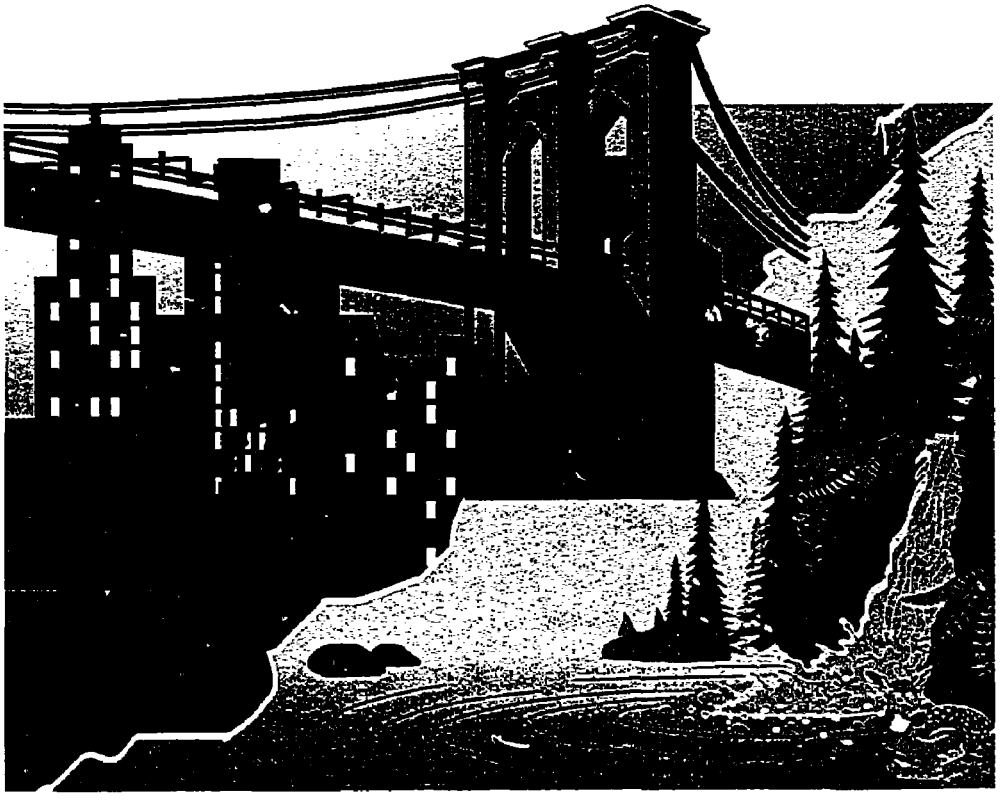
WORLD BANK ENVIRONMENT PAPER NUMBER 10

Economywide Policies and the Environment

Lessons from Experience

Mohan Munasinghe and Wilfrido Cruz



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Mohan Munasinghe is chief, Environmental Economics Division, in the Envrionment Department of the World Bank. Wilfrido Cruz is an environmental economist, working in the same division.

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Contents

Tables

Abbreviations

AIM	Action Impact Matrix
CAS	Country Assistance Strategy
CBA	Cost-Benefit Analysis
CEM	Country Economic Memorandum
CESP	Country Environment Strategy Paper
CGE	Computable General Equilibrium
CMEA	Council of Mutual Economic Assistance
DSM	Demand-Side Management
EA	Environmental Assessment
EDI	Economic Development Institute (of the World Bank)
FSU	Former Soviet Union
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas Emissions
GNP	Gross National Product
IMF	International Monetary Fund
LRMC	Long-Run Marginal Cost
MCA	Multicriteria Analysis
NAFTA	North American Free Trade Agreement
NEAP	National Environmental Action Plan
OED	Operations Evaluation Department
OECD	Organization for Economic Cooperation and Development
OD	Operational Directive
SAL	Structural Adjustment Loan
SECAL	Sectoral Adjustment Loan
SNA	System of National Accounts
SOE	State-Owned Enterprise
UNCED	United Nations Conference on Environment and Development

Foreword

Over the last decade there has been a growing awareness of the complementarities between sustainable development and a healthy environment. This period has also witnessed major political, social, and economic changes as many countries have embarked on a radical structural transformation of their economies. Thus, an examination of the environmental implications of economywide policies has become a matter of considerable relevance and urgency.

This study is particularly useful since it comes at a time when the environmental impacts of adjustment programs have come under close scrutiny. It is a key component of a broader Bankwide effort focusing on the links between environment and development, led by the Vice Presidency for Environmentally Sustainable Development and, within it, the Environment Department. Work is advancing in other related areas including pollution management, natural resource management, environmental valuation and indicators, national environmental action plans, and social policy.

Due to the complexity of policy-environment interactions, this study takes an empirical, case-study-oriented approach, including a thorough review of current work both within and outside the Bank. Specific case studies were carried out in a variety of countries, linking up with existing operational work but focusing in particular on the relationship between economywide policies and a range of environmental problems. While these efforts underscore the difficulties of developing a general methodology to trace the environmental impacts of policy reform, they offer evidence that empirical work may help identify and deal with the most important potential environmental impacts.

The paper focuses attention on identifying and avoiding unintended adverse environmental impacts of economywide policies that are intrinsically beneficial. More specifically, it concludes that adjustment programs, especially the market-liberalizing elements, are usually good for the environment. For example, removing price distortions and promoting market incentives generally will contribute to both economic and environmental gains. Focusing on policy reform packages that have economic as well as environmental benefits helps build a consensus for action among both economic and environmental managers.

However, economywide reforms sometimes cause unforeseen environmental harm. Overlooked policy, market, and institutional imperfections elsewhere in the economy may interact perversely with the broader policy reforms to provide incentives that lead to resource overuse and environmental degradation. The remedy does not generally require suspension of the original economywide policies. Instead, specific additional measures are needed that remove the policy, market, and institutional imperfections. Such measures are not only generally environmentally beneficial in their own right but are also critical complements to the broader economywide reforms.

Certain direct consequences of economywide policies are not difficult to identify. Through the tracing of such links, the paper identifies several practical implications that have already emerged in the context of work on recent Bank operations. No new policies or operational guidelines are required, but we are exploring the possibility of further improving policy analysis and preparing recommendations. We hope to accomplish this

by more systematically addressing the links between economic policies and environmental impacts through a four-step process consisting of problem identification, analysis, remediation, and follow up. The paper also stresses the importance of improving economic-environmental coordination--especially the strengthening of environmental analysis in country economic documents and vice versa. It shows how the implementation of such an approach would be facilitated by constructing an Action Impact Matrix (AIM), which helps develop an integrated view by articulating economic policies and projects, and meshing them with priority environmental and social impacts.

To follow up this initial effort, a broad collaborative program is continuing in the Bank (including the Environment Department, Policy Research Department, and Operations), as well as consultation and collaboration with others in the environment and development communities who are undertaking parallel work. Some of the techniques described in this paper have already begun to be more routinely applied in Bank operations through an outreach program and a more in-depth round of country studies. The agenda will include new aspects beyond the scope of the present paper, such as the longer-run links between sustained growth, poverty, and the environment, the role of distributional and political economy considerations in environmental management, and the exploration of new economywide indicators of sustainability that can be applied more easily to various countries.

The ultimate objective of all this work is to enhance the quality of Bank operations and make development activities more sustainable.

This paper has provoked lively and constructive discussions following its presentation on two previous occasions: to the Board of Executive Directors of the World Bank on 16 September 1994 and at a seminar in Madrid on 3 October 1994 in connection with the 50th Anniversary Annual Meetings of the World Bank and the International Monetary Fund. Follow-up activities are already under way, focusing on practical implementation of the results, as well as selected in-depth country studies.

Ismail Serageldin
Vice President
Environmentally Sustainable Development

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Abstract

Although economywide policies are not directed explicitly towards influencing the quality of the natural environment, they may, affect it for good or bad. Such policies include: altering exchange or interest rates, reducing government budget deficits, freeing markets, liberalizing trade, enhancing the role of the private sector, and strengthening institutions, often coupled with pricing and other reforms in key sectors such as industry, agriculture and energy. This paper relies on an empirical, country-specific approach to examine the links between economywide policies and the environment. The case studies utilize a variety of analytical methods and approaches for identifying such links. The analysis underscores the difficulties of developing a general methodology to trace all the environmental impacts of policy reform. However, it also offers evidence that careful case-specific work on important environmental impacts may help in identifying better ways to deal with them, and sets out several practical steps for implementing the results in operational work.

The specific findings of this study are: (1) removal of price distortions, promotion of market incentives, and relaxation of other constraints (which are among the main features of adjustment-related reforms), generally will contribute to both economic and environmental gains; (2) unintended environmental harm occurs when economywide reforms are undertaken while other neglected policy, market or institutional imperfections persist. The remedy does not generally require reversal of the original reforms, but rather the implementation of additional complementary measures (both economic and non-economic) that remove such policy, market and institutional difficulties; (3) measures aimed at restoring macroeconomic stability will generally yield environmental as well as economic benefits, since instability undermines sustainable resource use; (4) the stabilization process also may have unforeseen adverse short-term impacts on the environment; and (5) economywide policies will have additional longer term effects on the environment through employment and income distribution changes.

These findings have relevance for decision making. Proper recognition of the generally positive environmental consequences of economywide policy reforms would help to build additional support for such programs. At the same time, broader recognition of the underlying economic and policy causes of environmental problems can enhance support for environmental initiatives--both in terms of environmental policies as well as projects. The following are immediate steps that can be taken by decision makers: (1) more systematic efforts are needed to monitor environmental trends and anticipate emerging problems, when policy reform proposals are being prepared; (2) serious potential environmental impacts of proposed economywide reforms identified earlier should be carefully assessed, to the extent that data and resources permit; (3) where potential adverse impacts of economywide reforms can be identified and analyzed successfully, targeted complementary environmental policies or investments need to be implemented--to mitigate predicted environmental damage, and enhance beneficial effects; and (4) a follow up system for monitoring the impacts of economic reform programs on environmentally sensitive areas (identified earlier) should be designed, and resources made available to address environmental problems that may arise during implementation.

The paper stresses the importance of improving economic-environmental coordination--especially the strengthening of environmental analyses in country economic documents and vice versa. It shows how the implementation of such an approach would be facilitated by constructing an Action Impact Matrix (AIM), which helps develop an integrated view--by articulating economic policies and projects, and meshing them with priority environmental and social impacts. These efforts will assist the Bank in improving the design and implementation of its policy advice to borrowers.

Overview

Objectives, Approach, and Scope

In recent years, a conceptual framework for sustainable development has emerged which seeks to combine economic efficiency, social concerns and environmental protection. Environmental economics plays a key role in helping integrate these elements into conventional decision making.

The evolution of sustainability concerns within the Bank parallels the learning process within the environment and development community--a process that has resulted in significant gains, primarily in the treatment of the direct environmental impacts of projects. This paper reviews the progress being made to improve the understanding of a wider set of relationships beyond the project level--the links between economywide policies and the environment. Work is advancing also in other related areas (not treated here), including pollution management, natural resources and habitats, environmental valuation, sustainability indicators, environmental assessments, national environmental planning, social policy, and the global environment.

While the paper reports on work in progress, some practical implications may be drawn from the emerging lessons. These implications are set out in the form of specific steps which would be helpful to both the Bank and its borrowers, in better harmonizing and articulating economic and environmental actions. A wide range of economywide policy reform programs has been undertaken to address macroeconomic problems (such as those affecting international trade, government budgets, private investment, wages, and income distribution) and broad sectoral issues (such as those relating to agricultural productivity, industrial protection, and energy use). The economywide mechanisms for attaining these goals include: altering the rates of exchange or interest, reducing government budget deficits, promoting market liberalization, fostering international openness, enhancing the role of the private sector, and strengthening government and market institutions, often coupled with pricing and other reforms in key sectors such as industry, agriculture and energy.

Although these policies are not directed explicitly towards influencing the quality of the natural environment, they may, nonetheless, affect it for good or bad. This paper argues that there are significant payoffs for the Bank as well as its borrowers in attempting to better understand such linkages and to act upon them. Focusing attention on the positive impacts of economywide reforms on the environment as well as the economy, helps to build consensus for such reforms and improves cooperation among both environmental and economic managers. No less important are the potential negative environmental impacts of economywide policies that need to be analyzed, monitored and mitigated. In some instances the *direction* of environmental impact stemming from economywide policy reform is fairly straightforward. The *extent* of the impact, however, invariably requires empirical analysis. In more complex cases, even the direction of the impact is ambiguous. Therefore, this paper relies heavily on empirical findings and draws on a country-specific approach to examine the links between economywide policies and the environment.

Based on a comprehensive review of recent research as well as current Bank case studies, this paper utilizes carefully selected examples that reflect a wide range of country situations and environmental problems. Pollution issues are addressed with reference to air quality in

Mexico, industrial pollution caused by specific industries in Indonesia, and general industrial pollution in Poland. Environmental aspects of energy use are addressed in the Sri Lanka case. A variety of natural resource related issues are covered in the other studies: deforestation and land degradation in Costa Rica, deforestation in the Philippines, degradation of agricultural lands due to overgrazing in Tunisia, fertility losses due to extension of cultivated areas in Ghana, water resource depletion in Morocco, unsustainable agriculture in China, and wildlife management in Zimbabwe.

The case studies utilize a variety of analytical methods to illustrate the different approaches available for identifying the environmental implications of economywide reforms. These methods range from those tracing the links between economic incentives and resource use through direct observation, to others relying on more complex economic modeling of policies and their environmental effects. In all the studies, however, the analytical approach requires identifying key environmental concerns and relating these to important sectoral and macroeconomic reforms under consideration. The analysis underscores the difficulties of developing a general methodology to trace the environmental impacts of policy reform. At the same time, it offers evidence that careful case-specific empirical work on important potential environmental impacts may help in identifying better ways to deal with them, and sets out several practical steps by which the findings may be implemented in operational work. This report also indicates the considerable scope for developing better analytical tools to trace environment-economic policy linkages, and outlines areas for further work.

Main Findings and Conclusions

The specific findings of this study are presented below--grouped according to the principal ways in which economywide policies interact with the environment, highlighting how they might help in the design of better adjustment programs. Illustrative country examples are provided in Part I of the report.

- **Removal of price distortions, promotion of market incentives, and relaxation of other constraints (which are among the main features of adjustment-related reforms), generally will contribute to both economic and environmental gains.** For example, reforms which improve the efficiency of industrial or energy related activities could reduce both economic waste and environmental pollution. Similarly, improving land tenure rights and access to financial and social services not only yields economic gains but also promotes better environmental stewardship.
- **Unintended adverse side effects occur, however, when economywide reforms are undertaken while other neglected policy, market or institutional imperfections persist.** The remedy does not generally require reversal of the original reforms, but rather the implementation of additional complementary measures (both economic and non-economic) that remove such policy, market and institutional difficulties. Such complementary measures are not only generally environmentally beneficial in their own right, but also help to broaden the effectiveness of economywide reforms. Typical examples of potential environmental damage caused by remaining imperfections include:

  Policy distortions: Export promotion and trade liberalization, that increases the export profitability of a natural resource, might encourage excessive

extraction or harvesting of this resource if it were underpriced or subsidized (for example, low stumpage fees for timber).

Market failures: Economic expansion induced by successful adjustment may be associated with excessive environmental damage, for example, if external environmental effects of economic activities (such as pollution), are not adequately reflected in market prices that influence such activities.

Institutional constraints: The environmental and economic benefits of economywide reforms could be negated by unaddressed institutional issues, such as poor accountability of state-owned enterprises, inadequately defined property rights, or weak financial intermediation--which tend to undermine incentives for sustainable resource management.

- **Measures aimed at restoring macroeconomic stability will generally yield environmental benefits, since instability undermines sustainable resource use.** For example, stability encourages a longer term view on the part of decision makers at all levels, and lower inflation rates lead to clearer pricing signals and better investment decisions by economic agents. These are essential prerequisites for encouraging environmentally sustainable activities.
- **The stabilization process also may have unforeseen adverse short-term impacts on the environment.** For example, while general reductions in government spending are deemed appropriate, targeting these cutbacks would be desirable to avoid disproportionate penalties on environmental protection measures. Another important issue is the possible short-term impact of adjustment on poverty and unemployment, which may aggravate existing pressures on fragile and "open access" natural resources by the poor due to the lack of economic opportunities. In this case, appropriate measures designed to address the possible adverse social consequences of adjustment will be justified even further--on environmental grounds.
- **Economywide policies will have additional longer term effects on the environment through employment and income distribution changes.** Several of the examples confirm one predictable conclusion--adjustment-induced changes generate new economic opportunities and sources of livelihood, thereby alleviating poverty and reducing pressures on the environment due to over-exploitation of fragile resources by the unemployed. However, while growth is an essential element of sustainable development, it will necessarily increase pressures on environmental resources. Increasing efficiency and reducing waste, as well as properly valuing resources, will help reshape the structure of growth and reduce undesirable environmental impacts.

The foregoing conclusions also offer further support to the World Bank's four-fold agenda of action[1] and suggest ways of strengthening the implementation of this agenda.

First, Bank operations seek to avoid causing harm to the environment. The main focus of past efforts in this area has been on the environmental assessment of investment projects to mitigate potential environmental damage. This paper confirms the emerging consensus that the leverage exerted by sectoral and macro level economic policies as well as other institutional, legal and social policies is of great importance in determining

environmentally related behavior. Therefore, more effort should be devoted to improving the understanding of the environmental consequences of such economywide policy reforms, especially to anticipate and mitigate negative impacts.

Second, all "win-win" opportunities (that is, where economic, social and environmental goals could be jointly pursued) should be fully exploited. A key message of the *World Development Report 1992* on environment and development is the need to promote options where poverty reduction or efficiency oriented reforms may be combined with the goals of sustainable resource management and environmental protection. This paper shows that more systematic attempts to address economic as well as distributional and environmental concerns in programs of economywide policy reform help to increase the collaboration between the economic development and environmental communities, and thereby improve the effectiveness of the response to the pressing problems of poverty and environmental degradation.

Third, the Bank has sharply increased its financing and advisory services to help member governments make their environmental management efforts more systematic and effective. Thus, in the two years following the 1992 Rio Earth Summit, the Bank has committed $4.5 billion to projects specifically designed to help improve environmental management in borrowing countries, and about twice this amount for "pro-environment" development activities, such as support for population, education, water supply, and agricultural research and extension. This work is necessarily drawing on the analyses embedded in National Environmental Action Plans (NEAPs) and Country Environment Strategy Papers (CESPs). Our findings indicate that the improved analysis of the environmental impacts of economywide policies should be better reflected in country economic documents (like the country assistance strategy, CAS) and more closely integrated with the NEAP/CESP and related work, thereby making both sets of initiatives more consistent and mutually reinforcing.

Fourth, the Bank is helping its borrowers address global environmental concerns, primarily through the Global Environment Facility (GEF), but also increasingly through its own lending. This report suggests the need to anticipate the implications of existing and emerging international environmental obligations to which governments have agreed, and adjust national economic and environmental policies accordingly.

The first two points in the Bank's four-fold environmental agenda are closely linked in the context of our findings. More specifically, while economywide policy reforms will generally improve economic efficiency, alleviate poverty, and also benefit the environment, unaddressed issues like policy distortions, market failures and institutional constraints elsewhere in the economic system may cause unforeseen environmental and social harm. In most such cases, mitigating this harm will require the introduction of additional environmental and social measures–to complement (rather than halt) the ongoing economywide reforms. While the focus of this paper is on environmental impacts, there is a discussion of associated social issues such as poverty alleviation, income distribution and resettlement. This suggests that the generic findings and AIM-based approach presented here could be useful also in systematically identifying other social issues, and analyzing them when tools are available for this purpose.

Practical Implications

The findings have relevance for decision making. While the relationships between economywide policies and the environment are complex, there is usually a small number of identifiable linkages affecting high priority environmental concerns. The environmental analysis and implementation efforts related to

specific programs can therefore be sufficiently focused to be practical and effective. *Proper recognition of the generally positive environmental consequences of economywide policy reforms would help to build additional support for such programs. At the same time, broader recognition of the underlying economic and policy causes of environmental problems can enhance support for environmental initiatives*--both in terms of environmental policies as well as projects. The following are immediate steps that can be taken by decision makers:

- *Problem Identification*: More systematic efforts are needed to monitor environmental trends and anticipate emerging problems when policy reform proposals are being prepared and implemented. A review of the range of currently available environmental information would help identify the highest priority pre-existing or emerging environmental problems, and their sensitivity to policy measures.
- *Analysis*: Serious potential environmental impacts of proposed economywide reforms identified in the problem identification stage should be carefully assessed, to the extent that data and resources permit. Many of the techniques and examples presented in this paper will be helpful in tracing the simpler and more obvious links between economywide policies and the environment.
- *Remedies*: Where potential adverse impacts of economywide reforms can be identified and analyzed successfully, targeted complementary environmental policies or investments need to be implemented--to mitigate predicted environmental damage, and enhance beneficial effects. Where linkages are difficult to trace ex-ante, greater reliance should be placed on preparing contingency plans to be invoked ex-post (see below).
- *Follow up*: A follow up system for monitoring the impacts of economic reform programs on environmentally sensitive areas (identified earlier) should be designed, and resources made available to address environmental problems that may arise during implementation.

As the understanding of the issues involved and the quality of the data improve, Bank operations are beginning to take the foregoing points into account--none of which imply a need to change existing Bank policies which are relevant (Operational Directive No. 8.60 on Adjustment Lending, No. 4.01 on Environmental Assessment, and No. 4.02 on Environmental Action Plans).

While the Bank's country analyses have historically followed separate economic and environmental tracks, good progress has recently been made in integrating the two approaches, especially at the project level. Several operational initiatives have also begun to address economywide policy-environment issues seriously, but there is scope for considerable deepening of this effort. The complementarity of economic and environmental measures for sustainable development should be used to mobilize more environmental support for economic reforms, and vice versa. However, the difficulties of analyzing the potential environmental impacts of proposed economywide reforms (ex-ante), should not be underestimated. Linking specific causes with particular effects is especially problematic in countries where many conditions are simultaneously changing. Nevertheless, this paper indicates that many direct linkages may be traced using existing methods. Since the better incorporation of environmental aspects into the Bank's policy dialogue with governments could result in

substantial gains, (particularly in the context of adjustment operations), more analytical work is needed to better understand the complex links involved.

This paper indicates how the analytical process may be strengthened, starting from fairly simple considerations. The various relationships identified here, although based on country-specific work, have been used to develop a general framework based on the concept of an Action Impact Matrix (AIM), which more clearly identifies a country's environmental problems in relation to its program of economywide policy reforms and major projects. This stepwise approach focuses initially on the links among a relatively small subset of priority environmental concerns and a few key economic policy reforms. In subsequent stages, the analysis may be made much more comprehensive. The paper points out the advantages of using such a matrix-based approach to link the various environmental processes (such as assessments, NEAPs, CESPs, conservation strategies, and so forth), with the many aspects of country economic work, and in particular with Country Economic Memoranda (CEM) and Country Assistance Strategy (CAS) Papers. These steps would also help to focus more attention on environmental concerns in the growing dialogue among the Bank, the International Monetary Fund (IMF), and national economic and environmental managers.

The foregoing indicates another important implication of our findings.

- *Economic-environmental coordination*: Country economic documents (such as CEMs and CASs) should more systematically discuss environmental issues, while environmental documents (such as NEAPs and CESPs) should strengthen their analyses of economic linkages. This will improve economic-environmental coordination. The steps involved in developing an AIM will facilitate such coordination in the operational processes of both the Bank and member countries.

Further Work

A broad collaborative program has begun within the Bank (drawing upon the expertise in the Environment Department, the Policy Research Department and Operations), to undertake the next phase of work. First, an outreach program is underway to more systematically apply some of the techniques described here in Bank operations, especially focusing on the preparation of AIMs for specific countries. Corresponding training efforts are underway within the Bank and in member countries. Second, more in-depth studies have been initiated, for example, in analyzing the environmental implications of comprehensive economic reform packages (rather than individual policies), and on improving our understanding of the role of distributional, political economy, and institutional factors that may constrain the potential benefits of reform programs. Finally, work is underway on practical indicators of sustainability that will promote more systematic monitoring of countrywide environmental conditions and trends. This work within the Bank is being complemented by collaboration and consultation with researchers carrying out parallel work among development institutions, NGOs, and the academic community.

Notes

1. World Bank 1993g, 1993h and 1994d.

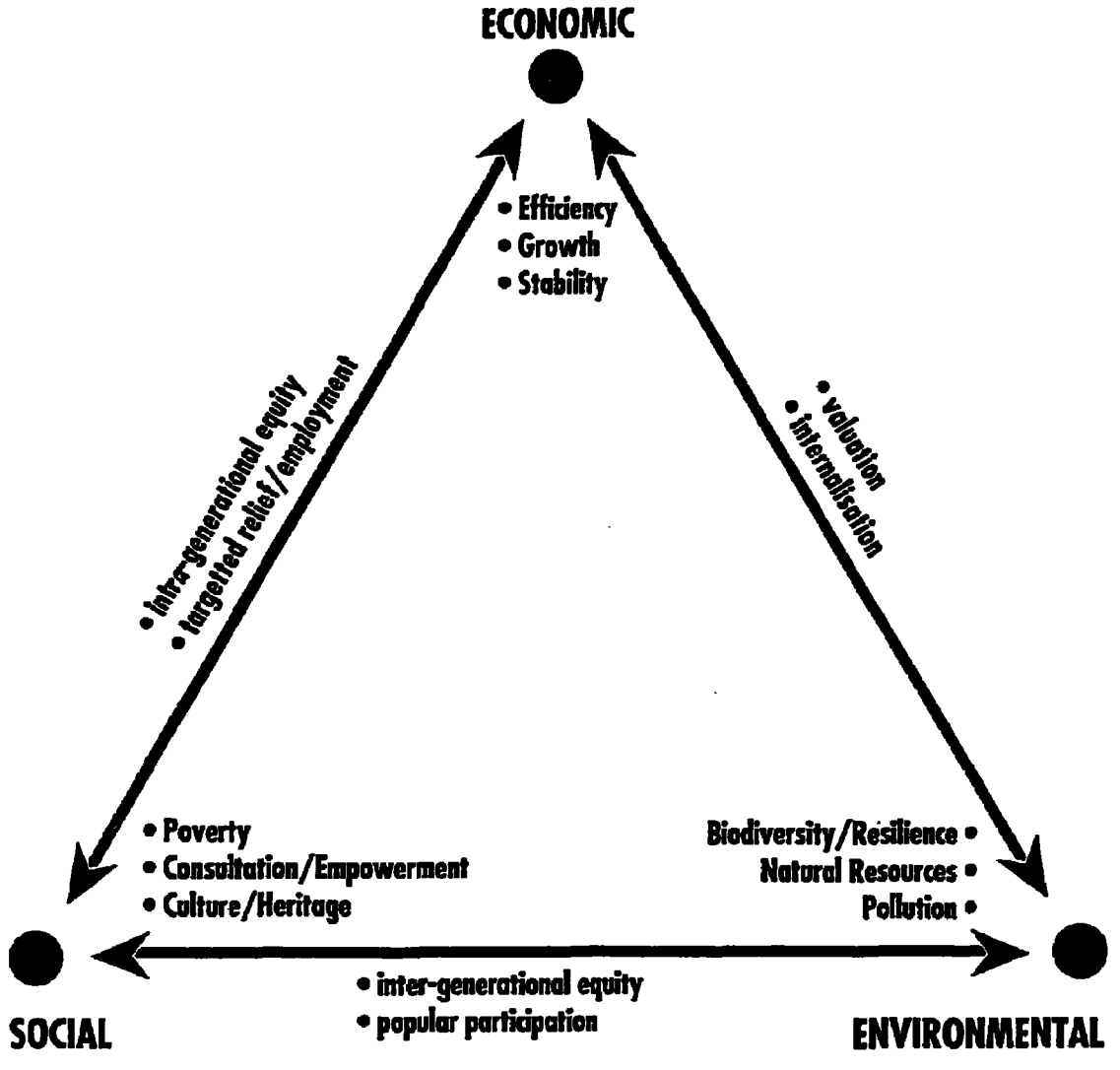
Part I

Linkages Between the Environment and Economywide Policies

The evolution of environmental activities within the Bank reflects the learning process within the environment and development community, regarding the way in which sustainability concerns should be integrated into various aspects of development work. An early concern of many national and development agencies, including the Bank, was to ensure that development projects cause no environmental and social harm, and by the late 1980s significant progress had already been made within the Bank in this regard. The Bank had also been active in efforts by the international community to help countries undertake projects and adopt policies to better address national and global environmental challenges.

More recently, a third area of concern, both within the Bank and the development community in general, has been to examine environmental problems from a countrywide perspective and to combine development and environmental initiatives within an integrated framework for sustainable development. While no universally acceptable practical definition of sustainable development exists as yet, there is increasing agreement that it should incorporate economic, social and environmental objectives in a balanced manner (see Box 1). The analysis in this paper focuses mainly on economic-environmental linkages, with some treatment of related social effects. However, the comprehensive assessment of social impacts of economywide policies is outside the scope of this paper, and will be the subject of future studies.

Box 1. Approaches to Sustainable Development



Source: Munasinghe 1993a.

Current approaches to the concept of sustainable development draw on the experience of several decades of development efforts. Historically, the development of the industrialized world focussed on production. Not surprisingly, therefore, the model followed by the developing nations in the 1950s and the 1960s was output and growth dominated, based mainly on the concept of economic efficiency. By the early 1970s the large and growing numbers of poor in the developing world, and the lack of "trickle-down" benefits to them, led to greater efforts to directly improve income distribution. The development paradigm shifted towards equitable growth, where social (distributional) objectives, especially poverty alleviation, were recognized as distinct from, and as important as economic efficiency.

Protection of the environment has now become the third major objective of development. By the early 1980s, a large body of evidence had accumulated that environmental degradation was a major barrier to development. The concept of sustainable development has, therefore, evolved to encompass three major points of view: economic, social and environmental, as shown in the figure (Munasinghe 1993a).

Box 1. (Continuation)

The *economic* approach to sustainability is based on the Hicks-Lindahl concept of the maximum flow of income that could be generated while at least maintaining the stock of assets (or capital) which yield these benefits (Solow 1986, Maler 1990). There is an underlying concept of optimality and economic efficiency applied to the use of scarce resources. Problems of interpretation arise in identifying the kinds of capital to be maintained (for example, manufactured, natural, and human capital) and their substitutability, as well as in valuing these assets, particularly ecological resources. The issues of uncertainty, irreversibility and catastrophic collapse pose additional difficulties (Pearce and Turner 1990).

The *social* concept of sustainability is people-oriented, and seeks to maintain the stability of social and cultural systems, including the reduction of destructive conflicts (UNEP et al. 1991). Equity is an important aspect of this approach. Preservation of cultural diversity and cultural capital across the globe, and the better use of knowledge concerning sustainable practices embedded in less dominant cultures, are desirable. Modern society would need to encourage and incorporate pluralism and grass-roots participation into a more effective decision making framework for socially sustainable development.

The *environmental* view of sustainable development focuses on the stability of biological and physical systems. Of particular importance is the viability of subsystems that are critical to the global stability of the overall ecosystem (Perrings 1991). Furthermore, "natural" systems and habitats may be interpreted broadly to also include man-made environments like cities. The emphasis is on preserving the resilience and dynamic ability of such systems to adapt to change, rather than conservation of some "ideal" static state. Natural resource degradation, pollution and loss of biodiversity reduce system resilience.

Reconciling these various concepts and operationalizing them as a means to achieve sustainable development is a formidable task, since all three elements of sustainable development must be given balanced consideration. The interfaces among the three approaches are also important. Thus, the economic and social elements interact to give rise to issues such as intra-generational equity (income distribution) and targeted relief for the poor. The economic-environmental interface has yielded new ideas on valuation and internalization of environmental impacts. Finally, the social-environmental linkage has led to renewed interest in areas like inter-generational equity (rights of future generations) and popular participation.

In seeking to integrate the three approaches in a practical way, it is useful to recognize that most development decisions continue to be based on the economic efficiency criteria. Thus, it is useful to turn to the relatively new area of environmental economics as a starting point for developing a broader conceptual framework that integrates the economic, socio-cultural and ecological approaches (see also Box 2). For example, economists attempt to incorporate environmental concerns into decision making by valuing environmental resources in monetary terms, and ensuring that resource prices reflect their scarcity values. Similarly, economists have addressed social-equity concerns by placing special emphasis on costs and benefits accruing to the poor, by ensuring that those who impose costs on others pay commensurate charges, and more recently, by seeking to protect productive assets for future generations.

The foregoing suggests a broad integrated conceptual approach in which the net benefits of economic activities are maximized, subject to maintaining the stock of productive assets over time, and providing a social safety net to meet the basic needs of the poor. Some analysts support a "strong sustainability" rule which requires the separate preservation of each category of critical asset (for example, manufactured, natural, socio-cultural and human capital), assuming that they are complements rather than substitutes (Daly 1991). Other researchers have argued in favor of "weak sustainability," which seeks to maintain the aggregate monetary value of the total stock of assets, assuming a high degree of substitutability among the various asset types (Nordhaus and Tobin 1972). At the same time, the underlying basis of economic valuation, optimization and efficient use of resources may not be easily applied to ecological objectives like protecting biodiversity, or to social goals such as promoting public participation and empowerment--thereby forcing reliance on non-economic indicators of social and environmental status, as well as on other techniques like multi-criteria analysis to facilitate trade-offs among a variety of such non-commensurable objectives.

1. The Bank's Environmental Agenda and Evolution of Policy

In this context, the present study is especially relevant since it comes at a time when the environmental impacts of adjustment programs have come under close scrutiny both inside and outside the Bank.

This paper is a key element of a broader Bankwide effort focusing on the links between environment and sustainable development (see Box 2).

The Bank's environmental concerns are reflected in a four-fold agenda for action adopted by it, subsequent to the United Nations Conference on Environment and Development (UNCED) in 1992.[1] The findings of this paper support the Bank's four-fold agenda:

- To ensure that potential adverse environmental impacts from Bank-financed activities are addressed;
- To help member countries build on the complementarities among poverty reduction, economic efficiency, and environmental protection;
- To help member countries set priorities, build institutions, and implement programs for sound environmental stewardship; and
- To address global environmental challenges through participation in the Global Environment Facility.

The agenda reflects the evolution of environmental policy and the role of environmental economics in Bank work. Environmental economics plays a key role in helping to incorporate environmental concerns into economic decision making (see Box 3).

Through the 1980s, the main focus of the economic analysis of environmental issues had been on microlevel resource allocation (cost-benefit and cost-effectiveness analysis combined with environmental impact assessment of individual projects), with stress on mitigating potential environmental harm from Bank-supported projects. However, even at that time, there was recognition that addressing developing country environmental problems would require a broader, more "proactive" response--to move from the first item on the agenda to the second. For example, the review of lessons from Bank experience and proposals for change contained in a report to the Development Committee in 1987, noted that most environmental problems are less the result of individual large-scale development projects that have gone wrong than the combined consequences of numerous relatively small-scale activities--such as unsustainable agricultural practices, pollution caused by large numbers of small, inefficient factories, and decisions made by individuals to enter and destroy tropical rainforests.[2]

The 1987 paper emphasized the need to search for the underlying causes of such activities and *identify* policy interventions aimed at the source, rather than the symptom,

Box 2. Comprehensive Work Program on the Environment

This paper is a major component of a Bankwide work program led by the Environment Department, which seeks to better understand the full range of links between the environment and sustainable development. The entire work program draws on operational experience and research both within and outside the Bank. A series of best practice papers, handbooks and other outputs are planned during the next two years, on a comprehensive set of topics, including pollution management, natural resources and habitats, environmental assessments, national environmental planning, environmental valuation, sustainability indicators, social policy, and the global environment (World Bank 1994d).

of the problems. One example, which underlines the scale of resource wastage and the urgency for reform, is the fact that many governments initiate energy conservation campaigns while maintaining huge subsidies for the use of energy. A recent Bank policy paper for the energy sector has estimated that developing countries spend more than $250 billion annually on subsidizing energy, over four times the total amount of development aid worldwide.[3] Thus, priority should be given to improvements, including the elimination of government interventions in the market that are economically and environmentally perverse, and introduction of interventions (such as pollution taxes) when market forces are inadequate.

A series of studies by the Operations Evaluation Department (OED) also took a more holistic view of environmental problems, and explicitly linked them with macroeconomic and sectoral policies, starting with *Renewable Resource Management in Agriculture*[4]. This report examined the extent to which resource management issues had been addressed in Bank operations and the policy dialogue in twelve countries. Subsequent reports in the series included detailed country studies of Nepal[5] and Bolivia[6], where the entire gamut of Bank operations in a country were examined ranging from individual projects to sectoral and structural adjustment loans.

In most of Bank work in Bolivia (according to OED), natural resources were underpriced (and continue to be):

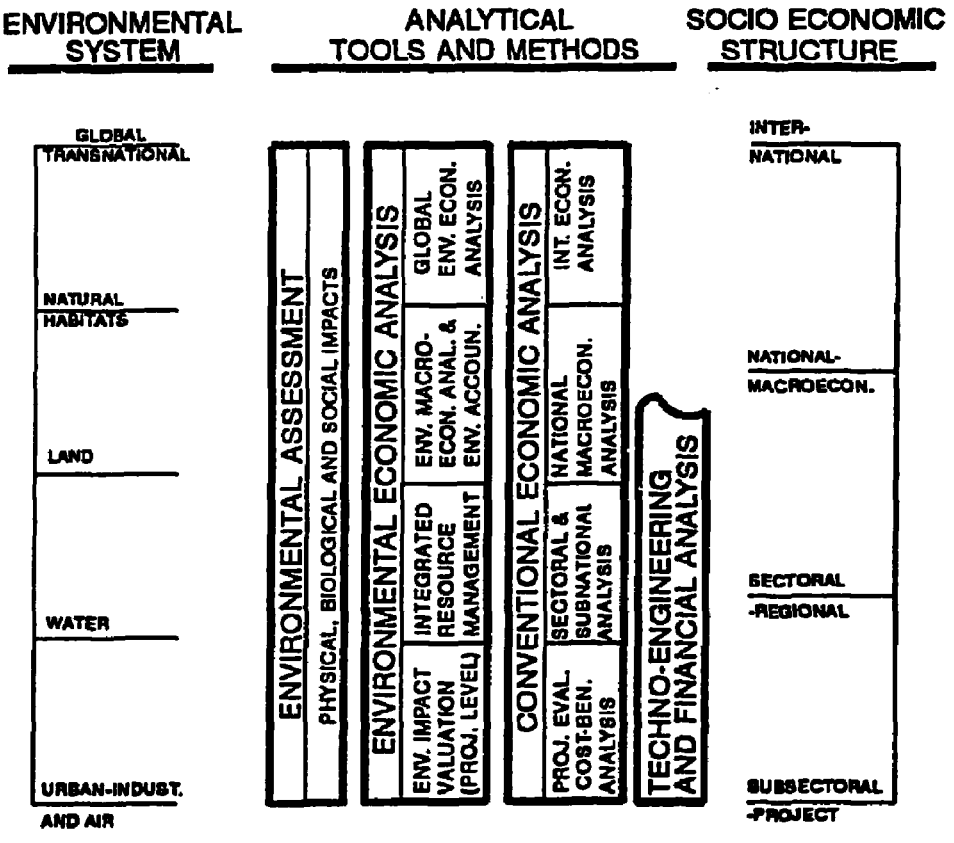
> . . . very little was done to establish an adequate pricing policy for such natural resources as land, forest, water, and vegetation. Natural resources were still assumed to be "abundant," which meant prices did not matter. The strategy embodied a significant undervaluation of natural resources and gave a false sense of comparative advantage; and it still does... As the demand for tradable natural resources is often price-elastic, and the supply response requires minimal capital investment, those subsidies may have significantly increased the use rates of natural resources.[7]

In the case of Nepal, OED concluded that the Bank approach to policy on resource management achieved limited results, because it did not address the underlying issues. For instance, in the Structural Adjustment Loans (SALs) of 1987 and 1989, increased application of fertilizer was identified as a key component for raising agricultural productivity and for accelerating growth in per capita GDP, but this was clearly a case of misplaced emphasis since replacing nutrients is a temporary remedy for more complex and long-term agricultural problems.

There appear to be many opportunities for "win-win" policy reform, and these are well documented in *World Development Report 1992*.[8] Environmental degradation often stems from market failure or policy distortions which are induced by inappropriate government policies. The scope for reform to address such imperfections and therefore identify "no regrets" actions is central to the required analysis. The *World Development Report* identifies a number of such "win-win" cases and documents the scope for identifying and minimizing tradeoffs.

During the past three years, in the spirit of priority setting and capacity building (item three of the four-fold agenda), the Bank has begun to help member governments address environmental issues more systematically through the preparation of NEAPs. Up to now, about fifty NEAPs have been completed and many are entering the implementation stage. While several NEAPs provide a good first-step basis for environmental priority-setting, few contain a careful analysis of the links between economic policies and environmental degradation. There is, however,

Box 3. Role of Environmental Economics in Decision Making



Source: Munasinghe 1993a.

Environmental economics helps us incorporate environmental concerns into the structure of economic decision making, as shown in the figure. The right-hand side of the diagram indicated the hierarchial nature of modern society. The global and transnational level consists of sovereign nation states. The next level represents the multisectored macroeconomy of a country. Various economic sectors (like industry and agriculture) exist in each economy. Finally, each sector consists of different subsectors and projects.

Unfortunately, the environmental analysis cannot be carried out readily using the above socioeconomic structuring. The left side of the figure shows one convenient environmental breakdown in which the issues are: (1) global and transnational (for example, climate change, ozone layer depletion); (2) natural habitat (for example, forests and other ecosystems; (3) land (for example, agricultural zone); (4) water resource (for example, river basin, aquifer, watershed); and (5) urban-industrial (for example, metropolitan area, airshed) - related. In each case, a holistic environmental analysis would seek to study a physical or ecological system in its entirety. Complications arise when such natural systems cut across the structure of human society. For example, a complex forest ecosystem (like the Amazon) or a physical resource system (like a large river) could span several countries, and also interact with many economic sectors within each country.

The causes of environmental degradation arise from human activity (ignoring natural phenomena), and therefore, we begin on the right side of the figure. The physical effects of socioeconomic decisions on the environment must then be traced through to the left side. The techniques of environmental assessment (EA) have been developed to facilitate this difficult analysis. For example, destruction of a primary moist tropical forest may be caused by hydroelectric dams (energy sector policy), roads (transport sector policy), slash and burn farming (agricultural sector policy), mining of minerals (industrial sector policy), land clearing encouraged by land-tax incentives (fiscal policy), and so on. Disentangling and prioritizing these multiple causes (right side) and their impacts (left side) will involve a complex analysis.

Box 3. (Continuation)

Meanwhile, the usual decision making process on the right side relies on techno-engineering, financial and economic analyses of projects and policies. In particular, conventional economic analysis has been well developed in the past, and uses techniques such as project evaluation/cost-benefit analysis (CBA), sectoral/regional studies, multisectoral macroeconomic analysis, and international economic analysis (finance, trade, and so forth) to assist the process of decision making at the various hierarchic levels.

The figure also shows how environmental economics plays its crucial bridging role, by mapping the EA results onto the framework of conventional economic analysis. A variety of environmental economic techniques including valuation of environmental impacts (at the local/project level), integrated resource management (at the sector/regional level), environmental macroeconomic analysis and environmental accounting (at the economywide level), and global environmental economics (at the worldwide level), facilitate this process of incorporating environmental issues into traditional decision making. Since there is considerable overlap among the analytical techniques described above, this conceptual categorization should not be interpreted too rigidly.

Clearly, the formulation and implementation of such policies are difficult tasks. In the deforestation example described earlier, protecting this single ecosystem is likely to raise problems of coordinating policies in a large number of disparate and (usually) non-cooperating ministries and line institutions (that is, energy, transport, agriculture, industry, finance, forestry, and so on) in several countries.

an encouraging recent trend where the results of some of the studies reported on here and the recommendations to address policy-environment linkages (presented in Part II, Section 8 below) are being increasingly used by countries to better coordinate environmental plans with economic policy reforms.

This paper focuses on the environmental implications of economywide policy reforms undertaken at the sectoral or macroeconomic level. Economywide policies primarily involve a variety of economic instruments, ranging from pricing in key sectors (for example, energy or water) and broad sectoral taxation or subsidy programs (for example, agricultural production subsidies, industrial investment incentives) to macroeconomic policies and strategies (exchange rate, interest rate, or wage policies; trade liberalization, privatization, and so forth). Economywide policies are often packaged within programs of structural adjustment or sectoral reform, aimed at promoting economic stability, efficiency and growth, and ultimately--human welfare. Although the emphasis is on economic policies, other non-economic measures are also relevant, such as social, institutional and legal actions. While the focus of this paper is on economic-environmental linkages, it also includes a discussion of associated social issues like poverty, income distribution and resettlement. Other key social objectives like popular participation, empowerment and the rights of indigenous peoples fall outside the scope of this paper. Nevertheless, the generic findings and AIM-based approach presented here could be useful also in systemically identifying a wider range of social impacts, and analyzing them--provided that tools are available for this purpose.

In the following sections, the paper consolidates the results of current Bank case studies and a review of completed research, both within and outside the Bank, to gain a better understanding of the relationships between economywide policies and the environment. One recurring theme is that the potential for achieving parallel gains in conventional economic, social and

environmental goals is often present whenever economywide reforms attempt to improve macroeconomic stability, increase efficiency, and alleviate poverty. However, in important cases these potential gains cannot be realized unless complementary environmental and social measures are carried out. The results are elaborated below (under the five main findings summarized earlier in the overview):

- Efficiency Oriented Policies
- Unaddressed Policy, Market, or Institutional Imperfections
- Restoring Macroeconomic Stability
- Short-Term Adverse Effects of Recession and Government Cutbacks
- Long-Term Poverty and Income Effects

Notes

1. World Bank 1993g, p. 15.
2. World Bank 1987.
3. World Bank 1993h.
4. World Bank 1989c.
5. World Bank 1992j.
6. World Bank 1993l.
7. World Bank 1993l.
8. World Bank 1992a.

2. Efficiency Oriented Policies

The main feature of most policy reforms directed at various levels of economic decision making are price changes which are designed to promote efficiency and reduce waste. The findings of this report reinforce the view that such programs which address price-related distortions ("getting prices right"), can contribute to both economic and environmental goals.

In many developing countries, misplaced efforts to promote specific regional or sectoral growth and general economic development have created complex webs of commodity, sectoral, and macroeconomic price distortions, resulting in economic inefficiency and stagnation. Often, these economic distortions also lead to unanticipated changes in production and input-use that promote resource over-exploitation or pollution. Such economic distortions may arise from a macroeconomic policy (such as the over-valuation of the local currency) or from a sectoral policy with economywide implications (such as subsidized energy prices). In either case, economywide policies that are not designed for environmental purposes may have substantial effects on the level and conduct of environment-related activities, suggesting that correcting such price-related distortions will also result in environmental gains. Among the broadest remedies are those correcting the foreign exchange rate and taxes that distort trade. More sector-specific reforms seek to shift key relative prices--for example, setting efficient prices for energy or water (which have pervasive effects), and removing taxes or subsidies on particular commodities or factors of production.

Macroeconomic Reforms

At the level of "macroeconomic" pricing policies, the **Zimbabwe** study illustrates how foreign exchange reforms associated with adjustment efforts can support a key environmental sector. (See Annex A for Bank case study summaries.) Wildlife-based economic activities in Zimbabwe, including ecotourism, safaris, hunting, and specialized meat and hide production, constitute some of the fastest growing sectors. Wildlife-based tourism alone grew at the rate of 13 percent in 1991, comprising 5 percent of the Gross Domestic Product (GDP). From the environmental perspective, wildlife-based activities, (unlike cattle ranching which competes for limited land resources), are better suited to the country's semi-arid climate and poor soils. Economically viable systems can be maintained with lower stocking rates and a reduced environmental burden, compared to cattle ranching and pastoral activities. Equally important is the indirect environmental benefit associated with wildlife management goals of conserving a natural habitat that appeals to visitors.

There is much interest in wildlife development in Zimbabwe, with emphasis placed on its potential role as a more sustainable land-use system than cattle ranching or conventional agriculture, in semi-arid zones. Wildlife enterprises currently account for 15 percent of land use on commercial and communal lands. Wildlife on which ecotourism is based competes with beef production--in terms of land use, rather than meat output. Despite its economic and environmental advantages, sectoral land policies have generally discouraged wildlife activities since these are still perceived as "under-utilizing" land. Livestock marketing and pricing policies have also traditionally subsidized cattle ranching. More importantly, for many years, the government's foreign exchange and trade policies severely penalized this sector. The Zimbabwean dollar was overvalued by 50 to 80 percent from 1981 to 1990. This meant that export-oriented sectors were implicitly taxed, among them wildlife and nature tourism concerns. Foreign

exchange earnings were diverted to other sectors, depressing incomes and investment in wildlife. In 1990, the government introduced an adjustment package, including measures aimed at boosting the level of exports. The currency was devalued by 25 percent, and more liberal access to foreign exchange was allowed. These moves were beneficial on both economic and ecological fronts. Exports increased. At the same time, the profitability of the wildlife sector improved, leading to a significant increase of wildlife in commercial farmlands.

While the Zimbabwe study above illustrates how relatively straightforward and unambiguous links between macroeconomic reforms and specific environmental effects can be traced and measured, in other cases the effects of policy change are more indirect. Such indirect or system effects of economic policies on the environment have prompted some interest in the use of computable general equilibrium (CGE) models. An early study of Thailand illustrated the importance of complementary measures to ensure that successful economic growth policies do not conflict with environmental objectives.[1] For example, in the absence of clear delineation of property rights, increased incentives induced farmers to over-exploit fragile lands while industrial growth, unaccompanied by adequate regulatory or economic instruments, was associated with major environmental damage. Although the quantitative results of this exercise should be interpreted with care, (because of data constraints), they make a useful contribution and, in agreement with others,[2] highlight the kind of information needed to be able to anticipate with greater accuracy, the environmental consequences of policy reform.

This general equilibrium approach has been extended in the study of **Morocco**, which employed a CGE model that linked agricultural water use with trade policies. Low water charges (coupled with ineffective collection of these charges), have artificially promoted production of water intensive crops such as sugar cane. Thus, rural irrigation water accounts for 92 percent of the country's marketed water use. At the same time, irrigation charges cover less than 10 percent of the long-run marginal cost (LRMC), while the corresponding figure for urban water tariffs is less than 50 percent. Given these policies, it is not surprising that a water deficit is projected for Morocco by the year 2020, notwithstanding the fact that by the same year, water sector investments would account for 60 percent of the government budget. The study, however, goes beyond the traditional sectoral remedy of proposing an increase in water tariffs. It links sectoral policy reforms with ongoing macroeconomic adjustment policies, involving the complete removal of nominal trade tariffs, and analyzes the overall effects of both sets of reforms.

In the CGE simulation, liberalization of trade alone leads to a modest increase in real GDP. Household incomes and consumption post significant gains as import barriers are reduced, exports become more competitive, domestic purchasing power rises and resources are allocated more efficiently across the economy. The two major drawbacks, however, are that elimination of tariffs leads to budgetary deficits, and domestic water use increases substantially due to the expansionary effects of liberalization. In the second scenario, only water price reforms are considered. The results indicate (as expected) that, other things being equal, doubling water prices reduces water use significantly--by 34 percent in rural areas and by 29 percent for the economy as a whole. This static efficiency gain is associated with a small decline (about 1 percent) in the incomes and real consumption of both rural and urban households. In the final scenario, the trade liberalization continues to stimulate growth, but simultaneously reforming water prices induces substantial reductions in agricultural

(and economywide) water use, unlike in the scenario involving price reform alone. To summarize, the macroeconomic policy reform (trade liberalization) alone resulted in more efficient allocation of resources and expansion of exports, but also led to environmental stress through increased water use. When complementary water price increases were simultaneously undertaken with trade liberalization, the beneficial expansionary economic effects of the latter were largely retained, but now with substantial reductions in water use as well (due to the higher water prices).

Other illustrative examples of the role of macroeconomic policies include the investigation of links between adjustment policy and environment in the agriculture sector in Sub-Saharan Africa.[3] Important contributions have also been made by environmental organizations through studies on the environmental impact of the adjustment process in Thailand (see above), the Ivory Coast, Mexico, and the Philippines.[4] Within the World Bank, a recent study suggests that trade policies which encourage greater openness in Latin America have tended to be associated with a better environment, primarily due to environmentally benign characteristics of modern technologies.[5] The nature of the environmental impacts of adjustment reforms (like the exchange rate changes and trade liberalization examples above), have been questioned for some time. The broader issues raised by links between trade and environment are summarized in Box 4.

Sectoral Reforms

More specific or restricted policies affecting major sectors, such as industry and agriculture, or key resources, like energy, are also addressed in programs of economywide policy reforms. For example, the potential gains from price reform in the energy sector may be enormous. All recent energy projects supported by the Bank have involved careful assessment of the adequacy of institutional arrangements and price efficiency. In each case efforts were made to promote rational pricing policies, improve institutional effectiveness, and achieve greater transparency and accountability in the provision of energy.

Energy sector reforms can contribute to both economic and environmental goals. In Sri Lanka, for example, as in most developing countries, electricity prices have been well below the incremental cost of future supplies. Many studies show that eliminating power subsidies by raising tariffs closer to the LRMC of power generation, will encourage more efficient use of electricity.[6] In projecting future electricity requirements in Sri Lanka, the Bank study found that the economic benefits of setting electricity prices to reflect LRMC is supplemented by an unambiguously favorable impact on the environment. In addition, pricing reforms were found to have better economic and environmental impacts than purely technical approaches to demand-side management, such as promoting the use of energy-saving fluorescent lights. Of course, a combination of both pricing and technical measures provided the best results.

This emphasis is reflected in two recent Bank policy papers for the energy sector.[7] As noted earlier, one of these reports estimates that developing countries spend more than $250 billion annually on subsidizing energy.[8] The countries of the former USSR and Eastern Europe account for the bulk of this amount ($180 billion), and it is estimated that more than half of their air pollution is attributable to such price distortions. Removing all energy subsidies would produce large gains in efficiency and in fiscal balances, and would sharply reduce local pollution and cut carbon emissions by as much as 20 percent in some countries, and by about 7 percent worldwide. Similarly, electricity prices in developing countries are, on average, barely more than

Box 4. Trade and the Environment

As noted by the *World Development Report 1992: Development and the Environment*, the concern with environmental implications of trade involves both the domestic implications of policy reforms as well as the global environmental dimension of international trade agreements. Although liberalizing reforms generally promote more efficient resource use (including use of environmental resources), in practice there is no clear-cut reason to expect that trade liberalization will be either good or bad for the environment. The reason is that trade reforms may be undertaken, but the presence of pre-existing market, policy or institutional imperfections in the environment sector may lead to adverse environmental impacts. The following discussion illustrates various environmental initiatives that will be needed to complement reforms in the trade sector.

Regarding national or domestic trade reforms, early concerns about negative effects were raised regarding the North American Free Trade Agreement (NAFTA) and pollution in Mexico. Similar concerns involved cassava exports and soil erosion in Thailand, and exchange rate depreciation and deforestation in Ghana. However, more recently there has been increased recognition that the links between trade and the environment are much more complex since economic expansion from trade is characterized not only by growth but also by changes in the intersectoral composition of output, in production techniques and input-use, and in location of economic activity.

For example, if liberalized trade fosters greater efficiency and higher productivity, it may also reduce pollution intensity by encouraging the growth of less polluting industries and the adoption of cleaner technologies. In Mexico, Grossman and Krueger (1991) conclude that increased specialization due to NAFTA-related trade liberalization would result in a shift to labor-intensive and agricultural activities that require less energy inputs and generate less hazardous waste per unit of output than more capital-intensive activities. Similarly, in the Indonesia case study (cited in the text), both pollution- and energy-intensity declined due to such shifts. Pollution impacts probably declined as well, due to the dispersion of industry away from Java. However, the rapid growth of the industrial sector in recent years has also meant an increase in total pollution in spite of reduced pollution intensities. As more countries succeed in attaining rapid and sustained growth, there will be an increasing need to more carefully examine the relationship between the changing structure of high growth economies and the danger of excessive pollution. In such cases, the pollution problem may need to be addressed aggressively, with a combination of regulations and economic incentives.

On agriculture and forestry, contrary to popular perceptions, a shift in cropping patterns towards export crops expansion does not necessarily imply increased erosion. Repetto (1989), using examples for Sub-Saharan Africa, concludes that many export crops tend to be less harmful to soils. In West Africa, tree and bush crops are grown with grasses, and erosion rates are two to three times less than similar areas planted for locally used food crops such as cassava, yams, maize, sorghum, and millet. In Malawi, Cromwell and Winpenny (1991) found that adjustment led to changes in product mix and production intensity instead of changes in cultivated area or production techniques. Soil improving crops were adopted and agricultural intensification helped absorb a rapidly growing population on less land. Also, contrary to popular belief, export crop expansion has not generally occurred at the cost of reduced food crop output, with subsequent potentially negative social and environmental effects. However, in a study of eleven developing countries, it was found that rapid expansion of cash crops, in fact, does not tend to reduce food production (Braun and Kennedy 1986). This complementarity rather than competition has been observed in countries where initial productivity is low and is partly explained by technology spillovers from cash crop activities that also enhance food crop production.

The more pressing question is whether these export crops displace forests. In Sudan, Stryker et al. (1989) found that trade and other adjustment-related reforms resulted in significant deforestation because increased producer prices encouraged woodland clearing for crop cultivation. However, recent studies have shown that in such cases, deforestation pressures are due to prevailing distortions within the forestry sector, such as very

Box 4. (Continuation)

low stumpage prices or poor forest management capacity that are not corrected with the trade reforms. Inadequate land tenure and land clearing, as a requirement for tenure, prevent more efficient exploitation of existing agricultural lands, and have also contributed to the problem. For example, in Cote d'Ivoire, the effects of price-related policies were believed to have led to deforestation, but to a lesser extent than the lack of a consistent and secure land tenure system (Reed 1992). The Ghana study (cited in the main text) also analyzed the interaction between effects of price changes and the institutional factors governing resource ownership and management. Using both household data and remote sensing information on agricultural and forest resources, the study found that increased crop incentives have contributed to pressures for deforestation. However, if producers had secure tenure and could internalize the implications of excessive land exploitation, these pressures would have been reduced significantly.

With regard to the global environmental dimension of international trade, the debate has revolved around the issue of whether freer trade is beneficial to global and national environmental conditions and whether it should be used to influence national and international environmental standards and agreements. Studies arising from a recent General Agreement on Tariffs and Trade (GATT) symposium have concluded that expanding global production and consumption does not necessarily cause greater environmental degradation (Anderson and Blackhurst 1992). Indeed, with appropriate national policy reforms, greater trade would generally contribute to environmental gains. In the case of coal, trade liberalization and the removal of price supports in richer countries would reduce coal output, lead to higher international prices, and consequently decrease coal consumption. This would be beneficial for the environment. In the case of food production, the reduction of agricultural trade protection in rich countries would lead to a relocation of production to poorer countries, leading to greater incomes, and reduced agricultural pollution in developed countries. In poorer countries, it is recognized that the incentive to produce more will probably increase fertilizer and pesticide use. However, maintaining high levels of agricultural protection in rich countries is not an effective way of protecting the environment.

Domestic tax incentives and regulations would be a better way of limiting environmental degradation (Anderson and Blackhurst 1992; Lutz 1992). The same general conclusion is reached in recent studies on biodiversity and forestry. For example, the over-exploitation of biodiversity and wildlife for international trade plays a minor role in species extinction since the major cause is habitat destruction (Burgess 1991). Thus, attempts to ban wildlife trade will have limited benefit plus large cost; proper trade mechanisms such as taxes and subsidies would be better at encouraging conservation.

With respect to global deforestation, Barbier et al. (1991) found that the timber trade has not been the major source of deforestation. The domestic factors (distorted prices, subsidies, tax regimes, regulations, management capacity) leading to conversion of forest land to agriculture has played the larger role. In general, an appropriate combination of domestic environmental and agricultural policy measures, combined with trade reforms, will result in both welfare gains and in better environmental quality (Harold and Runge 1993). On the international front, however, the challenge is to initiate coordinated international action on domestic reform measures to counter the environmentally negative effects of scale--any country attempting to implement domestic reforms in isolation will lose income and jobs to its neighbors.

An early view on the effect of freer trade given different national environmental standards between North and South, was that dirty industries would migrate to poor countries, where environmental standards were either less strict or non-existent (Leonard 1989). Recent work indicates that pollution abatement and control expenditures by firms do not appear to have had a significant effect on competitiveness in most industries since these expenditures represent a modest share of total costs. For example, environmental costs generally comprise only 0.5 percent of the value of output and only 3 percent for the most polluting industry (Low 1993). Thus, environmental costs are not a dominating factor in decisions for locating new industrial investments. In fact, trade openness which may promote newer technologies may tend to have positive environmental effects since most new technologies are also cleaner (Birdsall and Wheeler 1992; Wheeler and Huq 1993).

Box 4. (Continuation)

These findings also suggest that there is no pressing reason for requiring national environmental standards to be made identical. Patterns of resource exploitation and pollution are primarily affected by economic and social conditions, with environmental regulations or standards (especially in poor countries) playing a minor role. Promoting acceptance of similar environmental principles, such as requiring that polluters pay for the damage they inflict, or incorporating environmental values in cost-benefit analysis, will probably be more effective as well as politically more acceptable.

Further work in this field should include efforts to establish more clearly: (a) the environmental implications of liberalized trade flows; (b) the extent to which pollution from industrial growth may undermine declining pollution intensity effects from trade reforms; and (c) whether trade measures should be resorted to as "second best" policies when international coordination fails to remove domestic distortions (for example, green labeling in the timber trade when the timber resource is underpriced in exporting countries).

one-third of supply costs. As a result, consumers use about 20 percent more electricity than they would if they paid the true costs of supply. Moreover, recent evidence shows that far from correcting this distortion, many governments have been slow to adjust electricity tariffs to reflect higher costs from inflation, fuel, and interest charges. A review of electricity tariffs in 60 developing countries has shown that average tariffs declined over the period 1979-88 from 5.2 to 3.8 cents/Kwh (1986 US dollars).[9] This is particularly troubling as energy demands are expected to grow, and will probably double in the next 15 years.

Achieving commercial pricing policies is, therefore, central to achieving energy efficiency and economic sustainability. Of the 24 energy and power sector loans approved by the Bank in fiscal year 1993, 16 contained specific requirements to adjust energy prices. For example, the Energy Sector Deregulation and Privatization Project in Jamaica aims to expand power supply as well as improve energy sector efficiency, by focusing on creating a regulatory and policy environment favorable to private sector involvement. Among various activities to support this goal, the project will determine appropriate, market-based pricing principles for application to the petroleum sector. Another example, the Bulgaria Energy Project has as an objective the realignment of the level and structure of electricity tariffs to rationalize consumption, reduce imports, lessen the pollution associated with generation, and mobilize resources for the national electricity company (NEK). The project also aims to reorient the operations of NEK along more commercial lines, and improve and depoliticize the tariff setting system by establishing an independent regulatory mechanism.

The negative environmental effects of industrial protection policies also suggest the win-win potential of industrial policy reforms. This is illustrated in the experience of Mexico from 1970 to the late 1980s. Between 1970 to 1989, industrial pollution intensity (per unit of value added) in Mexico increased by 25 percent, induced by government investments and subsidies in the petrochemical and fertilizer industries. The energy intensity of industry also increased by 5.7 percent in the same period. Aside from the beneficial environmental aspects of removing such subsidies, there will also be direct fiscal implications. Energy subsidies are generally costly, and must be financed from government budgets that are often in deficit. In Mexico, broad subsidies for fuels and electricity absorbed $8-13 billion, or 4-7 percent of GDP, from 1980 to 1985.

Energy subsidies are not the only form of policy-induced inefficiency. Many natural

resources are subsidized, leading to distorted investment decisions and removing competitive incentives to use them efficiently. Unfortunately, subsidies tend to create powerful beneficiaries who come to regard their subsidy as a right, creating challenging political and institutional obstacles to full cost pricing. A recent Bank Operations Evaluation Department (OED) review of experience in urban water supply and sanitation projects between 1967 and 1989, for example, found that borrowers often fail to comply with covenants, especially those on pricing and financial performance. Another OED review of completed irrigation projects, found that cost recovery was unsatisfactory in 73 percent of the 107 projects surveyed. The Bank has taken steps to strengthen cost recovery mechanisms because benefits from removing subsidies can be substantial, economically, environmentally and socially–especially when such subsidies benefit large-scale users of a resource and the funds could be used to alleviate poverty more directly.

Experience in the water and sanitation sector illustrates the limitations of direct government provision and indiscriminate subsidization of household services. Despite progress in developing affordable engineering solutions, the delivery and maintenance of services have been disappointing. Subsidies are often captured by wealthier customers, and in most situations resources are inadequate to maintain a high quality of service or to extend facilities to low income areas. Subsidies may be justified in specific situations (rural water supplies in low income areas and sewage treatment in urban areas), but these are most effective when targeted and explicit. Thus, water and sanitation projects approved by the Bank in the last year have increased emphasis on cost recovery.

The Water Quality and Pollution Control Project in Brazil primarily focuses on urban water pollution and supply problems, which will benefit a substantial portion of the 14 million people in the metropolitan areas of Sao Paolo and Curitiba. Full cost recovery and improved water quality will be achieved through a variety of instruments--essentially tariffs on sewerage services and water use charges, but including park entry fees, increased property taxes and various forms of betterment fees, with a possible tax on pesticide use. The Karnataka Rural Water Supply and Environmental Sanitation Project in India also includes a component to recover operation and maintenance costs, to help ensure the sustainability of the project. Indeed, the project is designed to include a strong emphasis on community participation to increase the willingness of the beneficiaries to pay for the operation and maintenance of water supply services. Finally, in the Changchun Water Supply and Environmental Project in China, the Bank is helping to formalize a policy linking water charges to the marginal cost of water and to improve the collection and treatment of liquid wastes from both industries and households.

The negative effects of underpricing resources can also be seen in the agricultural sector. In **Tunisia**, the government's concern with ensuring sufficient supply and affordability of livestock products has resulted in a web of pricing and subsidy interventions. A variety of subsidies has promoted livestock production intensification in certain parts of Tunisia, while in other regions they have encouraged herd maintenance at levels beyond rangelands' carrying capacity. Particularly during dry years, subsidized feed imports have substituted for natural pasture, and have averted herd contraction. This failure of herds to respond to diminished feed availability in natural pastures, however, has contributed to significant rangeland degradation primarily in the central and southern regions of the country. This has direct effects on livestock production, and long-term, indirect implications for the entire agriculture sector.

In the Zambia Marketing and Processing

Infrastructure Project, one of the principal objectives of the project is to restructure public expenditures for agriculture by eliminating maize, fertilizer, and transport subsidies. Until November 1991, the Government pursued an interventionist agricultural strategy, nationalizing maize mills, establishing parastatals and government-controlled cooperatives, regulating markets and prices, and giving out subsidies. The resulting short-term gains in maize output were not sustainable since continuous cropping as well as fertilizer and pesticide subsidies, led to soil acidity and declining productivity. The reforms linked with the project address these distortions, setting the stage for improved efficiency in the production and supply of food, together with more sustainable farming practices.

In the past few years, several additional examples of the adverse environmental effects of these types of economywide policies have been examined. Bank studies on Brazil have demonstrated the role of sectoral policies in subsidizing frontier land clearing and use that have exacerbated deforestation in the Amazon.[10] Other non-Bank studies have addressed similar adverse impacts of agricultural policies on the environment in Indonesia (on soil erosion), Sudan (on deforestation), and Botswana (on pasture land degradation).[11]

Notes

1. Panayotou and Sussangkarn 1991.
2. Devarajan 1990; Robinson 1990.
3. Stryker et al. 1989.
4. Reed 1992; Cruz and Repetto 1992.
5. Birdsall and Wheeler 1992.
6. Munasinghe 1990.
7. World Bank 1993h, World Bank 1993i.
8. World Bank 1993h.
9. World Bank 1993i.
10. Mahar (1988) and Binswanger (1989) have analyzed the role of subsidies for agricultural expansion as the key factor leading to deforestation. Schneider (1993) focuses on institutional barriers at the economic frontier that prevent the emergence of land tenure services, such as titling and property rights enforcement, and thus undermine the potential for sustainable land use.
11. Barbier 1988; Larson and Bromley 1991; Perrings 1993.

3. Unaddressed Policy, Market, or Institutional Imperfections

While liberalizing policies typically help both the economy and the environment, unaddressed policy, market and institutional failures may undermine the beneficial environmental effects of economywide reforms. The reform process is typically handled in stages, with the initial adjustment package aimed at the most important macroeconomic issues. Some distortions that policymakers intend to address later in the adjustment process, or other constraints that have passed unnoticed in the initial screening, often cause environmental harm.[1] Paralleling the way in which the social consequences of adjustment should be handled, such potential adverse environmental consequences, due to remaining inefficiencies or inequities in the economic system may, therefore, require additional measures to complement the original economywide policies.[2] Such additional complementary measures include both market and non-market based policies, as well as specific investment projects. Some of the most frequently used market-based instruments include effluent charges, tradable emission permits, emission taxes or subsidies, bubbles and offsets (emission banking), stumpage fees, royalties, user fees, deposit-refund schemes, performance bonds, and taxes on products (such as fuel taxes). Non-market based instruments comprise regulations and laws specifying environmental standards which in essence mandate (or prohibit) certain actions ("dos" and "don'ts"). Common examples of environmental standards are ambient standards, emission standards, and technology standards.

Policy Distortions that Remain Need to be Addressed to Ensure Environmental Gains

Reforms in energy prices will help the environment, but remaining policy distortions elsewhere may reduce the beneficial effect. This is exemplified in the **Poland** case study, where energy intensity and excessive pollution are caused by not only the undervaluation of coal in the centralized price system but also the entire system of state ownership that suppressed market signals and incentives. Previous research has already shown how economywide adjustments, including increases in energy prices, contributed to improvements in energy use and pollution in Poland.[3] The current study indicates, however, that energy intensity and excessive pollution in Poland is due not only to the undervaluation of coal in the centralized price system but more importantly, to the entire system of state ownership that encourages output maximization rather than cost minimization. This means that price responsiveness is blunted, since financial losses are simply absorbed by the public budget, or passed on to consumers in the form of higher output prices.

The Poland study points out the special challenges that the Former Soviet Union (FSU) and other countries of Central and Eastern Europe face as they attempt to restructure their economies and make a rapid transition to a market-oriented system. All of these economies are more material intensive than market economies, as soft budget

constraints and centralized plans lead to maximization of output and resource use, rather than cost minimization. The energy intensity endemic to all socialist economies is manifested in Poland's case through excessive reliance on coal. The study also indicates that, especially in the case of economies in rapid transition, reform of regulations and institutions should not be allowed to lag too far behind economic restructuring.

In 1990, Poland initiated an economic transformation program that led to the privatization of many enterprises. The program was adversely affected by recession and the collapse of trading arrangements linked to the Council of Mutual Economic Assistance (CMEA). Furthermore, the process of privatization proved to be more complex and lengthy than initially expected. The government has therefore introduced an enterprise and bank restructuring program to assist in the restructuring of state-owned enterprises (SOEs) and in reducing their debt-servicing constraints.

Despite these changes, SOEs will continue to be major players in the Polish economy, at least in the short-term. Of particular relevance is the decision by the government to retain ownership in the energy, mining, steel and defense sectors in the medium-term, and to decide on privatization on a case-by-case basis over the next three years. Thus, energy sector restructuring efforts have focused on creating the institutional and legal framework to facilitate competition and greater private sector participation in the future. Coupled with aggressive energy pricing reforms, this strategy appears to be making some headway. For example, a recent survey of large state-owned manufacturing enterprises found that even without privatization, SOEs were already responding to the transformation program. In particular, the survey found that all firms reduced their consumption of materials and energy per unit of sales.[4]

The same generic set of issues is encountered in China, with specific reference to sustainable agriculture. Dramatic reforms have included reductions in subsidies for chemical fertilizers and pesticides, increases in energy prices, lifting of quotas for key agricultural products, and reduced intervention in product markets. One component of the study focused on farm level decision making in Jiangsu Province, where rapid industrialization is occurring and the opportunity cost of labor has increased considerably in recent years. Application of crop and animal residues as fertilizer (a labor intensive activity) has been discouraged by current trends in labor costs, thereby stimulating excessive demand for chemical fertilizer which may be less environmentally desirable. Increases in commercial energy prices may also result in burning of biomass. Another potential problem arises from the fact that one major agricultural input, namely land, is still subject to command and control and, in some communities, arbitrariness in its allocation. In such circumstances, the uncertainty about land allocation tends to encourage short-run profit maximization and exploitation of land at the expense of sustainability in agricultural production. Land access issues are also relevant in the institutional reforms discussed below.

Market Failures May Lead to Environmentally Costly Patterns of Growth

Aside from existing policy distortions, the absence of price signals for environmental services can undermine the contribution of efficiency- and growth- promoting reforms. However, recent studies on high-growth economies indicate that addressing environmental concerns early in the transition to growth may allow countries to limit the adverse environmental impacts of expanded economic activity. For example, a recent study

on mitigating pollution and congestion impacts in the high-growth economy of Thailand concludes that environmental effects are not solely determined by the scale of economic activity--the "structure of the economy, the efficiency of input-use (especially in energy and industry) and the types of production technologies in use all matter in determining the environmental impacts" of economic growth.[5]

The specific role of market failure in influencing the environmental implications of economic reforms is illustrated in the case of liberalization policies and industrial promotion in **Indonesia**. In this case, adjustment reforms which are successful in the traditional sense of stimulating industrial growth may have adverse pollution consequences because of market failure--no price signals prevent excessive build-up of pollution. Accelerated industrial growth, while clearly desirable for poverty reduction, could therefore bring with it increased pollution.[6]

The Indonesia study shows how reforms can mitigate some of the pollution problems associated with growth. In terms of emissions per unit of output, or pollution intensity, the study found that processing industries (for example, food products, pulp and paper) tend to be dirtier than assembly (for example, garments, furniture) industries. Liberalization in the 1980s promoted a surge in assembly industries, thereby reversing the 1970s pattern of more rapid growth in "dirty" processing sectors. Projections indicate that the share of basic processing industries in total industrial output will fall from 72 percent in 1993 to about 60 percent by 2020.

In addition, industry expanded rapidly outside densely populated Java, reducing the health impact of industrial concentration. However, industrial output growth has been so rapid that general pollution levels have nevertheless increased. Thus, while decreases in pollution intensity and industrial decentralization have helped to limit pollution, formal regulations will need to be strengthened also, to avoid health and environmental damage in the future.

Institutional Constraints that are Pervasive May Undermine Potentially Beneficial Environmental Impacts of Policy Reforms

The nature of macroeconomic effects on the environment is also contingent upon prevailing regulations or institutions governing resource use. The current case studies indicate that institutional constraints are a pervasive problem and take many forms. For example, the eventual impact of economywide reforms (such as those affecting international and domestic terms of trade) on the incentives facing farm households will be influenced by intervening institutional factors (which are themselves determined by cultural, economic and political factors)--especially those affecting access and use rights over agricultural resources such as land and water.

The role of institutional constraints in macroeconomic reform programs is examined in the **Ghana** case study. In this example, trade liberalization, by reducing the taxation of agricultural exports leads to increased production incentives, while efforts to reduce the government wage bill tend to increase the pool of unemployed. Thus, the adjustment process helps to stimulate production of export crops, and combines with rapid population growth and lack of employment opportunities outside the rural sector to create increasing pressure on land resources, encroachment onto marginal lands, and soil erosion. This effect on resource use is influenced by the allocation of property rights. Whether in relation to the security of land tenure of peasant farmers, or to the right to extract timber by logging companies, uncertainty normally results in environmental degradation. In Ghana, as in many regions of Africa, agricultural lands are

governed by traditional land use institutions, and farms are communally owned by the village or tribe. These common property regimes may have been sufficient in allowing sustainable use of agricultural lands when populations were much smaller, and sufficient fallow periods could allow land to regain its fertility. However, such traditional arrangements would be overwhelmed ultimately by economywide forces, resulting in reduced fallowing, loss of soil fertility and environmental decline. The foregoing suggests that better clarification of property rights may help to resist externally induced pressures.

In the **China** case study discussed earlier, economywide pricing reforms in output markets have not been accompanied by similar reforms on the input side. Land resources are, of course, among the major agricultural inputs, and uncertainty may persist about future rights to farm individual plots of land in many localities, even as agricultural markets in general are being liberalized. This could worsen the incentives for short-term over-exploitation of land resources, leading to degradation.

Relevant laws and regulations governing resource access should be reviewed when economywide reforms are planned, especially when there is evidence that key resource sectors such as land, forests, minerals, or marine resources will be affected. A useful example of how such programs could incorporate legal reforms for environmental purposes is the recent adjustment operation undertaken in **Peru**. In this example, it was determined that economywide reforms to promote economic recovery could potentially increase harvesting pressures on Peru's over-exploited fisheries. Thus, the complementary new fishing regulations to protect various fishing grounds were incorporated directly into the adjustment program.[7]

Another common institutional problem relates not to the rules and regulations themselves, but rather to the government's capacity to establish and enforce such rules. Regulating large numbers of potentially environmentally degrading activities is especially difficult, even for industrialized country governments. Substantial reductions in institutional and monitoring needs may be achieved with the use of indirect measures or modified pricing-regulation approaches. This is illustrated, for example, by the **Mexico** City air pollution study which shows that while, in principle, pollution taxes are the most accurate means of achieving reductions in pollutants, in practice, administrative feasibility demands that less refined instruments such as taxes on consumption of fuels may have to be used. While recourse to blunt instruments may help, the magnitude of the institutional capacity-building challenge nevertheless remains clear. Building the relevant institutional capacity in developing countries therefore should be underscored, and appropriate resources should be made available early in the adjustment process to assist country governments in this task.

Notes

1. Munasinghe, Cruz and Warford 1993.
2. A recent paper by Maler and Munasinghe (1994) sets out a basic theoretical model to trace the environmental impacts of macroeconomic policies in the presence of other market, policy or institutional imperfections.
3. Hughes 1992.
4. Pinto, Belka and Krajewski 1993.
5. World Bank 1994c.
6. Changes in incomes and the structure of consumption may also have environmental implications, in terms of demand for both domestic and imported goods.
6. World Bank 1993j.

4. Restoring Macroeconomic Stability

One broad objective of structural adjustment lending is to help restore stability in countries beset by economic crises. A recent example involves the Sub-Saharan countries, where a Bank study concludes: "No economy can function well for long if it has rampant inflation, an overvalued exchange rate, excessive taxation of the agricultural sector, scarce supplies of needed inputs, regulations on prices and production, deficient public services, and limited financial services."[1] The causes of macroeconomic instability often arise from imbalances created by long-standing, internal policy failures and aggravated by adverse external conditions. For example, a history of policies which have allowed increased domestic spending without parallel growth in production eventually leads to inflation or current accounts deficits or both. When unfavorable external credit or trade conditions arise, the result is macroeconomic instability. Under these conditions, both government budget deficits and international trade balances progressively deteriorate. When an external shock occurs (such as an increase in the prices of imported energy or a decline in the prices of the country's main exports), the result is macroeconomic instability of crisis proportions.

The relationship between environmental issues and policy reforms is fairly straightforward at this general level. Macroeconomic instability is not only disastrous for the economy, but also frequently detrimental to the environment. For example, high interest rates associated with economic crises can severely undermine the value of sustainable production, as resource outputs in the future lose most of their expected value. Thus, to the extent that adjustment policies can help restore macroeconomic stability, their impact will be unambiguously beneficial for long-term natural resource management and environmental concerns. This link is illustrated in the Costa Rica case study, which used a macroeconomic model incorporating timber harvesting activities, to examine the deforestation implications of various macroeconomic factors. Simulation results demonstrate that lower interest rates associated with a stable economy allow the logging sector to correctly anticipate benefits from future returns to forestry, thereby leading to a decline in current logging activities.[2]

Other studies have indicated that low and stable discount rates favor the choice of sustainable farming rather than short-term cultivation practices.[3] This is important since "mining" of agricultural land resources is often the prevailing form of resource use in many tropical areas. Frontier farmers have to choose between a sustainable production system with stable but low yields and unsustainable practices which initially have high yields. Using farm models and data from Brazil,[4] a recent Bank study found that if interest rates are very high, farmers would tend to choose less sustainable methods. For example, at interest rates of 40 percent (the prevailing real interest rates at the time of the study),farmers would pursue unsustainable agricultural practices that yielded high initial returns but led to subsequent annual declines in productivity of 10 percent. This explains why agricultural land "mining" is so prevalent in the Amazon--since most sustainable farming technologies available to Brazilian farmers cannot provide such high incomes. The critical macroeconomic implication of this result is that attempts to resolve the land degradation problem solely by focusing on providing better agricultural technologies would probably be ineffective. To arrest land degradation, macroeconomic reforms which reduce the real interest rate would be needed.

The issue of high debt levels (often associated with sustained periods of government budget deficits and macroeconomic instability) and its implications

Box 5. Debt and the Environment

One of the early antecedents of the concern about the relationship between economywide policies and the environment was the debt and degradation link noted by the Brundtland Report (1987): *debt that cannot be amortized forces raw material-dependent countries in Africa to deplete their fragile soils, with the result that good land is turned into desert.* The perception was that many countries reacted to the external shocks during the economic crisis years of the early 1980s by exploiting natural resources unsustainably. However, evidence from country case studies and from cross-country statistical exercises does not support this view.

For example, a World Wildlife Fund report, based on case studies for Cote d'Ivoire, Mexico, and Thailand, concluded that there is no simple relationship between external debt levels and environmental degradation. In the case of Cote d'Ivoire the research team found that although the country's deforestation rate was one of the highest in the world, external debt did not affect environmental degradation in general or the forestry sector in particular (Reed 1992). In another study, using econometric models with cross-country deforestation data, no consistent statistical relationship was found between debt and forest depletion (Capistrano and Kiker 1990).

In fact, many factors are at work, and primary commodities such as timber exports do not exhibit any simple trend during the debt crisis and adjustment periods. For example, in the early 1980s, primary commodity exports were subject to falling international commodity prices. Thus, production, domestic absorption, and price effects need to be assessed for specific commodities and countries (Reisen and Van Trotsenburg 1988). Indeed, since the debt crisis was associated with falling export prices and domestic economic contraction for many developing countries, it would not be unreasonable to expect that in some countries the rate of resource extraction, instead of increasing, would have actually declined during this period.

Ideally, countries go into debt with the expectation that the benefits from the productive activities to be funded will more than pay for the loan. In practice, debt often is incurred to support balance of payments deficits. In the environmental context, debt-for-nature projects represent an effort to directly channel debt (or in this case its converse, debt-relief) to beneficial environmental activities. Such debt-relief efforts have enabled environmental organizations to leverage their available funds significantly (World Bank, 1994e). In countries such as Costa Rica, debt-relief programs have allowed environmental agencies to fund forest or biodiversity protection initiatives.

for environmental degradation have been raised some time ago. However, the available evidence indicates that the linkage is neither clear-cut nor significant, as summarized in Box 5.

Notes

1. World Bank 1994b, p. 37.
2. The effect of inadequate tenurial security over the resource (and future benefits from it) parallel the results for high discount rates. This corresponds to the well-known result in renewable resource exploitation models that the effects on economic behavior of open-access resource conditions are formally equivalent to those of having secure property rights with infinitely high discount rates.
3. Southgate and Pearce 1988.
4. Schneider 1994.

5. Short-Term Adverse Effects of Recession and Government Cutbacks

To the extent that economywide policy reforms promote new economic opportunities and employment for the long-term, they will clearly alleviate poverty and reduce pressures that encourage unsustainable exploitation of fragile resources by the unemployed (see later section on these long-term effects). In the first place, worsening poverty and income distribution result from the very economic distortions that stabilization and adjustment reforms seek to remedy. However, in the transition period when fiscal austerity is required to arrest deteriorating economic conditions, short-term distributional problems may arise, linked to the recessionary aspects of reforms. One issue concerns the relationship between short-run recessionary effects of adjustment reforms and their potentially adverse impacts on employment, poverty and the environment. The second focuses on the decline of environmental services associated with the government spending cuts mandated by many stabilization and adjustment programs.

Early views on the environmental implications of adjustment-related reforms, paralleled concerns raised about the social impacts of adjustment. Work on the social aspects of adjustment was motivated by the concern that adjustment programs would focus on growth, at the expense of distributional objectives.[1] A major issue was that the poor, who would be most vulnerable to the effects of macroeconomic contraction, also might be deprived of 'safety nets'--especially if governments unwisely cut social services. Many of the price-related policies would have differential implications for various sectors, and in some cases the poor would be badly affected unless special programs were introduced to buffer such effects and protect them. At the same time, since unemployment and poverty might be exacerbated by short-term contractionary effects of stabilization programs, there would be correspondingly important increases in population pressure on fragile resources. (See Box 6 on poverty and the environment.)

Reduced government spending and its potential adverse impact on environmental protection services have been the subject of criticism from environmental groups. In a study performed by ECLAC (1989), it was concluded that adjustment policies pursued in Latin America during the 1980s led to cutbacks in current expenditure allotments for managing and supervising investment in sectors such as energy, irrigation, infrastructure and mining.[2] This limited the funds available for environmental impact assessments and the supervision of projects to control their environmental impacts. Miranda and Muzondo (1991), in an IMF survey, recognized this problem and suggested that high levels of government expenditure in other areas may lead to reduced funding of environmental activities.[3] Recent case studies attributed increases in air pollution problems in Thailand and Mexico to reductions in expenditures for adequate infrastructure.[4]

While the argument sounds reasonable enough that government cutbacks undertaken as part of adjustment austerity efforts may undermine the funding for environmental initiatives, empirical assessment of its true importance is difficult. Usually, only general categories of expenditures can be identified in most government budgets, so that detailed assessments of environmental programs usually cannot be initiated. In one effort that was undertaken to assess the social consequences of adjustment lending in Africa, it was found that although there have been declines in government expenditures, the budget proportion going to social expenditures and agriculture actually increased during the

Box 6. Poverty and the Environment

It is no accident that assessments of the impacts of pollution invariably bring up concerns about poverty. In many cases, the worst effects of environmental pollution and resource degradation are borne by the poor, especially in terms of health problems and reduced productivity. In both urban and rural areas and in various occupations, they are the ones who can least afford to protect themselves from environmental degradation: the poor spend long hours in polluted factories; they are exposed to agricultural chemicals; and services, such as clean water and trash disposal which are usually taken for granted by those who are better off, are normally unavailable in slums and rural areas.

Environmental degradation is also systematically linked to the problem of access to productive resources. The rural poor and landless workers often depend on the exploitation of fragile, open access resources to supplement their meager livelihood. For example, agricultural plantation workers may depend on seasonal fishing or slash-and-burn agriculture for subsistence. In addition, if poverty and unemployment are pervasive the poor may be forced to migrate to environmentally vulnerable areas, such as hilly lands or coastal fisheries, where there is open access.

Such open access conditions in the face of increasing population and unemployment result in over-exploitation. The situation in many coastal fisheries illustrates this problem of the "tragedy of the commons." As long as there is a surplus to be gained from fishing, more households will migrate to the fishery, until eventually output declines and everyone is relegated to equally poor levels of subsistence. Population pressure on hilly lands lead to similar results for shifting cultivators. In both cases, the landless poor are driven to over-exploit open access resources and, in the process, degrade their source of livelihood

In brief, the very poor, struggling at subsistence levels of consumption and preoccupied with day-to-day survival, have limited scope to plan ahead and make natural resource investments (for example, soil conservation) that give positive returns only after a number of years. Such short time horizons are not innate characteristics, but rather the outcome of policy, institutional, and social failures. The poor's use of natural resources is also affected by their facing greater risks, with fewer means to cope. These risks range from misguided policy interventions in input and output markets to changing land tenure systems that favor those with greater political clout. This means that the poor will have little choice but to over-exploit any available natural resources.

How can policy reforms help alleviate the problem? From an individual decision-making perspective, policies that alter relative prices will affect current production and consumption activities of farming households as well as their future use of available resources. Thus, price policy reforms could promote environmentally benign crops and farming practices or discourage excessive water or pesticide use. Land improvement and soil conservation could also be encouraged if increased income and welfare allowed farmers to invest more in land and water management. Clearly, this "resource endowment" effect due to the increased valuation of the household's resources would be sensitive to whether or not access to such resources is secured, for example, through well defined land tenure arrangements.

Beyond the microeconomic aspects of poverty oriented reforms, broad sectoral price changes and macroeconomic prices that alter factor flows and change the structure of the economy will also affect conditions of poverty and the environment. Thus, to the extent that economywide policy distortions have contributed to population pressure on fragile resources, adjustment-related reforms should also help. Import-substitution, industrial protection, and regressive taxation are some policies that have historically been associated with lagging employment generation, income inequality, and poverty There reforms, such as those that promote export growth will lead to higher incomes for sectors producing exportable crops and manufactured goods, generally reducing poverty among rural and industrial workers. Better economic conditions in agriculture and industry would also reduce the problem of frontier migration that has been associated with agricultural extensification. Because of their economywide impacts, the potential contribution of such policies to alleviating poverty and reducing environmental degradation could be substantial.

adjustment period.[5]

The results of studies focusing on social safety nets during adjustment programs confirm that pursuing fiscal discipline and macroeconomic stability need not take place at the cost of increased hardship for the poor. In much the same way, specific environmental concerns can be incorporated in stabilization efforts. For example, it has been reported that in many countries in Sub-Saharan Africa, forestry departments and their activities have always been severely underfunded.[6] Thus, targeted efforts to support forestry management activities could, with modest costs, be included in reform packages as part of a proactive environmental response. In brief, both critical environmental and social expenditures could be protected if government budget cuts are made judiciously.

Notes

1. Cornia, Jolly, and Stewart 1992.
2. ECLAC 1989.
3. Miranda and Muzondo 1991.
4. Reed 1992.
5. Stryker et al. 1991.
6. World Bank 1994b.

6. Long-Term Poverty and Income Effects

In addition to the short-term concerns discussed earlier, the crucial long-term links between poverty and environmental degradation in developing countries are increasingly being recognized (see Box 6, and Dasgupta and Maler 1994). For example, the *World Development Report 1992* noted that the growing evidence of the relationship between reducing poverty and addressing environmental goals points to the need to undertake poverty and population programs as part of environmental efforts.[1] The need to break the "cycle" of poverty, population growth, and environmental degradation has also been identified in a recent report of the International Development Association as a key challenge for sustainable development.[2]

An important result of examining the general equilibrium effects of macroeconomic policy is that indirect resource allocation effects are important and may dominate the more direct effects of some price or income policy changes. In the **Costa Rica** study, the economic and environmental implications of wage restraints in structural adjustment are examined with the use of a computable general equilibrium (CGE) model which highlights the economic activities and factors affecting deforestation in Costa Rica. The model differs from standard approaches in two important respects. First, it can simulate the effect of introducing property rights on forest resources, thus allowing the private valuation of future forestry returns to contribute to sustainable management. Second, it also includes markets for logs and cleared land--loggers deforest to sell timber to the forest industry and squatters clear land for agricultural production and for sale to the agriculture sector (as the latter expands and requires more land).

The importance of indirect effects in Costa Rica is demonstrated in the analysis of economywide policy changes, such as an increase in the wage rate. Because the role of inter-sectoral resource flows is incorporated in the CGE model, the effects of changes in wages are different from partial equilibrium results. If the wage of unskilled labor were increased due to, say, minimum wage legislation, the model predicts that deforestation could worsen rather than decline. Although logging declines due to increased direct costs, this is more than made up by the indirect effect of inter-sectoral flows since the industrial sector (where minimum wage legislation is more binding) is much more adversely affected by the higher labor costs. Labor and capital thus tend to flow from industry to agriculture, leading to greater conversion of forest land for farming.

This simulation exercise suggests the need for caution in attempting to "legislate" income improvements by increasing minimum wages. Introducing higher wages initially improves labor incomes but a resulting contraction of industrial and agricultural employment leads not only to more unemployment but to environmental degradation as well. The increase in unemployment results in greater pressures for expanding shifting cultivation in forest lands.

Beyond pricing and inter-sectoral environmental linkages that can be identified in general equilibrium approaches, another set of studies has looked at the environmental implications of rural poverty and unemployment within the broader context of the social and demographic problems of inequitable land access and rapid population growth.[3] Import substitution, industrial protection, and regressive taxation are some economywide policies that have historically been associated with lagging employment generation, income inequality, and poverty. Unequal distribution of resources and inappropriate tenure are institutional factors that also contribute to the problem. In the context of inequitable assignment of endowments and rapid population growth, the resulting unemployment and income inequality force the poor to depend increasingly on

marginal resources for their livelihood. The result is pressure on fragile environments. This effect can be analyzed in conjunction with the assessment of large migration episodes. These may occur as part of direct resettlement programs or may be induced by inappropriate policies, such as land colonization programs.

Similar issues have been considered in the Bank's recent forest sector policy paper, which identified the relationship between *deforestation* and *poverty and population pressure* as a priority resource management concern. The need for correct economic incentives regarding timber harvesting, agro-ecological zoning and regulations, and the role of public investment and research were the other priorities identified in the policy paper.

With regard to sustainable agriculture concerns, the study of the *Population, Environment and Agriculture Nexus in Sub-Saharan Africa* explicitly links the related problems of rapid population growth, agricultural stagnation and land degradation in Africa.[4] The study found that shifting cultivation and grazing in the context of limited capital and technical change cannot cope with rapid population growth. At the same time, the traditional technological solution of relying on high yielding crop varieties is not available. Thus, the study identified the need for a mix of responses in terms of reforms to remove subsidies for inappropriate land uses, improve land use planning, recognize property rights, provide better education, and construct appropriate rural infrastructure to promote production incentives.

Among the current Bank research, the **Philippines** case study evaluates the policy determinants of long-term changes in rural poverty and unemployment that have motivated increasing lowland to upland migration. This process has led to the conversion of forest lands to unsustainable agriculture and has been identified as a key mechanism contributing to the deforestation problem. The inability of the government to manage forest resources is an important direct cause of deforestation, but there is increasing recognition that economic policies, both sectoral and economywide, also significantly contribute to the problem. For example, the study links lowland poverty to agricultural taxation, price controls, and marketing restrictions, and uses an econometric model to demonstrate that the poverty contributes significantly to migration pressures on forest lands.

Trade and exchange rate policies have also played important roles in the Philippines and have been dominated by an urban consumer and industrial sector bias. The agricultural sector was implicitly taxed by an average of about 20 percent for most of the 1970s and early 1980s. Because the industrial sector did not provide an alternative source of growth, poverty generally has worsened and rural incomes in particular have suffered. The study results indicate that the main mechanism by which these economic problems affect the environment is through migration and the conversion of forest lands to unsustainable agriculture. Population pressure already evident in the 1970s worsened during the 1980s. The net upland migration rate grew from 3.4 to 9.4 percent between 1970 to 1975 and 1978 to 1980, and increased substantially to 14.5 percent between 1980 and 1985. Consequently, upland cropped area grew at annual rates exceeding 7 percent from 1971 to 1987. These results suggest that while forestry specific conservation programs are needed, economywide policy reforms could be as important in arresting the process of deforestation.

Notes

1. World Bank 1992a.
2. IDA 1992.
3. Feder et al. 1988; Cruz and Gibbs 1990; Lele and Stone 1989.
4. Cleaver and Schreiber 1991.

Part II

Operational Issues and Practical Implications

Effective decision making for sustainable development has been hindered by lack of knowledge about the complex links between economywide policies and the environment. For example, from the economic side, the environmental implication of structural adjustment operations are inadequately explored, and from the environmental side, national environmental action plans (NEAPs), Country Environmental Strategy Papers (CESPs), and similar documents rarely contain careful economic analysis. Discussed below are some of the current attempts to analyze economic policy-environment links in Bank operations, as well as several practical steps to improve this process--based on the findings of this report.

7. Integrating Environmental Concerns Into Economic Decision Making

The preceding discussion shows that the links between economywide policy reforms and the environment can be complex and usually require country-specific analysis. However, while impacts are often too diverse to be comprehensively traced with precision, *many key economywide reforms have specific, identifiable, impacts on a much smaller subgroup of priority environmental problems.* Some of these impacts may be intuitively obvious, and many of them, with some effort, may be traceable. Even modest progress in this regard is helpful because the *proper recognition of the environmental benefits of economywide policies will clearly help build support for economic reforms.* At the same time, *broader recognition of the underlying economic and policy causes of environmental problems can enhance support for environmental initiatives*--both in terms of environmental policies as well as projects.

A recent review of loan conditions in adjustment operations indicated an increase in the number of environmental components included in these loans. The review covered adjustment lending operations over the period fiscal 1988 to fiscal 1992 and found that about 60 percent of the sampled loans explicitly included environmental goals or loans conditionalities addressing environmental concerns in agriculture, forestry, energy, trade, and industry. This was up sharply from only 37 percent during the fiscal 1979 to fiscal 1987 period. Moreover, the recent loans encompassed a much wider range of policy instruments or sectoral strategies (for example, from energy and resource pricing reforms to institutional capacity building).[1]

Formal recognition by the Bank of the operational relevance of linkages between adjustment programs and environment is already evident from the most recent Operational Directive on adjustment lending (OD 8.60), which states that:

> Positive or negative linkages may ... arise from relative price shifts--changes in the pattern of taxes, trade duties, real wages, exchange rates, and so on. For example, there are usually strong positive linkages between energy conservation and reforms in energy pricing. On the other hand, trade liberalization may encourage deforestation or over-fishing in some cases. Where such negative linkages exist, the answer is not to delay stabilization or the adjustment program, but rather to devise specific measures, such as sensible forestry and fishing laws, to counteract the possible negative effects.[2]

In most cases the foregoing conclusions will be appropriate. In a few cases involving more severe environmental degradation (especially where ex-ante analysis has carefully prepared the ground), special care may be required to orchestrate the timing and sequencing of various economywide policies and complementary environmental measures, to minimize environmental damage.

As indicated in OD 8.60 and elaborated in the findings of this paper, the best approach to avoid environmental damage would be to identify, prioritize and analyze the most serious economic-environmental linkages, and devise specific complementary mitigating measures, when economywide reforms are contemplated. Where data and resource constraints preclude the accurate tracing of such links (ex-ante), the preliminary screening and prioritization of environmental issues could be followed by establishing contingency plans and carefully monitoring these environmental problems, to deal with them if they worsen ex-post (see next section on Action Impact Matrix).

This kind of economic-environmental integration may be enhanced in Bank analysis. While Bank country analyses have historically followed separate economic and environmental tracks, considerable progress has recently been made in integrating environmental issues into lending operations. This process has been assisted by a number of regional and country-specific environmental studies. At the regional level, the essential links between countrywide policies--specifically those relating to social issues, population and poverty--and the environment have been identified in major studies for the Africa Region and in a recent regionwide stocktaking of environmental initiatives.[3] Similarly, a report on "East Asia's Environment: Principles and Priorities for Action" has been completed that also analyses environmental-economy linkages. An earlier environmental strategy paper for the Asia Region specified the nature of links between economic policies and the environment in the region.[4] Furthermore, the Bank has taken the lead in a major inter-agency study for Eastern Europe which stresses, in addition to specific environmental policies and targeted expenditures, the importance of basic market reform, especially with regard to energy pricing, as well as economic and industrial restructuring and management.[5] This effort has led to the recent "Environment for Europe" report (published by the World Bank), "Environmental Action Programme for Central and Eastern Europe."[6]

At the country level, environmental issues are becoming increasingly significant in energy, agriculture, urban, industry and transportation sector work. Environmental strategy and action plan documents in both Sierra Leone and Sri Lanka have integrated environmental priorities with needed economic policy reforms (as noted below). A recent study of Bolivia has also explicitly linked forest management concerns with a range of sectoral and macroeconomic policies.[7] In the Philippines, agriculture and forestry sector work evolved into a study addressing underlying causes of environmental degradation, a number of which were related to countrywide economic policies.[8] Specifically, environmental strategy studies are also becoming of major importance in determining country economic strategies, and, by paying attention to the underlying causes of environmental problems, identifying the range of policy reforms required to address them. The links between economywide policies and the environment have, for example, been a significant element of environmental strategy papers for China, Indonesia, Malawi, Jamaica and Peru[9] and have done much to lay the foundation for subsequent lending strategies.

Environmental sector work in Nigeria,[10] recognizing the potential impact of economic policies on the environment, has identified the need to strengthen the capacity of government finance and planning agencies to properly integrate environment into their operations; such a component was subsequently built into an actual lending operation. One of the most comprehensive treatments of economy-environment links is found in a recent study for Sao Tome and Principe.[11] Environmental issues relating to fisheries, water resources, coastal erosion, agriculture, forestry, energy, toxic waste and biodiversity are considered with respect to policies on trade, money supply, land distribution, privatization, sectoral pricing and government budgets.

In addition to the above, numerous efforts have been made in the context of Bank operations to study the links between economic policies and specific environmental problems. One of the most important of these is a series of studies of government policies which have encouraged deforestation in the Brazilian Amazon (although similar studies have been conducted in other parts of Latin America). The impact of subsidies for cattle ranching, combined with a policy of providing free title to forest land once it has been cleared, has been well documented.[12] The

importance of effective enforcement of property rights in encouraging sustainable agricultural practices has also been demonstrated.[13]

Notes

1. Warford et al. 1994. In this study, eighty-one loans were examined, representing about 65 percent of total adjustment lending during the FY88-FY91 period and including forty-seven structural and thirty-four sectoral adjustment loans in fifty-eight countries. Other loans were excluded, because they were mainly financial sector adjustment programs considered to have no direct- -nor traceable--implications for the environment.
2. World Bank 1992i.
3. World Bank 1989a; Cleaver and Schreiber 1991.
4. World Bank 1993k.
5. World Bank 1993b.
6. Environment for Europe 1994.
7. Anderson et al. 1994.
8. World Bank 1989b.
9. World Bank 1992a, 1992f, 1993a, and 1993e; Scarsborough 1991.
10. World Bank 1990.
11. World Bank 1993f.
12. Mahar 1988; Binswanger 1989.
13. Schneider 1993b.

8. Action Impact Matrix: A Tool for Analysis and Coordination

In the context of the foregoing discussion, economic and environmental analyses and policies may be used more effectively to achieve sustainable development goals, by linking and articulating these activities explicitly. Implementation of such an approach would be facilitated by constructing an **Action Impact Matrix (AIM)**--a simple example is shown in Table 1, although an actual AIM would be very much larger and more detailed.[1] Such a matrix helps to promote an integrated view, meshing development decisions with priority economic, environmental and social impacts. The left-most column of Table 1 lists examples of the main development interventions (both policies and projects), while the top row indicates some of the main sustainable development issues. Thus the elements or cells in the matrix help to: (a) explicitly identify the key linkages; (b) focus attention on valuation and other methods of analyzing the most important impacts; and (c) suggest action priorities. At the same time, the organization of the overall matrix facilitates the tracing of impacts, as well as the coherent articulation of the links between a range of development actions--that is, policies and projects.

A stepwise procedure, starting with readily available data, has been used effectively to develop the AIM in several country studies that have been initiated recently.[2] This process has helped to harmonize views among those involved (economists, environmental specialists and others), in the country concerned and the Bank, thereby improving the prospects for successful implementation. First, data from NEAPs, EAs, and so forth may be organized into an environmental issues table that prioritizes these problems, provides quantitative or qualitative indicators of damage, and helps identify underlying economic causes. Second, using information readily available from country economic and sector work, the main economywide policies (current and intended) could be set out in a second table, together with a brief review of the basic economic issues that they address and potential environmental linkages. The information from these two tables are then combined to develop a preliminary Action Impact Matrix. (For an example of this process, refer to Annex Tables B-1 to B-3, which first present the main environmental issues, then describe various economywide policy reforms, and finally combine these two building blocks to produce an illustrative Action Impact Matrix for Sri Lanka.)

One of the early objectives of the AIM-based process would be to help *in problem identification*--by preparing a preliminary matrix that identifies broad relationships, without necessarily being able to specify with any accuracy, the magnitudes of the impacts or their relative priorities. For example, in Table 1, a currency devaluation may make timber exports more profitable and lead to deforestation of open access forest. The appropriate remedy might be to strengthen property rights or restrict access to the forest areas. A second example might involve increasing energy prices toward marginal costs to improve energy efficiency and decrease pollution. Adding pollution taxes to marginal energy costs will further reduce pollution. Increasing public sector accountability will reinforce favorable responses to these price incentives, by reducing the ability of inefficient firms to pass on cost increases to consumers or to transfer their losses to the government. In the same vein, a major hydroelectric project is shown in Table 1 as having two adverse impacts--inundation of forested areas and villages, as well as one positive impact--the replacement of thermal power generation (thereby reducing air

Table 1. Simple Example of an Action Impact Matrix (AIM)[1]

ACTIVITY/ POLICY	MAIN OBJECTIVE	IMPACTS ON KEY SUSTAINABLE DEVELOPMENT ISSUES			
		Land Degradation	*Air Pollution*	*Resettlement*	*Others*
1.Macroeconomic & Sectoral Policies	Macroeconomic and Sectoral Improvements	Positive Impacts Due to Removal of Distortions Negative Impacts Mainly Due to Remaining Constraints			
• *Exchange Rate*	• Improve Trade Balance and Economic Growth	(-H) (deforest open-access areas)			
• *Energy Pricing*	• Improve Economic and Energy Use Efficiency		(+M) (energy efficiency)		
• *Others*					
2.Complementary Measures[2]	Specific/Local Social and Environmental Gains	Enhance Positive Impacts and Mitigate Negative Impacts (above) of Broader Macroeconomic and Sectoral Policies			
• *Market Based*	• Reverse Negative Impacts of Market Failures, Policy Distortions and Institutional Constraints		(+M) (pollution tax)		
• *Non-Market Based*		(+H) (property rights)	(+M) (public sector accountability)		
3. Investment Projects	Improve Efficiency of Investments	Investment Decisions Made More Consistent with Broader Policy and Institutional Framework			
• *Project 1* (Hydro Dam)	• Use of Project Evaluation (Cost Benefit Analysis, Environmental Assessment, Multi-Criteria Analysis, etc.)	(-H) (inundate forests)	(+M) (displace fossil fuel use)	(-M) (displace people)	
• *Project 2* (Re-afforest and relocate)		(+H) (replant forests)		(+M) (relocate people)	
• *Project N*					

Source: Munasinghe 1993b.

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[1] A few examples of typical policies and projects as well as key environmental and social issues are shown. Some illustrative but qualitative impact assessments are also indicated: thus + and - signify beneficial and harmful impacts, while H and M indicate high and moderate intensity. The AIM process helps to focus on the highest priority environmental issues and related social concerns.

[2] Commonly used market-based measures include effluent charges, tradable emission permits, emission taxes or subsidies, bubbles and offsets (emission banking), stumpage fees, royalties, user fees, deposit-refund schemes, performance bonds, and taxes on products (such as fuel taxes). Non-market based measures comprise regulations and laws specifying environmental standards (such as ambient standards, emission standards, and technology standards) which permit or limit certain actions ("dos" and "don'ts").

pollution). A re-afforestation project coupled with adequate resettlement efforts may help address the negative impacts. The matrix-based approach therefore encourages the systematic articulation and coordination of policies and projects to achieve sustainable development goals. Based on readily available data, it would be possible to develop such an initial matrix for many countries. Furthermore, a range of social impacts could be incorporated into the AIM, using the same approach.

This process may be developed further to assist in *analysis* and *remediation*. For example, more detailed analyses may be carried out for the subset of main economywide policies and environmental impact links identified in the cells of the preliminary matrix. This, in turn, would lead to a more refined final matrix, which would help to quantify impacts and formulate additional measures to enhance positive linkages and mitigate negative ones. The more detailed analyses which could help to determine the final matrix would depend on planning goals and available data and resources. They may range from the application of conventional sectoral economic analysis methods (appropriately modified in scope to incorporate environmental impacts), to fairly comprehensive system or multisector modeling efforts. The former approach is used in many of the case studies mentioned above. The latter approach is illustrated by the **Costa Rica** and **Morocco** studies where computable general equilibrium models were constructed that include both conventional economic, as well as environmental or resource variables. At the moment, data and analytical shortcomings are likely to preclude reliance upon general equilibrium or comprehensive system modeling approaches. Current efforts constitute a first step in this direction--their major contribution being to identify more precisely the information and data required for operational policy purposes, and test the strengths and limitations of a general equilibrium approach.

Thus far, the more successful attempts to value environmental impacts in the macroeconomic context have been based on their effects on conventional economic output which are priced in the marketplace (supplemented sometimes with shadow pricing corrections). This approach may be linked up more easily with commonly used market measures of well-being like Gross National Product (GNP). For example, the new United Nations handbook for the System of National Accounts (SNA), includes a proposal to supplement the conventional SNA with a set of satellite accounts that reflect pollution damage and depreciation of natural resource stocks.[3] Some environmentally and socially crucial impacts (for example, loss of biodiversity or human health hazards) may be as important in certain cases and may require the extension or adaptation of conventional economic techniques. One step would be to improve environmental valuation by using a wider range of methods which employ both market and non-market information to indirectly estimate the economic value of environmental assets (for example, travel cost or contingent valuation methods). Such techniques have been used quite widely in project level applications in the industrial countries.[4] There is a growing body of case studies on the environmental valuation of project impacts in the developing countries.[5] However, considerable work is required to extend this experience to cover economywide impacts.

Other (non-economic) indicators of environmental and social well-being (both micro and macro) also would be helpful in decision making, especially in cases where economic valuation of environmental and social impacts was difficult.[6] Techniques such as multicriteria analysis (MCA) may be used to trade off among different economic, social and environmental indicators, as a supplement to conventional cost-benefit

analysis (CBA).[7]

The **Sri Lanka** case study explores the MCA approach, in attempting to analyze economic-environmental as well as environmental-environmental tradeoffs. The essential point is that even when valuation of environmental and social impacts is not possible, techniques exist that will help to better prioritize such impacts, thereby improving development actions.

Notes

1. Munasinghe 1993b.
2. For example, Ghana and Sri Lanka. The process used in Sri Lanka is shown in Annex B.
3. United Nations Statistical Office (UNSO) 1993.
4. For a recent review, see for example: Freeman 1993.
5. For a recent review, see for example: CIDIE 1993, Munasinghe 1993a.
6. Munasinghe et al. 1995.
7. Munasinghe 1993a.

9. Identifying Economic-Environmental Links

As shown above, the better integration of environmental issues in economywide policy analysis will help generate support for economic reforms. However, this can also improve the policy context for environmental initiatives. Implementation of Bank projects that have environmental objectives or components has posed problems. This stems from the fact that it may not be in the narrow self interest of the borrowing entity to adhere to loan conditions which are primarily of benefit to others in the country. At the national level, enforcement of standards and regulations often encounters severe institutional constraints. Similarly, from the Bank's own perspective, ensuring compliance with environmental conditions is difficult. Part of the answer is to create conditions in which the interests of the party causing environmental damage coincide with the social good--integration of environmental concerns into sectoral and macroeconomic incentives is therefore required.

Overall, the studies discussed earlier suggest that economic techniques exist--and for most countries, so does natural resource information--to improve the way environmental issues are addressed by policies at the sector and macro levels. Although data problems remain, the studies illustrate the feasibility of carrying out better analyses of the environmental impact not only of projects, but also of economic policies--and in particular--adjustment operations. This will hasten the integration of the environment into the mainstream of the Bank's work. Where the environmental impact of the adjustment process is potentially adverse, such studies would form the basis for identifying measures to counteract these effects (both ex-ante and ex-post); where on the other hand they are likely to be positive, complementary measures might be devised to maximize such beneficial impacts.

This approach is consistent with and supports the existing project environmental assessment (EA) procedures. While the function of the EA as a proactive instrument of project preparation and design is clearly understood in theory, more could be done to achieve this objective in practice. The "add-on" nature of environmental concerns, the lack of breadth in identifying relevant issues, the limited attention to alternatives and the weak mitigation plans in some projects show this to be the case. Clearly, the search for fundamental underlying causes of environmental degradation and the design of economic and other instruments at the country or sector level could substantially support the EA process at the project or investment level.

One means by which NEAPs and CESPs could better link economic and environmental issues is through the analysis of the connections between natural resource management and broader economic policies. In particular, the recognition that resource depletion is in reality the liquidation of an asset[1] would focus economic managers' attention on the national balance sheet and variety of macroeconomic and resource sector policies relating to royalty regimes, investment of government royalties and the fiscal and monetary determinants of savings effort in their countries.

The lessons from the case studies are also relevant from the viewpoint of those with explicit environmental responsibilities, including preparation of National Environmental Action Plans (NEAPs), Country Environmental Strategy Papers (CESPs), or their equivalent. These documents have rarely responded adequately to the growing need for greater understanding of links between economic policies and the environment. Of the NEAPs reviewed, none have conducted a systematic analysis of the economic policies underlying environmental degradation and, therefore, of the appropriate ways in which environment should become

part of countrywide economic planning. There are, however, current efforts to address this issue. The Environment Department is carrying out a study of existing NEAP reports. With respect to country studies, a study on Sierra Leone explicitly attempts to relate NEAP issues to economywide policies.[2] The Sri Lanka NEAP, now being elaborated on and implemented in Bank operational work, is also an important country initiative that is serving as a framework to integrate economic policies and environmental objectives.

This paper provides examples to those responsible for environmental management, of the way in which economic policies may impact on the environment. By implication, therefore, it also demonstrates the kinds of opportunities available for achieving environmental objectives, not simply in a cost-effective manner, but indeed often in ways that impose no costs at all upon society. Such opportunities should receive systematic attention in the NEAPs, which would then become much more operationally useful as inputs into various aspects of country economic work, and in particular into Country Economic Memoranda (CEM) and Country Assistance Strategy (CAS) Papers. In turn, this will strengthen the discussion of environmental issues in country economic documents. This process would also facilitate the necessary cooperation between the Bank and the International Monetary Fund (IMF). It would help to focus more attention on environmental concerns in the dialogue among the Bank, the IMF, and national economic and environmental managers, while also encouraging the closer coordination of economywide policies and environmental objectives, in practice.

Notes

1. Hamilton and O'Connor 1994.
2. World Bank 1994a.

10. Topics for Further Work

As indicated earlier, more systematic implementation of the present findings and more in-depth work in tracing the environmental implications of economywide policies are required. A broad collaborative program, including several specific initiatives and country case studies, has begun in the Bank (including the Environment Department, Policy Research Department and Operations). This work is being complemented by collaboration with researchers undertaking parallel work among development institutions, NGOs and the academic community.

With regard to implementation, an outreach program has already begun in the Bank to better incorporate environmental issues into country economic and sector work and improve the economic analyses in country environmental documents. This process will be facilitated by preparing Action Impact Matrices for more countries. Several training workshops have been held for Bank staff, to disseminate the results of this paper, and these efforts will be intensified in the future, both within and outside the Bank (with EDI).

Follow up work will also include another round of studies that will examine links between the longer-run structure of growth, poverty alleviation, and environmental protection. These studies also will seek to relate packages of macroeconomic and sectoral policy reforms to a fuller range of priority environmental concerns, in a variety of countries. Some areas of current interest such as trade reform and privatization policies are to receive early attention. At the same time, more emphasis should be placed on developing more practical models and analytical tools which can be applied in a variety of situations.

Distributional, political economy and institutional issues also are to be addressed in future work. In this context, greater attention needs to be paid also to the identification, evaluation and mitigation of the social impacts of economywide policies. The nature of environmental and social problems is heavily dependent on the allocation of political and institutional power, and policy reforms may have substantial implications for the distribution of income and welfare. Thus, there are obvious obstacles to overcoming what might be very powerful vested interests when environmental reforms are recommended. Implementation issues such as asymmetries in the incidence of environmental costs and benefits (especially health impacts), consultation and empowerment of disadvantaged groups, timing of reforms and the role of environmental conditionalities, will need to be studied.

Finally, the need for a more systematic way of monitoring the environmental implications of reform programs suggests that economywide indicators of sustainability should be developed. Recent work in the Bank and elsewhere has focused on methods of incorporating environmental aspects into national income accounts. However, severe data constraints limit the applicability of such a comprehensive approach in many developing countries. "Short-cut" methods therefore need to be developed. For example, easily applicable rules-of-thumb (calibrated by well-chosen national studies) could be used to devise baseline estimates of national wealth in the form of natural resources, human capital and produced assets. A current Bank project is studying the ways in which selected indicators (both physical and economic value-based) might be constructed, so that they can contribute to the more effective monitoring of economywide conditions of sustainability.

Annex A

The Environmental Implications of Economywide Policies: Summary of Case Studies

In recent years, World Bank operations have resulted in a fairly good understanding of the general role and limitations of explicit environmental measures such as pollution taxes and regulations. The relative merits of market based economic instruments versus non-market based "command and control" approaches, with special reference to the cost-effectiveness of alternative methods, are well established in the literature.[1] In the Bank itself, the subject has received analytical treatment in lending operations at least as far back as the early 1970s, when these alternatives were closely examined in the preparation of the Finland Pollution Control Project. The *World Development Report 1992* also highlights this issue, concluding that there is a place for both economic instruments as well as regulatory methods in any national pollution control program.

Built upon many years of experience of assisting in sectoral policy reforms such as pricing of water and energy, the Bank also has acquired considerable expertise in understanding the relationships between these reforms and the environment. Although compliance with loan conditions on pricing still needs to be improved. the general principle is increasingly accepted that the price of a resource (or charge for using environmental services) should reflect the marginal opportunity cost involved.[2] The latter should incorporate the economic costs of production, depletion, and externalities or, where relevant, trade opportunities foregone. Thus, without necessarily explicitly recognizing the environmental objectives of price reform, much of the Bank's historical preoccupation with pricing policy is consistent with environmental goals.

The foregoing type of sector policy reform has become a standard element of adjustment lending operations, the impact of which may have wide-ranging environmental effects. Although progress has recently been made in understanding the nature of these relationships, the Bank and the development community at large still have much to learn about the linkages between macroeconomic policies and the environment. Recent work in the Bank has addressed this gap, through a series of case studies. These studies have been carefully selected to reflect a wide range of country situations, and of environmental problems. The very diversity of the cases considered is intended to demonstrate the generality of the overall theme--which is the actual or potentially major impact that economic policies have on the environment. The cases include countries in Latin America (Costa Rica, Mexico); Sub-Saharan Africa (Zimbabwe and Ghana);North Africa (Tunisia, Morocco); Asia (Indonesia, the Philippines, China, and Sri Lanka); and Eastern Europe (Poland).

Various results from these case studies have been included in the main report, as examples pertinent to specific policy issues. However, to illustrate the analytical approach on a country basis, individual summaries of findings are presented here by country case study. (For continuity of presentation, some of the points mentioned in the main text are repeated in the country summaries.)

China.[3] The study on China focuses on sustainable agriculture in the context of rapid evolution in the Chinese economy. Dramatic, economy-wide changes have taken place in the relative prices of relevant farm inputs, including reduction in subsidies for chemical fertilizers and pesticides, and increases in the

price of energy, and the opportunity cost of labor. Changes in other government policies also affect environmental behavior, via their influence on prices. Among these are lifting of quotas for key agricultural products and substantial reduction in intervention in product markets. Other important changes relate to policy and practice regarding government support for eco-farming and security of land tenure.

Using farm-level data from communities in Jiangsen Province, the study illustrates the vast range of variables that determine environmental behavior. The area has been experiencing rapid industrial development, and the opportunity cost of labor has increased rapidly in recent years. This trend in labor cost discourages the application of crop and animal residues to the land--a labor intensive activity. Increases in commercial energy prices may also result in the diversion of biomass for fuel, thereby stimulating demand for chemical fertilizer. Alternatively, where cotton is produced (perhaps to meet a government quota), cotton waste, which has little environmental value, may be burned instead. In assessing the environmental policy implications of changes in the prices of key inputs, the study makes it clear that "second best" problems abound. For example, one major agricultural input, namely land, is still subject to command and control and, in some communities, arbitrariness in its allocation. In such circumstances, the uncertainty about land tenure generated by this system has encouraged short-run profit maximization and exploitation of land at the expense of sustainability in agricultural production.
Surveys of farmers' reaction to changes in strategic prices and policy variables suggest ways in which they might react in the future under various scenarios of price and other policy reform. Based on the assumption that farmers are profit maximizers, farm models are being designed to simulate reaction to various scenarios of future changes in the prices of inputs and outputs, for example, by crop switching, reducing scale of operations, changing mix of inputs, or going out of business. The environmental implications of these reactions, and therefore the need for possible remedial action, will then be assessed.

Policies are rapidly evolving, but the relevance of this study, location-specific though it is, is in illustrating the leverage exerted by macro-level and sectoral policies on farmers' behavior and therefore, by definition, upon the environment. It also suggests that while market liberalization is a necessary condition to encourage farmers to operate efficiently and thereby to ensure that neither producers nor consumers use resources wastefully, it is far from a sufficient condition for sound environmental management. Market reforms need to be accompanied by various forms of public intervention. This may take the form of education and training to bring farmers up to date with latest techniques. However, where modern techniques and the changes in the relative prices of key agricultural inputs yield unsatisfactory environmental by-products, the study illustrates the kind of situation in which government should be prepared to step in and compensate for market failure. Above all it demonstrates that policy reform in the environmental area, while urgent, has to parallel overall trends in market liberalization in the Chinese economy.

Costa Rica.[4] While the other studies described in this paper (except the Morocco study) generally adopt a partial equilibrium approach in addressing the environmental consequences of economic policy, it is clear that general equilibrium effects are important. Indeed, failure to protect the environment may have serious feedbacks and may constrain economic development. To capture this whole economy perspective a study of the linkages between economic policies and environment in

Costa Rica uses a computable general equilibrium (CGE) model. The model pays special attention to deforestation, which is proceeding at a rapid pace in Costa Rica; together with soil erosion, it has been identified as the main environmental problem of the country. Even conservative estimates of remaining forest cover forecast that if current deforestation rates continue, the commercial forests of Costa Rica will be exhausted within the next five years. To evaluate how sectoral and economywide policies can help control deforestation, the study constructed a CGE model that highlights the economic activities and factors affecting deforestation in Costa Rica. The model differs from standard approaches in two important respects. First, it can simulate the effect of introducing property rights on forest resources, thus allowing the private valuation of future forestry returns to contribute to sustainable management. Second, it also includes markets for logs and cleared land: loggers deforest to sell timber to the forest industry and squatters clear land for agricultural production and for sale to the agriculture sector as the latter expands and requires more land.

The model retains features that are fairly standard in most CGE models. The tradable sectors--forestry, agriculture, and industry--are price takers in the world market, while infrastructure and services produce non-traded output. To focus on the natural resource sectors, the domestically mobile factors include, aside from capital and labor, cleared land and logs. The supplies of both labor and capital are exogenous. The demand for these factors arises from the producing sectors (agriculture, industry, and so forth) and from the deforestation activity of loggers and squatters. The supply of "cleared" land is initially based on Costa Rica's total land area that has been deforested. However, additional cleared land is made available from increased deforestation. This rate of land clearing depends on the definition of property rights as well as on taxes (or subsidies) that affect the forest and agricultural sectors. In addition, the expansion of squatting activities augments the cleared land factor. Agricultural production provides the demand for cleared land.

The results of the CGE simulations support the conventional view that establishing property rights tends to decrease deforestation. The reason is that such rights allow the logging sector to capture the future benefits of reducing excessive logging damage on residual stands. Initially, this loss is presumed to be 28 percent of the value of the residual stand. Using an interest rate of 10 percent, the simulation indicates that deforestation is dramatically reduced to 5 percent of the base level as both the logging and squatters sectors internalize the losses associated with deforestation. Significant reductions in deforestation occur even when the estimate of logging damage is substantially reduced. The CGE results on the deforestation effects of discount rate changes also parallel the predictions of partial equilibrium models: higher interest rates promote deforestation while lower interest rates contribute to conservation.

Beyond augmenting the analysis of partial equilibrium models, an important contribution of the model is in illustrating how the direct impacts of forestry sector-specific policies are modified once the indirect effects arising from inter-sectoral linkages are accounted for. For example, partial equilibrium analysis predicts that stumpage price increases will reduce logging. However, the model shows that, while deforestation from logging will indeed decline, total deforestation nevertheless increases. The reason is that the contraction of the logging and forest industry sectors causes a shift of resources toward agriculture. As agriculture expands, deforestation increases.

The importance of these indirect effects is also demonstrated in the analysis of economywide policy changes, such as an increase in the wage rate. Because the role of

inter-sectoral resource flows is incorporated in the CGE model, the effects of changes in wages are different from partial equilibrium results. If the wage of unskilled labor were increased due to, say, minimum wage legislation, the model predicts that deforestation could worsen instead of declining. Although logging declines due to increased direct costs, this is more than made up by the indirect effect of inter-sectoral flows since the industrial sector (where minimum wage legislation is more binding) is much more adversely affected by the higher labor costs. Labor and capital thus tend to flow to agriculture, leading to the conversion of forest land for farming.

Finally, both these last two examples suggest the importance of pursuing sectoral reforms in the context of growth. Without alternative employment opportunities, reducing logging activities will tend to direct labor and capital resources toward agriculture, industry and other sectors. Expansion of some of these sectors may lead to a second round of effects on forestry which could actually result in more deforestation.

Ghana.[5] In Ghana, socio-economic and land-mapping data were combined to analyze the effects of on-going trade liberalization and public employment reduction on agricultural productivity and land use in the country's western region. A key empirical result underlying the policy simulations is that the main source of supply response in agriculture is the expansion of cultivated area rather than agricultural intensification. It was estimated that biomass, measured in terms of the proportion of land under forest cover, is an important factor of production, contributing 15-20 percent of the value of agricultural output. This is close to the contribution of "conventional" factor inputs: 26 percent for land cultivated, 25 percent for labor, and 26 percent for capital. Since the share of agricultural output in national GDP is about 50 percent, this means that the contribution of biomass to national income is about 7.5 percent. Thus the stock of biomass is an important determinant not only of agricultural production but also of GDP.

In the agricultural system prevalent in the area, a large proportion of the land available in the village is reserved exclusively for the use of villagers. The system is consistent with shifting cultivation since the individual has exclusive rights on the land actually being cultivated, but once the land is left idle in fallow it can be reallocated by consensus and consent of the village chief. Under these conditions, biomass is already being overexploited through a more than optimal level of land cultivated. Fallow periods appear to be too short, and the stock of the environmental resource is below socially optimum levels. The study found that increasing agricultural prices or reducing wages cause an expansion in the cultivated area, with the direct effect of increasing output. For example, a 10 percent increase in land cultivated leads to a 2.7 percent increase in the direct output effect. However, such an increase in cultivated area leads to a reduction in fallowing, and total biomass declines by 14.5 percent. This, in turn, leads to a 2.5 percent loss in sustainable agricultural productivity. Thus, the net effect of expanding area cultivated (2.7 percent direct output effect less 2.5 percent biomass loss effect) is still positive but only 0.2 percent--many times smaller than the direct effect alone. In addition to policy changes, other factors contribute to expansion of cultivated area: large family size, availability of capital, and the presence of migrant populations in the area.

The results suggest that, in general, economywide price and wage policy reforms that do not include changes in land management practices will have limited impact on national income, once the existence of land quality effects is considered. This means that sustainable development efforts would be

better served if such links between agricultural production and environmental degradation could be analyzed in the context of economywide reform programs. To demonstrate this, a very simple, illustrative model was constructed that linked agriculture and land productivity with taxation, trade, and employment policies. More work is clearly needed before policy implications can be drawn, but this basic model already shows interesting results. For example, further reducing implicit taxation of agriculture may have limited benefits. However, reducing the fiscal deficit (through reducing public employment or wages), could have a positive effect on agriculture and national income.

Indonesia.[6] The trade liberalization experience in Indonesia shows that while economic policy reforms can promote less pollution intensive industrialization, the rapid expansion of the scale of industrial activity points to the urgent need for regulation as a complement to economic policy reforms. The study first decomposed industrial pollution in Indonesia by breaking it down into three dimensions: (1) the pollution intensity of output, (2) its location relative to human populations and fragile ecosystems, and (3) the increase in absolute levels of pollutants due to the expansion of output. Using industrial data from 1975 to 1989, the likely impact of continuing reforms on the scale and structure of pollution was then projected to the year 2020.

Secondly, the sectoral characteristics of pollution-intensive activities were examined, by classifying them according to indicators of air, water, and toxic pollution per unit of output. Materials processing industries (for example, food products, tobacco, pulp and paper, basic industrial chemicals, petroleum refineries, iron and steel) were generally found to score higher on these indicators than assembly type industries (for example, garments, furniture and fixtures, printing and publishing, metal products, office and computing machinery, transport equipment). For example, the ratio of air pollution intensities in assembly to processing industries ranged from 2.4 to 6.1.

Finally, the impact of liberalization on all three dimensions of pollution and on the pollution characteristics of different industrial sectors were assessed. The analysis showed that liberalization in the 1980s promoted a surge in relatively clean assembly processes, reversing the 1970s pattern of more rapid growth in "dirty" materials-processing sectors. Projections indicate that the share of basic processing industries in total industrial output will fall from 72 percent in 1993 to about 60 percent by 2020.

In addition to changes in composition of output, within Indonesia liberalization efforts were also associated with differentially rapid growth of "dirty" sectors outside the densely populated island of Java, thereby reducing the health and productivity impact of pollution on population centers. On Java, assembly industries have grown faster than processing activities, and will probably be larger than the latter by the year 2020. However, processing industries outside Java will continue to account for about 80 percent of industrial output.

While reforms contributed to mitigating the impact of pollution from these two sources, industrial growth has been so rapid that the scale effect dominates current patterns and future trends in industrial pollution. Industry has responded very strongly to liberalization; manufacturing output has doubled in volume every six to seven years during the 1970s and 1980s, so that in 1990 manufacturing value added was about eight times its 1970 level in real terms. This accelerated growth, while clearly desirable for poverty reduction, has nevertheless undermined the positive impacts of liberalization on reduced pollution intensity and the relocation of "dirty" industries. Thus, Indonesian industry in the aftermath of liberalization has a much-improved sectoral

and locational profile from an environmental perspective. However, accelerated growth has pushed pollution to new heights almost everywhere. Efforts to augment the reform program with institutional support and regulation will clearly be required if Indonesia is to avoid severe pollution problems in the future.

Mexico.[7] Another study addressed the environmental consequences of industrial growth in Mexico, in terms of air pollution and changes in energy intensity of industrial output. The impact of industrial development on the environment has been substantial. Industrial production increased by a factor of 10 between 1950 and 1989. With respect to pollution, the study results suggested that the environment did not only deteriorate as a result of the growth of manufacturing output but also due to a considerable shift towards the more polluting subsectors leading to an increase in the pollution intensity, that is the amount of emissions per unit of manufacturing output.

Between 1950 and 1970 the pollution intensity of the manufacturing industry (calculated with fixed emission coefficients) increased by 50 percent. The growing participation of the production of highly polluting intermediates in total manufacturing output was the main cause of this increase. The study also showed that industrial pollution intensity increased by another 25 percent from 1970 to 1989, particularly in the second half of this period. This increase is almost completely explained by the growth of public sector investments from 1978 to 1982 in the petrochemical and fertilizer industries. The pollution intensity figures used in the study were derived from US emission data for 1987 using fixed pollution coefficients by subsector. Thus, changes in the estimates of total industrial pollution intensity are completely produced by structural shifts in the composition of manufacturing output. Neither the possibility of technology choice nor the influence of economic policies, for example trade policies, on this choice were taken into account in the estimates.

To complement this analysis, the energy intensity of Mexican industry in relation to energy pricing policies between 1970 and 1990 was examined. It was found that energy pricing policies led to annual implicit subsidies for energy products (that is, petroleum fuels, gas and electricity) of between US $8 and 13 billion, or 4 to 7 percent of GDP, from 1980 to 1985. Associated with this, the energy intensity of Mexican industry increased by 5.7 percent from 1970 to 1990 while industrial energy intensity in OECD countries decreased by 35.3 percent over the same period.

An increase in petroleum-fuel and electricity intensity appears to be almost exclusively attributable to technological and other changes within subsectors, and not to structural shifts in production towards more energy intensive sectors. To some extent, the failure of Mexican industry to follow the trends towards energy saving adopted by the OECD countries after the oil price shocks of 1973 and 1979 could be attributed to the government policy of keeping energy prices far below international levels in the late seventies and early eighties. The more recent reduction of implicit subsidies to energy is expected to induce a lower increase of energy demand during a period of renewed economic growth.

The study found no evidence to support the view that foreign trade policies were to blame for the growth in industrial pollution. Pollution has resulted mainly from structural changes, such as the increasing importance of intermediates and public investment in the heavily polluting petro- and agro-chemical industries, and also from the low pricing policies for publicly provided petroleum fuels and electricity. By contrast, foreign trade policies have been strongly biased in favor of the less polluting consumer good industries.

In addition to environmental aspects of

industrialization for the whole country, the study also addressed the specific problem of air pollution in Mexico City. Exacerbated by low fuel prices, air quality in Mexico City has steadily declined in recent years. Efficient air quality management requires, *inter alia*, that pollution reductions be obtained from the least costly source. Taxing pollution directly would conform with this prescription, since it would provide incentives to firms and individuals to pursue emissions reductions in the least costly manner. However, because Mexico City's sources of pollution are many and varied (buses, taxis, and private vehicles, all of varying ages), each vehicle's emissions cannot be monitored continuously, so it is not feasible to tax emissions directly.

This suggests the need to develop indirect instruments, which target proxies for emissions (for example, indicators of how clean the car is and how much it is used). These indicators could be influenced by regulations such as emissions standards, and market-based tools such as fuel taxes. The latter are particularly relevant where, as has traditionally been the case in Mexico, fuel prices are well below their opportunity costs. In fact, the general conclusion stemming from this study is that the appropriate policy for combating vehicular air pollution consists of two elements, namely, policies aimed at making vehicles and fuels cleaner, and policies aimed at reducing demand for trips. To reduce emissions by modifying fuels and vehicles, some measures will be best implemented by regulation, others by market-based instruments. But when it comes to reducing demand, taxation is immensely more effective than regulations, which often limit choices unnecessarily. The study in fact concludes that by combining such an environmental tax instrument with regulatory approaches, targeted emission reductions can be obtained with savings of at least 10 percent of the cost of "regulation-only" approaches.

The inadequacy of reliance upon regulatory methods was exemplified by Mexico City's one day-a-week driving ban, a measure that could have been effective on a temporary basis, but which proved ineffective when applied permanently. Gasoline taxes, in contrast--now being forcefully applied in Mexico--manage demand by screening out only the least essential trips. They also have the advantage of raising public revenues, as well as reducing road congestion and accidents.

Morocco.[8] The Morocco study focuses on the linkages between macroeconomic policies and how the existing water allocation system has led to sub-optimal and unsustainable patterns of water use. Specifically, low water charges (coupled with ineffective collection of these charges), have artificially promoted production of water intensive crops such as sugarcane. Thus, rural irrigation water accounts for 92 percent of the country's marketed water use. At the same time, irrigation charges cover less than 10 percent of the LRMC, and the corresponding figure for urban water tariffs is less than 50 percent. Given these policies, it is not surprising that a water deficit is projected for Morocco by the year 2020.

The study, however, goes beyond the traditional sectoral remedy of proposing an increase in water tariffs. It links sectoral policy reforms with ongoing macroeconomic adjustment policies, namely the complete removal of nominal trade tariffs, and analyzes the overall effects of both sets of reforms. As a consequence of the trade reforms, prices of sugar, cereals, oilseeds, meat and dairy products, among other things, would decline to world levels from their current protected levels. Further, a *simultaneous* introduction of trade and water pricing reforms would imply increased input prices and a decline in output prices. As in the Costa Rica case above, a CGE model is used to trace the impact of these reforms on output, consumption, imports, exports, and the use of factors of

production (including water), by the different sectors in the economy.

To separate out the effects of the sectoral and macroeconomic reforms, the study considers three scenarios: trade reform only, water pricing reform only, and a combination of the two. In the first scenario the only policy change is a complete removal of nominal tariffs (which in 1985 averaged 21 percent for the whole economy and 32 percent for agriculture). Similarly, in the second scenario the only change is a doubling in the price of rural irrigation water. In the final scenario the two policy reforms are combined.

In the first scenario, liberalization of trade only results in a small rise in real GDP, while household incomes and consumption post significant gains as import barriers are reduced, exports become more competitive, domestic purchasing power rises and resources are allocated more efficiently across the economy. The two major drawbacks, however, are that elimination of trade tariffs leads to budgetary deficits and domestic water use increases substantially due to the expansionary effects of liberalization. In particular, this result is not sustainable if water prices remain unchanged, because water demand increases by about 13 percent.

The results indicate that, in the second case, reforming water prices alone reduces water use significantly--by 34 percent in rural areas and by 29 percent for the economy as a whole. This is as would be expected. This achievement of static efficiency is accompanied by a small (less than 1 percent) fall in real GDP, as well as in incomes and real consumption of both rural and urban households.

In the final scenario which combines both the water price increases and trade reforms, the expansionary effects of trade liberalization are retained, but there are also substantial reductions of around 43 percent in agricultural (and economywide) water use. Moreover, this reduction in water consumption occurs against a backdrop of growth in real GDP of about 10 percent. In summary, only the joint implementation of water pricing and trade policy reforms result in sustainable improvements in both income and water use.

Philippines.[9] The Philippines case study evaluates the policy determinants of long-term changes in rural poverty and unemployment that have motivated increasing lowland to upland migration. This process has led to the conversion of forest lands to unsustainable agriculture and has been identified as a key mechanism contributing to the deforestation problem. The inability of the government to manage forest resources is an important direct cause of deforestation, but there is increasing recognition that economic policies, both sectoral and economywide, also significantly contribute to the problem. These policies take the form of direct sectoral interventions through agricultural taxation, price controls, subsidies, and marketing restrictions. They could also be indirect, working through exchange rate policies and industrial protection.

The study shows that in general these policies have tended to penalize lowland agriculture in favor of industrial sectors. On the one hand, this has resulted in the limited ability of the agricultural sector to productively employ a growing labor force. On the other hand, trade and exchange rate policies have made the industrial sector inefficient and increasingly difficult economic conditions during the late 1970s and early 1980s further reduced its lagging capacity to absorb surplus labor from the agricultural sector. The net result has been growing unemployment and worsening rural poverty, and these provide the "push" factors motivating migration to forest lands. Deforestation in the Philippines has exceeded 150,000 hectares per year of forest area for the last two decades. Conversion to agricultural land constitutes the largest form of

land use change from forest land. Between 1980 to 1987, for example, the cultivated areas on land with 18-30 percent slope alone increased by more than 37,000 hectares annually.

The study evaluates government interventions for key crops to illustrate the role of commodity specific policies in altering the incentives for lowland compared with upland agriculture. Policies on rice production, which dominates lowland agriculture, have been governed more by the goal of maintaining low prices for consumers rather than assuring price incentives for producers. Corn and coconut production, which together make up the majority of agriculture in sloping lands, have also fared differently from government intervention. Corn cultivation has generally been encouraged while coconut, a more environmentally stable crop, has been excessively taxed. Corn, for example, has received favorable protection while the copra export prohibition and the coconut levy kept producer prices below world prices by more than 25 percent. The net effect of these policies has been to reduce the attractiveness of lowland compared with upland agriculture and to encourage upland farming households to shift from coconut farming to more environmentally demanding corn production.

In addition to commodity specific policies, trade and exchange rate policies have also played important roles and have been dominated by an urban consumer and industrial sector bias. The agricultural sector was implicitly taxed by an average of about 20 percent for most of the 1970s and early 1980s. Because the industrial sector did not provide an alternative source of growth, poverty in general has worsened and rural incomes in particular have suffered.

The study estimated an econometric model of migration from lowland to forest land, to analyze how migration patterns depend on both economic and environmental factors, including income in lowland agriculture, accessibility of forests, and property rights governing forest areas. Provincial migration levels from lowland to forest land areas were obtained from 1990 census data. A multinomial discrete choice framework was then utilized to represent each migration decision as a choice among many discrete alternatives.

The estimates indicate that both lowland and upland incomes are important, but migration is more responsive to levels of lowland income. The latter is the best indicator of the poor condition of traditional farm incomes, and improvements in such incomes would significantly reduce migration to forest areas.

Accessibility of forest areas and lack of effective property rights also encourage migration to forest areas. These results demonstrate that while forestry specific conservation programs are needed, economywide policy reforms to improve lowland agricultural conditions are just as important in arresting deforestation in the Philippines.

Poland.[10] The massive structural changes now occurring in Eastern Europe and China clearly present even greater analytical challenges in predicting the environmental impacts of economic reforms. The former centrally planned economies of Eastern Europe are burdened by the twin legacy of low energy prices and the absence of an incentive system that ensures efficient utilization of resources. This is exemplified in the Poland case study, which evaluates the relationship between economic reforms (including both price and institutional changes) and energy and air pollution issues. The assessment proposes that energy intensity and excessive pollution in Poland is due not only to the undervaluation of coal in the centralized price system but more importantly to the entire system of state ownership that encourages output maximization rather than cost minimization.

This means that price responsiveness is blunted by the fact that financial losses are simply absorbed by the public budget, or passed on in the form of higher output prices.

In addition to the institutional constraints, Poland also explicitly pursued a macroeconomic strategy which emphasized rapid industrialization in general and the development of heavy industry in particular. Four energy-intensive industries--energy, metallurgy, chemicals and minerals--tended to dominate the sector. As a result, they were also the most polluting sectors in industry and made heavy demands on other natural resources, such as water. While an industrialization strategy based on heavy industry is common to most centrally planned economies, in the case of Poland, where coal is an abundant resource, it also led to excessive energy intensity.

Finally, it was not only the types of economywide policies pursued in Poland which historically promoted high levels of energy use. Environmental policy was not used to offset adverse impacts of industrialization on the environment. To some extent, this was due to the lack of price responsiveness of state-owned enterprises, which limited the effectiveness of an otherwise sophisticated system of pollution taxes. In addition, environmental inspection and audit capabilities were weak and environmental statutes were not stringently enforced. For example, even by the end of the 1980s, only a third of plants emitting air pollutants had emission permits.

In 1990, Poland initiated an economic transformation program that led to the privatization of many enterprises. The program was beset by recession and the collapse of trading arrangements linked to the Council of Mutual Economic Assistance (CMEA). Furthermore, the process of privatization proved to be more complex and lengthy than initially expected. The government has therefore introduced an enterprise and bank restructuring program to assist in the restructuring of state-owned enterprises and in reducing their debt-servicing constraints.

Despite these changes, SOEs will continue to be major players in the Polish economy, at least in the short term. Of particular relevance is the decision by government to retain ownership in the energy, mining, steel and defense sectors in the medium term, and to decide on privatization on a case-by-case basis over the next three years. Thus, energy sector restructuring efforts have focused on creating the institutional and legal framework to facilitate competition and greater private sector participation in the future. Coupled with aggressive energy pricing reforms, this strategy appears to be making some headway. For example, a recent survey of large state-owned manufacturing concerns found that even without privatization, SOEs are already adjusting to the transformation program. In particular the survey found that all firms reduced their consumption of materials and energy per unit of sales.

While progress in economic reforms has already produced some results, the timing and speed of further change are matters of considerable uncertainty in Poland. The case study therefore analyzed a number of scenarios to quantify the possible impact of various economic reforms on the environment. Projections of energy generation and the associated emissions from three alternative models indicate clear environmental gains from restructuring combined with energy pricing reforms. Although there are improvements, the study also concluded that economic reforms by themselves will not be enough to meet the medium-term environmental goals set by government in 1991. Specifically, the simulations suggest that sulphur and particulate emissions will not be sufficiently reduced unless complementary environmental regulations are also adopted.

Sri Lanka.[11] Bank work has traditionally addressed the problem of subsidies in key sectors such as energy and water, that result in inefficient use of these services. In Sri Lanka, the study approached the assessment of policy reforms and environmental concerns from two perspectives: by first investigating the environmental implications of energy sector pricing reforms and then by evaluating the effectiveness of alternative policy approaches in meeting specific environmental goals, such as reducing greenhouse gas emissions (GHG) which is mandated by the World Climate Convention. The study focused on electricity price reforms as an example of a sectoral policy change with broad economic and environmental implications and on evaluating the effectiveness of levying externality taxes on electricity compared with applying carbon taxes to meet GHG constraints.

The economic rationale for eliminating power subsidies or raising tariffs is documented in many studies, and covenants between the Bank and its borrowers often provide for tariff increases to generate sufficient revenue to meet self-financing or rate-of-return on equity targets. However, problems arise in evaluating the environmental consequences of such policies. For example, higher electricity prices, based on long-run marginal cost (LRMC) of power generation, may be expected to encourage more efficient use of electricity. However, reduced consumption could also affect the least cost expansion path, such that the addition of more efficient generating units might be delayed, resulting in higher emissions.

The extent to which this effect would be offset by the lower generation requirement is an empirical question, which can only be answered by investigating specific cases. In projecting future electricity requirements in Sri Lanka, the study found that the efficiency effect of setting electricity prices to reflect LRMC dominates and there is a significant and unambiguously beneficial impact on the environment. The difference between tariffs based on average incremental cost of generation (as an approximation of LRMC) and one based merely on meeting financial covenants that require achieving a 10 percent return on equity is a 6 percent reduction of greenhouse gas emissions by the year 2010, and a 10 percent reduction in the health effects associated with human exposure to incremental ambient concentration of air pollutants. In addition, pricing reforms were found to have a more general impact than technical approaches to demand-side management (DSM), such as promoting the use of energy-saving fluorescent lights. DSM programs tend to be difficult to implement and limited in scope.

With respect to meeting GHG reduction goals, at present per capita carbon emissions in Sri Lanka (0.06 compared with 4.9 tons per capita in the U.S.) are extremely low, due to the dominance of hydro-power sources and the low energy intensity of the industrial sector. However, beyond the year 2000, CO_2 emissions will rise very sharply as the generation mix moves toward fossil fuels. As generating capacity is increased, the study found that imposing carbon taxes on fuels has a more direct impact on greenhouse gas reductions than adding the equivalent externality cost (an environmental tax) to the electricity tariff. The reason is that the fuel tax gives more direct signals for implementing a power generation expansion path that reduces the use of "dirty" fuels such as coal.

Tunisia.[12] In Tunisia, the government's concern with increasing the country's self-sufficiency in livestock products and with the affordability of these products for its citizens has resulted in a web of pricing and subsidy interventions in the livestock sector. The environmental consequence of these measures, namely the degradation of Tunisia's rangelands, however, has rarely been a central consideration. A variety of subsidies has

promoted the intensification of livestock production in certain parts of Tunisia, while in other regions government subsidies and policies have encouraged the maintenance of the national herd at levels beyond the carrying capacity of the country's rangelands. Particularly during dry years, subsidized feed imports have provided a substitute for reduced grazing supplies, and have succeeded in averting the large declines in animal numbers often associated with droughts. This failure of livestock numbers to respond to diminished feed availability in natural pastures, however, has contributed to significant environmental degradation of the Tunisian range. This has direct effects on livestock production, and longer term, indirect implications for the entire agriculture sector. While important efforts at pasture improvement and reforestation are underway, the positive impact of these and other measures are often undermined by subsidy and pricing policies that fail to consider or respond to environmental signals.

Livestock policies have had different environmental impacts in the north, center and south regions of the country. Government subsidies for feed, irrigation and fertilizers have promoted intensification of livestock production and integration with cropping activities in the north. This has occurred to a lesser extent in the central part of the country, where sheep herds have increased without commensurate increase in feed production. Rangeland appears to be degrading, exacerbated by stabilization of herd sizes in drought years through the subsidized distribution of barley feed imports, and more generally through the mild protection of domestic mutton production. Following liberalization of mutton prices in the late 1970s it became profitable to increase use of feed concentrates for sheep production, but this has not been sufficient to alleviate the pressure on Tunisia's central rangelands. In addition, government policy encouraged the conversion of marginal lands from pastures into cereals, mainly barley. Not only did this encourage land degradation through the removal of permanent cover, it also shifted some of the best pasture lands to marginal cereal production, further shrinking the rangeland resources available to a growing livestock herd.

Thus while subsidies may have a beneficial effect when implemented in the north and perhaps in certain parts of central Tunisia, their impact on rangelands in much of central and southern Tunisia has been negative. Failure of policies to distinguish between bioclimatic zones has thus contributed to the severe degradation of the country's range resources. The intention has been to protect herders in the southern and central regions from major losses and wide income fluctuations; this short term objective has been accomplished, but no durable solution has been found to alleviate the herd pressure that is slowly degrading the capacity of rangeland to sustain herds and livestock income. In addition, subsidies on feed concentrates have reduced the incentives for forage production.

While government policy may have had a small measure of success in social terms, these benefits threaten to be short-lived if the environmental consequences of policies are not adequately considered. Income stabilization of small-scale herders will only be temporary if it is achieved through means that result in the degradation of the rangeland upon which the incomes ultimately depend. The long-term effects of environmental degradation will ultimately result in the permanent reduction of rangeland productivity and the consequent reduction of herd size and incomes from livestock. In addition, the impacts of increased desertification and soil erosion will find their way into the rest of the economy, affecting agricultural productivity and infrastructure (siltation of reservoirs through increased erosion). The challenge is to introduce less environmentally destructive means to achieve

the social objectives.

Sweeping policy changes introduced gradually since the launching of structural adjustment reforms in 1986 will ultimately have an important impact on how livestock activities affect rangeland. These policy changes were primarily driven by budget constraints and market strategies, with environmental consequences rarely taken into account. The interaction of these policies makes it difficult to predict the magnitude of their impact on the various feed sources, and their introduction is still too recent for clear trends to be identifiable. It is probable that strengthening producer prices for beef will encourage growth in the cattle herd after years of stagnation. This growth will be concentrated initially in the north where feed resources are more abundant, but a critical issue will be whether the derived demand generated by cattle herd growth will help to maintain fodder and barley production in the face of reduced subsidies on fodder crop inputs such as irrigation water and fertilizer. In central Tunisia, the financial returns to sheep herding are likely to decline with subsidies being eliminated on feed concentrates, and some shift to beef production can be expected. The impact of such shift will depend on whether permanent cattle herds are maintained, or whether incentives encourage a focus on reproduction using seasonally available range feed resources for sale to fattening operations in the north.

Zimbabwe.[13] The study of the impacts of economic policies on wildlife in Zimbabwe, like the Tunisia case, illustrates the opportunity for economy-wide reforms that also have environmental benefits. The wildlife-based economic activities in this country, including eco-tourism, safaris, hunting, and specialized meat and hide production, constitute one of the fastest growing sectors of the economy. Wildlife-based tourism alone grew at the rate of 13 percent in 1991 and comprised 5 percent of GDP. The sector is also important from the environmental perspective. Wildlife-based activities, unlike cattle ranching, with which they compete for limited land resources, are better suited to the country's semi-arid climate and poor soils. The direct environmental advantage is that economically viable systems can be maintained with lower stocking rates than those associated with commercial cattle ranching and subsistence pastoral activities. Equally important is the indirect environmental benefit associated with wildlife management goals of conserving a natural habitat that appeals to visitors.

Thus, there has been much interest in wildlife development, with emphasis placed on its potential role as a more sustainable land-use system than conventional agriculture in semi-arid zones. Except for specially protected species, the 1975 Parks and Wildlife Act and its amendment for communal areas allowed wildlife utilization by the private sector to expand rapidly. Wildlife enterprises currently account for 15 percent of land use on commercial and communal lands. The large wildlife enterprises are found in arid ares where farmers concentrate on extensive game or mixed game and cattle ranching. Wildlife resources are generally not used for meat production. and most meat offtake is sold locally at prices well below beef prices. Nevertheless wildlife competes with beef production; not in terms of meat output but in terms of land use.

With respect to sectoral policies, government land policies have generally discouraged private sector involvement in wildlife activities since these are still perceived as "under-utilizing" land and therefore invites future taxation or appropriation. Livestock marketing and price policies have also traditionally subsidized cattle ranching. Since 1985 subsidies directed to an inefficient parastatal marketing system have been the main cattle sector policy instrument.

Industrial promotion and exchange rate policies are two areas where there have been adverse effects on wildlife activities. Zimbabwe followed a strongly interventionist policy regime and the structural adjustment program initiated in 1990 has only marginally moved the economy toward liberalization. The problem is that Zimbabwe inherited a highly centralized and regulated economy at the time of independence. As recently as 1990, the government budget comprised 48 percent of GDP. This excessive public sector role in the economy crowded out private initiative and contributed to very low investment levels and productivity. Government policy tends to channel the limited private sector investment into the mining and manufacturing sectors, primarily through simplifying project assessment and approval procedures. In areas where wildlife resources are still abundant, the establishment of commercial schemes does not require major capital investment, and the sale of concessions for offtake or for viewing access can be used in initial development. However, even where wildlife activities may be socially beneficial, they will not be successful if government policies undermine their private profitability.

Foreign exchange controls, however, have played the more important role. For many years, the government's foreign exchange and trade policies have severely penalized this sector. The Zimbabwean dollar was overvalued by 50 to 80 percent from 1981 to 1990. This meant that export-oriented sectors were implicitly taxed, among them wildlife and nature tourism concerns. Foreign exchange earnings were diverted to other sectors, depressing incomes and investment in wildlife. In 1990, the government introduced an adjustment package, including measures aimed at boosting the level of exports. The currency was devalued by 25 percent, and more liberal access to foreign exchange was allowed. Although further progress needs to be made, these moves have contributed on both economic and ecological fronts. Exports increased; at the same time, the profitability of the wildlife sector increased, allowing an expansion of land allocated for wildlife.

Consolidated Summary of Economywide Policy-Environment Linkages

While the case studies undertaken in this program focused on a particular environmental issue for each country, the various linkages between economywide policies and a range of environmental concerns presented above may be of relevance in other developing countries. Table A-1 summarizes the different findings from the case studies within a consolidated matrix.

In fact, land degradation, deforestation, industrial pollution, and energy inefficiency and water management problems could all occur in the same country. By identifying the possible linkages between policies and such environmental concerns, the examples drawn from these different country case studies may help guide future, more comprehensive studies of specific countries.

Notes

1. Eskeland and Jimenez 1991, Oates et al. 1989, OECD 1994e.
2. See, for example, Munasinghe and Warford (1982) for energy, Munasinghe (1992) for water.
3. Researchers: Hu Tao and Jeremy Warford.
4. Researchers: Annika Persson and Mohan Munasinghe.
5. Researcher: Ramon Lopez.
6. Researchers: David Wheeler and Paul Martin.
7. Researchers: Gunnar Eskeland and Adriaan Ten-Kate.
8. Researchers: Ian Goldin and David Roland-Host.
9. Researchers: Wilfrido Cruz and Herminia Francisco.
10. Researchers: Robin Bates, Shreekant Gupta, and Boguslaw Fiedor.
11. Researchers: Peter Meier, Mohan Munasinghe, and Tilak Siyambalapitiya.
12. Researchers: Stephen Mink and Zeinab Partow.
13. Researchers: Kay Muir-Leresche, Jan Bojö, and Robert Cunliffe.

Economic Policies and Other Measures	Erosion and Land Degradation	Deforestation	Pollution	Energy and Water Use
Macro-economic Policies	Foreign exchange liberalization has increased profitability of ecotourism based on environmentally friendly wildlife industry (**Zimbabwe**) Agricultural price increases associated with liberalization lead to agricultural extensification and decline of fallowing and yields (**Ghana**) Rapid economic transformation has increased chemical inputs and labor costs and reduced incentives for organic farming practices (**China**)	Improved rural incomes and employment opportunities reduce lowland poverty and population pressure on fragile, open access forest lands (**Philippines**) High interest rates lead to increased deforestation; higher wage rates in industrial sector reduce employment and encourage expansion of both agriculture and deforestation (**Costa Rica**)	Trade liberalization and industrial promotion lead to increased efficiency and growth; total pollution increases but population per unit of output declines (**Indonesia**)	Credit reforms and privatization efforts impose harder budget constraints on state-owned enterprises, allowing higher energy prices to reduce energy intensity (**Poland**) Trade liberalization may promote economic expansion at cost of increased water use (**Morocco**)
Sectoral Policies	Livestock promotion policies have discouraged wildlife resource-based activities (**Zimbabwe**) Agricultural subsidies have led to over-grazing of arid/semi-arid range lands (**Tunisia**)	Disadvantageous terms of trade of agriculture relative to industry penalize rural sector, aggravate migration into marginal forest lands (**Philippines**) Agricultural growth needed to reduce deforestation pressures (**Costa Rica**)	Petroleum and fertilizer industry subsidies during 1970s led to increased air pollution (**Mexico**) Low energy and fuel prices encouraged energy use and aggravated air pollution (**Mexico, Poland, Sri Lanka**)	Marginal cost pricing of power promotes energy conservation (**Sri Lanka**) Underpricing of coal associated with excessive energy intensity of industry (**Poland**)

Table A-1 (continued). Summary of Economywide Policy-Environment Linkages Discussed in Case Studies

Economic Policies and Other Measures	Erosion and Land Degradation	Deforestation	Pollution	Energy and Water Use
Explicit Environmental Policies		Increased stumpage valuation reduces logging but may lead to expansion of agriculture into forest areas (Costa Rica)	Fuel taxes more efficient than purely regulatory approaches to reducing vehicular air pollution (Mexico) Standards and regulations needed to control pollution from accelerated industrial growth (Indonesia)	Taxation of carbon content in fuel use for energy leads to less use of "dirty" fuels such as coal (Sri Lanka) Subsidies for industrial and agricultural water use undermine conservation (Morocco)
Other Policies: Institutional, Property Rights, and Demographic Factors	Tribal land use customs have not adequately adjusted to increased pressures for agricultural expansion, leading to reduction of fallow period (Ghana) Uncertainty regarding land rights prevents individuals from investing in land management (China)	Rapid population growth and associated unemployment in industry and agriculture are associated with increased pressures for farming in forest areas (Costa Rica, Philippines) Open access conditions in many forest areas encourage encroachment and deforestation (Costa Rica, Philippines)	Health effects of emissions linked to location of power plants in populated areas (Sri Lanka) Decentralization of industrial growth reduces health impacts of pollution (Indonesia)	

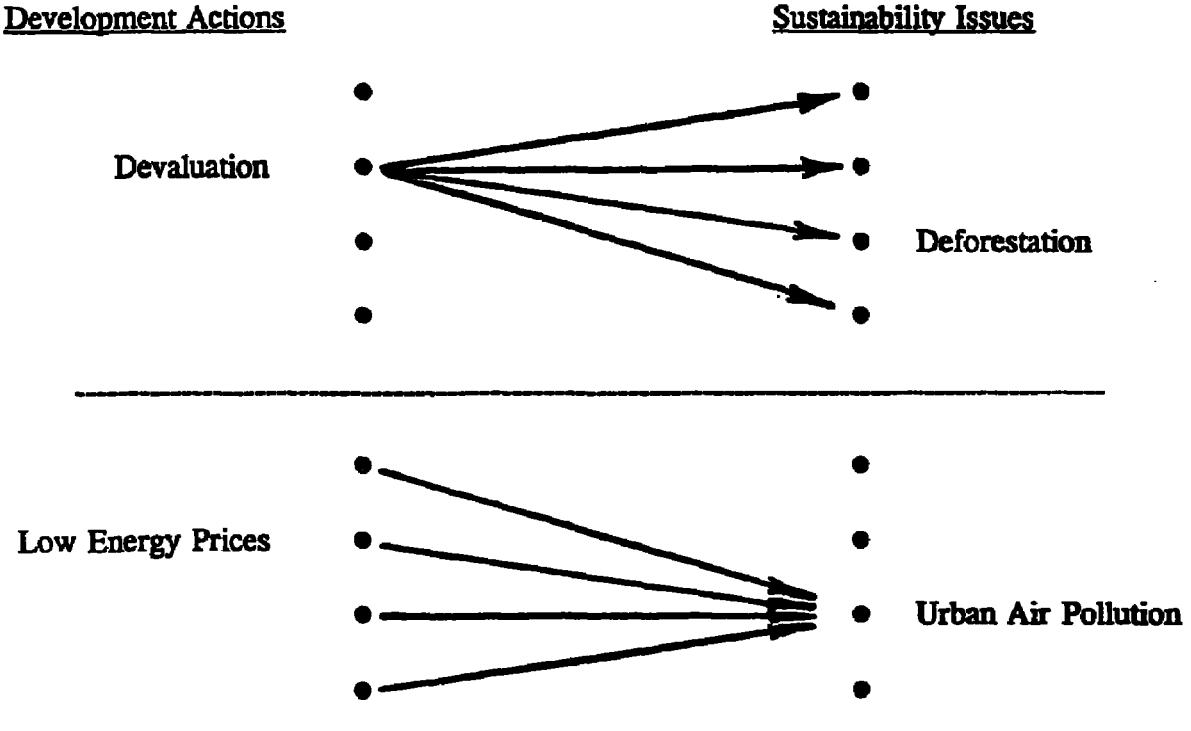
Annex B

Illustrative Tables for Developing an Action Impact Matrix

The preparation of an Action Impact Matrix (AIM) has been found to be a useful step empirically–in prioritizing, tracing and analyzing linkages between development decisions and their impacts. More specifically, the AIM helps to: (a) provide an integrated overview of development actions (that is, policies and projects) and their impacts on key sustainability issues; (b) prioritize and analyze the most important linkages between actions and impacts; and (c) articulate and coordinate a range of policies and projects to achieve desirable outcomes. Furthermore, the stepwise process used in developing an AIM (as described below), facilitates closer coordination between economic and environmental planners, while helping to build a more effective consensus.

Consider the viewpoint of environmental policymakers—for example, those in the Environment Ministry who are charged with preparing a national environmental action plan (NEAP) or country environmental strategy (CES). They may be quite concerned to find out which of a wide and complex range of development policies (current or proposed) would have substantial impacts on a specific environmental issue that has high priority in the CES or NEAP (for example, urban air pollution, water resource degradation or deforestation). If air pollution is the major concern, then the CES or NEAP should seek to review policies such as energy pricing (indicated by the arrows in the bottom part of Figure B-1).

Figure B-1. Interactions Among Development Actions and Sustainability Issues



The outcome of such an environmentally driven approach is shown in Table B-1, for the case of Sri Lanka. Based on readily available information, the priority environmental issues are set down in the first column. The main bio-physical and socio-economic indicators associated with these key issues are summarized in columns 2 and 3. The last column indicates the main causes that might underlie such environmental problems.

Next, consider the viewpoint of macroeconomic and sectoral planners or decision makers, especially those involved in national economic planning in the Ministry of Finance or Planning, or in key sectoral line Ministries. Increasingly, they would wish to know the likely impact of a specific policy on a range of sustainability issues. Typical policies might include local currency devaluation, price liberalization, or reduction of government subsidies. Each such policy would have different implications for various environmental areas of concern. For example, devaluation may significantly affect timber and crop prices and therefore influence deforestation trends (indicated by the arrows in the top half of Figure B-1).

Table B-2 sets out the results of such an economically driven approach. Once again, data that is already available may be used to describe the main economic policy tools, the current situation and policy reforms found in the first three columns, respectively. The last column indicates the likely implications of the various economywide policies, particularly their impacts on areas of concern for sustainable development.

The final Table B-3 is a preliminary AIM for Sri Lanka which brings together the information in the earlier Tables B-1 and B-2. Review of the individual cells in the preliminary AIM will help to determine the most important priorities. These matrix elements represent the key economic-environmental linkages that need to be analyzed in greater detail, to better understand the mechanisms involved and to determine what mitigating measures (for example, complementary policies and projects) are required. The AIM permits all these related development activities to be coordinated and articulated more effectively. Greater involvement of both economic and environmental managers and analysts in this AIM process helps to achieve a more substantive result and better consensus regarding priorities and future actions for sustainable development.

Table B-1. Indicators and Causes of Selected Environmental Problems in Sri Lanka

Environmental Areas of Concern	Bio-physical Indicators	Socio-economic Indicators	Underlying Causes: Economic Policies, Prices and Institutions
Soil Erosion and Degradation	Increasing pressure on land (land-human ratio has declined to 0.38 ha), as economic growth continues to impinge on agricultural land. Cultivation of marginal lands, particularly the shallow and lateritic soils of the wet zone, results in erosion and landslides. Forests have been removed from steep slopes for tobacco cultivation. Erosion rates in neglected tea lands (up to 30% of total area under tea) are as high as 40 tons/ha/yr, compared to an achievable rate of 0.3 tons/ha/yr. In the dry zone where land is flat, erosion is not a severe problem. However, chena (shifting) cultivation is now practiced with greater intensity and very short fallow periods have replaced the traditional longer periods that made the system sustainable. As a result, soil is becoming infertile and about 1.2 million hectares of land (mostly in the dry zone) are now degraded. Severe land degradation due to gem mining in specific areas (mostly in Ratnapura district).	Productivity losses due to soil erosion estimated in the range of Rs. 613 to 4,283 million annually. Tea yields only 52-64% of yields in Indonesia, India, Malawi, and Kenya. Severe erosion has led to the Polgolla reservoir silting up to 45% of its capacity after only 12 years of operation, resulting in reduced irrigation water and electricity generation, as well as greater flooding.	Land markets are very limited and the resource is severely underpriced. This leads to inefficient and distorted land allocation decisions. Land tenure system results in disincentives for long-term soil conservation measures. This includes poorly managed state-owned tea and rubber plantations. Higher protection for erosive crops (e.g., potatoes). In the case of gem mining, lack of environmental or rehabilitation charges encourages small-scale pit mining operations which do not reflect the social cost of these activities.
Deforestation and Biodiversity Loss	Decline in forest cover from 55% of total area (1950s) to 28% (1980s). NEAP estimates forest area in 1989 at 1.58 million ha (24% of total area), with closed canopy forest down to 20%. Deforestation rate is estimated to be 30,000-50,000 ha/yr.	Decline in sustainable timber yield due to deforestation is estimated at Rs.300 million annually. The wood industry also has been forced to shift to lower quality wood. In addition, conversion of forest land to chena, poorly managed plantations, or food crops result in soil erosion and significant loss of productivity.	Low timber charges (royalty only 10% of sales value) encourage over-extraction of this resource. Demographic pressures and landlessness lead to encroachment onto forest lands (80% of which are state-owned, but are *de facto* open access).

Table B-1 (continued). Indicators and Causes of Selected Environmental Problems in Sri Lanka

Environmental Areas of Concern	Bio-physical Indicators	Socio-economic Indicators	Underlying Causes: Economic Policies, Prices and Institutions
Urban and Industrial Pollution	Less than 20% of the population of Colombo Metropolitan Area (CMA) is served by sewers. Less than half of CMA's daily solid waste disposal of 1,200 tons reaches landfills. Similar situation prevails in other urban areas as well. CMA is the only urban area with a (partial) sewer system.	Diseases associated with pollution and poor sanitation constitute the number one cause of morbidity and mortality in CMA. Nation-wide, the rate of intestinal infections more than doubled to 1,025 per 100,000 population between 1965-84.	Absence of user fees for municipal services results in poor quality of services and financially weak municipalities that are dependent on government grants. Lack of effluent/emission charges implies that activities that generate them do not internalize the costs of these damages.
Water Pollution and Water Shortage	Water shortage in areas other than the western part of the wet zone. Sedimentation of reservoirs and canals in irrigated areas in the dry zone. Salinity and waterlogging in downstream lands also a growing problem. Fertilizer residues from paddy cultivation contaminate surface and sub-surface water. Poor fertilizer storage is one of the main causes of groundwater pollution. Extensive water pollution in urban and industrial areas. Nearly 75% of Colombo's untreated sewage is discharged into the lower Kelani river. Water quality at the city's water intake at Ambatale often unfit for public water supply.	A disproportionate share of public investment has been allocated to irrigation, particularly the Mahaweli project (public expenditure on this project alone accounted for 7% of GDP in 1982). However, the returns have not been commensurate. Water use is inefficient (biased toward paddy cultivation). Large volume of water is unaccounted for (39% in Colombo) due to leaks, faulty meters and illegal connections. The irrigation infrastructure is deteriorating prematurely: funds allocated for operation and maintenance cover only 40 to 60% of the actual requirement. Small size of holdings (1 ha) in Mahaweli, and the incentives provided by subsidies, trade policy and research and extension contribute to excessive concentration on (water intensive) paddy cultivation, as do land-use and cropping restrictions. Area under high value added cash crops is limited in the Mahaweli, implying sub-optimal use of irrigation water. National water tariff is below marginal cost and the collection system is relatively ineffective. Cross-subsidies (from low cost to high cost regions and from Greater Colombo to the rest of the country), discourage conservation.	Lack of effluent charges or enforceable standards. Fertilizer subsidies result in misallocation of resource inputs to agriculture.

Table B-1 (continued). Indicators and Causes of Selected Environmental Problems in Sri Lanka

Environmental Areas of Concern	Bio-physical Indicators	Socio-economic Indicators	Underlying Causes: Economic Policies, Prices and Institutions
Marine and Coastal Resource Degradation	One-third of the coastline (1,600 km) is subject to varying degrees of erosion. Average annual rates on the southwestern and western coasts range from 1 to 7 meters. Extensive sand and coral mining aggravate erosion. The latter is most severe along southwestern coast, where approximately 7,700 tons of coral and coral debris are collected annually along a 60 km stretch. Sedimentation and run-off from rivers and agricultural lands, and inappropriate infrastructure also lead to coastal and marine degradation. There is a growing list of mangrove areas and lagoons that have been seriously damaged by pollution.	Potential sites for managed sand mining have largely disappeared. Coastal fisheries have declined. Coastal tourism potential in sites such as Hikkaduwa and Bentota is threatened by fecal pollution of beaches and coastal waters. (About 85% of tourist revenue comes from facilities in coastal areas.) About 75% of graded hotels and over 80% of hotel rooms are located along the coast. Thus, tourism is threatened by (as well as a cause of) marine and coastal resource degradation.	Virtual open access to coral reefs and coastal fishery resources. Excessive reliance on legislation and laws for the protection of coastal resources. Mining of sea coral in the coastal zone (a punishable offence under the Coast Conservation Act), continues unabated. Though the demand for coral is a *derived demand* for construction, there has been no focus on economic incentives for reducing this (derived) demand by encouraging alternative construction materials. In terms of agro-chemical runoff, fertilizer and pesticide subsidies are a major cause of overuse.
Energy Shortage	Fuelwood accounts for 70% of energy consumption, and is used for cooking by 94% of households. Fuelwood shortage in the dry zone by 1995 and for the entire country by 2000. No domestic petroleum. All large hydro-power resources (50% of hydro potential) already exploited.	Both industry and households generally do not practice energy conservation. Thermal efficiency of traditional stoves is 10-15%.	Electricity tariffs are low. Even after a 30.5% increase in 1993, average tariff (6 cents/kWh) is approximately two-thirds of the long run marginal cost (LRMC). Household consumers are cross-subsidized (some pay only 15% of LRMC). Uneconomic rural electrification schemes are a burden on the Ceylon Electricity Board.

Table B-2. Current Economic Conditions and Proposed Reforms in Sri Lanka

Economic Policies	Current Situation/Policy Issues	Ongoing/Proposed Reforms and Implications	Environmental Implications
Government Budget	Deficit has crowded out the private sector and driven up real interest rates. It was 11.6% of GDP in 1991. However, in 1992, a 1% reduction in current expenditure and a sharp drop in capital expenditure reduced the deficit to 7.5%, well below the target of 8.6%. It went up to 8.1% of GDP in 1993, and may worsen in 1994.	Reduce overall deficit (excluding official grants) to 6.5% of GDP in 1994, through improved revenue performance, consolidation of current expenditures, and rationalization of the public investment program. Reduce deficit to $\leq$ 6% in long-run.	A lower inflation rate, reduction in government deficit, downsizing of the public sector, and rationalization of the tax structure, all contribute to stable expectations and create an environment conducive to private capital formation (as well as replacement of capital stock). Newer capital is generally cleaner and technologically more efficient. In a stable macroeconomic climate, long-term investment planning is more feasible.
(i) Government Expenditures	Some misallocation, including large, unviable investment programs; inadequate maintenance expenditures; and excess spending on defense and debt servicing.	Limit large village-level public works programs; administrative reform, including civil service reform; US$ 600 million Airbus purchase by Air Lanka should be reconsidered and scaled down.	
(ii) Public Enterprises	Losing money: losses at 8 largest public enterprises accounted for half of the deficit in 1991; 2 insolvent state-owned banks with 2/3 of total assets in the banking sector, required a massive capital injection from government in 1993.	Half of small/medium enterprises already privatized or divested. Complete the privatization of small/medium enterprises, start with large ones (Air Lanka, sugar factories, cement companies, tea plantations). Also see *Industry* following. However, there is no sign that hard budgets will be imposed on the ones that remain state-owned, e.g., Ceylon Electricity Board (CEB), Sri Lanka Railways (SLR) and Ceylon Petroleum Corporation (CPC). CEB's tariffs are to be increased in 1994 & 1995. SLR has been made into an autonomous corporation and an IDA-assisted restructuring program is under way.	However, an expansion in economic activity could lead to more pollution overall (*scale effect*) even if there were less pollution per unit of output (*intensity effect*). Quick reductions in government expenditure may be achieved through disproportionate cuts in environmental expenditures and social sector spending, but this may in fact be harmful for long-run economic growth. This underscores the fact that the *quality* of fiscal adjustment is as important as *quantitative targets*.
iii) Tax Policy	Substantial reliance on indirect taxation (83%); arbitrariness (proliferation of tax holidays, ad hoc tax concessions).	A VAT was planned for 1994, but has been postponed by a year to April 1995. Progress in computerizing returns continues to be slow. Corporate income tax reduced to 40%; elimination of export taxes; simplification of turnover tax (rate bands reduced from 10 to 3).	

Table B-2 (continued). Current Economic Conditions and Proposed Reforms in Sri Lanka

Economic Policies	Current Situation/Policy Issues	Ongoing/Proposed Reforms and Implications	Environmental Implications
Infrastructure/ Energy	Transport, telecommunications, electricity generation are heavily concentrated in the public sector; backlog of necessary rehabilitation and maintenance works; inadequate cost recovery; regulatory framework inhibits private sector entry. Ceylon Electricity Board (CEB) and Sri Lanka Railways (SLR) face financial problems; they require tariff and fare hikes. In the CEB, tariffs are well below long-run marginal cost (LRMC). Level and structure of petroleum prices out of line with border price relatives; public import monopoly of petroleum products. The massive Mahaweli project has been going on since 1970 (almost complete now) to provide irrigation and electricity. It is the government's largest investment project: over 43 billion rupees had been spent by 1987 and the total expenditure was then anticipated at 60 billion rupees. (Sri Lanka's GDP in 1987 was 200 billion rupees.)	Sri Lanka Telecom Department is now a public corporation. In addition, there is now a limited role for private services in this sector. Sri Lanka Railways has been converted from a government department to an independent authority. No increase in long-awaited tariff and fare revisions for CEB and SLR, respectively; no indication that tariffs in the infrastructure sector in general will be increased toward LMRC. BOO/BOOT (Build-Operate-Own/Build-Operate-Own-Transfer) schemes are being actively pursued in the power sector. Private sector entry allowed in petroleum sector (e.g. blending plant and blending services privatized and divestiture of retail stations is ongoing). Inadequate operation and maintenance (O&M) is already causing premature deterioration of the infrastructure. It is now necessary to focus on maintenance and rehabilitation rather than further investment. Studies by International Irrigation Management Institute (IIMI) indicate there is no economic justification to increase irrigated area such as through the Kalu Ganga project.	Progressive privatization of the infrastructure and energy sectors and accompanying price reforms (LRMC pricing) should increase their efficiency and also encourage optimal use of water, energy, etc. This would not only reduce the resource costs of economic growth, but also be beneficial for the environment. Rehabilitation of the irrigation network could reduce water loss and associated environmental problems such as waterlogging and salinity.

Table B-2 (continued). Current Economic Conditions and Proposed Reforms in Sri Lanka

Economic Policies	Current Situation/Policy Issues	Ongoing/Proposed Reforms and Implications	Environmental Implications
Industry/ Mining	Manufacturing, the most dynamic sector in the economy, grew at 9% in 1992. Private sector grew at 20% and its performance overshadows the sluggish public sector. Foreign investment remains strong. This should enable the economy to grow and diversify its industrial and export base. Garment industry highly successful (partly due to import quotas in the European Union and USA). The government set up 200 rural clothing factories by the end of 1992 to promote job growth in rural areas and reduce the current concentration around Colombo--however, many may not be economically viable; also, this is the only major non-agricultural manufactured export. A recent agreement with the USA, which accounts for 65% of all garment exports, increased quotas by 16%, and the start of the quota year was brought forward to January from July.	Privatization continues, and 23 state enterprises had been privatized by the end of 1992. However, plans to privatize Air Lanka and the two state-owned banks have not taken off. Following protests from local gem miners and environmentalists, in January the government banned mechanized gem mining in all rivers and stream beds in Sri Lanka. (Possible environmental impacts: destruction of river fauna, lowering of surrounding water table, collapse of river banks leading to flooding in heavy rains.) Comprehensive new mining regulations introduced under an Act in 1992. All current licensed and unlicensed operations involved in exploration, mining, processing, trading or export of minerals must acquire *new licenses* under the act. The act does not cover gems and hydrocarbons.	Privatization and economic reforms lead to greater efficiency in resource use. Pollution intensity declines as resources are used more efficiently (*intensity effect*). However, overall pollution may increase due to increase in total output (*scale effect*). Unless costs of pollution are internalized, profit-maximizing private firms may now substitute "free goods" (such as the environment) for purchased inputs in the production process. (In other words, to the extent that such substitution possibilities exist, private profit-maximizing firms are more likely to exploit them than state-owned enterprises (SOEs)). Closure of the more inefficient SOEs may reduce overall pollution. Elimination of subsidies for inputs such as electricity or water leads to more efficient use and as a consequence, less pollution. Greater inflow of modern technology through foreign collaboration could reduce pollution intensity.

Table B-2 (continued). Current Economic Conditions and Proposed Reforms in Sri Lanka

Economic Policies	Current Situation/Policy Issues	Ongoing/Proposed Reforms and Implications	Environmental Implications
Agriculture	Sluggish growth and narrow export base due to (i) excessive government intervention in pricing and trade; (ii) public expenditure excessively oriented toward self-sufficiency in food (free land and water inputs); (iii) poor O&M of existing irrigation infrastructure. Dominant crops are paddy, tea, rubber and coconut. Most rubber and tea are exported. Tea: Output almost back to normal in 1993 after the drought-affected slump of 1992 (also due to privatization of plantation management). World demand is high and prices are firm. There is an urgent need to modernize tea industry and increase output of CTC tea (for Western markets) compared to orthodox teas. (In 1993 CTC tea accounted for only 3.4% of total output, rest was orthodox tea--this could be a big problem in the future.) Tea growers also hampered by high interest rates. Another major problem is advanced age of tea bushes--in 1987 average age was approximately 60 years. Only 15% of the area under tea has been replanted with HYVs. Low replanting in 1960s and 1970s because high export taxes plus low tea prices meant low profits; also there was a risk of nationalization.	Insufficient political will to implement meaningful reform, especially to relax legislated cropping and land-use restrictions and to remove non-tariff barriers. Export crop taxation, however, being phased out; rationalization of sugar industry (including privatization of factories); rice, wheat and flour markets partially deregulated; tea and rubber plantations contracted out to private management companies (see below); Mahaweli restructuring plan under preparation. The government is offering cash subsidies per hectare to tea smallholders as well as rebates on fertilizers (trade-off needed since fertilizer subsidies are bad for the environment, but required to increase production); tea marketing system to be reformed; regulations on tea growing relaxed--growers do not have to register tea holdings with the Tea Commissioner or obtain permits for planting and replanting, establishing nurseries or factories, or selling tea locally. There is a proposal to conduct the Colombo tea auction in dollars rather than rupees (enabling planters to borrow working capital in foreign currency, at much lower interest rates).	Reforms in management of the tea sector should encourage better stewardship of natural resources such as soil and water. Current 30 year leases are a distinct improvement over the earlier 5 years, which encourage deforestation of plantation forests for quick profits. This underscores the importance of *ownership* issues for the environment. Eventual privatization of these plantations (presumably once they are profitable) would further encourage long-term investments to increase productivity, e.g., soil conservation and replanting (which are also good for the environment). Given other distortions such as underpricing of timber, rapid privatization could lead to deforestation of forests on plantation lands (for short-term profits). Deforestation of plantation forests could also occur in response to rapid growth in tea output--for use as firewood in tea factories.

Table B-2 (continued). Current Economic Conditions and Proposed Reforms in Sri Lanka

Economic Policies	Current Situation/Policy Issues	Ongoing/Proposed Reforms and Implications	Environmental Implications
Agriculture, continued	**Rubber:** A large number of plantations suffer from old age and neglect; output and area have been declining since the 1980s. **Coconut:** Like tea and rubber, suffers from inadequate replanting. Large proportion of trees are old and past optimum productivity levels. Output is on a declining trend due to recurring droughts and withdrawal of fertilizer subsidies.	Smallholders who produce the bulk of the coconut output have not taken advantage of several subsidy schemes that the government has offered to encourage coconut production.	Subsidies on fertilizer in the past may be encourage overuse and resulted in acidification of soils, nutrient imbalances, and soil erosion. This is in addition to downstream pollution of surface and groundwater from agro-chemical runoff.
Forests	Continuing deforestation and degradation of forests through illicit felling and encroachments which are periodically "regularized"; lax implementation of statutes for limited felling; many good plans on the books but not implemented. The Forestry Master Plan (1987) is the blueprint for this sector for the next two decades. While a large reforestation program has been implemented, essential follow up silvicultural operations are frequently neglected.	The Master Plan envisages clearing all 1.3 million ha. of dry zone forest (except 0.5 million ha. set aside for national parks). The remaining forests are in the wet, intermediate and montane zones (278,000 ha.). Of these, 159,000 ha. (57%) will be protected and the rest selectively cut. The Plan also recommends reintroduction of the cooperative reforestation scheme (a highly successful program for raising industrial wood plantations in the dry zone). A five year program to improve forestry conditions and management started in 1990.	Economic growth and job creation, particularly in the manufacturing sector, may reduce pressure on agriculture, especially on chena cultivation which is the main cause of deforestation. As the construction sector grows, however, domestic demand for wood will increase. Completion of the Mahaweli project should provide extra land and energy that may also reduce the derived demand for deforestation (for agriculture and fuelwood). Removal of price distortions in timber (royalty only 10% of sale price) would also reduce incentives for deforestation.

Table B-3. Sri Lanka Action Impact Matrix (Selected Elements)

Economywide Policy Reform Goals/ Instruments	Sustainable Development Issues					
	Urban and Industrial Pollution	Forest and Biodiversity Protection	Agricultural Land Conversion and Degradation	Energy Generation and Conservation	Water Resources Depletion and Degradation	Coastal Resource Degradation
Sectoral/Inter-sectoral Price and Institutional Reforms (i) Resource Access Rights and Tenure	[+] property rights allowing community-based management of coastal areas and coral reefs could strengthen incentives to reduce industrial and agricultural pollution	[+] decentralization and social forestry-type institutional support will reduce open-access exploitation of forest and wildlife resources	[+] tenurial security will promote investment and improve land management (note: in some cases, privatization may be externally imposed on communally managed lands, leading to a breakdown of traditional management systems)			[+] introduction of community rights over fishing & mangrove resources would encourage better resource management
(ii) Price and Subsidy Reforms			[+] removal of subsidies will encourage more efficient/reduced use of agricultural chemicals	[+] improving energy prices will promote more efficient energy generation and use [-] higher prices may reduce access to the poor	[+] introducing higher industrial and irrigation water fees will encourage efficiency in water supply and use [-] higher prices may reduce access to the poor	

Table B-3 (continued). Sri Lanka Action Impact Matrix (Selected Elements)

Economywide Policy Reform Goals/ Instruments	Sustainable Development Issues					
	Urban and Industrial Pollution	Forest and Biodiversity Protection	Agricultural Land Conversion and Degradation	Energy Generation and Conservation	Water Resources Depletion and Degradation	Coastal Resource Degradation
Privatization (i) Improve Efficiency in Use of Resources (e.g., with financial reforms and hard budget constraints)	[+] reduce waste in resource-based manufacturing		[+] increase efficiency of tea plantations, leading to better land management (note: in communally managed lands, privatization may be associated with negative effects, as discussed under institutional reforms above)	[+] increase efficiency of generating plants; with pricing reforms (see below), it will also increase energy efficiency among industrial users	[+] promote more efficient provision of urban and industrial water supply	
(ii) Promote Private Investment	[+] private investments tend to introduce less polluting technology	[+] alienating land for plantations or allowing sufficiently long-term leases could promote plantation development	[+] may increase investment in land improvement	[+] new plants tend to be more energy efficient	[-] together with price increases, this may reduce access to water by the poor	

Table B-3 (continued). Sri Lanka Action Impact Matrix (Selected Elements)

Economywide Policy Reform Goals/ Instruments	Sustainable Development Issues					
	Urban and Industrial Pollution	**Forest and Biodiversity Protection**	**Agricultural Land Conversion and Degradation**	**Energy Generation and Conservation**	**Water Resources Depletion and Degradation**	**Coastal Resource Degradation**
Government Deficit Reduction (i) Cut Expenditures, Reduce Subsidies	[-] social and environmental programs like urban pollution abatement (e.g. MEIP) are often the first to be cut; poor communities often at risk	[-] protection efforts may be reduced especially in forestry (e.g., Forest Department budget constraints)	[-] reduced agricultural extension programs, increasing problem of chena cultivation, soil erosion	[+/-] reduced energy subsidies also control wasteful energy use, but may reduce access to the poor	[+/-] reduced subsidies will discourage wasteful water use, but poor communities may have reduced access to safe supplies	[-] coastal/coral reef protection efforts may further decline (e.g., CEA, NARA budget constraints)
(ii) Introduce Resource Rent Taxation and User Charges		[+] reduce pressures on use of forests and protected areas and raise funds to improve community self-management or government protection services	[+] taxation of idle or neglected lands will encourage land improvement		[+] encourage more efficient use of water sources	[+] promote more efficient use of coastal resources
(iii) Introduce Environmental taxes and fees (in contrast to above instruments, these are charges on environmental externalities)	[+] taxes or charges on emissions or effluents will increase incentives for abatement; may also reduce land degradation from mining	[+] reforestation deposits could encourage sustainable logging		[+] introduce incentives to reduce emissions or effluents in energy generation	[+] tailings or discharge fee will reduce water degradation problems	[+] charges or penalties would discourage coral reef and mangrove degradation

Table B-3 (continued). Sri Lanka Action Impact Matrix (Selected Elements)

Economywide Policy Reform Goals/ Instruments	Sustainable Development Issues					
	Urban and Industrial Pollution	Forest and Biodiversity Protection	Agricultural Land Conversion and Degradation	Energy Generation and Conservation	Water Resources Depletion and Degradation	Coastal Resource Degradation
Trade Promotion (i) Export Promotion and Foreign Exchange Liberal-ization		[-] export stimulus may increase timber cutting -- depending on land tenure and account-ability, this may worsen deforestation	[+/-] both crop output and input prices will be affected if they are tradables; better land management is encouraged by higher crop prices if tenure is secure (see tenure issue above)	[-] outward-oriented growth will increase energy generation needs		
(ii) Reduce Tariffs and Other Trade Barriers	[+/-] industrial openness is associated with new and more efficient technologies, but absolute pollution levels may increase with rapid sectoral growth		[+/-] may initially affect industrial output and employment as inefficient firms fail to compete with imports; long-run improvements in resource allocation should increase employment and income, reducing pressures for marginal resource exploitation			
Industrial Promotion (i) Reduce Special Industry Programs and Investment Subsidies	[+] special government industrial projects tend to favor industries (especially parastatals) that are often pollution prone; thus, reducing direct government programs will help improve the structure of industrial production		[+] increased industrial employment may reduce pressures on marginal lands			[+] promo-tion of tourism will create new jobs in coastal areas, thus relieving pressure on coral mining and over exploitation of fisheries

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The World Bank

Headquarters
1818 H Street, N.W.
Washington, D.C. 20433, U.S.A.

Telephone: (202) 477-1234
Facsimile: (202) 477-6391
Telex: MCI 64145 WORLDBANK
MCI 248423 WORLDBANK
Cable Address: INTBAFRAD
WASHINGTONDC

European Office
66, avenue d'Iéna
75116 Paris, France

Telephone: (1) 40.69.30.00
Facsimile: (1) 40.69.30.66
Telex: 640651

Tokyo Office
Kokusai Building
1-1 Marunouchi 3-chome
Chiyoda-ku, Tokyo 100, Japan

Telephone: (3) 3214-5001
Facsimile: (3) 3214-3657
Telex: 26838

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