the "right footing" for sustainable growth.[4]

The present study is concerned with the impact of structural adjustment on natural resources and, going one step further, on sustainable growth. In particular, the discussion is directed at the following questions:

(i) Do the policies have a chance of succeeding in promoting growth? Scarcity of natural resources, particularly of agricultural resources, is a major constraint to the development of most sub-Saharan African countries (FAO, 1986).[5] Structural adjustment however takes either a light view of the resource constraint or ignores it altogether. We have outlined the conditions for sustainable growth which are explicitly recognized in all growth models (generation of a surplus, reinvestment) and the additional condition of diversification of the economic structure. Whereas structural adjustment may contribute to the first, it tends to ignore both the second (reinvestment) and the third (diversification). What this study will be questioning is the extent to which structural adjustment is an adequate growth promoting strategy for low-income, debt-distressed, resource over-dependent economies.

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[4] Comprehensive discussions of different aspects of structural adjustment are presented in Norton, (1987), Sarris (1987), Cleaver (1988), The World Bank (1988a and 1988b). Streeten (1987) present a survey of the issues involved.

[5] A detailed discussion of the resources and environmental constraints to African development is presented in Lewis and Berry (1988).

We won't be questioning the principles which underlie the strategy (comparative advantage) -- although the critics' views on this strategy are briefly discussed -- but rather, the overall objectives of structural adjustment in light of the structural growth constraints to the African countries. We do feel that structural adjustment programs have not paid enough attention to those constraints.

(ii) **What is the likely impact of structural adjustment on natural resources?** If natural resources in sub-Saharan Africa are one of the pillars of economic growth, the reverse is also true, that is, sustainable exploitation of natural resources is inconceivable without a certain degree of economic growth. Resource "conservation" requires appropriate extraction technology and diversification of the economy (reduced resource reliance). Conservation itself is a form of investment. Only by stimulating investments can structural adjustment -- or for that matter any policy -- contribute to "proper" utilization of natural resources over the long run. In the short run, resources are depleted to satisfy immediate consumption needs. To conserve resources, the adjustment policies will need to reduce poverty and generate alternatives for those people whose day to day survival depends on natural endowments. From the outset, one thing is clear: if the adjustment policies fail to promote equitable economic growth or worse, if they concentrate income, they will almost inevitably be detrimental to environmental conservation.

Despite structural adjustment's drawbacks -- which we discuss in some detail -- the conclusion the analysis points to is not so much that structural adjustment is unnecessary, but that it is not enough. Take, for example, the case of adequate utilization of

agricultural resources. Conservation of soil fertility in African agriculture is not mere avoidance of practices inherited from the past. Agricultural production systems in most of the tropics, based as they are on shifting field cultivation, must be credited for being remarkably sustainable over millennia. The problem with such systems is that they are stable only when there is an abundance of land relative to population. As population grows, pressure arises to shorten the duration of the fallow, putting sustainability at risk (Boserup, 1965). In sub-Saharan Africa, both the demographic explosion (at an average annual rate of 3.03%), and the need to balance foreign accounts, combine to strain traditional fallow systems beyond the soil's capacity to regenerate its natural fertility. The challenge of finding new farming systems that are sustainable in face of heightened present day pressures is no easy task; it requires investments in human and physical capital and investments in the generation and dissemination of new knowledge. This task is not for years, but for decades. Unfortunately, structural adjustment's outlook is not so far sighted. Indeed, one of our principal criticisms of structural adjustment programs is not that they seek to promote undesirable goals, but that they try to force change too quickly.

3. Methodological Approach

A rigorous formal analysis of policy effects requires a well specified (preferably general equilibrium) model. Such a model, of course, would have to be purpose-and-country-specific, with particular policy instruments, closure rules, etc. all clearly stated. No model such as this is presently available, nor can such a country-specific model address the more general issues that concern us here.

Furthermore, the purpose of this study is not so much to trace the impact of specific measures on resource extraction, but to see how the overall aim of the policies squares with sustainable resource exploitation and sustainable development. For this more limited objective, the analysis focuses on a hypothetical "typical" sub-Saharan African (SSA) country and on "typical" structural adjustment (SA) policies. In addition, although the impact of some policies may not be the same under different circumstances, conventional policy effects will be assumed in order to derive more general results.

Very few countries have adopted, in full, the package of adjustment and stabilization policies. Moreover, for those who have adopted SA, it is too early to tell whether eventual gains outweigh the costs of the policies. While this more complete evaluation awaits the passage of time, there are several short and medium term effects which are already evident. It is these effects that we will concentrate on in the analysis that follows.

Economic Conditions in SSA

This section discusses some of the characteristics of the "typical" SSA country relevant to the analysis of SA. It encompasses a brief survey of indicators of the structure and performance of the economy, an analysis of the constraints to growth, and a review of the causes of foreign indebtedness and balance of payments problems. It is assumed that it was the imbalance of foreign accounts that prompted the IMF/WB to intervene and the government of SSA to accept the adjustment policies.

1. Economic Structure and Performance

Table 1 presents select indicators of SSA economic structure and performance. The indicators are averages for the entire region. Since SSA is intended to represent a typical sub-Saharan African country, extreme points, or "outliers," were eliminated for the computation of the average (arithmetic mean). Table 1 also presents the range of each indicator.

The picture that emerges from the analysis of these indicators is that of a country caught in the "poverty trap." With a population growth rate (3.03%) outstripping the rate of growth of GNP (1.3%), the economy is not just stagnant, it is moving backwards. The savings rate of 8.5% probably isn't enough to cover even depreciation of physical assets. Coupling that with the degradation of natural resources, a fair conclusion is that the erosion of the country's resource base will make a reversal of the declining trend very difficult.

Under such circumstances, it is no surprise that the country is "living beyond its means." The fiscal deficit is equivalent to 5% of GNP, while the current account deficit is 132 million dollars. Obviously this is not a sustainable situation given unwillingness of creditors to continue funding the gap. "Aid (for the entire sub-continent) stagnated at $6.9-$7.3 billion . . . while net private flows turned negative and took out $480 million in 1985" (World Resources, 1988, p. 222). As of 1986, the accumulated foreign debt had reached 70.3% of the value of GNP, and debt service amounted to 19% of the value of exports (33% in 1985 according to World Resources, p. 222). Another sign of macroeconomic

TABLE 1. Select Indicators or SSA Economic Structure and Performance - 1986

Indicator	Average	Range
General Economic Indicators:		
GDP growth rate (1980-86)	1.3%	Min: -9.0% (Mozambique) Max: 11.9% (Botswana)
Income per capita	$ 400	$120 (Ethiopia) $1200 (Mauritius)
Savings rate	8.53%	- 7.0% (Burk. Faso) 30.0% (Congo)
Structure of GDP:		
Agriculture	35.5%	4.0% (Botswana) 76.0% (Uganda)
Industry	24.0%	6.0% (Uganda) 58.0% (Botswana)
Services	40.5%	18.0% (Uganda) 55.0% (Gabon)
Inflation rate (1986)	17.3%	1.1% (Liberia) 74.9% (Uganda)
Fiscal budget surplus/deficit (% of GNP)	5.03%	- 16.3% (Zambia) 1.6% (B. Faso)
Growth rate of agric. production (1980-86)	0.9%	-15.9% (Mozambique) 7.9% (Somalia)
Index of food production per capita (1979-81 = 100)	96	76 (Botswana) 114 (Benin)

Demographic Indicators:

Rate of population growth (1980-86)	3.03%	2.3% (Mali) 4.4% (Gabon)
% of population in rural areas	74%	46.0% (Mauritius) 52.0% (Zambia)
Population density (person/square km)	20.3	

Balance of Payments Indicators:

Current acc. balance	$ -132.4 million	
Reserves (mos. of import coverage)	2.3	
Rate of export growth (1980-86)	0.51%	-13.4 (Niger) 13.8 (Cameroon)
Terms of trade (exp/imp ratio) 1980 = 100	87.3	44.0 (Nigeria) 133.0 (Rwanda)
Merchandise import structure (% of total):		
Food	15.4%	4.0% (Zambia) 32.0% (S. Leone)
Fuel	9.2%	(Chad) 24.0% (Benin)
Machinery	33.5%	17.0% (Benin) 47.0% (Somalia)
Other primary	3.4%	1.0% (Zambia) 11.0% (Niger)
Other mfg	17.0%	(Togo) 56.0% (Burundi)

External Debt Indicators:

External debt (% of GNP)	70.3	23.9% (Cameroon) 240.5% (Zambia)
External debt service (% of exports)	19.7	2.2% (Chad) 62.1% (Somalia)

Sources: The World Bank, World Development Report 1988.

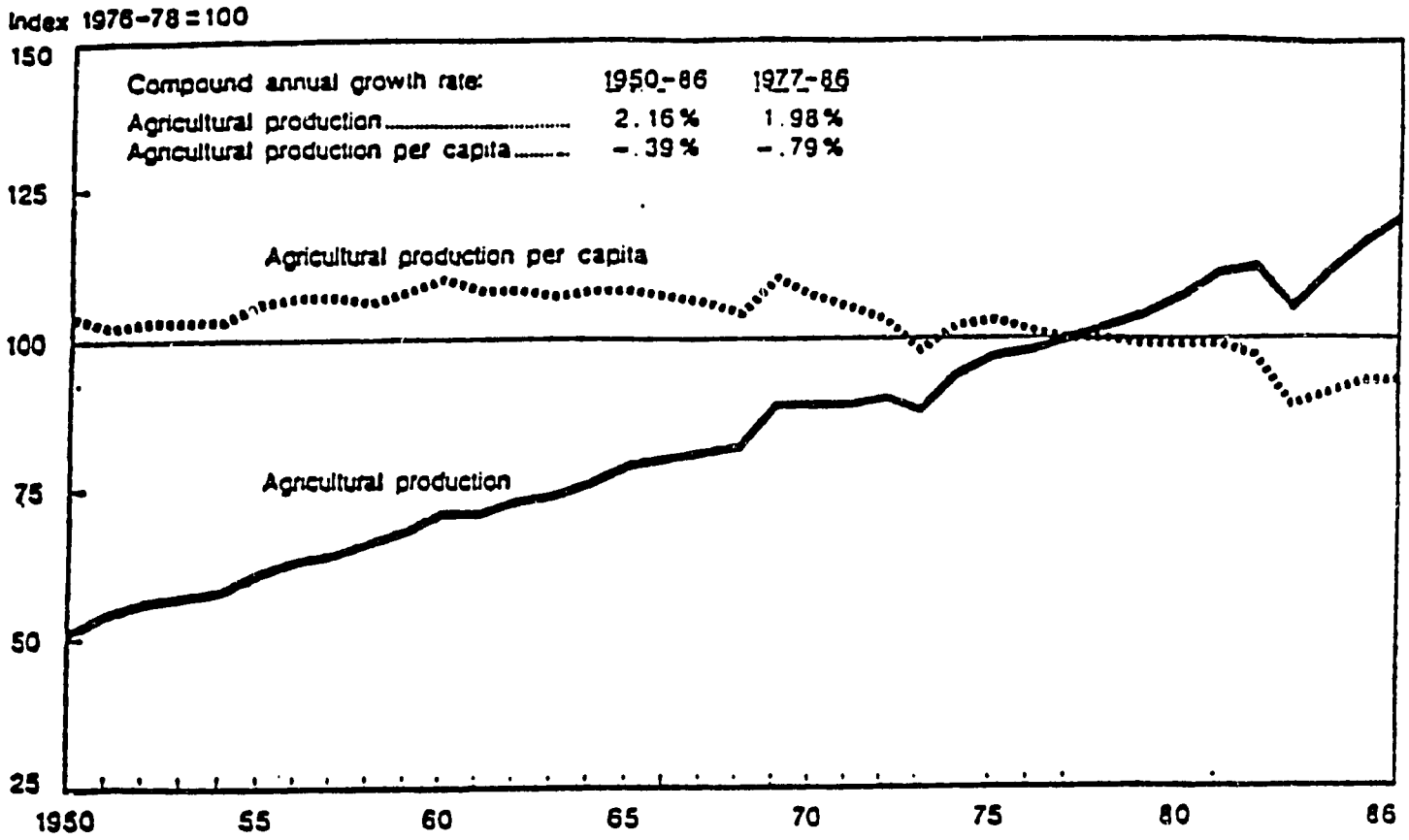
disequilibrium, the inflation rate has reached 17% per year (in 1986).

Sectorally the situation is not much different. Agriculture, which employs 74% of the population and is responsible for 35% of GNP, is also declining. The growth rate of agricultural production reached only 0.9% in the 1980-86 period, with the index of production per capita falling to 96 in 1986 (1979/81 = 100). Worse, as Figure 1 indicates, the decline in food production per capita resembles more a trend than a short term phenomenon. Agricultural output per capita has been declining at an annual rate of -.39% since 1950. In more recent years, the decline has accentuated (-.79% per year since 1977). Food imports represent 15.4% of total imports. To make a difficult situation worse, the terms of trade index is also declining. From the base period of 1980 (= 100), the index reached 87.3 in 1986, making it doubtful that a policy of incentives to traditional exports can by itself be an adequate growth strategy.

2. Constraints to SSA Economic Growth

We have stated that SA has typically taken a light view of some of the important constraints to SSA economic growth. In the following paragraphs we examine some of the

Figure 1. Sub-Saharan Africa: Index of Agricultural Production



Source: USDA, World Indices of Agricultural Food Production, 1977-1986, p. 122.

factors that must be taken into account in the formulation of a growth strategy. The factors are: the endowment of natural resources, the scarcity of capital, the relative immobility of resources, the limited size of the domestic market, SSA's colonial heritage, competition for international resources, and the backwardness of the public sector.

a) Endowment of Natural Resources

Despite the fact that agriculture is the most important sector in the SSA's economy, fertile land is the exception rather than the rule. Only 20% of SSA's soils have no inherent fertility limitations whereas roughly 55% have severe or very severe impediments to cultivation.[6] Most of SSA lies outside of the humid zone where rainfall is highly variable and "occurs in erosive downpours." Two-thirds of the land area faces high risk of drought and soil erosion. Irrigation is a possibility which so far has been largely unexplored; only about 1.0% of the cultivated area is irrigated at present.[7] Even though most of SSA's hinterland is thinly to moderately populated, when allowance is made for the quality of the soil and variability of rain pattern, it is evident that the land/labor ratio is comparable to many countries of Asia.[8] Over-exploitation of scarce agricultural resources is a fact of life in SSA. Over-grazing of traditional range lands and cultivation of marginal lands are both common. Technological change which economizes on natural resources offers the best

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[6] FAO, 1986, Atlas of African Agriculture.

[7] FAO, 1977, Production Yearbook.

[8] Cleaver, K. M., "The Use of Price Policy to Stimulate Agricultural Growth in Sub-Saharan Africa." The World Bank Agricultural Symposium, January 6-8, 1988, p. 4. The author is quoting FAO's "Report on Agro-Ecological Zones Project."

way out of the resource endowment constraint, but much of the new technology currently available "off the shelf" is ill suited to African conditions. In addition, insecure tenure and imperfect land markets cause farmers to under-estimate the value of soil fertility. Furthermore, new agricultural technology is often site-specific and is only available where a well developed agricultural research/extension system is in place. The more widespread use of farm machinery facilitates incorporation of marginal lands and contributes overall to more intensive soil depleting cultivation.

An undisturbed tropical forest which covers 703 million ha of SSA's territory is still an important natural resource. However, it is being cleared at the rate of 0.6% per year by encroaching settlers as well as the logging industry (World Resources, 1988). "Local rates range from 0.2% for the vast Cameroon-Congolese forest up to 4% a year in West Africa" (World Resources, p. 222). At present clearing rates, the forest is expected to last for no longer than 10 to 15 years in many areas. Fuelwood shortages, already noticeable, are expected to be exacerbated. Large mammals are both a tourist attraction and a (culturally) valued source of meat in SSA, but face the same prospect as the moist forest; at present rates of extraction these animals will practically disappear over the next few decades.

b) Capital Scarcity

Scarcity of capital is a major impediment to SSA economic growth. Three aspects of the capital constraint have a bearing on policy. The first is the extreme scarcity of capital itself. SSA's savings rate of 8.5% is hardly enough even for maintenance of the

capital stock (Table 1). In addition, the poorly developed financial system is unable to mobilize whatever resources there are for productive investments. Without a network of private financial institutions to mobilize resources, the government ends up assuming that responsibility and, with it, the role of allocating the resources.

The second aspect of the capital scarcity problem is evidenced by the wasteful utilization of economic surplus. Part of the blame goes to inefficient government allocation. In addition, factors such as population growth, rapid urbanization, etc., increase demand for social infrastructure and other investment projects with low output/capital ratios.

The third factor to be noted is that capital is the most mobile factor of production. If no artificial barriers to capital movement are in place, existence of profitable projects are often all it takes to attract capital. Shortage of capital is, in many respects, a symptom reflecting the absence of various complementary factors such as small size of markets, poor endowment of natural resources, inelastic supply of factors of production, and inadequate technology. One of the most important obstacles to attracting capital is the riskiness of investing in the uncertain political and economic climate in the country.

c) Resource Immobility

Relative resource immobility hinders growth by making the economy less responsive to price incentives. Africans are certainly as motivated to material incentives as anybody else, but cannot always respond to these incentives. A partial list of possible constraints would include: inadequate infra-structure, lack of credit, inelastic supply of qualified labor, monopolistic control of markets (barriers to entry), government controls and bureaucratic

red-tape, imperfect information, risk aversion, indivisibility of capital or high project break even point, overall small size (or nonexistence) of an entrepreneurial class, and a hostile environment to investors. Labor mobility, in particular, is further hampered in SSA by language barriers, cultural barriers among ethnic groups, and tribal rivalries.

In agriculture, it is also possible that defective price signaling compounds relative factor immobility. Both para-statal enterprises (in food and input distribution as well as in banking) and private local monopolies flourish in SSA, the second because of the favorable environment created by the deficient system of transport and communications, and the first to "correct" the abuses of the monopolists. Either way, prices fail to properly signal abundance or scarcity.

One indication of the seriousness of resource immobility in SSA is given by studies of agricultural supply functions. While in individual crop studies it has been found that supply may be responsive to prices, aggregate supply elasticity coefficients are nil.[9] Farmers, in other words, respond to prices within the limits of their capacity, by substituting crops, but are unable to expand their scale of operations no matter what the incentive.

Needless to say, resource immobility can render ineffective any policy instrument based on manipulation of price incentives, as economists of the structuralist tradition have

[9] See Cleaver, A. Annexes 1 and 2, for empirical evidence. The point is recognized by Streeten (1987, p. 1473). Rigidity of the agricultural supply function has been one of the mainstays of the structuralists' arguments since the 1950's.

emphasized. A corollary is that a policy priority should be the removal of the factors hindering mobility of resources.

d) Limited Size of the Market

Since Adam Smith, economists have known that the size of the market limits the scope for division of labor. While this is an important factor in SSA, it is equally important to recognize that, because of widespread poverty, SSA agricultural producers face a highly price inelastic demand function for food that, furthermore, crosses the vertical axis at a rather low price level. The situation is such that, if production increases, prices will fall steeply due to the market's limited capacity to absorb the extra output at going (or slightly lower) prices; on the other hand, if prices go up by any significant amount, there will be no buyers. The policy implication of this situation is that, unless consumption is subsidized, there isn't much room for price incentives to agricultural producers for the domestic market. It would be wonderful for SSA agriculture if farmers could receive for their grains what German consumers pay; the problem is that they would have to sell to Germans! This has in fact been recommended. However, trade barriers sharply limit the prospects for increased agricultural exports to developed countries.

e) Colonial Heritage

Most countries in SSA have been politically independent for less than 30 years and have not yet overcome distrust of foreigners... and not without reason! It is therefore understandable that there is resistance to extending privileges to foreigners, no matter what the long term benefits to the country. Suspicion of aliens has made much needed foreign

capital and entrepreneurs less than welcome in SSA. This is a non-economic barrier which policy proposals to "open" the economy will have to face.

f) Other Countries' Competition for International Investments

If on the one hand Africans are suspicious of foreigners, on the other, foreign investors are in no rush to put money in SSA, with the probable exception of enclave type exploitation of rare minerals. Fast growing East Asian countries, resource rich Latin American countries, the post-perestroika Soviet Bloc, and the developed countries themselves are all eager to attract as much foreign capital as possible. How can resource poor, politically unstable, Africa beat the competition? For them, the safest assumption one can make is that they are on their own.

The same is true of foreign loans. SSA is a high debt risk and banks that have "burned their fingers" in the Third World debt crisis are not likely to voluntarily resume lending no matter what "solution" to the present debt situation is reached. Policies designed to improve SSA's standing with creditors will not bear fruit for a long time.

g) Underdevelopment of the Public Sector

When foreign advisers make policy recommendations a fair presumption is that there is a government in power to carry them through. Such is not always the case. Many less developed countries' governments are extremely vulnerable to pressure of interest groups, lack effective self-control mechanisms, and have a very limited capacity to levy taxes. If on the one hand governments don't have many resources to control, on the other, they don't have the means to make effective use of the resources.

One would like to think that government can be a force in modernizing society whereas what we see is that only by modernizing society can one hope to modernize the government. For the econometric minded reader, there is an identification problem here (all variables are endogenous). For development policy, it means that society's and government's modernization, part as they are of the same problem, are to be tackled together. This is probably the most difficult constraint to structural adjustment, or for that matter, to any kind of policy.

3. Causes of SSA Foreign Indebtedness

Correction of the foreign accounts imbalance is the prime reason for enactment of a SA program. Whereas "external shocks" are the recognized prime culprits for the debt crisis, proponents of SA tautologically argue that the potential for shock damage would not be so great had the country's economic structure been less vulnerable. To form a background picture against which SA can best be seen, this section discusses some of the reasons for the spiralling debt accumulation.

a) Chronic Currency Overvaluation

Foreign exchange scarcity is the most binding constraint and most difficult to substitute "factor of production" in SSA's economies. A fall in foreign exchange earnings has a direct and immediate depressing effect on consumers' welfare. SSA depends on imports for most of its non-farm final consumer goods (including essential items such as medicines), for almost all of its capital and intermediate goods, including oil, and in many countries for food. A depressing effect on consumers' welfare is observed when prices of

imported goods are raised across the board through currency devaluation. The presence of imports is, in some cases, so pervasive that there is little room for product substitution in response to price increases. As a result, the fall in welfare is almost proportional to the increase in prices, at least in the short run.

Not all consumers suffer, however. The vast majority of the population in rural areas or on fringes of towns have access to imported items anyway. It is the middle and upper urban classes who lose the most when import prices go up. It is therefore understandable that these groups use their political influence to prevent any devaluation of the national currency. In fact, the major political conflict in the country pits export farmers, who stand to gain from a devaluation, against urban consumers who would lose from it.

Historically, the urban classes have had the upper hand in the conflict and the exchange rate has been chronically overvalued, implicitly taxing the tradeable goods sector. Exports are assumed to have fallen short of their full potential and import substitution to have been discouraged. Being historically discriminated against, these activities have failed to develop. As a consequence, with or without the debt burden, vulnerability to foreign exchange shortfalls is a permanent problem.

b) Instability of Export Earnings

Price instability is a well known characteristic of primary export products. The instability is brought about by supply fluctuations in face of inelastic world demand. For

the exporting countries, instability of prices means instability of foreign exchange earnings as the price fluctuations are not offset by changes in export volume.

Instability of earnings naturally leads to borrowing to smooth consumption. The problem arises as countries attempt to stabilize consumption at income peaks, rather than averages. If an increase in export prices lead to transitory windfall gains, imports are adjusted upwards on the assumption that the "good times" will last forever. Development plans are redrawn on the basis of this optimistic assumption and availability of consumer goods also increases. When the "hard times" hit, countries find it all the more difficult to adjust to reality.[10]

c) "Irresponsible" Lending

Lenders, on the other hand, also have difficulties in distinguishing random, zero average, earning fluctuations from structural shifts in the markets for LDC's exports. For instance, the 1981-82 slowdown in OECD economies led primary goods export prices to plunge, but recovery didn't seem to have much of an effect in bringing them up to pre-recession levels. What was a permanent downward demand shift was mistaken for a temporary problem. Forecasts of OECD economic growth in the eighties were grossly overestimated and interest rates have remained a few percentage points above what was previously considered its "normal" level. Worse still, developed countries have become more protectionist, permanently lowering demand for LDC's exports. A profound change

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[10] For an interesting discussion of this problem in connection with the fluctuations in oil prices see Gelb et. al.
(1988).

for the worse had taken place in the international economic environment, with disastrous consequences for much of the Third World; this was not recognized until a long time had elapsed.

Structural Adjustment Policies for SSA

1. Policy Objectives

Structural adjustment programs were initiated in 1980 with the objective of helping less developed countries adjust to balance of payments problems. (The World Bank, 1988a and 1988b). Those problems in SSA stem from a combination of "external shocks" and a policy of implicit and explicit subsidies to consumption. The external or exogenous shocks were: (i) deterioration in the terms of trade because of the rise in price of imported oil combined with the price decline of the country's traditional exports, (ii) rise of interest rates on accumulated debts, and (iii) droughts which led to a decline in exports and the need to import food. The subsidies to consumption, particularly in the form of chronic overvaluation of the national currency, stimulated overspending, including public sector overspending. Aggravating the imbalance, production was penalized. Exchange rate overvaluation is a tax on the tradeable goods sector which in SSA means mostly

agriculture. Production disincentives contributed to country failure to modernize key food production sectors and to fully exploit export potential.[11]

As the imbalances became serious, the countries lost their ability to service their accumulated foreign debt. Trade flows were impaired, as were international payments flows. To correct the disequilibrium, the debtors were induced to adopt the IMF stabilization program by conditioning loan reschedulings to acceptance of IMF programs. The disequilibrium, according to standard IMF stabilization procedures, was to be fixed through reduction of aggregate expenditures, obviously at very high social costs for countries already at the margin of subsistence. The social costs of stabilization were simply unacceptable to many countries and therefore politically unviable. The pains of stabilization had to be cushioned and that, precisely, is the objective of structural adjustment. (The World Bank, 1988a, Chapter 1). To put it bluntly, not only were these policies insufficient by themselves but one had to sugar coat the IMF medicine.

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[11] One of the main purposes of SA, as stated in World Bank official documents (for instance, The World Bank, 1988a) is to make the economy "less vulnerable to future shocks." In the words of P. Streeten (1987, p. 1470) this means increasing flexibility, or reducing rigidities in the economy. "Unless (such rigidities) can be removed, structural adjustment can be very costly, or altogether out of reach." When one talks about "shocks," one must be referring to "sudden or large, often unexpected changes." Streeten goes on to say "For slow and gradual change, the price mechanism is one of the best instruments of adaptation" (p. 1469). But we are not talking about small changes. To reduce structural rigidities and to adjust the economy to large sudden changes, "price manipulations" cannot be the first instrument we reach for in our tool box. This, however, is not what we usually see in the daily experience of SA.

From its inception structural adjustment has sought to enable debtors to resume servicing their debt. The program was created to stave off a break down of the international economic order, to allow debtors to keep their contractual obligations and creditors to receive interest payments on schedule. For that, economic growth per se is not enough; a particular kind of growth is required which we shall call outward oriented growth (OOG).

While following comparative advantage clearly has benefits, the generation of a trade surplus has no such firm theoretical basis. It is, however, a prerequisite to remaining current on international debt payments if no new lending is forthcoming. In fact, the historical experience of developed countries suggests that SSA should not attempt to generate a sustained trade surplus at current levels of per capita income. The pressure to do so comes from creditors who have neither this historical experience not the best interests of SSA in mind.

In the short run, a trade surplus can be a generated through a contraction of income and imports. But that is not sustainable. In the long run, if countries are to emerge from the debt crisis by their own means, they will need OOG, the only way a trade surplus can (hopefully) be maintained for a long period of time. These are the objectives and the rationale of the structural adjustment policies.

2. Structural Adjustment Policy Instruments

Structural adjustment can best be understood as an evolving set of policies since new programs have been instituted in response to unforeseen problems and to correct

deficiencies or side effects of previously undertaken measures.[12] Examples are the poverty relief measures which have been added to the adjustment programs in countries like Ghana, Cote d'Ivoire, Tunisia, Korea, and Chile (The World Bank, 1988a). The program is also flexible enough to address specific countries' problems such as those contemplated in the sectoral adjustment programs. This feature makes a taxonomy of the policy instruments of structural adjustment particularly difficult. However, focusing on the core of the program, two sets of measures are apparent: realignment of administered prices (exchange rate, interest rates, tariffs, public employee nominal wages, etc) and liberalization of the market by trimming both the size of the public sector and the scope of government intervention. In the specific case of SSA, because of the overwhelming importance of agriculture, the reform measures tend to be related to agricultural prices and agriculture related governmental institutions.

In the words of an official World Bank document, the following is a diagnosis of the SSA difficulties:

> "Central to their problems have been a bias against agriculture, inefficient state enterprises, unproductive government investment, a tendency to emphasize public service employment over maintenance and rehabilitation expenditures, and severe shortages in qualified manpower." (pp. 84 and 85).

Regarding solutions to those problems, the Bank prescribes a reform of agriculture and public sector institutions:

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[12] Iona Sebastian, "Overview of Adjustment Lending Policies," presentation at Cornell University Workshop of Structural Adjustment and Natural Resource Use, November 1988.

"... emphasis has been placed on raising producer prices, reducing the taxation of farmers through the high profits of low efficiency of marketing boards, and improving the quality of public services in such areas as extension and research. Programs for public sector enterprises and agencies have emphasized improving profitability by raising prices and efficiency, reducing overmanning, restructuring activities and finances, and divesture" (pp. 84 and 85).

And to reverse price disincentives to farmers, the following is proposed:

" changes in prices set by marketing boards; price decontrol; exchange rate depreciation; and macroeconomic policies to reduce inflation" (p.74).

With respect to devaluation, the Bank's report concedes that it:

"...should normally benefit traded sectors, such as agriculture, if the exchange rate increase is passed on to producers" (p.74).

Based on the reading of these quotations and adding well known elements of IMF programs, a "bare bones" structural adjustment/stabilization package for our "typical" Sub-Saharan African country would include the following measures:

(i) Currency devaluation followed by inflation stabilization measures such as:

- cuts in the fiscal deficit,
- restriction of monetary expansion,
- restrictions on bank lending.

(ii) Elimination of subsidies to agricultural credit and inputs.

(iii) Decontrol and/or privitization of the food marketing system with elimination of marketing boards.

(iv) Elimination of quantitative restrictions on imports and exports together with reduction of import tariffs.

The price realignment in this "package" is aimed at increasing farmgate product prices in proportion with the devaluation while making farmers pay the "true" opportunity cost of agricultural inputs. Regarding the role of the government, it is at once removed from control of foreign trade and from the marketing of agricultural products. The size of the public sector is reduced through expenditure cuts in connection with the trimming of the fiscal deficit. Removal of inefficiencies brought about by government intervention in markets and the price stimuli to farmers is expected to promote growth of the critical agricultural sector as well as of exports. Meanwhile, macro level stabilization -- a pre-requisite for resumption of growth -- should be achieved through restrictive monetary and fiscal policies.

A Critical Evaluation of Structural Adjustment

1. A Critique of the Programs' Objectives

Structural adjustment seeks to promote trade through outward oriented growth. The idea is that by growing outward toward world markets, heavily indebted countries will not only be able to keep (or resume) servicing their debts but will also become more resilient to future external shocks. This objective can be challenged on several counts:

First, to require SSA to run trade surpluses to repay debt at current low levels of development, runs counter to experience and to the clear need to invest what funds are

available in development of the economy. No currently developed country had such a debt burden at a comparable stage of development; it is unreasonable to expect SSA to perform better than did the U.S. or Western European countries. Even if they succeed in repaying debt, it is not at all clear that this would improve creditor perceptions of credit worthiness enough to generate renewed capital flows. On the contrary, commercial creditors seem to be averse to extending new loans to SSA under any circumstances.

Second, it is based on the overly optimistic assumption that SSA can grow its way out of the debt crises. Promotion of African development is an awesome enough task even without the extra burden of the debt. The presumption that Africa can grow while paying requires (i) an unrealistic assessment of its resource potential, (ii) an unwarranted optimism about the international economic environment, and (iii) naive expectations about developed countries' cooperation.

Despite an overwhelming dependence on natural resources, SSA is not resource rich. At present rates of growth, population will double in less than two decades, putting additional pressure on the resource base. One simply cannot count on exploitation of those resources for payment of foreign debt.

With respect to international cooperation, it is well established that developed country policies are geared towards their own domestic problems. One cannot imagine the American Fed or European Central Banks refraining from raising interest rates in the face of a threat of inflation just out of concern for the impact of the policy on Africa's debt burden. It is equally improbable that the United States would eliminate subsidies, let's say,

to peanut farmers to promote demand for Africa's vegetable oils. The trend, on the contrary, is toward more, not less protectionism. With Europe readying its trading bloc, and the United States and Japan all looking for ways to match the initiative, Africa will likely be left out in the cold.

Third, the outward oriented growth strategy, despite its merits, needs a few qualifications. Let's start with the merits. OOG is justifiable because it is a way to relieve the constraint imposed on the economy by the smallness of the domestic market. Foreign trade can provide "a vent for surplus" which can be transformed into investible capital for diversification of the economy. Trade also offers the quickest way to modernize the economy. Africa depends on foreign inputs and technology which it can only acquire through exports. Finally, OOG is based on the efficiency enhancing principle of comparative advantages that allows the country to exploit its full production potential. In other words, there is an economic cost attached to violations of the comparative advantages principle.

One can ask whether the principle of comparative advantage can be safely applied to resource over-dependent economies. Doesn't it run counter to the objective of reduction of resource dependency? If SSA were to follow the comparative advantage principle it would have to specialize in extraction of a resource that, although relatively abundant today, is slowly renewable (or exhaustible), and for that precise reason, won't be the most abundant tomorrow. In other words, we are talking about temporary

comparative advantage.[13] For sustainable growth, the country has to exploit all the productive opportunities it may have in the present -- and this means stimulating resource extraction and exports -- but with a view toward acquiring the means of diversifying the economy, not specializing. The only proper way a resource over-dependent country can utilize its resource is to use it to change its comparative advantage.[14]

Also, one shouldn't neglect a problem of fallacy of composition. No one disputes that expansion of exports promotes economic growth. To have several African countries competing with each other to export the same product does not. Export oriented growth on a continental scale requires, to be successful, export diversification by the national economies.

For OOG to succeed, there is a need for policy coordination on a global scale. What good would it do to have the less developed countries go through a costly effort to reorient resources towards the export sectors when the more developed ones are striving

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[13] The presence of exhaustible resources constitutes one of the classic cases of "market failure" (Fisher, 1981, Georgescu-Roegen, 1976 and 1979). Prices of exhaustible resources, in other words, are not reliable guides to abundance or scarcity. For this reason, it is difficult, even conceptually, to determine where a country's comparative advantage lies. Failure to compute the opportunity cost of used up resources or degradation of the environment (a public good), we suspect, is a reason why countries are wrongly said to have a "comparative advantage" in many resource overdependent activities.

[14] Comparative advantage is a static efficiency enhancing principle which is not necessarily compatible with "dynamic efficiency." As Krueger (1980) states, ". . . there is nothing in theory to indicate why a deviation from the optimum should affect the rate of economic growth. Most growth models suggest that there are once-and-for-all losses arising from nonoptimal policies with lower levels of income resulting from them but no change in growth rates" (p. 2).

hard to reduce their imports? Without coherent world-wide policies, OOG is risky. One of the aims of structural adjustment is to make the countries more resistant to future external shocks. However, just the opposite may be true. If countries grow outward towards world markets they will become more, not less, vulnerable to world market fluctuations. It makes sense to gear the economy in such a way that it can take advantage of favorable external market conditions and generate a margin over and above subsistence levels in order to be better able to bear risk. But should a non-risk loving country put all its eggs in that basket? Resources are not so mobile that one year they can be used to produce exportable goods and in the next domestic consumption goods. Many sub-Saharan African countries are so poor that they cannot afford the risk of submitting their economies to the vagaries of developed countries' policies.[15]

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[15] Since the times of David Ricardo, few economic issues have been more controversial than the question of free trade (implied in OOG) versus protectionism (and inward oriented growth). However, for the World Bank/IMF there is no controversy. It surprises the independent observer that "donor" agencies would attempt to induce countries to accept costly SA programs without a word of caution being mentioned about the possibilities of failure. The fact of the matter is that there is neither theoretical nor empirical evidence to support the superiority of OOG and free trade over protectionism and IOG as strategies to accelerate growth of countries in the early stages of development such as those of SSA. The asymmetry of the distribution of gains from trade between producers of manufacturers and producers of primary goods is what lies at the heart of the controversy. Is there any way to explain why countries stand for protectionism before and for free trade after development? The names that quickly come to mind in a discussion of this subject are those of Prebisch (1949 and 1959), Singer 1950 and 1974), Hirschman (1958), and Lewis (1958). A recent theoretical work of excellent quality on the subject is that of Pinto (1987). Others who have questioned the advisability of OOG cum free trade include Bacha (1978), Ocampo (1986), Taylor (1986), and Agarwal (1988). Empirical evidence on the subject is hampered by difficulties of cross-country comparisons. Pointing against OOG are the works of Taylor (1986), and Grilli and Yang (1988) and Agarwal (1988). In favor of OOG are Krueger (1978 and Bhagwati (1978). Surprisingly, however, one reads in Krueger "while there are numerous microeconomic changes that

2. A Critique of the Adjustment Policies

We have argued that structural adjustment programs in SSA pursue what are, in our judgement, unrealistic objectives and also that programs are based on inaccurate assessment of the constraints facing the African countries. Now, we take a critical view of specific instruments and policies. There is no question that some form of adjustment is necessary and that most of the recommended policies are a step in the right direction. However, we feel that the appropriateness and probability of success of many policy recommendations have been exaggerated.

a) Exchange Rate Devaluation

Currency devaluation in order to depreciate the real exchange rate is the cornerstone of the outward oriented growth strategy. The real exchange rate is defined as the relative price of internationally traded goods vis-a-vis those which are produced and consumed only domestically (Dornbusch and Helmers, 1988, Edwards, 1988). A devaluation implies an increase in the relative price of tradeables, both exports and imports. By making imports dearer, devaluation discourages "waste" of scarce foreign currency while promoting foreign exchange earnings. The assumption implicit in the argument is that higher prices will attract resources to export as well as import substitution sectors.[16] Other advantages of

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accompany devaluation, liberalization and altered (trade policy) bias, it was not possible to detect significant effects of these changes on growth performance" (quoted from Agarwal, p. 25). Tang and Worley (1988) present several articles on the lessons of East Asian countries, obviously in favor of OOG. The emphasis of the studies supporting OOG, however, is on industrialization policy and, we think, bear little relevance to SSA.

[16] As far as agriculture is concerned, it is not at all certain that devaluation of the currency can have a significant effect in promoting import substitution in SSA. The

bringing the real exchange rate closer to its "equilibrium" level are the following: it attracts foreign capital while discouraging capital outflow; it is a broad price incentive that can dispense with inefficient government management of specific instruments (subsidies, tax breaks, quantitative restrictions on trade, etc.); it is the only effective way to protect the service sector; and within limits it can enhance a country's competitive position, being for instance an alternative to wage squeezes.

On the negative side, two major problems with a real devaluation can be singled out: difficulties of implementation and uncertainty about its effectiveness.

Any change in relative prices, particularly such an over-reaching change as in the prices of tradeables vs. non-tradeables, is bound to have important consequences for income redistribution. Potential losers will not stand idle in face of a policy damaging to their interests. However, political opposition is only part of the problem. As the different segments of society attempt to maintain their share of real income, the resulting inflationary pressure "undoes" devaluation by causing an appreciation of the real exchange rate. For a devaluation to be successful, it must be accompanied by recessive price

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problem is that rice and wheat constitute the main imported food items, neither of which can be easily or widely grown in many African countries. "The large and growing market that should exist for African farmers has therefore become illusory: the market prefers products that few farmers can grow, and it can obtain imported food for less than the price for which it is economic for the rural population to grow it (because of developed countries' food subsidies)" (FAO, 1986, p. 5). The impact of a devaluation on prices of imported agricultural inputs will further reduce its effects on import substitution of food products. On the other hand, we recognize that exchange rate overvaluation is not a distortion which exists by itself, on the contrary, as the need to ration scarce foreign currency arises, it commonly leads to all sorts of government controls and to inefficiency. If the devaluation is accompanied by decontrol, side benefits can be reaped.

stabilization policies. Indeed, devaluation itself causes contractionary pressures due to its negative impact in the value of real balances (Krugman and Taylor, 1978) and to its impact on the "aggregate supply side of the economy" (Van Wijnbergen, 1986). Of course, the magnitude of the recession depends upon the extent of the intended change in relative prices and on the structure of the economy (share of tradeables in GNP, strength of trade unions, degree of oligopolization of the economy, etc.).[17]

If the economic (lost income) and social costs of a devaluation can be high, its effectiveness may fall short of expectations. First, a devaluation works by providing price incentives; but there is no guarantee that the economy will respond to the incentives at a desirable speed. As we have seen, resources in SSA are not only extremely scarce but often slow moving. With so many "structural" constraints to economic growth, the price incentives are more likely to increase rents (to scarce factors) than production. The speed at which resources respond to price incentives is a major difference between developed and less developed economies. This difference should be recognized if workable strategies to implement structural adjustment are to be devised.

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[17] These are all factors which make prices inflexible downwards. The problems with currency devaluation, however, go far beyond those treated in the limited space of this paper. It is conceivable, for instance, that changes in the nominal exchange rate will have little effect on the real exchange rate; the structure of the economy may be such that a devaluation will have negative effects on both output and price level; it may even happen that, given a large initial deficit, a devaluation will magnify that trade imbalance (Katseli, 1983). Structuralists maintain that all along a devaluation causes "stagflation" (Taylor, 1987). If the country is running a trade surplus, a devaluation may contribute to the fiscal deficit, working against the other objective of SA. The trade-off between reductions in the resource balance (goods and non-factor services) in the balance of payments and increases in the GDP growth rate (pp.2-3, Figure 1).

Second, a successful devaluation must meet conditions w ch are not always present. A devaluation tends to increase exports and reduce demar The question is: by how much? Although the answer to this question requires an emp cal investigation, one can determine a priori the relative magnitude of the relevant p meters. Accordingly, the more inelastic is the demand for imported products, the less fective a devaluation will be in reducing imports. To the extent that SSA depends on sic necessities or hard to substitute goods (oil, medicines, certain food items) the decl in imports will probably be less than proportional to the price rise and the foreign ex nge savings smaller than otherwise.

With regard to exports, the effectiveness of a devalu on in promoting foreign exchange earnings depends on the elasticity of the export sup y function (which in view of resource immobility is expected to be small) and on the elas city of the import demand function for the country's exports. Problems will arise if a lar number of countries with similar export products adopt the same policy. Developed c ntry demand for primary products are, in many cases, inelastic with respect to price s well as to income. An orchestrated effort to increase primary good exports will und these circumstances lead to more than proportional price decline and all exporting co tries will lose.[18]

Nevertheless, devaluation is a step in the right direc for the many countries which have extremely overvalued currencies. What we nt to emphasize is that

[18] The discussion refers to the Marshall-Lerner conditio See for instance, Krueger (1983) and Agarwal (1988).

beneficial results are likely to be slow in coming and may, in fact, never materialize if complementary policies are absent.[19]

b) Agricultural Pricing: Stimulating Prices Vs. Input Subsidies

To increase agricultural profitability -- and attract resources to food production -- one can either increase farm product prices or lower agricultural costs. In Africa, it seems, the latter has been the most often chosen option. While agricultural prices have been kept "artificially" low, governments have tried to compensate farmers with subsidies to agricultural inputs and credit. By lowering "modern" input prices and providing cheap credit, it is hoped that farmers will be induced to modernize production techniques, increase productivity, and actually lower production costs. The implicit assumption, of course, is that appropriate modern technology in fact exists. The subsidies and the credit would be required to lead farmers into experimenting with it and to finance the overhead costs of the transition to the new farming methods. The subsidies could then be rationalized as temporary "educational" costs that will bear fruit in the form of increased agricultural productivity.

The opposite view is that it is more efficient to stimulate agriculture through higher product prices than through lower input costs. Against the subsidies, one can convincingly

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[19] Discussing the complementary policies in the case of agricultural development, Streeten (1987) calls attention to the "futility" of applying only price measures. "It so happens that the six prongs which are necessary to achieve an agricultural supply response each begin with In so that we can call them the six Ins. Prices are the first in because they serve as incentives" (pp. 1473-1474). The others are: inputs, innovation, information, infrastructure, and institutions."

argue that: (i) subsidies are hard to manage. A few farmers end up receiving most of the benefits, there is no way to assure that the funds will actually be used for the intended purposes, and the possibilities for corruption are unacceptably high. Very likely, the subsidies will be nothing more than transfer schemes to well connected individuals. (ii) Subsidies distort relative factor prices. The subsidies lower the price of capital and that of imported inputs with respect to the price of labor, encouraging the use of more scarce factors at the expense of more abundant labor, thereby reducing employment opportunities. (iii) Subsidies raise land rents, not food production. The benefits of the subsidies are directed towards ownership of the land, not actual production. By raising land prices the subsidies make access to land all the more difficult to landless workers, concentrating wealth still further. (iv) The subsidies represent a high percentage of fiscal expenditures to governments which are notoriously incapable of raising tax revenues. They are an important contributor to the public sector deficit.

Opponents of agricultural subsidies are entirely correct: it is very hard to subsidize agriculture and not create pernicious distortions. However, even in this overwhelmingly agreed upon instance of superiority of price incentives over subsidies, substitution of the one for the other is not completely cost free. A major reason is the dualistic structure of African agriculture. Although no figures are available, with 74% of the population living in rural areas, it is safe to presume that a high proportion of the agricultural product is non-traded. While there may be some overlap, for the most part, agriculture consists of two quasi-separate sub-sectors: commercial and subsistence agriculture. The higher prices

that would result from a devaluation would benefit the first, not the second. In fact, the food producing subsistence sector could be harmed as the two sub-sectors compete for the same factors of production. As, say, the prices of coffee, tea, or palm oil rise, land and labor tend to be shifted away from staple food grains and roots into the more profitable crops, with consequent decline in food production and increased dependence on food imports.[20]

c) Trimming of the Public Sector

A fiscal deficit occurs when government's revenues fall short of public expenditures. Although, by itself, the deficit is not a macroeconomic imbalance, it nonetheless contributes to one since at least one of the sectors of the economy -- the public sector -- lives beyond its means. To keep aggregate demand equal to aggregate supply, "excessive" public sector consumption has to be matched by a reduction in someone else's consumption. In other words, someone has "to pay" for the fiscal deficit. If you can't levy taxes to make the private sector pay for the government's excessive expenditures you still may resort to borrowing, in which case future generations will pay. Borrowing is a tempting option not only because it is a way of postponing the problem but because, in

[20] From sugar-cane, in colonial times, to coffee, in the early 20th century, to soybeans in the present day, Brazilian history is full of examples in which expansion of export crops has led to decline in food production for the domestic market. Brazil's example, of course is far from unique. What is remarkable about it is that the country is one of the world's leading exporters of food even though as much as one third of the country's population is underfed. To increase food production alone isn't the answer.

a growing economy, the future reduction in consumption will come out of a higher income level and therefore the sacrifice in welfare is lessened.[21]

The difficulty with borrowing is that it requires fairly sophisticated capital markets, something which SSA does not have. If the public sector is going to borrow, the private sector must be doing the savings. With a low savings rate, the private sector just does not have the wherewithal to finance the government. As a consequence, in general, public sector deficit does lead to macroeconomic imbalance (aggregate demand larger than supply) and to inflation. To correct for the imbalance, structural adjustment prescribes the "obvious solution": cut fiscal expenditures.

The real deficit problem -- even Milton Friedman would agree -- is not that the government spends too much but that it spends badly (Thomas, 1988). Any solution to the problem would require a reshuffling of expenditure priorities. This means interference with a sovereign country's most basic claim that it is no one's business but its own to decide where its money should go. Definition of expenditure priorities is what the political struggle is all about; it is how political power asserts itself. There is thus no way one can effectively alter priorities in a government's budget without changing the balance of political forces in the country.

When forced to, the government may cut expenditures but, most likely, the "wrong" ones. Politically motivated expenditures, because of their very nature, may well escape the axe, while critical items for social are trimmed. Prime candidates for cuts are, as always,

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[21] Under the assumption of declining marginal utility of money.

education, public health, agricultural research and extension, infrastructure maintenance, environmental protection, modernization of the State's bureaucracy, etc. Salaries would be cut, compelling the most competent public servants to leave the government, but retrenchment of idle public employees will hardly occur. On the other hand, military expenditures, transfers to powerful political supporters (under some rubric like fiscal incentives), conspicuous consumption, and so on, will scarcely be touched. What this all adds up to is that deterioration in the quality of bureaucratic machinery is inseparable from reduction in the size of government.

From the point of view of international lending agencies, politically motivated expenditure priorities of sovereign governments can be a most troublesome constraint to development of resource poor economies. But to tell this government to cut expenditures without realigning priorities is "to throw out the baby with the bath water." Simply stated, it is counter-productive. To modernize the government, not just to reduce its size, seems a more appropriate objective of structural adjustment.[22]

The Third World debt crisis and the emergence of structural adjustment programs point out the extent to which the management of national economies have become internationalized. The present discussion illustrates how difficult it is to manage African economies from Washington, D.C.

d) The Stabilization-Growth Trade off

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[22] The World Bank recognizes this problem and has taken steps to deal with it (World Developments Reports, 1983 and 1988). The effort so far, however, has been "a drop in the bucket."

As painful as it is, a recession has become recognized as an unavoidable component of structural adjustment. It is needed to reduce imports, to prevent inflation from undoing the devaluation, and it is a consequence of expenditure cuts and monetary restraint. Devaluation itself is recessive as it reduces the value of real assets. A recession, of course, means both lower income and unemployment. In addition to the unemployment that comes from the lower level of activity, there is still another kind of unemployment to worry about in the course of adjustment. It is the "frictional" unemployment that takes place as factors of production leave the penalized non-traded for the stimulated traded goods sector. Supporters of structural adjustment admit as much. They are, however, quick to add that the recession will be short lived. "Sound growth" will make the social costs of the recession well worth its while.

That might be so in well structured developed economies, but not in countries in the early stages of development. Boom and recession are not symmetrical opposites. A recession can come quickly but reconstruction is much slower. There is nothing automatic about resumption of growth in a less developed country and, contrary to the prevailing view in the World Bank and the IMF, we think that the recession may last a rather long time.[23]

We back up our position with the following arguments: first, because of the exploding population, economic growth is, in some respects, a race against time. Every

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[23] Although it is often implied the adjustment caused recession to be a "short-term" event, the duration of the Bank's structural adjustment loans (initially expected to continue for three to five years) suggests that a much longer period of difficulties is to be expected.

year lost just adds to constraints. There are more mouths to feed, more environmental degradation to cope with, more jobs to find, and more pressure on savings.

Second, the savings rate itself declines with the recession, as we know from Duesenberry's "ratchet effect". Under conditions of extreme capital scarcity, reduction of savings will make it harder to finance the recovery.

Third, rearticulation of the economy is a slow and not always successful process. Even though there may be price incentives for resources to move to other sectors, incentives alone probably won't be enough. In face of all the barriers to resource movement, response to incentives tends to be painfully slow.

Fourth, recovery is not based on utilization of idle capacity as it would be in a more developed country. Just remember that structural adjustment might be shifting resources to the export sector. Under adjustment, as capital is being scrapped in the non-tradeable goods sector, recovery requires the building up of productive capacity in the tradeable sector, such as planting new coffee, tea, or cocoa trees, and improving harbors and roads to take increased production out to market. Although investments do stimulate demand, they take time to mature; years will go by before supply catches up.[24]

Fifth, one crucial element, the entrepreneur, may be absent from SSA. "Privatization" is difficult if the private sector is weak, non-existent, or undercapitalized.

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[24] A related phenomenon is the "J" curve which describes the impact of an exchange rate devaluation on the balance of payments. At first, a devaluation is expected to worsen the trade deficit, improvement coming only after a period of time has elapsed. The reason for the "J" curve is that it takes time for supply to respond to the price stimulus of the devaluation (Krugman and Taylor, 1978).

Sixth, a recession is more serious when you are at the brink of survival. There is no featherbedding, no social security in Africa, natural resources being the only cushion to soften the fall. Under such conditions, the risks that a recession might evolve into social unrest and political instability are just too great.

Implications of Structural Adjustment for Sustainable Exploitation of Natural Resources

Generally speaking, there are three basic ways through which structural adjustment can influence the way natural resources are exploited and utilized: (i) by creating incentives/disincentives for more intensive extraction; (ii) by reducing/increasing either people's motivation to conserve or their capacity to do it; and (iii) by affecting the government's will to enact or its ability to enforce protective legislation. In the short run we expect all three to be operative, to the detriment of conservation. The problem is that the picture might not be so different even in the long run.

If adjustment succeeds in promoting growth, the people and the government alike will be in a better position to take a more far-reaching view of resource exploitation. That is the positive effect. However, as comparative advantage promoted specialization increases, reliance on resource exploitation will increase, not diminish. In fact, the structural adjustment growth strategy is to concentrate on exploitation of the relatively more abundant factor of production which, in SSA, is said to be natural resources. The flaw of this strategy is that the most abundant resources -- soil fertility, fish, natural forests, wildlife -- not only are not so abundant in absolute terms, but are also either

exhaustible or slowly renewable. The reason extractive based activities are said to have a comparative advantage is because the cost of used up natural resources are normally not imputed in cost estimates.

If, on the other hand, after inducing a recession, the adjustment policies fail to promote growth, people will fall back on resource extraction, and the environment will be just one more victim of policy failure. As shall become clearer in the following paragraphs, the cause of conservation cannot win unless it becomes part of the objective function of the adjustment policies.

1. Incentives to Extraction

Under the assumption that structural adjustment will succeed, price stimulated African agriculture is expected not only to modernize but also to expand horizontally. As better quality lands go into cultivation of export and import substitution crops, subsistence agriculture will be pushed farther into marginal lands. There might be a compensating effect, however. If agricultural product prices go up, land value will also rise, creating an incentive for conservation. But the opposite situation may also be true. Farmers may decide to take advantage of the high prices and cultivate as intensively as they possibly can, in effect trading short term profits for long run benefits. Risk aversion may explain the farmers' high implicit discount rate. Familiar as they are with the record of primary product price fluctuations, they may well prefer "a bird in the hand to two in the bush." But there is still another problem. Profits and losses are not always measured by the same scale. Farmers may have a fairly clear idea of how many dollars and cents they will forego

if they decide not to cultivate a certain patch of land, but it is very difficult for them to figure out the consequences of tilling soils that are fragile or unfit for agriculture.

2. Capacity to Conserve

Structural adjustment influences the way natural resources are exploited through its impact on the level of income, on income distribution, and on the level of employment. SSA does not have an institutionalized system of social security, benefits to the unemployed, etc. The country's reserves of natural resources, together with the extended family system, tribal solidarity, and a host of formal or informal arrangements, such as public sector hiring of "surplus employees", constitute the de facto system of "social security". When recession strikes, this system is stretched as people reach out to the country's inventories of natural resources and to "godfathers" in government. A prolonged recession will cause dislocated people to probe the limits of the available means of survival, which includes digging deeper into resource reserves.

Over the long run (still under the assumption that structural adjustment will succeed in promoting growth), the ultimate effect of the adjustment policies on natural resources rests on its capacity to reduce income inequality, create employment opportunities for people who would be "slashing and burning", and reduce poverty. Growth, in other words has to be "broadly based." Developing agriculture is, of course, a promising way to do it. However, it is important to recognize that it takes more than price incentives to develop agriculture.

3. The Government's Attitude

For resource conservation as well as for sustainable extraction, government regulation is indispensable. An immediate effect of adjustment policies is to reduce the government's ability to enforce environmental protection statutes. It is very unlikely that a government compelled to cut expenditures will let protection of the environment remain a priority -- if it ever was one. In the face of social pressure, the government's attitude towards enactment and enforcement of protective legislation is bound to be lax. Worse still, as recession or "narrowly based" growth compounds social problems, the government may well turn to new resource frontiers -- if the country has one -- in search of "escape valves" for social tension. As that happens, the government will not just look the other way; it will officially promote devastation of the country's resource reserves.[25]

Conclusions and Recommendations

Since independence, most countries in sub-Saharan Africa are said to have pursued an inward oriented growth strategy which has emphasized production for domestic market.[26] In most cases, this strategy has failed in that it has not generated adequate

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[25] Such is precisely the Brazilian policy with respect to the Amazonian frontier. The government has a commitment to give land to landless peasants, but an even stronger commitment to protect the property rights of the large land holders, so it launches the peasants against the forests.

[26] SSA has pursued a policy of subsidizing consumption, heavily tilting the balance against production. This is why we don't think it correct to say that they have pursued an inward oriented growth strategy. If one looks at the set of policies that have been implemented, one can only conclude that they haven't pursued any growth strategy at all. The policies, by and large, tend to favor consumption while discriminating against production.

growth in per capita income. At present time, multilateral lending agencies are pushing those countries into adopting an outward oriented growth strategy, and that -- the study has concluded -- cannot be expected to yield results within the time frame envisioned. Regarding the relationship between structural adjustment, natural resources, and sustainable growth, analysis has concluded:

- First, that it is unlikely that structural adjustment can, by itself, generate a process of sustainable growth.
- Second, disregard for natural resource constraints is one of the factors that can contribute to failure of the adjustment policies.
- Third, insofar as economic performance falls short of expectations, structural adjustment will compound socio-economic problems, thereby increasing pressure on natural resources.

In short, degradation of the country's resource base can be both a cause and a consequence of failure of the adjustment policies.

The primary objective of structural adjustment in sub-Saharan Africa is to reverse present foreign sector imbalance from deficit to surplus and to promote GNP growth (in the future). Generating a trade surplus is the only way debt distressed countries can hope to meet their external obligations and regain access to external markets for goods and (maybe) capital. As a means to this end the policies have, without much question, adopted outward oriented growth as their basic underlying strategy.

Policies of outward reorientation of the economy are accompanied by policies to also correct public sector imbalances. While it is clear that neglect of comparative advantage has been a problem in the past, it is important to recognize that this in no sense constitutes an argument for requiring SSA to generate a trade surplus to allow repayment of external debt. In fact, historical experience indicates that countries at SSA's stage of development should not attempt to export capital but should instead devote available resources to investment.

It is unquestionable that the problems which structural adjustment addresses have exacted a heavy toll from sub-Saharan African economies in terms of diminished efficiency. It is therefore impossible to deny that some sort of corrective measures are called for. However, this study concludes that structural adjustment is not all that is needed.

One of the problems with structural adjustment is its disregard for natural resources in countries whose development possibilities are almost entirely dependent on sustainable extraction and efficient utilization of such resources. Resource conservation, by which we mean the non-wasteful utilization of resources, is neither an objective of, nor a constraint of, structural adjustment. However, resource scarcity -- particularly scarcity of agricultural resources -- is a grim reality in sub-Saharan Africa. In spite of this, structural adjustment seeks to induce the African economies to specialize in resource intensive activities, leading to over-extraction pressures.

Worse still, the policies do not include any mechanism which could eventually reduce dependency on the resources, such as diversification of the economic structure. On the

contrary, the adjustment policies tend to lock the economy into the position of exporter of resource intensive primary products. Even if one abstracts from all the problems of primary product exports which the literature on "unequal exchange" emphasizes, sustainable growth is constrained by the regeneration capacity of the resources on which the activity is based. Increased production above the long term sustainable level in one period implies that less production will be possible in the next. Disregard for resource scarcity, and a short view on outward growth as a means to normalize trade relations, makes one think of structural adjustment as a remedy to short run disequilibrium, not a solution to long term growth.

But there are other problems. Structural adjustment can also be viewed as an attempt to transplant to the African context policies that may be adequate for countries in much more advanced stages of development (as the middle income countries). As such, the policies take a light view not only of the constraint imposed by natural resource endowments, but also of the massive structural constraints facing the African countries. Such constraints include: lack of an entrepreneurial class, scarcity of human resources, resource immobility, low savings rate (capital scarcity), rudimentary financial intermediation, difficulties of attracting foreign capital, fragile institutions, incapable state bureaucracy, overall poverty level that reduces the size of the market and leaves little leeway for expenditure restriction measures, etc. By failing to tackle these problems, structural adjustment runs the risk of backfiring. It provokes a recession, compelling people to dig deeper into reserves of natural resources, but does not guarantee a recovery.

Outward oriented growth is a good strategy if the policies' aim is to allow countries to liquidate past debts. In addition, it is foolish not to take advantage of export opportunities to generate an economic surplus and relieve the constraint of foreign exchange scarcity. However, correction of static inefficiencies is not nearly enough if the goal is promotion of growth over the long term. Natural resources must be used to generate foreign exchange and increase the economic surplus; but it is also necessary to modernize and diversify the economy so that resource dependency can be reduced. Outward orientation of the economy is fine, as long as it is part of coherent policies on a global basis. Comparative advantage per se is an efficiency enhancing principle, but the country's objectives should be to change its comparative advantage. This will serve to lessen the economy's dependence not only on slowly renewable natural resources, but also on slowly expanding price inelastic primary product markets.

One can argue whether or not SSA should attempt to pay its foreign debt. But with a savings rate of 8.5% -- probably not enough to cover depreciation -- a high rate of population growth, extremely low income levels, a small endowment of natural resources, and no prospects of continued inflow of foreign loans or investments, there is no way an effort to liquidate the debt can be justified on economic grounds. Credits to SSA should be transformed gradually into grants on the condition that certain agreed upon policy objectives are met. There is no place where foreign aid is more needed than SSA. Of course, donors should require that investment, not consumption, stimulating policies be implemented.

In addition, and as part of the adjustment-cum-aid package, the SSA countries should be assisted in: implementing environmental protection policies; developing educational and health care systems; enacting population control programs; building a transportation, communications and energy supply infra-structure; developing a banking system; modernizing governmental institutions; and in developing sustainable agricultural practices. A major difficulty is that SSA isn't prepared even to (productively) absorb the aid. Continuous technical assistance over a long period will be necessary. While major price distortions should be corrected, major efforts should be made to avoid a recession. Also, it is vitally important that the macro and microeconomic policies be coherent with one another.

Finally, one simply cannot think of sustainable extraction of natural resources without a policy to reduce poverty. The immediate effect of structural adjustment is to raise food prices. While some farmers may benefit from this, urban as well as landless rural workers will be confronted with a higher cost of living and lower real income. Increased poverty is the short run effect of structural adjustment. In the long run, the odds that the policies might succeed in starting a growth process are open to debate. But even if they do succeed, if we wait for sub-Saharan Africa to "travel" all the way up its "Kuznets curve," we might discover, to our disappointment, that the countries' supply of natural resources will be exhausted long before the end of the journey.[27]

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[27] Reference to Kuznets' suggestion that the degree of income concentration increases in the initial phases of the process of economic growth but decreases as the process advances (Kuznets, 1966).

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FINANCING ENVIRONMENTAL EXPENDITURES IN AFRICA

Steven Kyle and Ann Hawkins[1]

Introduction

The economic crisis in Africa in the 1980's has increasingly come to be seen as rooted in its agricultural crisis - food production has failed to keep pace with a fast growing population, and the intensification of agricultural production in response to increased population pressure has in many areas put the fragile natural resource base in danger of permanent damage. The intensification of economic problems on a macro and international level has limited the extent to which governments can devote resources to environmental protection while at the same time increasing the need to use the resource base to generate export revenues to service debt and to feed growing urban populations.

This paper is directed toward examining possibilities for financing environmental expenditures in African countries by means of debt swaps or other innovative mechanisms. One of the most interesting options is that of converting outstanding external debt into local funds for conservation or preservation. In addition, use of blocked funds, or bilateral or multilateral aid funds are also important.

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In addition to examining the pros and cons of various financing mechanisms, it is equally important to assess the scope for positive action in Sub Saharan Africa. The degree to which countries are vulnerable to environmental pressure varies considerably, as do both the environmental conditions themselves and the pressures on them. Similarly, the political climate and will to promote environmentally sustainable development policies varies as well. This is true both for national governments in Africa as well as in the various multilateral and bilateral aid agencies that fund development projects. Finally, the extent to which any particular mechanism for financing environmental expenditures can be used depends on the particular circumstances. For example, debt for nature swaps require not only the availability of debt to be swapped, but also government regulations that permit the transactions and viable projects or purposes toward which the funds can be directed.

The next section of the paper will outline the mechanics of one of the most widely touted avenues for funding environmental expenditures, the debt-for-nature swap. This will be followed by a discussion of previous examples of such transactions together with an assessment of the extent to which they might be used to address environmental issues in the African context. Next, the policy climate for environmental expenditures will be examined in Africa and in donor countries and agencies. Finally some major issues and controversies surrounding debt for nature swaps will be addressed, followed by a survey of other options for conservation financing and some conclusions as to the degree to which these various schemes can contribute to conservation in SSA.

The Mechanics of Debt Swaps

Debt swaps come in a variety of forms, but all involve the exchange of a liability denominated in foreign currency for one denominated in local currency. Originally, the exchanges were of foreign currency denominated debt for equity, or stock, in local companies in what was known as debt for equity swaps. Under normal circumstances, where a country enjoys a good credit rating and equilibrium in its external accounts at an exchange rate reflecting the real value of national currency, there would be little incentive to engage in such a transaction. However, under the constrained conditions of a country unable to remain current on its external debt service payments, there are advantages to both creditors and debtors.

Basically, the possibility for mutual gain comes from the fact that the debt of a country experiencing difficulties in repayment is worth less than face value. That is, if a country owes $1 billion to foreign banks but there is substantial doubt as to its ability to repay, then its IOU is worth less than $1 billion. How much less? This is a subjective matter which depends upon perceptions of the country's willingness and ability to pay. In recent years a market for such discounted developing country debt has emerged, in which banks seeking to unload what they regard as bad debt sell participation in syndicated loans to developing countries to investors willing to take on the risk or who wish to swap the debt for locally denominated assets such as equities. The discounts in this market have varied widely, from as much as 90% off face value in the case of Sudan, a country undergoing extreme economic difficulties, to discounts of 20% in the Ivory Coast or 3%

in Algeria, both countries judged to have better repayment prospects. (March 1987 figures provided by Salomon Bros. International Loan Trading Dept.) Of course, for countries which retain good credit perceptions, there is no discount at all.

Once debt is purchased at a discount on the secondary market, it is then redeemed at the Central Bank of the borrowing country for local, rather than foreign, currency. Redemption at par at official exchange rates means that the swapper will profit to the extent of the discount on the originally purchased debt. Alternatively, the monetary authorities can limit the size of the profit by either redeeming the debt at less than face value or by exchanging the foreign currency at an exchange rate greater than the official rate.

It is common for the host government to stipulate that the proceeds of the swap be used for designated purposed, such as the purchase of equity or for investment in some approved project. Otherwise, the swapper is free to use the local currency for whatever purposes are desired. In this case, investments are typically subject to existing regulations on foreign investment, such as limits on repatriation of capital and interest. In some cases, notably Chile, much of debt is swapped by local residents, thus making this a mechanism for the repatriation of capital held abroad.

All of these possibilities presuppose that the overall investment climate of the country is such that investors will <u>want</u> to invest there. If the prospects for positive returns are low, it is unlikely that the existence of a debt swap scheme will induce either foreigners or residents to convert foreign holdings into local currency. While this is

immaterial in the case of foreign donors who are swapping debt for conservation or preservation purposes, it can be an important factor where the goal is to stimulate private sector investment in environmentally sound development projects.

Countries have various motivations for implementing debt swap programs. The chief gain is in the elimination of some of the demand for scarce foreign exchange. Internal debt is often easier to manage than is external debt, while equity investments do not carry a contractual obligation to pay interest, since dividends can be eliminated if cash positions require. Investments in land or nature preserves would not require debt service or dividend payments per se, but may in fact be associated with substantial recurrent expenditures for maintenance. It is important to note that in all of these cases, the net foreign asset position of the country does not change. That is, if a foreigner owns a dollar denominated debt instrument or a local currency denominated asset such as land, bonds or stock, the capital asset is still owned abroad. Only the form and denomination of the asset has changed.

This change does, however, have ramifications for the domestic economy. If the external debt is swapped for a domestic debt instrument, then interest rates will rise as a consequence of the increase in government debt outstanding held by the private sector. Alternatively, the debt instrument can be liquidated, in which case there is an increase in the money supply with consequent upward pressure on inflation. It should be noted that the size of the transactions involved with debt-for-nature swaps to date are small enough that these effects can be ignored. However, these factors must be considered if a

government intends to put a debt swap facility into place for more than just nature swaps. In this case, the government may well wish to put a limit on the quantity of debt to be swapped in any given time period.

Banks may wish to sell discounted debt for various reasons, but perhaps the strongest motivating factor is the desire of banks to remove excessive quantities of bad debt from their portfolios. Clearly, the lower the bank's estimate of a country's ability to repay as compared to the market, the greater the desire to supply the secondary market. In addition, if the debt has already been written down on the bank's books, the less the current loss incurred by selling at less than face value.

This last consideration is important given accepted accounting practices. If a bank sells an asset at less than face value, it is then required to "mark to market" any remaining assets on its books of the same type. In other words, to sell at a discount is, in accounting terms, to admit to the impaired value. In many cases, the implied loss to a bank, especially large money center banks which have a very large exposure, would wipe out such a large percentage of capital as to make the transaction prohibitive. Smaller banks which can feasibly sell off all of their exposure to a given country are often more willing to sell into the secondary market. Valuation considerations similar to these apply also to international organizations such as the World Bank even though it is not subject to US accounting regulations. This will be discussed at greater length below in the context of options for action by the World Bank to promote environmentally sound development.

Current Debt-for-Nature Swaps

To date there have been four international arrangements known as debt-for-nature swaps, taking place in Bolivia, Ecuador, Costa Rica, and most recently, the Philippines. Each case has differed, depending on local circumstances and needs. The four cases briefly presented here are an overview of possible scenarios. No African debt-for-nature swaps have yet occurred, although World Wildlife Fund, USAID and others express interest for the future. Madagascar is presently under consideration as a suitable country for debt-linked conservation efforts, with possible cooperation from the World Wildlife Fund, USAID, and the World Bank.

The world's first debt-for-nature swap took place July 1987, with an agreement reached between the government of Bolivia and Conservation International. Conservation International purchased the equivalent of US $650,000 of Bolivian external debt which had an actual cash value of US $100,000. This commercial debt was purchased on the secondary debt market through a transaction which involved Citicorp Bank.

In exchange for this debt, the Bolivian government agreed to several conditions: (1) a buffer zone of 2,870,561 acres (the Chimane Forest Reserve) to be created around the existing Beni Biosphere Reserve. Local populations, including the indigenous Chimane Indians, should continue to have access to the reserve for sustainable development activities; (2) protection for other areas, i.e. the Yacuma Regional Park and the CORDEBENI Hydrological Basin (877,205 acres surrounding the Beni); (3) all of these areas were given Congressional Law Status, the highest form of legal protection in Bolivia;

and (4) a trust fund of US $250,000 in local currency was established for management and protection of the reserve.

The second debt-for-nature swap occurred August 1987 in Costa Rica. The Central Bank of Costa Rica approved a proposal by the Ministry of Natural Resources, Energy and Mines, allowing the National Parks Foundation of Costa Rica to trade up to US $5.4 million of debt in one year. In exchange for debt titles, the Central Bank of Costa Rica agreed to issue Monetary Stabilization Bonds at 75% of the face value of the debt. The bonds, with interest rates of 25% annually over five years, would be used solely for financing conservation-related projects. Part of the debt conversion established the Natural Resources Conservation Fund, and financed other future activities:

(1) planning and maintenance of national parks (i.e. infra-structure development, management, tourism);

(2) land purchases for conservation;

(3) environmental education projects;

(4) control of deforestation, reforestation of reserves and watersheds;

(5) research and development on sustainable resource uses.

The third Latin American debt swap occurred in December 1987 between World Wildlife Fund-US, Fundacion Natura and the Ecuadorean government. The Monetary Board of Ecuador approved a maximum of US $10 million of external debt to be

converted into stabilization bonds. The interest from these bonds would be used exclusively to support Fundacion Natura's work in maintenance and conservation of national parks.

The agreement said that World Wildlife Fund would purchase an initial indebtedness of US $1 million (at 35 cents on the dollar). That amount would be assigned to Fundacion Natura at full face value in local currency bonds to be used as an endowment. The interest from the principal would be used for a number of activities: (1) management of protected areas and buffer zones; (2) acquisition of new areas to protect unusual habitats and biological diversity; and (3) conservation training for Ecuadoreans. During the first year of the agreement, geographic areas selected included Andean and Amazonian national parks. These include some of the most biologically diverse habitats in Ecuador.

The latest debt-for-nature swap is the only one to have occurred outside of Latin America. In June 1988 World Wildlife Fund, the Haribon Foundation and the Philippine Government arranged the purchase of US$ 2 million of Philippine external debt for conservation efforts. In 1988 an initial amount of US $390,000 was allocated to fund a variety of conservation-related activities. Sixty percent of these funds were designated for the protection and management of certain core reserves and surrounding buffer zones. Thirty percent of the funds went for training and research to improve local capacity for dealing with natural resources. Activities include: development and training for the Department of Natural Resources and community level resource managers; fellowships for graduate study and field research; further application and enforcement of CITES (the

Convention on International Trade of Endangered Species) and other Philippine laws concerning wildlife and wildlife products trade; ethnobotanical field investigations of Philippine medicinal plants; field site surveys for biodiversity conservation; and the planning of a national integrated system of protected areas.

No debt-for-nature swaps have yet taken place in Africa. However, several countries are being examined as candidates for such debt/conversion exchanges, most prominent at the moment being Madagascar. Later sections in this paper discuss some of the constraints to debt-for-nature swaps in Africa, and possible opportunities due to international pressures, legislative reforms in donor countries, and domestic policies in African countries.

US Policy Climate: Background and Context

During the past fifteen years, the US Congress and the US Executive Branch have promoted initiatives on protecting the environment and natural resources as important aspects of foreign assistance policy. Initially, Congress focused its attention on USAID. From about 1983 however, Congress has examined environmental issues and concerns related to US involvement in multilateral development agencies. The National Environmental Policy Act of 1969 (NEPA), initially was intended as domestic US legislation. Through debate in the 1970s, questions grew regarding its applicability to federal legislation of US overseas development activities. A federal lawsuit filed by four US environmental organizations in 1975 first tested applying NEPA to US government

expenditures outside the legal jurisdiction of the United States (Rich, 1987; Lintner, 1987) This particular lawsuit pressed for USAID to prepare an Environmental Impact Statement (EIS) on intended US sales of pesticides to developing countries; by 1976, AID required adherence to general environmental regulations.

Executive Order Number 12114, "Environmental Effects Abroad of Major Federal Actions," issued by President Carter in 1979 established internal environmental review procedures in federal agencies. Reasons for the legislation were two-fold: (1) EIS would be required in cases where major federal actions could have significant environmental effects on global property; and (2) environmental reviews would be prepared of activities in foreign countries that involved toxic substances, impacts on "outside" nations, or which could affect global natural resources. (Rich, 1985)

This legislation made AID one of the most stringent federal agencies, however, it did not affect US involvement in multilateral development banks. These were specifically excluded, probably out of concern that US participation would be further complicated if policy decisions by US bank directors required an environmental review.

The issue of US involvement in foreign development activities continued during the late 70s and early 80s, primarily through amendments to the US Foreign Assistance Act of 1961 (FAA), which focused further attention on environmental and natural resource problems. The addition and revision of Section 118 to the FAA in 1978 strengthened developing countries' capacities to protect and manage their environments. Part of the amendment included country-specific studies by AID of major environmental problems, and

mechanisms for dealing with those problems. In 1981, another subsection added to the FAA directed US government attention to massive tropical deforestation in developing countries, with activities of multilateral organizations. FAA Section 119, added in 1983, concerned preservation of animal and plant species, regulation of hunting and trade, pollution, and protection of wildlife habitats.

AID's financing fo. environmental activities greatly increased with these environmental amendments to the FAA. AID expenditures for projects involving forestry, natural resources and the environment increased by more than an estimated ten times between 1978 and 1982, rising from $ 13 million to $ 150 million (Rich, quoting T. Stoel, 1985)

House Foreign Affairs special hearings in 1980 directed the US Office of Technical Assessment (OTA) to examine how to sustain tropical forests. Based on OTA's 1984 report, Congress was to evaluate how far environmental provisions of the FAA were implemented by AID and US representatives to multilateral organizations.

From the mid 1980s on, increasing attention monitored economic and environmental impacts of multilateral bank-sponsored projects and programs. Congress has mandated AID to prepare quarterly "early warning lists" of multilateral development bank (MDB) projects with potentially harmful effects on the environment, natural resources, and indigenous people (Lintner, 1987; Bissell/USAID, January 1987; FAA Sec. 119, House Joint Resolutions 738 and 465, and FAA Section 539(g) were all directed towards AID monitoring of MDB projects) MDB projects of special concern to Congress have included those with construction of dams, industry, irrigation, access roads, port facilities, power

generation, and water resources development.

Since June 1983, Congress has held 22 hearings on the environmental performance of multilateral development banks (Rich/EDF, 14 June 1988). Ten of the 22 hearings were special oversight hearings which specifically built a public record on needed environmental reforms within MDBs. Environmental defects of MDBs, as well as how the US could support effective and necessary reforms, have been extensively explored. More recently, pressure on both US bilateral and multilateral development policies has been used as a means to change and affect major environmental and development issues.

In 1984 and 1985, the Senate Subcommittee on Foreign Operations took an active role in promoting various MDB reforms. From 1985 onward, legislation mandated the US Treasury Department to push for significant environmental reforms through the US Executive Directors to the multilateral banks (Rich/EDF, 14 June 1988). The Treasury Department is responsible for coordinating US policy with regard to the multilateral development banks.

Beginning 1983, environmental groups and non-governmental organizations (NGOs) have exerted further influence and attention to the development and environmental policies of the multilateral development banks. (Aufderheide and Rich, Spring 1988). Public accountability as the driving force to evaluate and influence MDB development policies was reflected in the 22 Congressional hearings.

MDB responses to mostly adverse publicity regarding bank-financed development and environmental destruction has been to control environmental damage and promote

reforms. The World Bank's major internal reorganization in 1987 under Barber Conable included wider environmental staffing and new environmental divisions. This was influenced, in part, by the role of environmental groups, Congressional testimony and investigation.

Within the last two years, further legislation and ongoing measures have been introduced to Congress regarding environmental concerns. In July 1987, Representatives John Porter (R-Illinois) and David Obey (D-Wisconsin) introduced a bill entitled the "Tropical Forest Protection Act of 1987" (HR 3010). A main concept in the bill is similar to the "debt-for-nature" swap mechanisms discussed earlier. Chief provisions of the legislation are directed at World Bank program initiatives. A second concept, besides the "debt-for-nature" provision, would require the US Directors to the World Bank to propose a three year pilot "structural adjustment lending program" to promote long-term natural resource conservation. Conservation efforts based on economic returns for the sustainable use and protection of tropical forests could include uses such as scientific tourism, indigenous peoples, nonconsumptive uses, as well as "service" values in terms of watershed protection, soil erosion control, local food, fuel and building supplies. Senator Robert Kasten (R-Wisconsin) sponsored a similar 1987 bill in the Senate (S 1538).

While neither bill has passed, further Congressional activity on debt-for-nature swaps has occurred. The fiscal year 1988 Congressional Continuing House Resolution, often used to amend the Foreign Assistance Act, directed the Secretary of the Treasury to analyze MDB-linked initiatives to enable developing countries to participate in debt-for-nature

swaps (Weekly Bulletin, 12 September 1988). The Treasury Department reported on its findings in April 1988.

In September 1988 the House Banking Committee reviewed another bill addressed to the World Bank and African Development Bank that contained provisions for debt-for-nature swaps. The bill (HR 4645) legislates US participation in a capital stock increase of the World Bank and a replenishment of the African Development Bank. Three amendments were added to the bill by Representative Doug Bereuter (Nebraska), the panel's ranking Republican. The amendments included:

(a) encouraging the World Bank to provide technical advice to developing countries wishing to develop "debt-for-development" swaps (a wider category including "debt-for-nature");

(b) calling on the US executive director to the African Development Bank to create local currency funds for resource restoration; and

(c) proposing that the World Bank consider enforcing, as part of its own lending process, a government's compliance with its debt swap agreements.

These amendments to HR 4645, the legislation by Porter, Obey and Kasten, the revisions of the FAA, as well as recent activity by the US Treasury Department, all point to the current level of US interest in the potential of debt-for-nature swaps and related financing mechanisms for resource conservation and restoration.

Other individuals and countries, however, express reservations about the mechanism of debt swapping, at least with regard to their own participation, pointing to possible

deleterious effects. Several national governments have suspended debt/equity swaps, or have declared a moratorium on such swaps, including Mexico and Costa Rica, partly out of concern over inflationary effects and higher interest rates (Forbes, 28 November 1988). The World Bank continues to express its policy that it does not make loans to refinance existing debts and that it must consider its international credit rating if the Bank were to allow swapping arrangement with World Bank funds. Some of these considerations and concerns are reflected in the policy climates of multilateral development banks, African nations, and other major development assistance organizations.

Policy Climate in SSA

Given the need for African governments themselves to put a high priority on environmental expenditures, a legitimate question is the extent to which debt-for-nature swaps would be in the interests of these governments, and the extent to which domestic or political considerations might impede such a transaction.

First, it must be conceded that nature preserves is rarely at the top of the list in terms of governmental priorities. Certainly, preservation of a government's hold on power is a more important consideration, and the establishment of nature preserves are unlikely to generate substantial political support or opportunities for job creation or patronage given the inherently remote nature of appropriate sites. An important exception to this generalization is the case of countries such as Kenya which derive significant foreign exchange from the existence of wild game parks.

Nevertheless, the idea of establishing nature preserves, though they may not have a lot to recommend themselves to African leaders in many circumstances, by the same token have relatively few drawbacks either, unless they involve land which might otherwise be put into production. Proof of this is the fact that well over one hundred game parks and/or preserves already exist in SSA. A debt-for-nature swap which left local authorities in control of operation of a park and which did not alienate land ownership would seem to pose few local problems in a situation where funding was provided from abroad.

This last point is crucial. Most governments in SSA are already in a position of spending more than they receive. Indeed, the widespread existence of IMF stabilization programs and World Bank Structural Adjustment programs is a testimony to the relative difficulty for governments to promote activities which involve new expenditures. This is true not only for the initial costs of setting up a preserve, but also for the recurrent expenditures required to keep the preserve viable. Table 1 presents estimates of these costs for various SSA countries. Provisions for recurrent costs have been a problem for development projects in SSA since independence, and few adequate solutions have yet been found. One option would be to set up a sort of endowment or annuity at the outset in order to provide for these costs.

Overall then, it would seem that there are few insurmountable difficulties from the African end. However, it must be emphasized that African governments must see sufficient incentives for them to undertake the considerable costs in time and administration to execute what is often a quite complex transaction. In a situation where

Table 1. Recurrent cost expenditures and densities of staff of wildlife management and protection.

Country	Area/Man 1984[1]	Area/Man 1987[2]	Change
Botswana	577.5		
C.A.R.	329.5	680	106
Ethopia	77.2		
Ghana	8.7		
Kenya	20.0		
Malawi	45.8	57	24
Mozambique	100.4	1133	1028
Niger	292.4	3400	1063
Rwanda	21.7		
Somalia	14.7		
S. Africa	41.0	4	-90
Tanzania	273.2	109	-60
Uganda	7.2		
Zambia	299.7		
Zimbabwe	21.9	34	55

1. From Bell and Clarke, 1984.
2. From Du Toit and Cumming, 1987.

Source: Lassoie, J. P. and E. W. Wischusen, "The Impact of Structural Adjustment Programs on Wildlife in Sub-Saharan Africa," in "Policy Reform and Natural Resources Management in Sub-Saharan Africa," draft, February 1989.

no debt-swap program exists already, the country must either set one up (no trivial matter) or arrange each transaction on a case-by-case basis. Again, this can be expensive in terms of time and effort.

A prerequisite for any swap program is the existence of debt to swap. This is covered in the next sections.

Options for World Bank & IMF Involvement

One much debated avenue for the promotion of debt for nature swaps is the possibility of World Bank or IMF participation. However, close consideration of the history and operating procedures of these organizations indicates that although they may play a catalytic or informational role, they are unlikely to be a direct participant in any scheme of the types discussed above.

The IMF lends money but does so strictly as a transaction between itself and the central bank of the recipient countries. There is no negotiable debt instrument which can be sold to a third party in order to effect a swap. Given the relative short term nature of most IMF financing (less than two years) and the fact that it cannot be sold off at all, much less at a discount, there is little scope for swapping of IMF debt. In fact, the short term nature of IMF credits mirrors the short term horizon of IMF economists and stabilization programs.

The mandate of the IMF is to aid countries in overcoming transient balance of payments problems. Though these problems may in fact have root causes which are

structural or long term in nature, the IMF is interested mainly in the restoration of financial viability and sustainability in terms of international payments. The outlook is purely monetary and financial and focuses on the arithmetic of the balance sheet, where it is always possible, arithmetically speaking, to devise a program which returns the bottom line to any desired figure. Such a focus leaves little room for considerations of a longer term nature, which environmental concerns always are. Indeed, the relatively small size of the IMF staff means that there is no in-house capability or expertise in these areas - the Fund would have a difficult time addressing these issues even if it considered them to be within its jurisdiction.

The World Bank, in contrast, takes an explicitly long term view. IDA credits from the Bank's soft loan affiliate, for which most Sub Saharan countries qualify, makes loans for terms as long as forty years, and concentrates on the promotion of growth and poverty alleviation rather than short term financial viability. So, the Bank certainly is well placed to influence investment programs in terms of environmental concerns but until recently has not done so. In fact, the Bank has come under severe criticism in some areas for being insensitive to environmental concerns. In the last two years, this situation has begun to change, partly as a result of the lobbying efforts of environmental groups, but also because of increased awareness at the Bank of the need to ensure that development strategies do not degrade the resource base upon which they depend.

It is important to note in this connection that the Bank cannot by itself guarantee environmentally sound investments. It is equally, if not more, important for the

governments of the countries involved to place a high priority on such concerns. The Bank can exercise a leadership role and can at least refuse to become involved in environmentally damaging projects, but even this is unlikely to have major effect in the absence of a government commitment due to the fungibility of loan proceeds. That is, given that the World Bank usually tries to fund projects with the highest available return, it is reasonable to expect that these projects would have been among the first to be funded even in the absence of foreign support. Under these circumstances the effect of World Bank funding for these "first in line" projects is to liberate the domestic funds that would have supported them for other purposes. Whether these other purposes are environmentally damaging or not depends on the government's sensitivity to these problems.

Another possibility that has been much discussed is the idea of swapping World Bank debt since a large amount of the outstanding external debt of Sub Saharan countries is of this form. Unfortunately, this runs into several problems; first of all is the unwillingness of the World Bank to sell off debt. Though the Bank has engaged in a relatively small loan sales program in the past, this activity has involved sales of the least risky loans in the portfolio (e.g. Malaysia) or, as in a recent proposal, packages of loans. To date no credits to the poorest countries have been sold.

The main reason for this is that the World Bank does not wish to compromise its own credit rating in world capital markets. The legal ramifications of selling off good loans are complicated enough; it is virtually unthinkable that the Bank would admit to

impaired status of any part of its portfolio by selling at a discount. Its triple A borrowing status rests on its solid record of repayment, a record which the bank will go to great lengths to protect.

A final consideration in terms of the involvement of multilateral organizations lies in the effect of conditions on their lending on the ability of bilateral organizations to pursue environmental goals. Specifically, there have been cases in the past in which environmental expenditures by bilateral aid agencies such as USAID have been constrained by limits on public spending or credit outstanding agreed on in the context of IMF programs. At root, this is a problem which is caused by the fact that environmental expenditures often receive a low priority in African governments. As noted above, the IMF is interested only in monetary and financial balance; it is of less concern to them on what money is spent. What is important to the Fund is the bottom line increase in money supply, the government budget deficit, and domestic credit outstanding. If limits in these areas cause environmental investments to be foregone, it is of no concern to the IMF; in their view, it is up to the government of the country concerned to set spending priorities.

Bilateral aid agencies counter that they merely want to fund such investments out of their own pocket. What is ignored in this logic is that regardless of where the money came from, if it is spent within a country it will add to domestic financial pressures just as do other expenditures, and will be taken into account by IMF economists just as will other expenditures. While it is theoretically possible for a bilateral organization to buy

physical capital and put it in place without local expenditures, in practice it is virtually impossible to operate without counterpart funds and local procurement or labor. The inescapable need is for host governments themselves to place a high enough priority on environmental expenditures to ensure that they are not squeezed out. This, however, would raise the overall cost substantially, as can be seen in Table 2 which shows estimated recurrent costs for such preserves in Africa.

The Distribution of External Debt in SSA

Table 2 shows the amounts of external debt outstanding in SSA as of 1986. The debt has been divided into that owed by the public and private sectors and within these categories into that borrowed from official creditors (multilaterals such as the World Bank and IMF are included here) and that from private creditors, virtually all of which consists of syndicated bank loans.

In order to execute a debt swap, it is necessary to have access to debt which can be bought at a discount on the secondary market. This virtually precludes use of debt from official sources, including that from the multilateral development agencies. The table shows clearly that the vast majority of external debt in SSA is owed to official creditors and is therefore ineligible for debt swaps. Nevertheless, the size of the external debt owed to private creditors is in most cases larger than the amounts needed to set up a nature preserve.

Table 1. Overview of Adjustment Lending Policies in Selected Countries.

	Industrial Performance (1984-86)		Change in TOT against the country	Improvement in GDP growth[1] (1982-86)	Incremental private cons.[2] (1982-86)	MAJOR POLICIES			SECTOR POLICIES	
						Balance of[3] payments reform	Fiscal reform	Financial reform	Agriculture[4]	Industry
	Import pentration	Export expansion								
Chile		x	medium	medium	low	All QR elim. tariff reduced to uniform 10%; devaluation		Rescue financial inst.		Restructure to make it competitive
Colombia		x	medium	high	high	low exp. prom. & import ref; deval.	Major tax reform	Separate credit op. from phys. input supply		
Cote d'Ivoire	x		high	low	medium	strong trade ref.	Public enterprise reform			
Ghana	x		low	high	high	trade ref. deval.	Increase in public spending	Rescue financial instit. raise interest rate	Reduce overstaffing	
Jamaica	x	x	high	medium	medium	strong trade ref; export prom; deval.	Major tax reform			
Kenya		x	high	medium	medium	low implement. cap.				
Korea		x	medium	high	low	5% QR & 20% tariff red.; exp. prom; devaluation				
Malawi			medium	medium	medium	deval.	Incr. excise & trade taxes		Emphasis needed on smallholder producer prices	

Table 1. Overview of Adjustment Lending Policies in Selected Countries - continued.

	Industrial Performance (1984-86)		Change in TOT against the country	Improvement in GDP growth[1] (1982-86)	MAJOR POLICIES				SECTOR POLICIES	
	Import pentration	Export expansion			Incremental private cons.[2] (1982-86)	Balance of[3] payments reform	Fiscal reform	Financial reform	Agriculture[4]	Industry
Mexico	x	x	high	low	medium	strong trade ref; exp. prom; deval.			Link farm p. to intern p. thru a p. band	Restructure to make it competitive
Morroco	x		high	high	high	Strong trade ref;	Incr. excise & trade taxes		Limit agencies power in the sector	
Pakistan	--NA--		low	high	medium	Remove QR on inputs; exp. prom; deval	Public inv. in infrastructure for private sector			
Philippines	--NA--		high	low	medium	Conflict with need to incr. rev. thru' higher custom duty	Incr. excise & trade taxes			
Thailand		x	high	low	medium	Reversed reduction of prot.: exp. prm; deval.; trade ref.	Incr. excise & trade taxes			
Turkey	--NA--		----------NA----------			20% QR and tariff protection: exp. prom; deval.	Public inv. in infrastructure for private sector			
Zambia	--NA--		----------NA----------			Reversed policy; deval.				

high indicates an increase in the growth rate and growth of more than 1 percent.
low indicates a decline in the growth rate and growth of less than 3 percent.
medium indicates a decline in growth rate but growth of more than 3 percent: or little growth despite an increase in the rate (less than 1 percent).

[1] Based on an improvement during 3 years after AL compared to 3 years before, and the level of GDP growth in 1982-86.
[2] Per capita growth
[3] Quantitative restrictions (QR) and tariff reduction with exchange rate depreciated and fiscal disequilibrium corrected. Result: Increase in export, [illegible]

Table 2. Debt in Sub-Saharan Africa.

COUNTRY	PUBLIC Official	(Multilat)	Private	PRIVATE Official	Private	TOTAL Official	Private
Benin	742.2	(549.8)	394.8	0.0	0.0	742.2	394.8
Botswana	613.2	(453.4)	50.2	0.0	0.0	613.2	50.2
Burkina Faso	916.5	(681.1)	35.3	0.0	0.0	916.5	35.3
Burundi	837.5	(603.4)	31.0	0.0	0.0	837.5	31.0
Cameroon	2573.0	(1206.8)	593.2	0.0	504.9	2573.0	1098.1
Central African Rep	520.1	(302.9)	23.2	0.0	0.0	520.1	23.2
Chad	258.2	(161.3)	34.0	0.0	0.0	258.2	34.0
Comoros	212.6	(134.6)	0.2	0.0	0.0	212.6	0.2
Congo	1608.6	(444.5)	2369.8	0.0	0.0	1608.6	2369.8
Cote D'Ivoire	3932.8	(1977.0)	3596.9	..	2955.0 ..	..	..
Djibouti	227.6	(103.6)	5.0	0.0	0.0	227.6	5.0
Equatorial Guinea	201.5	(86.7)	12.0	0.0	0.0	201.5	12.0
Ethiopia	2766.7	(1359.0)	349.4	0.0	0.0	2766.7	1359.0
Gabon	647.5	(173.3)	977.2	0.0	0.0	647.5	977.2
Gambia (The)	333.4	(241.5)	27.1	0.0	0.0	333.4	27.1
Ghana	1886.6	(1230.0)	70.5	0.0	0.0	1886.6	70.5
Guinea	1711.2	(573.6)	202.1	0.0	0.0	1711.2	202.1
Guinea Bissau	336.7	(206.5)	94.1	0.0	0.0	336.7	94.1
Kenya	3840.3	(2116.2)	793.9	..	262.6 ..	..	..
Lesotho	318.2	(295.1)	17.5	0.0	0.0	318.2	17.5
Liberia	964.2	(466.2)	182.7	0.0	0.0	964.2	182.7
Madagascar	2923.4	(1100.1)	383.8	0.0	0.0	2923.4	383.8
Malawi	1232.2	(951.2)	68.3	0.0	0.0	1232 2	68.3
Mali	2043.5	(867.8)	55.9	0.0	0.0	2043.5	55.9
Mauritania	2079.5	(709.0)	156.1	0.0	0.0	2079.5	156.1
Mauritius	543.9	(312.4)	123.2	0.0	21.8	543.9	145.0
Niger	1244.2	(685.4)	241.7	..	224.3 ..	..	..
Nigeria	10036.4	(3064.8)	14032.3	..	50.0* ..	..	..
Rwanda	725.3	(557.4)	12.7	0.0	0.0	725.3	12.7
Senegal	2785.2	(1083.8)	335.4	..	15.0 ..	..	..
Sierra Leone	435.3	(296.2)	168.0	0.0	0.0	435.3	168.0
Somalia	1597.2	(784.5)	68.1	0.0	0.0	1597.2	68.1
Sudan	7210.0	(1903.6)	918.0	0.0	0.0	7210.0	918.0
Swaziland	280.4	(165.9)	10.9	0.0	0.0	280.4	10.9
Tanzania	3751.8	(1551.4)	409.6	0.0	** 0.0	3751.8	409.6
Togo	964.3	(490.2)	83.4	0.0	0.0	964.3	83.4
Tunisia	5578.9	(2171.6)	2010.0	..	250.0 ..	..	..
Uganda	1325.7	(913.9)	115.2	0.0	0.0	1325.7	115.2
Zaire	5601.3	(1596.5)	814.2	..	..	..	..
Zambia	3713.6	(1392.5)	657.4	0.0	0.0	3713.6	657.4
Zimbabwe	1410.2	(690.6)	1011.0	..	46.0 ..	..	..

.. data not available all figures in millions of U.S. dollar
* Nigeria: down from 1416.0 in 1985
** Togo: down from 60.0 in 1985

From World Debt Tables: External Debt of Developing Countries, Vol II., Country Tables, World Bank, Washington, D.C., 1988.

In this case the problem becomes that of trying to buy this debt on the secondary market. This narrows the field somewhat, but still leaves several possibilities. Salomon Bros. Inc. is one of the most important players in the secondary loan market and issues periodic price lists for traded debt. SSA countries on this list at one time or another include:

Gabon
Ivory Coast
Liberia
Madagascar
Malawi
Nigeria
Senegal
Sudan
Togo
Zaire
Zambia

Though some of this debt is traded only sporadically, the existence of a precedent for such trades in these countries makes them better candidates for a nature swap. This is due to the high administrative costs involved in swap transactions. Most countries have legal requirements (or prohibitions, in some cases) which must be met for any cross-border capital flow. In the case of government debt, the approval of the relevant government agency would be necessary. All of this implies that a substantial amount of time and effort must be invested before a nature swap can take place. Since an existing precedent can reduce these complications, and a quoted price by recognized market-makers implies that existence of tradeable debt, the countries on the above list are more likely candidates that others.

There does in fact appear to be some overlap between this list and those countries where a nature preserve could prove particularly beneficial. However, there are still some possible snags on the creditor side. As discussed above, US accounting regulations require banks which sell some but not all of their exposure to a country at a discount to mark down the value of the debt remaining on their books accordingly. This means that a debt-for-nature swap arranged directly with a bank would likely have to involve the purchase of all of that bank's exposure. Given the amounts involved in setting up nature preserves, it is unlikely that this could be done. Even if a bank could be found which qualified under this criterion, the small amount of the transaction would make it hard for the bank to justify the administrative costs involved.

Assuming that all of the problems discussed can be overcome, we are left with the fundamental question of what attractions remain for this method of conservation finance. These attractions can be divided into two groups - those for the donors, and those for the debtors.

On the donor side, it is probably safe to assume that the desire to finance third world conservation implies that some quantity of money to do so is available in the first place. A debt swap then amounts to a way to magnify the value of these resources and is in effect identical to a preferential exchange rate to the extent that the discount in the purchased debt is less than that at which the debt can be redeemed.

There is no particular reason for donors to prefer a swap to a preferential exchange rate unless a swap is all that is available. This is dependent upon the extent to which

debtors perceive swaps to be in their own interest. The most obvious reason is the elimination of some outstanding foreign debt. Here, however, there are two important caveats. First, the amounts involved in nature swaps have not materially affected foreign debt in previous cases. In fact, the amounts transacted would not even cover one year's interest payments on an external debt in the majority of cases. Second, most SSA countries have not been repaying external debt anyway and are for the most part unlikely to do so in the near future. Even without nature swaps, large amounts of external debt will have to be written off, if not forgiven.

The case then, must rest on the debtor governments' own perceived need for conservation, and willingness to accord it a priority in public expenditure programs. As noted above, merely drawing boundaries for preserves is of little value without the complimentary expenditures needed to make the preserves viable. Government willingness to do this requires a judgment balancing the benefits of conservation and donor contributions on the one hand, and the value of designated land in alternative uses.

The situation in Brazil and the Amazon Basin makes an interesting example. Though the case for conservation seems clear, the Brazilian government has so far placed a high value on alternative uses of the land. Even the apparent unsustainability of many of the alternative uses does not seem to outweigh political and economic benefits for the current government. While other political parties have come out in favor of nature swaps, Brazil will still face the problem of actually appropriating money for conservation, a problem which may in fact prove insurmountable in a situation where the internal debt

is as large as the external debt and inflation is projected to 2000% by year end. This problem is also severe in SSA where in addition to inflation worries, there is no borrowing capacity at all.

An important lesson from Brazil is the degree to which external pressure for environmental preservation can generate hostility and seemingly perverse responses. Pressure can often be perceived as "preaching" which, when coming from North Americans, can sound hypocritical to developing country policymakers. Brazil certainly has more leverage vis-a-vis donor countries, but SSA policymakers are likely to have similar sensibilities.

Survey of Some Conservation Financing Approaches

Debt-for-nature swaps are currently the most publicized attempts to combine economic incentives with environmental protection. However, they are not the only mechanism for financing conservation. Since early 1988, the World Resources Institute and the United Nations Development Programme have conducted a feasibility study of possible ways to achieve substantial increases in conservation funding, despite cutbacks in LDC national government budgets, and foreign assistance funding. The IUCN (International Union for Conservation of Nature and Natural Resources) published a book in November 1988 entitled Economics and Biological Diversity: Developing and Using Economic Incentives to Conserve Biological Resources. Other organizations, such as the Osborn Center for Economic Development (World Wildlife Fund/Conservation

African end. However, it must be emphasized that African governments must see sufficient incentives for them to undertake the considerable costs in time and administration to execute what is often a quite complex transaction. In a situation where

Foundation) are pursuing projects and examining possibilities that combine both ecological conservation and economic benefit to local communities.

The WRI/UNDP proposal focused on two categories of activities for conservation financing: those which could generate revenue and be self-sustaining, versus those activities important for environmental reasons but not economic ones. The proposal briefly mentions funding possibilities such as blocked funds, local currency counterpart funds from PL430, bilateral aid funds channelled through a (proposed) world conservation bank, funds from multinational corporations to protect investments and to support host country conservation goals, co-financing of environmental projects from development finance agencies, and others.

The IUCN report on economics and biological diversity is more detailed, and outlines uses of economic incentives for resource conservation at the level of the community, national governments and the international arena. Each section discusses direct as well as indirect incentives, including incentives in-kind, fiscal incentives, service incentives, and social incentives.

Suggestions in the report of sources for conservation financing included:

(1) regular national budgets;

(2) initial special budget contributions;

(3) returning profits from resource extractive activities to local residents;

(4) charging entry fees to parks;

(5) community resource-based revenue activities;

(6) water use charges;

(7) special resource taxes on timber removal, wildlife trade, etc;

(8) establishment of "maintenance taxes" for environment in major development projects;

(9) obligatory investments in restoration for enterprises dependent on resource exploitation;

(10) making sustainable resource use a condition in extractive concessions contracts;

(11) direct support from development agencies and international conservation organizations;

(12) local currency counterpart funds from PL480;

(13) multinational corporation contributions to conservation programs;

(14) other sources, e.g. local foundations to generate funds, assigning "conservation concessions," and establishing of "property rights" for biological diversity.

Many of these suggestions originally derived from actual projects and case studies in various parts of the world. There is an increasing need to assess the long term results of such conservation financing, in terms of their economic and environmental impacts, and also their social and cultural appropriateness. Such events as the International Symposium and Conference on Wildlife Management in Sub-Saharan Africa (Harare, Zimbabwe, 6-13 Oct 1987) begin to provide information and feedback of results, with the potential for

more African-based initiatives for local and regional mechanisms to conserve natural resources.

A recent example of such a mechanism comes with the announcement in January 1989 of what is being called "The NGO Outreach Project," a cooperative effort between the African Development Bank and three US environmental organizations (The Sierra Club, American Farmland Trust, and the Natural Resources Defense Council.) The proposal is that the project will develop practical mechanisms to convert publicly held debt into natural resource investments for conservation, rehabilitation and use.

While possibly similar to debt equity/debt-for-nature mechanisms discussed earlier, those examples differed in that they have involved converting private commercial debt, rather than debt held by multilateral or bilateral institutions. However, in most African countries, publicly held debt is greater than private debt: African countries owe approximately $4 billion to the US government, and approximately $10 billion to European governments. Through the Outreach Project's trial effort, the African Development Bank, non-governmental development organizations (NGDOs) of five African countries, and member governments, are planning to work on ways to convert debt owed to the US and other creditor countries into "environmental bonds," for use in protecting the environment.

It is still possible to make some preliminary observations prior to the needed detailed assessment of these approaches. First, complexities of debt-swaps are avoided by making use of alternative internal financing mechanisms. However, this only serves to bring the question of debtor government priorities that much more to the forefront. This is obvious

in the case of budget allocations, but no less pressing for taxes or user fees which require political will for enforcement. Use of blocked funds or local currency proceeds from PL480 shipments is attractive but does not eliminate the need for prioritization of conservation in a situation where total expenditures must be retrained to maintain overall economic balance.

Conclusions

Our study indicates that debt for nature swaps performed in Latin America and elsewhere provide an interesting model for SSA, where there are numerous possibilities for the establishment of nature preserves. However, the limited number of countries with eligible debt sharply narrows the list of possible candidates. Given the high administrative costs involved both for creditor banks and for the countries themselves, it is unlikely that such swaps can be arranged unless a country's debt is already traded in the secondary market for LDC loans. Nevertheless, there is sufficient overlap between the list of countries with eligible debt and those where a nature preserve should be beneficial to make this an attractive option in some cases.

However, it would be a mistake to think of debt-for-nature swaps as a solution to either the debt crisis or the ecological crisis in SSA. The magnitudes involved are too small to materially affect the amount of external debt outstanding, while the establishment of nature preserves cannot directly affect processes of environmental degradation involving entire countries or agro-climatic zones. Even so, in the face of two crises of such

proportions, every possible avenue must be pursued in the absence of a "big fix" - debt-for-nature swaps are one way to move toward a more environmentally sound development strategy.

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THE IMPACT OF STRUCTURAL ADJUSTMENT PROGRAMS ON WILDLIFE IN SUB-SAHARAN AFRICA

by

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Introduction

Excessive national debts and resulting structural adjustment programs designed to promote economic growth and restore balances of payment, are often cited as the chief causes of many socioeconomic problems now facing sub-Saharan Africa (George 1988). Another problem of growing concern, however, is the rapid loss of biological diversity throughout this region (Huntley 1988). Multinational lending institutions and international development organizations have begun to recognize that such losses are becoming a major global problem. For example, the World Bank's wildlands policy (Goodland 1987) and U. S. Agency for International Development's new conservation biology program (Fitzgerald 1988) are two recent attempts to help protect and enhance biological diversity on a worldwide scale.

In this paper, we attempt to determine whether there is a cause-and-effect relationship between the observed changes in wildlife populations in various sub-Saharan African countries and the structural adjustment programs that have been implemented there. Due to the heterogeneity of this region with respect to wildlife and their habitats,

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human cultures, and structural adjustment programs, few causal relationships probably hold true for all countries and all situations. Instead of attempting to look for these, we have tried to identify the range of potential conflicts between wildlife and structural adjustment programs, and then use specific examples to further highlight actual problems as we see them. Our review is not encyclopedic for all of sub-Saharan Africa, but is meant to be illustrative.

It must be stated at the beginning that most, if not all, of the wildlife populations examined probably would have undergone some decline, and likely will continue to decline, in the absence of structural adjustment programs (Wilcox 1980). Furthermore, in some situations these programs could actually be having positive impacts on wildlife populations (Muir-Leresche 1989). However, we believe that in many situations structural adjustment programs are having negative impacts on wildlife populations that will cause long term detrimental effects on the economies of the countries involved (Juma 1988).

In order to investigate this question, we first provide some background information on the value of wildlife to local economies and as a source of foreign exchange. We then discuss the extent of conservation efforts and the rates of decline of some important wildlife populations in various countries in sub-Saharan Africa. Finally, we examine the possible direct and indirect impacts of structural adjustment programs on wildlife populations and conservation efforts aimed at their protection, including how certain program elements might be modified to prevent problematic results.

Wildlife Values

While almost everyone is willing to agree that wildlife has intrinsic aesthetic and ecological values, its economic worth is often not fully appreciated. This paper will address this economic value, specifically related to bushmeat, tourism, animal trade, and game ranching. Wild animals certainly have many additional values, especially for local populations (see McNeil, this volume), but these are difficult to quantify and are probably less significant to the overall economies of African countries than those to be discussed. We also have not included wildlife's potential future value in terms of pharmaceuticals or genetically engineered products.

Wildlife is an important source of protein for rural people in many countries (Ntiamoa-Baidu 1987). In Ghana, bushmeat supplies 12 percent of the total animal protein consumed and approximately 80 percent of the rural population depends upon it (Manu 1988). Bushmeat is also an important source of food for rural Nigerians where, depending on the region, it constitutes between 10 and 85 percent of all the meat consumed (FDF 1988). In another study, the monthly consumption of wildlife by Nigerian farmers during the 1986 rainy season was estimated to be over one billion kilograms (Adeola and Decker 1988). In parts of western and southern Ethiopia, bushmeat represents five-to-ten percent of the food consumed (EWCO 1988). In contrast, bushmeat does not appear to be as important in East Africa as it is elsewhere (Allaway 1989).

In terms of foreign exchange, the greatest value of wildlife is probably derived from tourism (Juma 1988, Muir-Leresche1988a). We considered both the consumptive type of wildlife tourism (e.g., safari hunting and trophy hunting) as well as the nonconsumptive

(e.g., photographic safaris, bird watching, etc.) together in terms of their values to the economies of sub-Saharan African countries. Receipts from tourism range from a few million U.S. dollars annually for countries like Chad, Uganda, and the Central African Republic to over a hundred million U.S. dollars annually for Kenya (Table 1). Since the majority of the tourists are probably foreigners (Pullan 1983, Allaway and Cox 1989), most of this money is in the form of foreign exchange.

Trade in animal products in Africa goes back many centuries with the best long term documentation being for ivory (Abel and Blackie 1986). Between 1979 and 1982 an average of 665 metric tons of raw African ivory was exported to Japan and Hong Kong annually (Parker and Martin 1983). This represented a yearly average of U.S.$42 million in foreign exchange for the exporting countries. Unfortunately, this also represented an annual loss of approximately 53,000 elephants; a harvest rate that can not be sustained indefinitely. With ivory now bringing as much as U.S.$200/kg (Booth 1989), the harvest rate will likely increase in the future.

Although ivory is the single biggest wildlife product traded in terms of total economic value, other products, such as skins, hides, and live animals, are also very valuable. The live animal trade from Africa has been established for many years and has potential for considerable growth. Tanzania, for example, has become an important exporter of live birds. It is now estimated that the sustainable live bird trade in Tanzania would be worth U.S.$17 million annually if properly managed (Thomsen 1988). Live animals exported from Ghana in 1986 included birds (specifically grey and green parrots),

Table 1. Receipts from tourism during 1982-1984 for selected sub-Saharan African countries (from Anonymous 1988).

	TOURISM RECEIPTS million (U.S.) $		
COUNTRY	1982	1983	1984
Angola	4	–	–
Botswana	36	47	53
Cameroon	64	59	59
Central African Republic	4	4	4
Chad	2	2	–
Ethiopia	11	8	6
Kenya	185	187	199
Malawi	6	10	6
Mozambique	27	–	–
Rwanda	4	5	6
Somalia	13	18	8
Sudan	47	25	51
Tanzania	16	13	13
Uganda	5	7	8
Zambia	59	43	49
Zimbabwe	46	35	31
TOTAL	529	463	493

lizards, snakes, and tortoises with an annual value of U.S.$140,800 (Manu 1988). Ethiopia exports on average some 12,000 monkeys and baboons per year worth approximately U.S.$700,000 (EWCO 1988).

Game ranching can generate foreign exchange, but its full potential is not yet fully known. One indication of its possible economic importance is the Buffalo Range Ranch in Zimbabwe where hunting safaris netted over U.S.$ 300,000 in 1986 alone (Style 1988). However, game ranching has not greatly spread despite being practiced in Africa for 30 years, which suggests unrecognized problems and illustrates the need for additional investigations (Allaway 1989).

The total economic value of wildlife to sub-Saharan Africa is likely to be quite large. For example, annual revenues from wildlife in countries such as Zimbabwe, where the resource has been well developed and managed, were estimated in 1985 to be about U.S.$200 million (Dalal-Clayton 1988). In contrast, incomes are much lower in Zambia, despite its wildlife being potentially worth hundreds of millions of U.S. dollars (Dalal-Clayton 1988). Regardless of the amounts currently generated, the potential for economic growth is great. For example, in Zambia's Luangwa Valley, one game management area has the potential of yielding U.S.$ 0.5-1.0 million annually from sustainable hunting (Dalal-Clayton 1988). The potential revenue from all kinds of wildlife use in this area (i.e., including nonconsumptive uses such as game-viewing, photography, and increased tourism) may be as much as U.S.$ 7.5 million per year (Larsen 1987). Investigations in the Zambezi Valley of Zimbabwe have estimated that potential revenues

from wildlife may be U.S.$14 per hectare per year (Norderhaug 1987).

We believe that wildlife is extremely important in most sub-Saharan African countries, not only because of its impacts on the rural economies (see McNeil, this volume), but also as a producer of foreign exchange (Muir-Leresche 1988b). Although it is virtually impossible to determine the future value that wildlife may provide, it is very reasonable to assume that it could be considerably greater than it is at present (Dalal-Clayton 1988, Muir-Leresche 1988a, b).

Conservation Efforts

Given this large and valuable wildlife resource, what steps have nations in this region taken to assure its conservation and what are the current trends in wildlife populations? Almost all sub-Saharan African countries have policies in place to protect various wildlife species. Nigeria is one exception, having no national wildlife laws (Anadu 1988). Most countries have also established protected areas, but the total amount of land involved varies greatly between nations (Table 2). There are approximately 165 national parks in sub-Saharan Africa encompassing about 64.8 million hectares and an additional 130 million hectares of land designated for conservation; this equals 2.6 and 5.4 percent of the total land area, respectively (Table 2; IUCN 1987, Asibey 1988). In addition, the International Union for the Conservation of Nature and Natural Resources (IUCN) is active throughout the region, with 58 members in 26 countries (Stuart and Edwards 1988).

Despite the conservation efforts listed above, many important wildlife populations in sub-Saharan Africa are drastically declining (Huntley 1988, Booth 1989). In some cases,

Table 2. Number and area of national parks in sub-Saharan African countries (from IUCN 1987).

Country	Number of Parks	Park Area (ha)	Total Area (km^2)	Percent
Angola	6	5,466,000	1,246,694	4.38
Benin	2	843,500	112,622	7.49
Botswana	3	3,737,000	574,978	6.50
Burkina Faso	2	390,500	274,200	1.42
Burundi	0	0	27,731	0.00
Cameroon	6	905,900	465,054	1.95
Central African Republic	3	2,980,000	622,996	4.78
Chad	2	414,000	1,270,994	0.33
Comoros	0	0	2,274	0.00
Congo	1	126,600	342,000	0.37
Cote D'Ivoire	7	1,757,000	322,462	5.45
Djibouti	1	?	21,699	--
Equatorial Guinea	0	0	28,051	0.00
Ethiopia	8	1,167,500	1,184,000	0.99
Gabon	1	358,000	267,667	1.34
Gambia	1	627	10,368	0.06
Ghana	5	1,130,258	238,538	4.74
Guinea	1	?	245,855	--
Guinea-Bissau	0	0	36,125	0.00
Kenya	16	2,584,424	582,600	4.44
Lesotho	1	6,805	30,344	0.22
Liberia	2	360,700	111,370	3.24
Madagascar	2	99,740	587,042	0.17
Malawi	6	707,300	94,276	7.50
Mali	1	350,000	1,204,022	0.29
Mauritania	1	1,173,000	1,118,604	1.05
Mauritius	0	0	1,843	0.00
Mozambique	4	1,590,000	784,961	2.03
Namibia	1	2,227,000	824,293	2.70
Niger	1	220,000	1,267,000	0.173
Nigeria	1	534,082	923,769	0.58
Reunion	0	0	2,510	0.00
Rwanda	2	262,000	26,338	9.95
Sao Tome	0	0	964	0.00
Senegal	6	1,009,450	197,160	5.12
Seychelles	2	3,720	444	8.38
Sierra Leone	1	98,000	72,326	1.35
Somalia	0	0	637,539	0.00
South Africa	9	2,971,817	1,225,100	2.43
St. Helena	0	0	122	0.00
Sudan	4	4,481,970	2,505,813	1.79
Swaziland	0	0	17,366	0.00
Tanzania	10	3,751,775	930,700	4.03

Togo	2	362,000	56,500	6.41
Uganda	4	769,800	236,036	3.26
Zaire	8	12,200,000	2,345,236	5.20
Zambia	19	6,359,000	752,617	8.45
Zimbabwe	13	3,375,895	389,361	8.67
TOTAL	165	64,775,363	24,220,564	2.77

the rates of animal losses are such that, if continued, certain species will be extinct before the turn of the century (Cohn 1988). Elephants and rhinoceroses are perhaps the two best documented examples of this unfortunate trend. There are basically two reasons for their marked reductions across most of sub-Saharan Africa. First, they are poached for either their tusks or horns and, secondly, there are increasing conflicts between humans (e.g., developers, farmers, and pastoralists) and wildlife for limited land resources resulting in the loss of critical wildlife habitat. The result can mean economic disaster for the countries involved. For example, in Zimbabwe, the poaching of these two animals over the last 15 years has robbed the economy of wildlife products worth about U.S.$ 200 million (Larsen 1987). The poaching of elephants in Zambia's South Luangwa National Park represents an annual loss of U.S.$16-323 million (Dalal-Clayton 1988).

African elephant populations have decreased approximately 28 percent between 1981 and 1987 (Table 3), and there is no reason to believe that the rate of decline will lessen in the future (Booth 1989). Even elephants in Africa's famous wildlife reserves are not safe. For example, in recent years Kenya has lost about 70 percent of the elephants living within its park boundaries (Booth 1989); an average of nine elephants are poached daily from Zambia's South Luangwa National Park (Kaweche et al. 1987).

Rhinoceros populations have decreased even more dramatically than elephant populations during the past seven years (Table 4). Overall, there has been a 55 percent reduction in rhinoceros populations between 1980 and 1987 with black and northern white rhinoceroses suffering the most severe declines. Many populations of both the black and

TABLE 3. Trends in sub-Saharan Africa's elephant populations between 1981 and 1987 (from Du Toit and Cumming 1987).

REGION	1981	1987	% CHANGE
EASTERN	300,000[1]	190,720	-36.4
SOUTHERN	311,000	181,600	-41.6
WESTERN	17,610	16,290	- 7.5
CENTRAL	436,200	375,800	-13.8
TOTAL	1,064,810	764,410	-28.2

[1]Estimate calculated from estimated population reductions (by authors).

Table 4. Trends in black and white rhinoceros poulations between 1980 and 1987 in certain Sub-Saharan African countries

BLACK RHINO	Numbers			% Change	
COUNTRY	1980[1]	1984[1]	1987[2]	80-84	80-87
CAR	3000	170	10	-94.33	-99.67
Sudan	300	100	3	-66.67	-99.00
Zambia	2750	1650	110	-40.00	-96.00
Mozambique	250	130	10	-48.00	-96.00
Tanzania	3795	3130	270	-17.52	-92.89
Botswana	30	10	5	-66.67	-83.33
Cameroon	110	110	30	0.00	-72.73
Kenya	1500	550	520	-63.33	-65.33
Rwanda	30	15	15	-50.00	-50.00
Malawi	40	20	25	-50.00	-37.50
S. Africa	630	640	580	1.59	- 7.94
Zimbabwe	1400	1680	1760	20.00	25.71
TOTAL	13835	8205	3338	-40.69	-75.87
SOUTHERN WHITE RHINO					
COUNTRY	1980[1]	1984[1]	1987	80-84	80-87
Zimbabwe	180	200	208	11.11	15.56
Zambia	5	10	6	100.00	20.00
S. Africa	2500	3330	4062	33.20	62.48
Kenya	25	30	47	20.00	88.00
Namibia	150	70	63	-53.33	-58.00
Mozambique	30	20	0	-33.33	-100.00
Botswana	70	200	125	185.71	78.57
Swaziland	60	60	80	0.00	33.33
TOTAL	3020	3920	4591	29.80	52.02
NORTHERN WHITE RHINO					
COUNTRY	1980[1]	1984[1]	1987[2]	80-84	80-87
CAR	20	1	0	-95.00	-100.00
Sudan	400	10	0	-97.50	-100.00
Uganda	1	1	0	0.00	-100.00
Zaire	400	15	18	-96.25	-95.50
TOTAL	821	28	18	-96.59	-97.81

[1]from Western and Vigne 1980

[2]from Du Toit and Cumming 1987

northern white rhinoceroses have become so small that only large scale intervention programs may be able to save them from extinction (Western and Vigne 1985). In contrast, efforts to save the southern white rhinoceros have shown some limited success (Table 4).

Almost all of the decline of this animal is due to poaching for its horn. For example, between 1979 and 1982 at least 72 percent of all rhinoceros mortality in Zambia's South Luangwa National Park was attributable to poaching (Williams 1985). In most cases, rhinoceros populations are so small that there is little conflict with humans as far as agricultural lands are concerned. This is not the case for elephants, however.

The potential for conflict between humans and wildlife over land use has increased in recent decades following the intervention of modern governments in pastoralist lifestyles (Lindsay 1987). In addition, commercial farming is also having significant effects at the margins of some protected areas, such as adjacent to the Kasunga National Park in Malawi (Dalal-Clayton 1989). Strong pressure for more agriculture land to feed rapidly growing human populations have also promoted the destruction of extensive forests in countries such as Kenya (Allaway and Cox 1989). The net result has been that sub-Saharan Africa has experienced a 65 percent loss of its original wildlife habitat (Table 5).

This loss of wildland is especially critical for migratory species that range great distances in response to alternating wet and dry seasons (Allaway 1979, 1989). Nairobi National Park in Kenya is an example of a protected area that is too small to support its

Table 5. Wildlife habitat loss in Sub-Saharan African countries in 1986 (from MacKinnon and MacKinnon 1986).

Country	Original Wildlife Habitat (km^2)	Amount Remaining (km^2)	% Change
Angola	1,246,700	760,847	39
Benin	115,800	46,320	60
Botswana	585,400	257,576	56
Burkina Fasco	273,800	54,760	80
Burundi	25,700	3,598	86
Cameroon	469,400	192,454	59
Central African Republic	623,000	274,120	56
Chad	720,800	172,992	76
Congo	342,000	174,420	49
Cote d'Ivoire	318,000	66,780	79
Djibouti	21,800	11,118	49
Equatorial Guinea	26,000	12,740	51
Ethiopia	1,101,003	30,300	70
Gabon	267,000	173,550	35
Gambia	11,300	1,243	89
Ghana	230,000	46,000	80
Guinea	245,900	73,770	70
Guinea Bissau	36,100	7,942	78
Kenya	569,500	296,140	48
Lesotho	30,400	9,728	68
Liberia	111,400	14,482	87
Madagascar	595,211	148,803	75
Malawi	94,100	40,463	57
Mali	754,100	158,361	79
Mauritania	388,600	73,834	81
Mozambique	783,203	36,776	57
Namibia	823,200	444,528	46
Niger	566,000	127,880	77
Nigeria	919,800	229,950	75
Rwanda	25,100	3,263	87
Senegal	196,200	35,316	82
Sierra Leone	71,700	10,755	85
Somalia	637,700	376,243	41
South Africa	1,236,500	531,695	57
Sudan	1,703,000	510,900	70
Swaziland	17,400	7,656	56
Tanzania	886,200	505,134	43
Togo	56,000	19,040	66
Uganda	193,700	42,614	78
Zaire	2,335,900	1,051,155	55

Zambia	752,600	534,346	29
Zimbabwe	390,200	171,688	46
Total	20,797,441	8,340,920	65

migratory animals (Allaway 1989). Also, since elephants seldom stay within the confines of protected areas and human populations have increased greatly around preserves, the potential for conflicts between elephants and humans is increasing (Allaway 1979).

The decline of African elephant and rhinoceros populations, and probably most endemic wildlife, appears to be due to ineffective management practices and enforcement policies and not necessarily the lack of adequate habitats or policies for conservation (Soule' et al. 1979). This situation likely stems from the "benign neglect" of wildlife resources by African governments resulting in the inadequate funding of ministries responsible for natural resources (Pullan 1983; see next section). Hence, there is constantly the lack of staff and operating funds needed to develop and maintain effective management programs (Juma 1988). In the face of growing populations and few economic alternatives, the unfortunate result will be continued large scale poaching and encroachment into national parks and protected areas (Booth 1989). In order to correct this situation, more funds must be made available and/or the effectiveness of managing and protecting the reserves and their wildlife populations must be enhanced. The estimated annual cost for managing and protecting a conservation area in Africa in 1984 was U.S.$200/km2, while the density of staff required for effective law enforcement was estimated to vary from 20 to 50 km2 per staff member depending on the intensity of pressure from poachers (Bell and Clarke 1984). In support of these estimates, Leader-Williams and Albon (1988) have calculated (using 1980 data) that in Zambia U.S.$215 and U.S.$230 should have been spent per kilometer to prevent declines in

elephant and rhinoceros populations, respectively. A comparison of this general range of figures with data from 1984 and 1987 shows that few countries spend at or near the levels needed, and that staff densities are grossly too low to guarantee adequate protection (Table 6; Booth 1989). Although there is a danger in equating increased policing with better management, the rate of decline of elephant and rhinoceros populations in countries supporting higher staff densities (Table 7; Leader-Williams and Albon 1988).

Potential Impacts of Structural Adjustment Programs

Structural adjustment programs potentially can have both direct and indirect negative impacts on wildlife populations. The direct impacts are most closely tied to recurrent costs of managing and protecting wildlife populations. Most, if not all, structural adjustment programs call for expenditure reductions. This is most often translated directly into a reduction in the civil servant force and/or reduced or fixed spending for salaries. In such a reduction, wildlife and natural resource ministries are usually the first to face budgetary cuts (Muir-Leresche 1989). At the same time, the local currency is usually devalued leading to higher costs for necessary imports, such as gasoline and spare parts for vehicles and equipment.

The net result of these direct impacts is that the cost of effective management and protection of wildlife resources increases, mostly due to the increased cost of travel and spare parts for equipment. This occurs concurrently with reductions in staff and the overall budget dedicated to wildlife and park protection. Such impacts can only make a bad situation worse.

Table 6. Recurrent cost expenditures and densities of staff for wildlife management and protection in selected sub-Saharan African countries.

COUNTRY	1984 Expenditures[1] U.S.$/km^2	km^2/staff 1984[1]	km^2/staff 1987[2]	% CHANGE
BOTSWANA	10	577.5	--	--
CENTRAL AFRICAN REPUBLIC	8	329.5	680	106
ETHIOPIA	57	77.2	--	--
GHANA	--	8.7	--	--
KENYA	188	20	--	--
MALAWI	45	45.8	57	24
MOZAMBIQUE	19	100.4	1133	1028
NIGER	--	292.4	3400	1063
RWANDA	--	21.7	--	--
SOMALIA	50	14.7	--	--
SOUTH AFRICA	206	41	4	-90
TANZANIA	20	273.2	109	-60
UGANDA	357	7.2	--	--
ZAMBIA	11	299.7	--	--
ZIMBABWE	277	21.9	34	55

[1]from Bell and Clarke 1984
[2]from Du Toit and Cumming 1987

Table 7. Black rhinoceros and elephant population declines (% change) compared to staff densities in selected sub-Saharan African countries.

COUNTRY	BLACK RHINO[1] % 80-87	ELEPHANT[2] % 81-87	ha/staff[3]
Mozambique	-96.00	-66.06	1133
Central African Republic	-99.67	-38.71	680
Botswana	-83.33	155	577
Zambia	-96.00	-74.38	299
Tanzania	-92.89	--	109
Sudan	-99.00	--	85
Malawi	-37.50	-46.67	57
Cameroon	-72.73	324	54
Zimbabwe	25.71	-12.24	34
Rwanda	-50.00	--	21
Kenya	-65.33	--	20
South Africa	-7.94	2.5	4

[1]from Table 4

[2]from Du Toit and Cumming 1987

[3]from Table 6

It must be emphasized that the lack of funding for wildlife management and protection has historically plagued sub-Saharan Africa and current structural adjustment programs may only be exacerbating a long term problem. For example, the Kenyan government has long under-funded its natural resource management agencies as wildlife has not been thought to be a renewable and valuable resource and was, therefore, was not able to successfully compete with internal social needs for operating revenues (Allaway 1989). The result has been that these agencies have not received enough funding, which has caused gradual deterioration in their infrastructures and capabilities to adequately manage their wildlife resources. It appears that there is a need to develop strong arguments in favor of building wildlife resources based on their economic benefits and income producing capabilities (Allaway 1989, Muir-Leresche, K. 1988a,b, 1989).

The indirect impacts of structural adjustment programs are manifested through their direct effects on other sectors of the economy, which in turn influence wildlife resources. In terms of sub-Saharan Africa, the most common structural adjustment programs are those promoting increases in export-oriented agriculture, reductions in governmental spending, and devaluations of local currency (George 1988). Each one of these actions potentially has indirect impacts on wildlife in the countries involved. The expansion of export-oriented agriculture and the reduction in government spending, most often achieved by reducing the number of civil servants, potentially increase demands for land that could increase encroachment into protected areas.

As more land is brought into production for export-oriented agricultural products, additional land must be cultivated to provide food for local inhabitants (i.e., or imports and/or production capacities must be increased). In fact, devaluation programs promote all exports and release agriculture from preexisting urban biases by eliminating price controls and government marketing monopolies, thereby stimulating agriculture in general, and export products in particular. Subsistence farmers are often pushed onto increasingly marginal lands. In addition, freeing food from price controls raises returns to farming and, hence more land is farmed. At the same time, since there is a delay in farmers' responses to produce more, people may be forced back to subsistence farming in the interim.

At one level, however, increased pressure from agricultural development is inevitable as is the resulting decreases in lands available for wildlife (Allaway and Cox 1989). Such pressures come from the increasing food needs of expanding human populations and would occur in the absence of structural adjustment programs, only at a slower rate. This situation makes it all the more important to fund the management and protection of wildlife resources wherever possible and/or modify current structural adjustment program policies.

The situation can be exacerbated by mandated layoffs from concurrent IMF (International Monetary Fund) programs. For example, in accordance with IMF prescriptions, 46,000 teachers were laid off in Zaire and in Tanzania approximately 50,000 government employees were laid off in 1986 (George 1988). Such a retrenchment in

numbers of government employees causes a general increase in unemployment that in some cases may give rise to an increase in the number of subsistence farmers (Cook 1988). One example of this may be the encroachment into the Kibale Forest Reserve in Uganda. Between 1971 and 1982, 97 km2, or 17 percent of the reserve, had been lost to agricultural encroachment including 42 km2 of forest habitat(Van Orsdol 1986).

Unfortunately, no data appear to exist linking such encroachment problems directly to retrenchment programs. However, this subject deserves future attention as the problem is severe and growing. For example, of all the sub-Saharan national parks established since 1925, three were considered as being threatened by large scale habitat loss from encroachment in 1984 (IUCN 1984). Not only is habitat loss now known to be more prevalent (Table 4), McNeil (1988) has recently shown that the encroachment problem is much more serious and complex than previously expected (Table 8).

The devaluation of local currency is often implicated as a general negative impact of structural adjustment programs if a country must import goods and services. However, it is very difficult to find direct evidence linking currency devaluation and negative impacts on wildlife (Muir-Leresche 1988a). Devaluations of the local currencies might lead to an increase in the use of ivory for trade or barter and as a hedge against further devaluations. This might increase the amount of poaching, although there are no data currently supporting this hypothesis (Muir-Leresche 1988a). Devaluations do increase the cost of many imported goods within a country and often give rise to increased inflation (George 1988). Since inflation causes the cost of goods to rise, the number of poor likely will

Table 8. Types of disturbance-causing human activities and structures in sample parks in sub-Sahara Africa (from McNeil 1988).

Type of activity	Number of mentions in sample (n=264) #	% of parks
residency	72	27
hunting and trapping	168	64
gathering	9	3
fishing	42	16
agriculture and aquaculture	50	19
livestock ranching and grazing	93	35
forest damage	104	39
water pollution	10	4
introduced exotics	13	5
mining	12	5
other physical, biological, esthetic damage	57	22
civil disturbances	12	5
recreation and tourism	16	6
structures: transp. and communication	33	13
structures: miscellaneous	31	12
scientific research facilities	43	16
visitor service facilities	217	82
Total mentions	982	--

increase if there are not off-setting increases in wages. This should increase the number of people who depend on agriculture to survive, possibly increasing pressures on land resources. Unfortunately, there appear to be no definitive studies available on the extent of this pressure, but it could be a major negative impact as far as wildlife resources are concerned (Muir-Leresche 1988a).

Structural adjustment programs appear to have possible negative impacts on the conservation and protection of wildlife in sub-Saharan Africa, which may be at least partly responsible for the rapid decline in certain "key" species due to their over-exploitation. A major question that needs to be addressed is to what extent the declining populations of "key" wildlife species (e.g., elephants, rhinoceroses, gorillas, etc) would negatively impact tourism and the generation of foreign exchange? This is a complex question that can not yet be answered; however, a number of initial hypotheses are possible. For example, if all tourists visited Africa solely to see wildlife and they stopped coming when "key" species were confined to zoos and heavily controlled reserves, the financial impact would be tremendous (see Table 1). Obviously, this situation is very hypothetical and unlikely, but it does represent a worse-case scenario. Furthermore, it illustrates that such indirect impacts of structural adjustment programs warrant further investigation as Africa's wildlife resources are certainly closely tied to its tourism trade (Henry 1976).

Mitigation

If a given structural adjustment program is thought to have negative impacts on wildlife are there mechanisms that might help mitigate these impacts? There appear to

be two main ways of lessening the impacts of particular structural adjustment programs. First, either increase the budget for recurrent expenditures on wildlife management and protection programs or increase their operating efficiencies. The second mechanism is to stimulate and facilitate the utilization of wildlife in order to generate foreign exchange.

The first mechanism involves increasing the budget or at least exempting the wildlife budget from the usual salary ceilings and budget cuts associated with structural adjustment programs. Another way of increasing these funds might be a type of "debt for nature swap" where a portion of the national debt is exchanged for funds to cover recurrent expenditures. At least one recent swap did involve consideration of some long term costs (see Hawkins and Kyle, this volume). The net result will be more staff and financial resources for wildlife management purposes.

However, continued losses of important wildlife species even in countries with relatively large staff densities (e.g., Zimbabwe, Rwanda, and Kenya) show that policing alone can not solve the poaching problem as the potential profits from poaching are simply too great (Allaway 1989). An additional need is to develop a sense of "ownership" in local people with respect to the wildlife resource.

The recurrent costs for managing a particular protected area can be decreased by involving the local inhabitants in the management and protection of the wildlife resources. The use of local inhabitants is especially useful in areas where conflicts exist between people and wildlife and where migratory animal populations are involved (Allaway 1989). In several areas where local inhabitants have been actively involved and, more importantly,

have directly benefitted from such involvement, there has been increased protection of wildlife and less encroachment. This would decrease the total cost of managing and protecting the wildlife. For example, some of the revenue generated by Amboseli National Park in Kenya goes to the local inhabitants, which has caused them to have a more positive view of the Park resulting in an increase in the wildlife species present (Western 1984, Lindsay 1987).

A major problem with this general approach, however, is assuring that the benefits really get to the local people and are not lost to corruption, incompetence, or intermediaries. When revenues derived from wildlife resources (e.g., hunting licence fees and safari earnings) are externalized to central governments or businesses outside the local area, very little direct benefit goes to local communities; the result has been an increase in highly organized poaching and the loss of revenues to urban areas and other countries (Dalal-Clayton 1988).

The other possible mechanism for reducing the impacts of structural adjustment programs on wildlife is to facilitate its sustainable utilization. Although this approach is intensely debated, some authorities believe that if wildlife is to survive in Africa it must pay for itself (Myers 1981, Abel and Blackie 1986, Muir-Leresche 1988b). In areas of low rainfall (e.g., 70 percent of sub-Saharan Africa receives less than 750 mm of rainfall annually) endemic wildlife species are able to compete successfully with alternate forms of land use (Child 1988). Compared to traditional livestock, wildlife can produce a greater number of products that can be used in a greater number of ways. Such diversification

can lead to less reliance on market price fluctuations of a single commodity. For example, in some parts of Kenya ranchers are beginning to reduce livestock numbers and increase wildlife populations, because of the greater financial return from wildlife (Olindo 1988). In the Luangwa Valley of Zambia, a project in conservation outside of reserves has shown that wildlife can pay for itself (Dalal-Clayton, D. B. 1988, Leader-Williams and Albon 1988, Lewis et al. 1988). This project not only benefitted local inhabitants, but also resulted in a 90 percent decrease in poaching in the area. A similar program aimed at managing wildlife on a sustainable basis is also in place in Zimbabwe (Martin 1984).

As shown earlier in this paper, wildlife already account for a significant proportion of the foreign exchange earnings of many African countries. If the sustainable utilization of wildlife can be enhanced, a concurrent increase in foreign exchange earnings might be realized. Instead of land being converted to produce export crops, it could be conserved for the raising of wildlife, which if managed in a sustainable fashion would have a positive impact on wildlife populations. Although there are several pitfalls to this approach and each specific case needs to be analyzed separately (Child and Child 1988), this may provide the best mechanism for mitigating the negative impacts of structural adjustment programs and ensuring the long term conservation of African wildlife.

Conclusions

Wildlife throughout sub-Saharan Africa is a valuable resource at both the local and national levels. In some countries, the foreign exchange earned directly and/or indirectly

from wildlife is significant and the potential for growth across the region is great. Unfortunately, wildlife populations are declining at a very rapid rate. If this continues, countries in sub-Saharan Africa will be faced with the loss of a very important economic resource. Structural adjustment programs appear to have potentially negative impacts on wildlife resources throughout sub-Saharan Africa. The major impacts are those affecting recurrent management costs for operating natural resource ministries, and those increasing land use pressures on reserves. However, the type and extent of these impacts vary with the country and the structural adjustment program policies in place.

We have outlined two possible mechanisms that might be used to mitigate the effects of these programs. The most promising of these would be to increase the utilization of wildlife to generate foreign exchange. This will probably need to be accomplished through intensification of management practices as increasing the amount of land available to wildlife will be very difficult given Africa's growing population and demand for arable land (Allaway 1989).

In closing, it must be emphasized that this review has concentrated on potentially negative aspects of structural adjustments programs on wildlife resources. However, if these policies remove direct and/or indirect subsidies and in particular mandate more realistic exchange rates, their impacts may actually be positive (Muir-Leresche 1989). In addition, currency devaluations can increase tourism if a positive exchange rate results (Allaway 1989).

The analysis of the possible impacts of structural adjustment programs on wildlife in sub-Saharan Africa reported in this paper suffers from the lack of definitive data sets indicating direct cause-and-effect linkages between the two. Based on a comprehensive search of the literature and discussions with and input from knowledgeable individuals in the United States, England, Zimbabwe, and Kenya (see Acknowledgments below), such data are likely not yet available. Hence, the linkages drawn between structural adjustment programs and wildlife resources and the suggestions offered for mitigating potential conflicts between the two must be considered preliminary. However, we believe that there is cause for concern and that this issue warrants further investigation. Such work will require careful research in sub-Saharan Africa if more complete analyses are to result.

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Structural Adjustment and Wildlife Resources

by

Richard J. McNeil[1]

Introduction

"Structural adjustment" refers to a package of economic policies, often dictated by some outside force such as the World Bank or the International Monetary Fund, which attempt to help a debtor nation to cope with external economic shocks and inefficient internal economic arrangements. Adjustment programs tend to include, for example, reduction of government expenditures, reduction of subsidies, and encouragement of exports. Side effects tend to include temporary recession, reduction of government work forces and increase in unemployment, and increased cost for imported goods.

In this paper, in addition to discussing effects of structural adjustment programs on wildlife and parks, I will also make some preliminary statements to clarify the meanings of "environment" and "natural resources" and will discuss briefly some values of wildlife. I will offer six concepts which may assist in designing improved macroeconomic policies, and some general suggestions for wildlife and parks management which should coincide with improved economic policy.

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Resources and Environment

This volume addresses a very narrow part of the entire range of environmental values. Among natural resources are included mainly soil, water, and the biological resources of forests, fish, and terrestrial wildlife; plant biomass, other than wood, is given nodding attention, and genetic information -- biological diversity -- is considered. But we omit almost all discussion of minerals, forms of energy other than biomass, grazing lands (and lands and land use generally) as well as scenic beauty, most information resources, most recreational resources.

Also, we are ignoring almost completely the vital processes conducted by nature, what some call "ecosystem functions". Since these processes represent work done "for free" they are among the non-market values often given too little attention. Among the processes, for example are: waste removal, disposal, and breakdown into nutrients; water storage and flow management; storage of energy, proteins, cellulose, etc. in living and non-living systems; homeostasis -- the stabilizing influences -- e.g. partial control of farm pest insects by wild organisms; weather and climate control; specialized functions such as pollination of crops.

Structural adjustment programs might consider more fully these non-economic values. This is difficult and complex. The ecologists' rule-of-thumb would be that disturbances of natural or quasi-natural conditions are likely to reduce the functioning of natural systems and cause losses in value. Replacement systems and transitional periods will tend to be less productive as measured by the output of natural, ecosystem functions.

Structural Adjustment Programs

Some Apparent Inconsistencies in Proposals

I am ready to accept that some national economies need structural adjustments to make them more efficient, effective, sustainable, and fair. (I am not so ready to accept the need for imposition of adjustments from outside.) And, not being an economist, I am perhaps, more puzzled than some by certain proposals for adjustment activities. Much of this is more eloquently stated by my colleagues, Drs. Steven Kyle and Aercio Cunha (this volume).

For example, it is argued that structural adjustment is needed, among other reasons, because economies have been subjected to outside economic shocks such as the explosive increases of oil prices during the 1970s. And yet we now argue that these same economies should become more outward-oriented, thus maintaining or increasing dependence on others.

We ask African countries to produce traded products which we seem to forget will be in competition with each other. We assume that those countries can also compete with aggressive, sophisticated, powerful, and economically developed countries such as the U.S., which also "needs" a trade surplus and which subsidizes exports of some of the products we encourage Africans to grow.

We look to Africa's supposed comparative advantage in agriculture, which we say is founded on availability of land and cheap labor. But the availability of land is perhaps

an illusion. Africa has little unoccupied land and vast areas of poor soils are already being farmed. I don't understand the logic of cheap labor being an advantage, since my impression is that we hope for economic growth and improved lives; this in turn seems to require higher wages and therefore higher labor costs.

Impacts of Structural Adjustment Programs

As suggested earlier, studies are unavailable which would conclusively demonstrate the costs in the natural resources sector of structural adjustment programs in Africa. I note here only three general kinds of effects which we should expect related to wildlife, parks, and tourism resources.

First, the indirect effects of recession, inflation, transitions in various sectors of the economy, and the reduction of government employees (in numbers or in their wages) tend to increase unemployment and poverty among some sectors of the population. Poorer people will turn (or return) to subsistence farming, hunting, fishing, fuelwood gathering, and related activities which tend to put undue pressures on natural resources. The results are seen in farming on marginal land, using farming techniques (such as reducing fallow periods) which "mine the soil", overharvest of fuelwood, fish, and terrestrial wildlife so that not only is the next year's crop reduced, but sustainability and the existence of plant and animal populations are threatened.

Second, expenditure reductions which call for reduced civil service forces, devaluation of currency which leads to higher costs of imports, and privatization which places open

access or commons resources in the hands of commercial interests, produce a net effect of reduced quality of resource management. Reduced staff and salaries for parks and resources, and increased costs of gasoline, spare parts, radios, etc. inevitably are reflected in less effective management and protection of natural resources. Privatization may lead to economically rational behaviors which, however, have the effect of overharvest and nonsustainability.

Third, devaluation of currency will tend to increase pressure to export traded goods. Increased tourism and increased export sales of plant and animal products can be a positive force environmentally and socially, but need to be conducted with care and sensitivity.

The advice which follows from these three types of impacts is that in structural adjustment programs it would be well also to consider:

1) complementary programs to support as necessary the poorest and the newly poor members of society,
2) support for recurrent costs for protection and management of publicly held natural resources, and
3) need for expert attention to the effects related to increased tourism and export of wildlife products.

Wildlife Values

Types of Values

Wildlife is generally an undervalued resource, and, like the "minor forest products" lumped together by foresters, often is revealed to have impressive values when considered carefully. In addition, production costs for wildlife products and services are often much lower than for domestic equivalents, since nature does so much work for us "for free". A useful way of examining wildlife values is to categorize them as follows:

1. non-economic (ecological functions, cultural values, contained genetic information, etc.)
2. economic
    a. goods
        1) subsistence
        2) traded
    b. services, especially:
        1) tourism
        2) sport hunting

Non-economic values of wildlife include their participation in ecological functions (such as production, storage, and transport of protein; breakdown and conversion of "waste" products), cultural values (such as national symbols, tribal or family totems, indicators of conditions and carriers of information, dwelling places for spirits or ancestors); contained genetic information; esthetic values, and others.

Non-economic values of wildlife are notoriously difficult to determine. What is the value of a bird whose appearance signals the appropriate time to plant a certain crop? How can we put a price on a family totem? How do we measure the shadow price of predatory insects in a swidden farmer's fields?

For now it may be best not to attempt to value the priceless, not to warp our calculations by including figures derived by dubious methods, but simply to continually remind ourselves that economic measures produce only partial values for wildlife.

Economic values of wildlife include both goods and services. Goods may be either harvested for subsistence use, individually or within a family or community, or they may enter commerce, either domestically or internationally. Products involved are extremely varied, and include meat, eggs, honey, skins and hides, furs, feathers, ivory, horn, and living animals.

"Bushmeat" includes not only the meat of mammals and secondarily of birds, but also of frogs, snakes, turtles, and lizards, and bird and reptile eggs, snails, and edible insects, which in Africa include large amounts of several species of beetles, termites, locusts and other insects.

In Ghana, 80% of rural people depend on bushmeat for a major part of the animal protein they eat (Manu 1988). In rural Nigeria, bushmeat represents 10-85% of all meat consumed (Federal Department of Forestry 1988) and in western and southern Ethiopia 5-10% of all food consumed (Ethiopian Wildlife Conservation Organization 1988).

Subsistence uses of wildlife include an amazing array of products, from skins and hides for clothing, housing, shields, drumheads, animal harness, etc., to decorative furs, feathers and ivory, to animal tails for fly whisks and elephant hairs for bracelets. Bones are used in dice games and sinew is used for sewing. Antelope horns make tobacco containers, carved ivory stoppers close them, and leather slings allow easy carrying. In short, the lives of many people are intimately tied to the wildlife around them, and economic changes which affect sustainable harvests will have important effects on African people.

Products entering commerce are nearly as varied; in terms of economic value meat, skins and hides, ivory, rhinoceros horn, and live animals are especially important. Ivory and rhino horn are unusual in that a large part of the trade is illegal. African ivory is said to represent a $500 million per year business (Knobelsdorff 1988). Rhinoceros horn is sold at very high prices, for example $3,000 for one horn, or $5,000 per pound for powdered horn in another case (Cohn 1988). The extra values from ivory, tail hair, leather, and the feet, have made some otherwise marginal elephant harvesting schemes into highly profitable enterprises. Live animals enter domestic and international markets for research, zoo specimens, pets, and for restocking parks, farms, and ranches. Senegal now exports some 10 million live birds each year; in Tanzania, it is estimated that export of live birds could be further developed into a $17 million per year industry (Thomsen 1988). Ethiopia exports 12,000 monkeys and baboons each year (Ethiopian Wildlife Conservation Organization 1988).

Among the many services provided by wildlife we will consider here only tourism and sport hunting. Africa has a genuine comparative advantage in its resource-based tourism, and in certain trophy hunting opportunities which are unavailable elsewhere. Resource-based tourism in Africa is mostly park-dependent, mostly wildlife-dependent, but also includes interests in climbing, hiking, canoeing and rafting, sport fishing, enjoyment of spectacular landscapes, and use of beaches and water areas. The value of tourism in Africa varies from countries where only a few million dollars per year are spent (Anon. 1988) to Kenya with a value in 1985 of $350 million and rapidly increasing (Olindo 1988).

Sport hunting (including "hunting safaris" and "trophy hunting") is a large source of income to some African governments and private individuals. Hunting license fees from overseas hunters produce $2 million per year in Botswana, $6 million per year in Zimbabwe (Parker 1984). In Zimbabwe, a rancher with buffalo on his land can receive about $4 per hectare per year for hunting privileges (vs about $1 without buffalo) (Martin 1984). (Cape buffalo were, along with elephant, rhinoceros, lion, and leopard, among the "big five" classical targets of trophy hunters in Africa.) On one ranch in Zimbabwe, over $300,000 were generated in 1986 from safari hunting (Style 1988).

Laws controlling hunting and ownership of wildlife might be considered as complementary targets of structural adjustment programs. Kenya has had a complete ban on hunting since 1977 and has foregone much of the subsistence value and commercial (including foreign exchange) value which could have been derived from trophy hunting and other sport hunting. In Zimbabwe, it was only in 1975 that laws gave ownership of wildlife

to the landowner, thus stimulating commercial use of the resource (Martin 1984). In this case, privatization was accompanied by other controls and seems to be working well. Also in Zimbabwe, crocodile farming and sales required amendments to an international treaty, Convention on the International Trade in Endangered Species (CITES), before the skins could enter commerce (Martin 1984).

Game Ranching

The commercial harvest of African wildlife is often said to be an underdeveloped possibility. Elephant and hippopotamus cropping was, by economic, ecological, and social measures, a notable success in Uganda in the 1960s (Parker 1984). Elephant cropping schemes were tried in Kenya and Tanzania in 1966, 1968, and 1969 with some success (Parker 1984). Today Zimbabwe, South Africa, and Namibia have successful, ongoing harvests (Parker 1984). Much of this occurs on public lands. In South Africa, many species of antelope are harvested from private land. Botswana Game Industries, Ltd. has taught hunters how to care for skins and hides from the animals they kill and now 5,000 hunters sell tens of thousands of skins in good condition there each year (Parker 1984). Zambia saw early failed cropping experiments under FAO sponsorship (Parker 1984) but today in the Luangwa Valley commercial hippo harvests and auctions for sport hunting permits bring in considerable income, much of which is captured locally (Lewis, Kaweche and Mwenya 1988; McNeely 1988).

Structural adjustment will tend to encourage these activities since the export value of products and services will tend to increase.

We are not very good yet at the complexities of harvesting wildlife from multispecies systems (especially perhaps from mixed systems containing both cattle and wildlife). Practical research would be productive in this area and might be encouraged as an activity complementary to structural adjustment programs.

Ecological Concepts to Aid in Designing Macroeconomic Policies

Economists ought to use economic criteria in planning structural adjustments and macroeconomic policy generally. But often it may be possible to choose between courses of action with nearly equal economic results but quite different environmental effects. Six concepts which may be useful in making those choices are: holism, sustainability, sufficiency, equitability, diversity, and elegance.

Holism

Holism simply means concerning ourselves with the whole picture. We need to scope projects, we need to draw boundaries around our studies, but we also need to be aware of the artificialities of the borders we create. National borders in Africa, often imposed by colonial governments, seldom define more-or-less natural ecosystems and often do not correspond to tribal or other cultural boundaries. And birds migrate, zebras and wildebeests migrate, rivers flow, locusts fly, air masses move, and people emigrate.

I am arguing for internalizing the externalities, or, at minimum, increasing awareness of them. One aid is to get a large variety of perspectives. Our research, planning, and policy decisions would certainly be improved by increased input from Africans, from political scientists, ecologists, anthropologists and sociologists, from historians and from artists.

Sustainability

To an ecologist, sustainability means maintenance of natural processes for very long time periods -- essentially forever. To the Iroquois of upstate New York the stated target is "the seventh generation." In many fields of work, for example among economists, elected officials, and people in various news media, such a long-term perspective is very difficult to accommodate.

Some ecologists worry that they are perhaps being co-opted by people with commercial interests when the term "sustainable development" is used. To some it seems to mean or to offer the hope of perpetual economic growth. The Brundtland Commission report (World Commission on Environment and Development 1987) in several passages equates "sustainable development" with "sustained economic growth."

Both "growth" and "development" need to be used and defined carefully. "Development," for example, might well be defined for our purposes as "creating conditions for the fullest possible expression of human and natural potential." And that may be incompatible with sustained economic growth.

Sufficiency

Sustainability is useless without sufficiency. In Africa today, the two concepts may present an irreconcilable conflict. The huge inputs of resources needed to accommodate present needs may require non-sustainable behaviors at least until population growth can be better managed and agriculture and other productive systems become more sophisticated.

Sufficiency, in nature, means that there is an appropriate balance between numbers of organisms and the resources necessary to maintain them. For human beings, sufficiency means that (almost) all needs of (almost) all people are met.

Human needs are much broader than customarily defined. In earlier development programs which took a "basic needs" approach, food, shelter, clean water, and sometimes health care were taken as human needs. These, in fact, represent only part of what Maslow (1943) defined as human needs. He named physiological, safety, esteem, love, and self-actualization needs as basic to every person. In addition, I believe that it can be demonstrated that we all have many other fundamental needs, such as: to know and understand, to celebrate, to be a member of a group, to belong to a community, to have choices, to encounter the sacred, to experience beauty. Most development programs do not consider such an extended idea of basic needs, and indeed, generally deal only with Maslow's physiological needs. Many development programs (and perhaps some structural adjustment programs), in ignoring these needs, may actually reduce the possibility of those needs being met, for example whenever tribal cultures are damaged or communities are

unduly disrupted or endemic information is destroyed.

"Sufficiency" also carries another implied meaning, and that is that it is possible not only to have or use too few resources but also too many. That brings us to a fourth concept, equitability.

Equitability

Equitability means fairness. It follows from sufficiency and is otherwise more an ethical than an ecological concept. It includes not only reasonable equality in distribution of resources or access to resources but also participation, a chance to influence decision-making processes, a reasonable sharing of power between individuals, between regions, between nation-states.

Incidentally, the evidence is now very strong that an equitable distribution of wealth and income is a remarkably powerful influence on reducing human birth rates.

Diversity

Diversity is an absolutely central concept in ecology. Just as we propose to reduce the effects of external shocks on an economy by diversification, in nature diversity similarly protects systems from outside perturbations.

Nature is better characterized by resiliency than by stability. Sahelian droughts should be expected again, as should Indian Ocean typhoons and Central American earthquakes. Nature is not stable, nor are human political systems or economic systems. Large-scale monoculture agricultural systems are inherently unstable, and need large inputs, for example of pesticides, to maintain them. Attempts to design stable systems may result

in failure, repressive regimes, or very high maintenance costs. Diversity, which tends to lend resilience, is usually a less expensive and more productive option in the long run.

Elegance

Elegance, or grace, is seen throughout nature. Nature provides few ugly landscapes, or plants, or animal species. (Well, maybe wildebeests.) A thousand dead antelope piled against a veterinary fence in Botswana is an inelegant solution to the problem of guaranteeing disease-free beef to European markets.

Translating Concepts into Action on the Ground

Besides the structural-adjustment-related proposals already mentioned, the following general suggestions stem from the preceding discussion:

1. Help people to stay in rural areas, to continue traditional uses of resources, to convert subsistence harvests (at sustainable levels) and subsistence techniques to commercial purposes.

2. Keep, and where possible enlarge, parks and reserves; continue to dedicate them to their natural process values, their scenic values, their biological diversity. Many African parks are "leftover" areas thought by colonial governors to be essentially valueless. Kenya's arid Tsavo National Park and Botswana's marshy Okavango swamp are typical of areas where highest use is probably their dedication to nature.

3. Consider harvesting resources from national parks and equivalent reserves. Subsistence hunting, safari- and trophy-hunting, commercial harvest of meat, hides, and

ivory, gathering of fuelwood, and use of forage, if carefully managed, can be compatible with other park uses. (See Abel and Blaikie 1986 for a sample proposal for Zambia, and Western 1984 for a Kenyan success story. McNeely 1988 provides many useful case studies.)

4. In protected areas encourage highly protected central zones and progressively more intensive and industrialized concentric outer zones of use as recommended by UNESCO's Man and Biosphere Program.

5. Provide donor support for universal values of parks and reserves (e.g. biodiversity) which are not supportable by local economic activity, and provide for government or donor subsidies to local people for regionally positive externalities (e.g. watershed protection for downstream water users).

6. Assure that at least a large part of the income from use of parks and reserves stays with the local people. Most successful parks have strong local endorsement, participation, and benefits.

7. Support adequate protection and management staffs for wildlife and park resources.

8. Tap endemic expertise, and hire local people to use artisanal techniques of management and harvest.

9. Work with local non-government organizations (NGOs) to maximize local benefits of small projects.

10. Institutional development is vital. According to George (1988), 25 years ago Zambia had just 100 university graduates among its 5 million people; just after its 1975 independence, Mozambique had in its Ministry of Education only five employees who could read and write. Governments and private institutions, like other systems, have carrying capacities. The needs are great in management and protection, in extension, in research, in education, in the environmental policy offices of African governments at all levels.

A Final Caution

Four serious realities, of unprecedented nature, need massive interventions and will require important changes in the ways we think and live. Unless we pay sufficient attention and apply sufficient resources to these four issues, all of our interest in structural adjustment programs will mean little. The four are:

1. human population increase: Officials in Rwanda found it necessary to kill all of the elephants in the country because they were incompatible with the high human populations there.

2. global climate change: we are already committed to major changes in African climate and ought to prepare now rather than waiting to respond to crisis.

3. the debt crisis: In my naivete I see this as relatively simple to solve: forgive the debt.

4. leadership crisis, the need for a "structural adjustment" in ethics and values.

It can be done, with sufficient hard work, sensitivity, and concern for one another.

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STRUCTURAL ADJUSTMENT PROGRAMS AND FISHERY POLICIES IN SUB-SAHARAN AFRICA

Bruce Wilkins[1]
Herbert Acquay
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Introduction

Fish are a significant component of the natural resource base of many African countries. In sub-Saharan Africa the fishery provides 9 million metric tons of food protein and employs several hundred thousand rural people. It earns needed foreign currency in some countries (US $30,000,000 in at least one) and has the potential for yielding much greater foreign currency returns in the future.

Fishery policies of most African nations have been and will continue to be heavily impacted by foreign loan programs, including structural adjustment programs (SAPs). The World Bank is understood to be currently considering requests for $50,000,000 in loans involving fishery investments in the region.

Past fishery development efforts have often had positive intended results, as well as unintended negative consequences on certain fish stocks or on fishermen and communities dependent on harvesting those stocks.

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This section provides a broad overview of the marine capture, and freshwater culture, fisheries It describes their characteristics and notes elements important in ensuring sustainable yields. We note resource policies increasingly important in managing the fishery, policies presumably related to SAPs. We suggest four fishery policies potentially highly sensitive to SAPs.

This assessment is grounded in an extensive review of the literature, consultation with others, and personal knowledge of the participants. The absence or questionable reliability of fisheries data from many African countries presented a considerable obstacle to our analysis. No in-country research supporting or testing our conclusions has yet been undertaken. For convenience, we often speak of Africa broadly, even though between-country variations are high.

The Role of Fish in Sub-Saharan Africa

1. Food Source

Fish are a major protein source in the diet of many Africans providing, in 8 countries,[2] more protein than do livestock and poultry combined (FAO 1988b). Africans consume an average of 7.3 kg. of fish per year, most coming from the marine capture fishery (Kambona 1984). The average masks the major significance of fish in the diet of some Western and Central African countries where they supply more than 40% of the annual protein requirement (Robinson and Crispolda 1984). Nearly 85% of the 9 million

[2]Senegal, Gambia, Sierra Leone, Liberia, Ghana, Nigeria, Congo, Malawi.

metric tons of fish supplying this protein is captured in the marine fishery. Unfortunately, this supply has not kept up with local population growth (Kambona 1984).

Fish (and protein) available per capita in Africa declined 7 percent between the periods of 1979-81 and 1983-85 (13 to 12.1 grams respectively (FAO 1988b). Kenya, Congo and Cameroon, however, did not experience a decline. Thus while fish have been a low cost source of fish protein in rural areas current trends make it increasingly scarce and a more expensive component of the diet in most countries. Consumer prices of fish in Kenya increased at an annual rate of 17.1% from 1978 to 1982 compared to 15.7% for beef and 5% for maize (Balarin 1985).

2. Rural Employment

The marine capture, and the inland culture fisheries, generate significant rural employment. In West Africa's marine fishery alone, more than 200,000 fishermen are employed (Pollnac 1988). Most of these people are employed in the artisanal fishery. This low capital, high labor cost fishery can be contrasted with the industrial (high capital, low labor cost fishery) more common in distant water fleets. Sub-Saharan Africa's marine fishery is predominately an artisanal fishery, with fishermen using canoes, some of which are motorized.

The controlled culture of fish (aquaculture) has a history, in China, many thousands of years old. Industrial aquaculture, large scale production of fish for domestic or export sales, is still quite rare in Africa with close to 11,550 metric tons of finfish produced in 1985 (Huisman 1986). A number of projects supported by FAO, USAID, and the Peace

Corps are underway to expand and develop small scale, or in some cases industrial, aquaculture and as many as 33,000 people may be actively participating in fish culture in tropical Africa (World Bank 1988a).

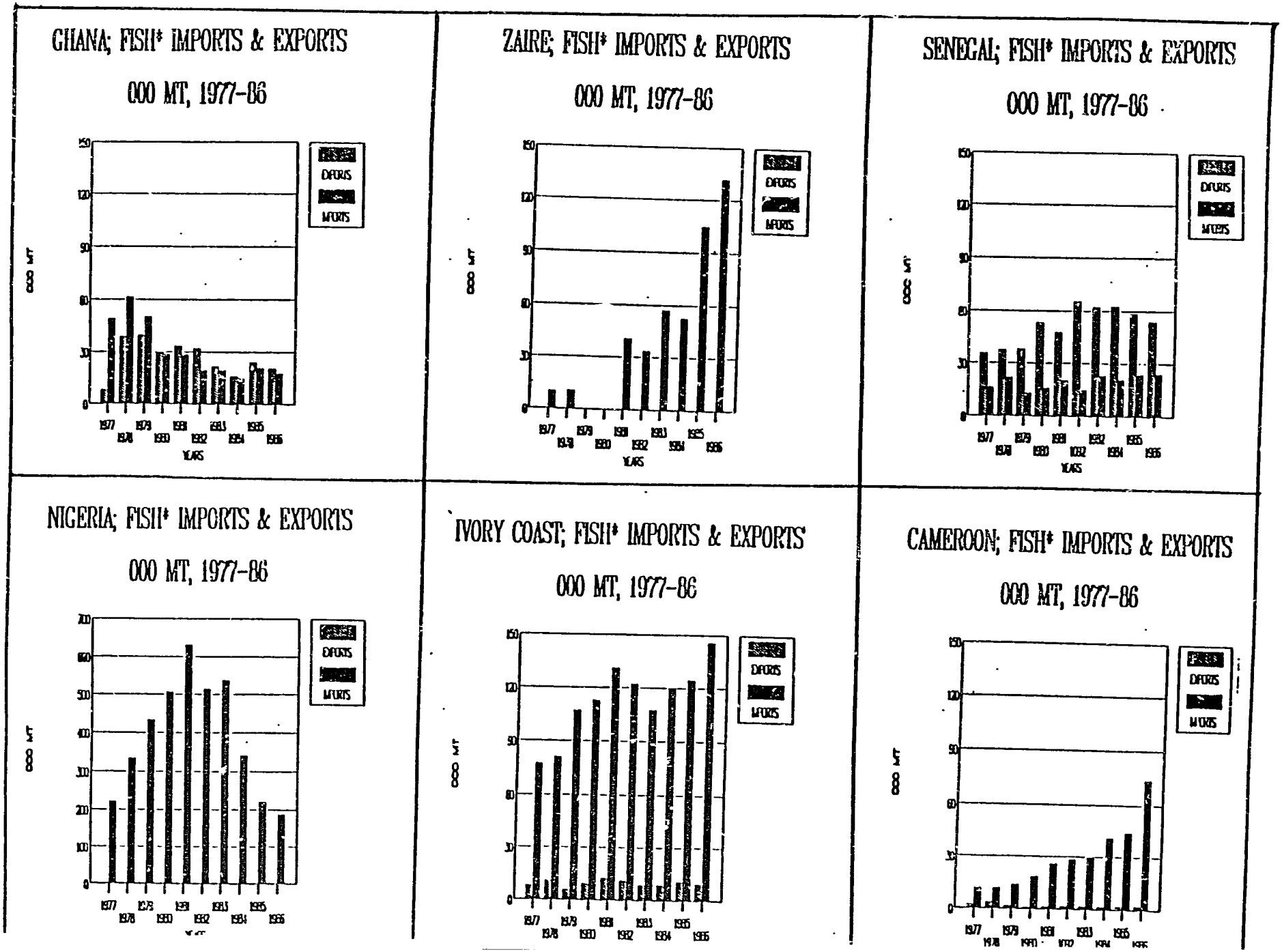
3. Export - Import Considerations

African fishery primarily supply domestic markets although some African countries, notably Senegal and Ivory Coast, do export fish products (Figure 1). In 1986, Africa exported 105,373 metric tons of fish products and preparations valued at US $226,671,000 (FAO 1988a).

Some African countries, notably Congo, Cameroon, and Zaire are net importers of fish and fishery products (Figure 1). Zaire's fish imports in 1986 (valued at US $13.4 million) represents 3.6 percent of their total debt service (FAO 1988b, World Bank 1988b). Most of these imports come from outside the region, intra-regional trade accounting for only 15% of West Africa's imported fish and fishery products (Robinson and Crispoldi 1984).

Most African nations claimed, in the last decade, control of all fish within an Exclusive Economic Zone (EEZ), the water and bottom 200 miles seaward from their shores. Vessels from developed nations harvest 50-60% of the newly claimed fish protein from these waters (FAO 1987; Kambona 1984). In a few cases, countries have received significant foreign currency for access to these newly claimed territories. For example, in 1978 Mauritania received US $30,000,000 from fees and fines charged on foreign vessels fishing in their EEZ (Kambona 1984).

FIGURE 1 Imports and Exports of Fish in Six African Countries.



4. The Marine Fishery

Between 40% and 67% of the fish caught off West Africa are harvested by the small-scale artisanal fishermen (Pollnac 1988). The rest of the catch comes from large, industrialized, fishing vessels owned by African governments, private domestic firms, through joint ventures between foreign and local enterprises (including governments) and by totally foreign owned vessels. For example, long range fleets from the Soviet Union and Eastern Europe harvest pelagics (free moving, ocean species) off West Africa while trawlers from Southern Europe and Japan harvest primarily high-priced demersals (bottom dwellers) and cephalopods such as squid.

Our discussion of the marine fishery focuses on the East Central Atlantic fishery zone, the waters off the western coast of Africa from Morocco to the Congo estuary (FAO 1987). We do not give equal attention to the Western Indian Ocean zone, off East Africa, for it has not been an important fishing ground for African nations. The modest fish populations in those waters are harvested primarily by fleets from Asian and East European countries. Fish play a less important role in the diets of East Africans, and most of the fish protein they do consume comes from inland waters, rather than through the marine capture fisheries. In Kenya, one-third of the population does not eat fish due to historical or cultural reasons (Balarin 1985).

The East Central Atlantic Zone has a wide diversity of species but biomass productivity is low except where there are upwelling currents (Crutchfield and Lawson 1974). Nevertheless, with the introduction of mechanized canoes and large vessels, the

foreign catch in countries now in the East Central Atlantic Zone increased from 2.1 million metric tons in 1963 to over 4.1 million tons by 1980 (Robinson 1982). FAO data for the now somewhat altered region indicates a 1986 catch of 3.0 million metric tons, a decline from 3.4 million metric tons in 1980.

The marine capture fishery harvest is significant to much of sub-Saharan Africa but:

- The fishery harvest is typically at or near its maximum (FAO 1987).
- Knowledge about the abundance or growth of major fish species is very sparse (FAO 1987).
- While most countries have claimed jurisdiction over waters extending 200 miles from their shores few have the management capacity to deal with this new territory.
- As much as half of the fish harvest from that recently claimed zone may be taken by vessels from foreign nations (FAO 1987).
- Productive coastal waters are increasingly stressed by pollutants from land or from alterations made to key habitat areas by developments such as dams, coastal dikes and shrimp culture ponds (World Bank 1988c).
- Substantial portions of the fish harvested in the marine waters are lost or wasted in post-harvest processes.

5. <u>The Culture Fishery</u>

Aquaculture is a modest but growing contributor to food production in sub-Saharan Africa. It has the potential of reducing fish imports and expanding exports, but perhaps most promising is its ability to contribute to the food stock of countries with adequate

water supplies. The 11,550 metric tons of cultured fish produced in 1985 could grow substantially in the future. Illustrative of the potential, participation in one USAID supported fish culture project in Zaire grew from 352 farmers in 1980 to over 900 farmers by 1986 (Kalende 1986).

The World Bank has noted the potential for aquaculture in other regions. In 1984, it spent 32% of its US $63 million assistance to the fishery, on aquaculture, none of this was spent in Africa, however (Josepeit 1984).

While a ready market exists for cultured fish products in several African countries some African countries could develop an export market for cultured species, particularly shrimp. Production techniques for large scale rearing of shrimp have advanced rapidly over the past decade and the market for shrimp has remained strong in the US and Japan. Ecuador, the world's largest exporter of cultured shrimp, earns over US $30,000,000 through exports each year (CIAT 1988). Shrimp culture has been expanding in Africa but it remains less than 1% of Latin America and Asia production (Table 1).

Expanding fish production through low input aquaculture would yield its most immediate and long lasting effects through enhancing food supply in rural areas. There it can create some additional jobs, improve nutrition of those in the immediate area and provide some supplemental income.

TABLE 1
WORLD CULTURED SHRIMP PRODUCTION

Region/Country	Weight in MT		
	1982	1986	1990 (projected)
WORLD	83,956	308,754	489,990
ASIA	59,729	104,032	373,490
LATIN AMERICA	24,225	52,121	113,000
AFRICA (total)	2	12	875
Gambia	-	-	500
Ivory Coast	-	-	200
Kenya	2	2	25
Madagascar	-	-	50
Nigeria	-	5	50
South Africa	-	5	50

Development Patterns in Africa's Marine Fishery

African countries traditionally exploited marine fisheries using dugout canoes powered by oar and sail. Since the late 1960's, the fishery has undergone rapid modernization with the introduction of motors for canoes, and large vessels. In Ghana, the number of small scale vessels with motors increased from 20% of the fleet in 1960 to 87% by 1973 (Bernacsek 1986). More efficient gear and infrastructure development -- ports, processing and marketing facilities -- were also important in maintaining or expanding harvests through the 1970's. The establishment or expansion of an industrial fishery composed of large, modern vessels accompanied the development of the infrastructure and mechanization of the artisanal fishery. These industrial fleets were controlled by both local and foreign-owned private sector enterprises as well as by some state-owned companies. Most were developed with financial and technical assistance from developed countries and international donor agencies (e.g. Japan, Spain, Italy, Canada, United States, the Food and Agriculture Organization of the United Nations, and the World Bank).

Rapid industrialization and modernization of Africa's artisanal and industrial fleets did initially lead to overall increases in total fish catches. Some sub-Saharan countries -- most notably Senegal and Ivory Coast expanded fish exports. Senegal in 1986 exported 51,522 tons of fish valued at US$80,937,000 (FAO 1988).

Unfortunately, the mechanization and increase of both the industrial and artisanal segments of the fleet involved uncontrolled increases in fishing power. Those possessing more efficient gear and fishing methods captured a larger share of the harvest and this

together with uncontrolled expansion in fishing power resulted in serious overexploitation of the marine fishery resources. This "tragedy of the commons" resulted in declines in the harvest of some species, for example, 1987 horse mackerel (*Trachurus sp.*) stocks off Senegal and Mauritania were estimated to be about 20% of their 1970 levels. Such high valued species as hake (*Merluccius sengalenisis*), squid (*Sepiola sp.*), and shrimp (*Penae sp.*), were often replaced in the catch with lower valued species such as trigger fish (*Balistes capriscus*) (FAO 1987).

In the area north of Cape Verde, fishing power as early as 1972 was about 65% more than was required to harvest fish at the maximum sustainable yield (MSY). The result of this excess harvesting capacity was catches 18% less than the MSY, indicating a dissipation of economic rent of about US$200 million a year (Christy 1979). Such overharvests can not continue, if sustainable production is desired.

More insidious are long term negative impacts on the fish populations that may result from unintended consequences of habitat manipulation. Fish production in coastal waters off Africa, as elsewhere, have suffered deterioration due to wastes from oil tankers and refineries and the use of these waters as dump sites for other human and industrial wastes. Construction of breakwaters, dredging for harbors and other massive land moving schemes (including upstream dams) often lead to diminished fish production through disruption of fish spawning or feeding sites.

Destruction of near shore habitats critical for capture fish production (such as mangroves and coral) for shrimp culture or recreational facilities (e.g. swimming areas or

marinas) is of potential concern.

In Benin, lagoon shrimp production has sharply declined due to the construction of a coastal dike which resulted in reduced salinity inside the lagoon (World Bank 1988c).

Some Major Economic Opportunities in Africa's Marine Fishery

Since 1977, coastal countries have established and claimed rights to all aquatic resources in their EEZ. The right to fish in this zone can be sold or leased. The EEZ has expanded the economic potential of marine fishery resources since benefits could be obtained from increased quantities of fish landed locally or from licenses and royalties paid by local and non-local fleets.

While some African countries have gained income through exercising these rights, most have not been able to significantly increase benefits from the EEZ partly due to inadequate enforcement of licensing regulation. In Guinea, royalty fees paid by foreign fleets operating within its territorial waters are virtually non-existent (World Bank 1988c).

Maintaining, or restoring, marine fisheries is a major concern for most sub-Saharan Africa. Their territorial waters are generally subject to little effective regulation and few bilateral fishery management agreements. This has led to overexploitation of many of the most valuable species.

1. Some Relevant Attributes of the Marine Fishery

When exploring resource policies exerting major influence on the marine capture fishery and those dependent on that resource, it is useful to recall some differences

between marine fisheries and management of many other resources. For example, marine fishes are frequently highly mobile; ownership of them is traditionally awarded to those who capture the fish; costs of entry into the fishery are often minimal.

The low cost of entry is associated with low costs in raising fish in the wild. There are no labor or facility costs incurred in their production, and no costs associated with feeding this wild crop. Low inputs to production mean fish have traditionally not been viewed as a saleable commodity by governments. This may contribute to their receiving modest attention.

Policy issues in the capture fishery typically center on:

maintenance of production

allocation of the harvest

post harvest handling

By influencing each of these, resource policies can enhance, diminish or virtually eradicate a fishery. It is these variables that must be considered when altering resource policies, either to avoid an undesirable outcome or to stimulate increased sustainability through enhanced management.

2. Maintenance of Production

The most efficient policies will protect the natural productivity of the marine system. Harvests from the East Central Atlantic Zone which rose to 3.4 million metric tons by 1980 had fallen to 3.0 million metric tons by 1986. Such declines typically foretell substantial overharvests and continued diminishment in the production of desired species.

1980 had fallen to 3.0 million metric tons by 1986. Such declines typically foretell substantial overharvests and continued diminishment in the production of desired species.

Overharvests can be controlled. Far less amenable to reversion is habitat destruction. Losses in marine productivity resulting from habitat alteration such as dredging, filling, waste disposal or other alteration to the natural system are seldom restored.

Some areas have established policies of protecting fish yields through retention of productive estuaries or coral.

3. Allocation of the Harvest

While artisanal fishermen harvest up to 70% of the fish landed in West Africa, it is the industrial fishery that has benefitted most from governmental financial and technical support. Less than 20% of designated fishery development funds have been allocated to the artisanal sector (Timberlake 1985).

State-owned industrial fishery enterprises have not performed well in sub-Saharan Africa. Most of them have incurred repeated financial losses due to inefficient management, overstaffing, and artificially low prices. Price setting has often not accounted for operational costs nor macroeconomic effects of subsidies (Lawson and Kwei 1974).

Foreign vessels continue to be major harvesters of fish in the EEZ of many coastal African nations. While several countries have sold, or attempted to sell fishing rights to developed countries, lack of effective enforcement capacity continues to limit earnings derived through this approach.

4. Post Harvest Handling

Over 500,000 tons of fish per year are lost after their capture due to insufficient cold storage, poor handling, and limited access to markets. These are particularly lacking in communities of artisanal fishermen (Kambona 1984). The opportunity and need to reduce these losses seems great. The small-scale culture fishery where numbers of fish can be made available regularly at dispersed location has particular advantages in reducing post-harvest losses.

Structural Adjustment Program Impacts on Fishery Policies

No primary studies on the impact of SAPs on the marine capture or freshwater aquaculture sectors were found in the published literature. This may be related to the modest attention given fisheries by most development programs in Africa. The scarcity of such studies may also be a result of the difficulty in establishing direct linkages between SAPs and the fishery sector, no SAPs sectoral loans have been allocated to the fishery sector by the World Bank (World Bank 1988d).

While such studies are needed, at the present time we can hypothesize possible impacts on the fishery sector of export promotion strategies and institutional reforms under SAPs. We suggest these areas merit particular attention in subsequent in-country studies.

Elements common to many SAPs that likely impact fisheries in a substantial manner include:

(1) Stimulation of privatization of unprofitable state-owned companies. In Ghana, as part of the restructuring of public enterprises, the State Fishing Corporation is being privatized. While favored by capitalistic countries, there is little evidence that either capitalistic or socialistic systems are better equipped to insure sustainability of fishery resources. That may be related to the failure, even in capitalistic countries, to charge fishermen for the value of the resource they harvest.

(2) Reduction in the number of civil servants available to work in the fishery. National governments claim ownership of the fishery resource in most countries. Eliminating portions of the workforce, especially in the areas of research and fisheries management, would further limit the ability of coastal sub-Saharan African states to design fishery management regimes based on valid scientific data.

(3) Prices of imports increasing as a result of local currency devaluation. This directly impacts the cost of fuel and imported spare parts needed to maintain vessels. Imported equipment is required for many non-traditional fish storage and processing plants, and in most training and research facilities. Although most devastating to the previously favored industrial fleet, the artisanal fishery also feels the effect of devaluation. The drop in motorized canoes in Ghana cited earlier has been attributed to the inability of many fishermen to afford the spare parts needed to keep their motors running (Everette 1979; Collart

1986). Devaluation has also discouraged importation of fish in a number of countries. Nigeria's fish imports fell 98% from 108,719 metric tons in 1981 to 2,018 metric tons (FAO 1988b). This presumably resulted in increased prices received by local fishermen. Without constraints on fishing effort, additional fishermen will then enter the fishery exerting further pressure on the already stressed fish stocks, frequently leaving individual fishermen no better off financially.

(4) Removal of government subsidies to the food sector. This leads to a direct increase in fish prices and combined with a decline in real wages in some African countries has resulted in fish becoming less affordable to most segments of the population. This contributes to a decrease in nutritional levels among the urban and rural poor, people for whom fish previously served as an affordable source of animal protein. In Senegal, real wages for the civil service has been falling at the rate of 6.9% a year since 1980 (Bristen 1988), with an accompanying 17% decline in the per capita intake of animal protein (FAO 1988b).

Fishery Policies and SAPs

Fishery management under structural adjustment must be based on a new paradigm, just as SAPs may need modifications reflecting a new understanding of the potential important contribution of the region's fishery. If the full potential of Africa's fishery

(marine and inland) were to be realized one author suggests over US $1,500 million could be added to Africa's gross product (Kambona 1984). Changes in fishery policies that may be subject to influence by SAPs are discussed in the following section.

1. Enhanced Within Country Management Capability

Additional management capability, not capture capacity, is urgently needed in most of Africa. Since most high-valued fish species have been harvested close to, or beyond, their maximum sustainable yields, opportunities for productive investments to increase fishing power is limited. Earnings from the fishery can be expanded through improved management of the resource and, perhaps, by reducing industrial fishing effort. As noted above, control on fishing effort is needed to gain full value from the fishery yet most fishery agencies have a weak capacity to design and enforce management regulations (Lawson and Robinson 1983). This capacity could be enhanced by seeking, where possible, to actively involve influential local fishery groups in the management process (Uphoff 1986).

Such a strategy will require diversion of investments from enhancing industrial fishing capacity to increased assistance for designing appropriate management regulations (e.g. limiting the number of boats, restricting mesh sizes of nets used, and instituting a quota system to control total catches). Improving management capability may require changes in present institutional structures and the orientation of fisheries agencies in Africa.

More local control over the allocation of the fisheries and the enforcement of management regulations is one such change. This could be effective if decentralization

permits local governments and fishing organizations to form committees to assist fishery agencies to monitor the compliance of administrative procedures and technical guidelines for a local fishery. Formulation of national fisheries policies should take an integrating approach, incorporating economic, scientific, and social concerns. Fisheries extension services should reduce emphasis on the introduction of new gear and increase emphasis on improving the understanding and involvement of local fishermen in management issues.

SAPs have the potential to stimulate joint ventures between coastal countries in sub-Saharan Africa with underdeveloped fisheries or having underutilized species, and investors from developed countries with needed experience, capital and technology. This potentially mutually beneficial arrangement can facilitate the transfer of fishing technology, increase the supply of fish, create employment, and help in developing conservation measures for the fishery. For the developed countries, joint ventures will insure optimum use of their fishing fleet, creation of employment, and a supply of fish (Marten et al. 1981).

Assistance from donor institutions to help countries gain the expertise needed to evaluate and manage the fishery seems essential.

2. Enhancing the Artisanal Fishery

The small scale fishery sector warrants greater financial and technical support than it has received in the past. Linsenmeyer (1976) suggests the artisanal sector in Sierra Leone created more jobs per dollar invested and produced fish at a lower cost per ton than did the industrial fishery. The small scale fishery also uses less energy, and causes less pollution than does the industrial fishery (Timberlake 1985). A World Bank study

(1984) indicates that 47% of its fishery development projects, mostly for the industrial sector, have failed to produce satisfactory rates of return. The artisanal fishery sector also contributes to a more evenly distributed settlement pattern and a more equitable distribution of income in fishing communities (Kirien and Mattew 1982).

Fishing grounds for artisanal fisherman can be protected from large scale vessel competition by designating sections of in-shore areas for small scale operators, as has been done in Cameroon, Mauritania and Senegal (OTA 1988).

Artisanal fishermen have problems obtaining credit. They usually lack the collateral required by local commercial banks. The problem of raising capital could be eased if fishermen are encouraged to form small independent production units with fish wholesalers and retailers who in most of West Africa are traditional sources of loans to fishermen (Lawson and Kwei 1974). The literature clearly suggests that management of artisanal fisheries might benefit most from attempts to enhance traditional allocation processes, and traditional forms of fishing (Panayotou 1982). There should be more research on appropriate fishing technology to improve harvesting efficiency of artisanal fishermen. Improved technologies will help generate more employment in rural coastal communities thereby stimulating larger numbers of people to remain in these communities. Such efforts might include development and placement of artificial habitat such as FAD's (fish aggregation devices) which have reduced the cost of harvesting fish in some South Pacific locations.

3. Improved Post-harvest Handling of Fish

Fish processing and marketing facilities in sub-Saharan Africa need to be revitalized to reduce post-harvest losses of fish and to improve accessibility of fish to local populations. Post harvest fish handling is another area where appropriate technology may yield extended "shelf life" of significant portions of catch. Dipping fish in boiling water and utilization of pasteurized air sealed packs are techniques that may prove useful in Africa. Research by intermediate technology centers in Africa is needed to test such applications. Support for such research has been provided by FAO, one result was development of the "chorkor smoker". This affordable fish smoking oven, built with local materials, smokes up to fifteen layers of fish compared to the traditional one layer, but uses the same amount of fuelwood (Brownell and Lopez 1986).

4. Development of Regional Management and Training

The fugitive nature of the fishery resource suggests that regional or multinational management is often desireable. Given the limited financial and technical resources available to individual countries, regional efforts may be essential in Africa. Regional management elements might include the sale of specified EEZ fishing rights to industrialized countries; regional reconnaissance of foreign fleet adherence to regulations; regional ownership and operation of research vessels and; regional education of fishery scientists and managers.

A regional approach could be highly effective in attaining the advantages of scientific management and would be much less costly than individual countries attempting to

develop such competencies. Regional consortia might also encourage sale of fishing rights and return of increased income without sacrificing inshore domestic fleets.

Regionalization might also yield increased bargaining power. The United States recently signed a treaty with 14 nations (South Pacific Tuna Act) which included United States government and private industry payments of at least US$12 million annually, nearly doubling previous U.S. payments (U.S Legis. Code and History 1988). A similar regional consortia in Africa might enhance the member nation's ability to obtain further concessions from developed nations, including hiring and training of some nationals including African observers to be placed on foreign fleets using a country's EEZ. An example of a regional fishery effort underway is the Regional Maritime Academy in Ghana currently providing training for maritime personnel from 15 West African countries. Another regional institution in Nigeria provides training for aquaculture personnel.

Conclusion

Africa's marine fishery are at or near their maximum harvest levels. Maintenance of natural productivity; allocating catches between artisanal, industrial and foreign fleets; and post harvest handling are key components in fishery policies. Freshwater culture fisheries can provide supplementary food for appropriate countries.

SAPs certainly influence major aspects of the fishery although no specific studies on their influence were found. In designing SAPs it would be particularly damaging if the program impeded:

Enhancing within country management capability

Enhancing the artisanal fishery

Improved post-harvest handling of fish

Development of regional management and training

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