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Development Strategies
for Fragile Lands
USAID/G/EG/EID

THE GREEN BOOK

VOLUME 1
POLICY SOURCE BOOK

1994

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Preface

The Green Book has evolved from a series of activities supported by the Policy Initiatives component of USAID/G-CAP's Regional Environmental and Natural Resources Management (RENARM) Project. Through buy-ins with the Agricultural Policy Analysis Project, Phase II (APAP II), natural resource policy inventories were performed by Abt Associates Inc. in Guatemala, Belize, Honduras, El Salvador, and Costa Rica from 1989 through 1990. The Green Book was subsequently developed to combine lessons from the five countries and to present information in such a way that it could be used by Missions and local decision makers to improve their understanding of the natural resource and environmental consequences of a broad array of policies.

The 1992 version of The Green Book was initially produced for RENARM as a loose-leaf notebook entitled *The Green Book: An Environmental Sourcebook*. That work was supported by RENARM buy-ins to Abt Associates Inc. through APAP II with additional support from the Development Strategies for Fragile Lands (DESFIL II) Project. This initial version was subsequently published as *The Green Book, Part 1: A Policy Taxonomy and Analysis of Policies Affecting Natural Resources and the Environment*, October 1992, APAP II: Methods and Guidelines No. 406 and *The Green Book, Part 2: Manual For Conducting A Natural Resource Policy Inventory*, September 1993, APAP II: Methods and Guidelines, No.406, Volume 2.

The Green Book 1994 builds and expands upon the 1992 edition. It is supported by a buy-in from RENARM to Abt Associates Inc. through DESFIL II. The objectives of the Green Book throughout its development have been to: (1) promote participation in natural resource policy formulation; (2) increase the quality and use of information and analysis; and (3) build institutional capacity for policy formulation and dialogue.

The Green Book has received strong support from two individuals whose ideas and energy have contributed significantly to its structure and evolution. Bill Sugrue, recently ADO for USAID/G-CAP and the RENARM Project Officer, has been an enthusiastic supporter of the vision. Ronald Curtis, former ADO for ROCAP, contributed significantly to the Green Book, especially to the articulation and development of the sections that analyze the trade-offs between growth, welfare, and conservation.

Three people made production of this version of the Green Book possible. Jack Hopper edited and provided the graphics. Scott Lacy processed the words and the chaos. Marsha Strother managed the tables and the printing process.

Users' Guide to the Green Book

THE GREEN BOOK

VOLUME 1: POLICY SOURCE BOOK

- POLICY SYNTHESIS
- PROBLEM-POLICY MATRIX
- POLICY ANALYSES

THE GREEN BOOK

VOLUME 2: METHODOLOGIES

- PARTICIPATORY WORKSHOP
- MANUAL FOR A NATURAL RESOURCE POLICY INVENTORY
- MODEL POLICY PROJECT

THE GREEN BOOK

VOLUME 3: APPLICATIONS

- ANALYSIS OF FOUR HONDURAN LAWS
- FOREST MANAGEMENT POLICIES IN CENTRAL AMERICA
- RAPID ASSESSMENT OF FORESTRY LEGISLATION

Green Book Volume 1: Policy Source Book

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POLICY SYNTHESIS

The policy synthesis section (1) summarizes major themes and (2) describes impacts on the intent of that policy produced by four other major policy categories.

PROBLEM-POLICY MATRIX

The problem-policy matrix identifies the impacts of each of the twelve policy categories on six major categories of environmental problems: Soil, Water, Air, Forests, Fisheries, and Biodiversity.

POLICY ANALYSES

The policy analysis section provides an analysis of what is known and not known about major policy tools that appear in each category:

Population
Macroeconomic Policies
Trade and Investment
Environment
Energy
Agriculture and Livestock
Forest
Land Tenure and Colonization
Indigenous Peoples
Protected Areas and Wildlife
Water and Watershed Management
Coastal Zone Management

Green Book Volume 2: Methodologies

THE GREEN BOOK
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PARTICIPATORY WORKSHOP

Opening Session
Problem Identification Part One
Problem Identification Part Two
Policy Identification Part One
Guided Tour of the Source Book
Policy Identification Part Two
Policy Assessment
Sharing Analyses
Conclusion

MANUAL FOR A NATURAL RESOURCE POLICY INVENTORY

Problem Identification
Policy Identification
Institution and Stakeholder Identification
Policy Assessment
Identification of Policy Alternatives and Research
Implementation of a Natural Resource Policy Inventory
Annexes
- Team-Building Exercise
- Taxonomy Guiding Questions

MODEL POLICY PROJECT

Key Project Activities
- Country Adaption of the Green Book
- Participation
- Dual Local and National Activities
- Training
- Indicators

Project Components
- Policy Inventory and Agenda
- Policy Information and Analysis System
- Policy Implementation and Education

Green Book Volume 3: Applications

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ANALYSIS OF FOUR HONDURAN LAWS

Agricultural Modernization Law
Forestry Incentives Law
Environmental Law
Municipalities Law

FOREST MANAGEMENT POLICIES IN CENTRAL AMERICA

Belize
Costa Rica
El Salvador
Guatemala
Honduras
Nicaragua

RAPID ASSESSMENT OF FORESTRY LEGISLATION

Guatemala Emergency Forestry Regulations
Nicaragua Emergency Forestry Regulations
El Salvador Proposed Forestry Law

Introduction

The Green Book 1994, Volume 1: Policy Source Book is organized around a policy taxonomy. The policy taxonomy shown in the next section lists the broad range of policies (not solely resource-specific policies) that must be considered when addressing resource issues. For example, the influence of macroeconomic and tenure policies on forest activities often is equal or greater than the influence of forest-specific policies.

The taxonomy was developed to facilitate comparison of policies across countries. The taxonomy structure and analysis were drawn from policy analyses and documents worldwide. The rationale for this approach is based on the premise that policy issues and analysis are similar across regions. Thus, regional policy issues and solutions can provide useful insights and applications that are useful in other areas of the world.

Because this methodology for analysis is still evolving, a loose "rule-of-thumb" definition for policy was chosen. A policy is what decision makers focus on when trying to deal with economic, welfare, or environmental problems. Thus, a policy can be a specific law or rule; a broad property and/or market system that controls access to resources; and values and beliefs. The categories in the taxonomy are common topics around which policies are discussed. There is some duplication of analysis because some topics, such as livestock policies, are aggregates of policies discussed elsewhere that also are relevant within this specific context.

The taxonomic structure is linear. This has both advantages and disadvantages. Analysis can be summarized easily and can be displayed in various accessible ways, and a great deal of information can be successfully incorporated into this format. It is important to recognize the wide scope of policies that must be considered. While some policies were not included in this document, the scope and flexibility of the taxonomy format makes it easy to add other categories as necessary. More important, each section can be revised as more is learned about the complexities of the policy analysis, reform, and implementation process.

The analysis involves estimates or probable outcomes given certain conditions. It is not deterministic. Other policies and changes in those policies will often obviate a specific conclusion.

Geographic or regional issues will also influence the final outcome of the analysis. Therefore, this information must be used as a framework that requires careful application to specific circumstances. As more is learned about those interactions, information can and will be added to the base. The framework's linear format, however, will impede the ability to include all nuances. In addition, the context and problems will affect the relative importance of a particular policy or set of policies, which will affect any given set of policy reform prescriptions.

A primary disadvantage to the taxonomy is that policy solutions for particular problems must deal with the dynamic interaction between and across policies and problems. Solutions are unlikely to be linear or to draw from only one policy category. Taking into account the broad array of policies was one of the primary reasons for creating the taxonomy. To address these issues we have provided two tools in this volume. The policy synthesis summarizes important themes that transect many policy issues and provides examples of how different policy categories interact. The problem-policy matrix allows the user to identify the relationship between broad categories of problems and the role of different policies in affecting resource user behavior that leads to those problems. Each of these tools is designed to show the interdependence of policies, behavior, and economic, welfare, and conservation issues.

This and its two companion volumes are designed to introduce policy information in a more participatory process. It does not provide answers but instead is intended to promote discussion and thought about the broad and complex issues associated with use of natural resources and the environment. We believe that greater participation will improve the policymaking process.

The taxonomy provides the overall outline for this document. Within the policy discussions one will find similar subsections. The visual design and purpose of these subsections is shown on the next page.

Policy Taxonomy Category

POLICY SUBCATEGORY

KEY POINTS

- Bulleted list of important points.
- A quick reference to the content of the section.

The text describes what is known and not known about the impact of a policy on resource use. It is a summary of theory and reality and is written in nontechnical language. Stakeholder and policy implementation issues are also addressed

Likely Impacts of a Policy or Policy Change

- **GROWTH**
  Short-term and long-term impacts on economic growth.
- **WELFARE**
  Short-term and long-term impacts on human welfare.
- **CONSERVATION**
  Short-term and long-term impacts on ability of the ecosystem to provide environmental services.

Mini-Case

Brief case studies used to illustrate specific policy situations or specific solutions to existing problems.

Indicators: Relevant Policy Subcategory

Problem Indicators: Lists potential physical and behavioral measures of problems.

Policy/Process Indicators: Lists potential policy and institutional measures that address problems.

RESEARCH QUESTIONS These questions specify some of the gaps in the existing knowledge base.

REFERENCES Readers who desire more information should consult these sources.

Policy Taxonomy

POPULATION

Policies to Slow Population Growth

- Population Growth Issues
- Beliefs and Assumptions
- Fertility Regulation
- The Demographic Transition Model

Redistributing Population

- Internal Redistribution
- External Redistribution

Gender Discrimination

- Reducing Gender Bias in Policies and Programs

MACROECONOMIC POLICIES

Natural Capital and the Economy

- Nature as Capital
- Natural Resource and Environmental Accounting

Economic Evaluation of Environmental Resources

Monetary and Credit Policies

- Monetary Policies
- Credit Policies

Exchange Rate Policies

- Overvalued Exchange Rate
- Floating Exchange Rates

Fiscal Management

- Fiscal Deficits
- Taxes and Revenue Sources
- Debt Financing
- Debt-for-Nature Swaps

Structural Adjustment Lending

TRADE AND INVESTMENT

Export Promotion

Tariff Policies

Trade-Generated Economic Growth

Export Promotion Policies

Trade Liberalization

Privatization

Privatization of State-Owned Enterprises (SOEs)

Re-regulation

Privatization of Natural Resources

Foreign Direct Investment

Special Incentives

Foreign Exploitation of Natural Resources

Technology Transfer and Human Capital Development

Pollution Havens

ENVIRONMENT

Protection of Environmental Quality

Water Quality

Direct Regulation

Effluent Charges

Subsidies and Tax Exemptions

Air Quality

Direct Regulation

Emission Charges and Environmental Taxes/Tax Differentials

Other Economic Instruments

Land Disposal

Direct Regulation

Economic Instruments

ENERGY

Fossil Fuels

Policies Affecting the Demand for Fossil Fuels

Policies Promoting End Use Efficiency

Policies Affecting the Supply of Fossil Fuels

Hydroelectric Energy

Policies Affecting the Demand for Hydroelectric Energy

Policies Promoting End Use Efficiency

Policies Affecting the Supply of Hydroelectric Power

Alternative Fuels

Policies Affecting the Demand for Alternative Fuel Sources

Policies Affecting the Supply of Alternative Energy Sources

AGRICULTURE AND LIVESTOCK

Product Price Controls

Price Ceilings

Price Floors and Support Prices

Price Bands

Input Subsidies and Prices

Credit Subsidies

Pesticide Subsidies

Fertilizer Subsidies

Subsidies for Agricultural Machinery

Direct Government Activities

Input Marketing

Product Marketing

Regulation of Pesticides

Direct Regulation

Indirect Regulation

Cross-Border Effects

Livestock Policies

Credit Policies

Fiscal Incentives

Tenure Policies

Provision of Public Services

FOREST

Concessions and Licenses for the Use of Public Timber

Duration of Timber Concessions

Conditions and Restrictions on Timber Concessions

Award Process for Timber Concessions

Concession Size

Forest Revenue Systems

Charges On Concessions

Charges Based on Standing Timber Volumes

Charges on Timber Harvested

Charges on Forest Products Production

Charges on Minor Forest Products

Charges on Foreign Trade

Charges For Services

Charges On Productive Factors

Charges On Companies

Government Participation in Concessions, Harvesting, and Processing

Forest Industry and Export Policies

Domestic Industry/Resource Protection Policies

Direct Government Involvement in Forest-Related Industries

Price Controls

Forest Industry Structure

Certification and Eco-labeling

Private and Community Forest Management

Private Forest Management and Tree Tenure

Farm and Community Forest Management

Nontimber Forest Products

Fuelwood and Other Biomass

Policies Affecting the Demand for Fuelwood

Policies Affecting the Supply of Fuelwood

Reforestation Policies

Fiscal Incentives and Policies

Public Reforestation Projects

LAND TENURE AND COLONIZATION

Land Tenure and Markets

Property Rights

Ownership Distribution

Land Markets

Land Banks

Colonization and Reform

Direct Government Policies

Indirect Government Policies

Spontaneous Settlements and Invasions

Land Use Capability and Planning

INDIGENOUS PEOPLES

Indigenous Land Rights

Values, Assumptions, and Policy Guidelines

Resource Management

Exclusion from Parks and Protected Areas

National Parks and Indian Parks

Conditional Occupancy and Use

Priority Use

Lease-Back Provisions

Compensation for Conservation

Biosphere Reserves

Management and Research

Forest Parks and Refuges Catering to Tourism

Recreational Development

Protection of Boundaries

Economic Development Projects

International Legal Instruments

UN Charter

Prevention and Punishment of the Crime of Genocide

Implementation

Organization of American States Charter

Implementation

Other Sources of Policy

Changing Values and Moral Persuasion

UN Working Group on Indigenous Populations

International Conference of NGOs, Indigenous Peoples, and the Land

Inter-American Indian Congress

PROTECTED AREAS AND WILDLIFE

Types and Legal Basis of Protected and Reserved Areas

Types of Protected Areas

Problem Resolution for Protected Areas

Land Use Policy and Issues

Resource Management and the Local Community

Community Participation

Direct Cash Incentives and Disincentives

In-Kind Incentives and Disincentives

Fiscal Incentives and Disincentives

Financing

International NGOs

Foundations, Trust Funds, and Endowment Funds

Public Law 480 Funds

Foreign Aid

Joint Government-NGO Financing

Debt-For-Nature Swaps

Bilateral Debt-For-Nature Swaps

International Conventions and Support

Nature Tourism

Wildlife Protection and Trade

International Conventions

Export Controls and Cross-Border Issues

Hunting Laws

WATER AND WATERSHED MANAGEMENT

Water Control, Use, and Pricing

Policies Affecting Water Use

Policies Affecting Water Quality

Watershed Management

Policies Applied at the Watershed Level

Institutional Policies

Irrigation Provision and Pricing Policies

COASTAL ZONE MANAGEMENT

Policies Affecting the Quality of Coastal Resources

Subsidies

Investment Incentives

Fiscal Instruments

Regulations

Voluntary Approaches

Integrated Coastal Zone Management Plans

Policies Affecting the Use of Coastal Resources

- Ownership
- Regulations
- Management

Policies Affecting the Management of Fisheries

- Subsidies
- Regulations
- Taxes
- Use Rights
- Public Participation

Glossary

Ambient standards	Environmental regulation based on the level of air and water pollution permitted.
Average cost pricing	Pricing services based on cost divided by number of users.
Capital flight	Where economic uncertainty and inflation result in investors moving capital to other countries.
Carrying capacity	The capability of a given system to support a population.
Discounted present value	How much some amount at a future date is worth today.
Economic or resource rents	Returns above costs of production resulting from natural limitations in supply.
Efficiency	How well inputs are combined in making outputs (with the least waste).
Marginal cost pricing	Pricing based on the incremental total cost associated with one additional unit of output.
Marginal product	The amount of output change associated with a small change in inputs.
Real interest rates	Nominal or recorded interest rate less the rate of inflation.
Open-access resource	Resources where access and use are not controlled by individuals, groups, or the state.
Opportunity cost	The benefit forgone by using a resource for one use and not another.
Resource mining	Where resource use exceeds the replacement or absorptive rate of the resource.
Technology-based standards	Environmental regulations requiring the use of specified technology.

Policy Synthesis

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Land Tenure and Colonization 20

Indigenous Peoples 22

Protected Areas and Wildlife 24

Water and Watershed Management 26

Coastal Zone Management 29

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Policy Synthesis

Policy issues permeate the complex interdependence between economic growth, human welfare, and environmental conservation. Policy has been defined in the introduction as what decision makers focus on when trying to deal with a specific law or rule; as a broad property and/or market system that controls access to resources; and as values and beliefs. Policy analysis also, however, considers important the absence of policies or lack of ability to implement policies. Knowledge of both biophysical and socioeconomic interdependencies is required.

The policy taxonomy and analysis provides information in a linear format and does not often cross-reference the reader to other policy elements. The taxonomy will be the primary source of policy information in the Green Book.

This policy synthesis summarizes some of the major themes found in the primary sections of the policy taxonomy and in twelve boxes shows important interactions with other policies. A primary objective of the Green Book is to broaden policy discussions to include other policies that may need to be addressed before a particular policy change will be effective. Those seeking to change policies will need to consider policy interactions and some of the following questions:

- What are the cumulative effects of a set of policies?
- Are some policies contradictory and others complementary?
- In what sequence should you change policies? If you change one policy without changing another, what will happen? Changing some policies first may have no results or negative results if other policies are not also addressed.
- Can the policy be implemented? If not, is it possible to change the policy to make it easier to implement?
- Who wins and who loses from a proposed change in policy? This information will affect the success of the policy and/or identify the potential coalitions and obstacles.

- What are the intentional and unintentional consequences of a policy? Policy effects are frequently the opposite of their design.

This synthesis is designed to aid the process of addressing some of these issues by indicating some of the key interactions between policies. The connections drawn are illustrative of a much more complex situation faced by those concerned with environmental policies.

POPULATION

Beliefs and assumptions determine the importance of policies to slow population growth in national decision making. Clearly population growth and other policies interact to place pressure on resources. The relative importance of these factors and concomitant solutions vary from situation to situation. Local population problems have been on the increase. In some cases, population growth and density have increased to the point that the environmental carrying capacity has been exceeded and the resource base destroyed. A slower rate of population growth would have long-term social, economic, and environmental benefits but would not have an impact on current environmental problems.

A strong government position on population control is the most important policy tool. Devolving from this position are public and private fertility services and regulations, cash and in-kind payments, subsidies, education, and disincentives for reaching population goals. The development and success of any package of policies to slow the rate of population growth will depend on the social, cultural, and economic constraints in a given situation.

Policies to address the consequences of not slowing population growth are much more in evidence than policies to reduce the rate of population growth. Where local population has exceeded the carrying capacity of the natural resource base, people often either move into more marginal lands in the region, colonize other regions, or migrate to urban areas. Each of these outcomes has serious environmental consequences. In some cases, governments in developing countries have supported large-scale resettlement projects to deal with localized population pressure. This has usually been a short-term response and not a long-term solution to population and policy problems. Management of the settlement and colonization process has had severe environmental consequences.

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Population: Interaction with Other Policies

Macroeconomic Policies

Monetary, credit, and exchange rate policies that reduce the relative prices of agricultural products decrease rural incomes and increase the pressure for more children. The availability of credit for intensive agriculture and livestock operations increases the skewed distribution of wealth, again directing population growth onto more marginal land. Thus, macroeconomic policies can increase the probability of localized increases in population density that exceed the carrying capacity of the resource base.

Environment

Policies to address water and air pollution and land disposal that result from population growth and urbanization are coming to the forefront of policy discussions in Central America. As population has grown watersheds have deteriorated and there has been an increase in non-point sources of pollution from agricultural and mining activities. Population growth in urban areas has not resulted in a significant increase in environmental policies or enforcement. Urban wastewater is usually untreated. Air pollution is in some cases severe. Pollution policies, whether regulatory or market based, must be easy to administer given the scarce institutional resources available to implement policies. To the degree environmental laws regulate point pollution, they are usually ignored. Environmental pollution is, therefore, a cost of population growth in Central America.

Land Tenure and Colonization

Land tenure and colonization policies implicitly and explicitly direct population growth as well as contribute to the pressure for more children. The skewed distribution of land forces the poor onto marginal land and into the agricultural frontier, where more children are needed to make a living. Thus, whether local population pressures exceed the carrying capacity of the resource base depends on who has access to the resources and how they use it. Colonization and spontaneous settlements serve only as a short-term solution to unaddressed population growth.

Energy

Energy policies affect and are affected by population growth. The location, price, and availability of energy affects the options for rural economic development and the ability of the rural poor to meet both water and energy needs without expanding family size. Population growth increases the demand for energy, and fuelwood is a common source of energy in rural areas. Energy policy has focused on improving the efficiency of fuelwood stoves and on subsidizing alternative energy sources such as kerosene, natural gas, and small- and large-scale hydroelectric projects.

Women are particularly vulnerable to the consequences of population growth and related environmental degradation. Because women have primary responsibility for food harvesting, fuelwood collection, and water collection, depletion of resources significantly increases their workload and, perversely, increases the pressure for having more children to help in these chores.

Women are often unable to own land, get credit or other inputs, or have their views considered in local and national decision making. This bias removes a significant resource user group from

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the ability to inform and shape decisions that influence the environment.

MACROECONOMIC POLICIES

Natural resources and the environment are integral aspects of economic activity and human welfare. Natural resources are inputs into production and the environment absorbs wastes from that production. Where resources are not being replaced as quickly as they are being used (renewable resources) or are not replaceable (nonrenewable resources) the decline in natural resource stocks and environmental quality represents a drawdown of one form of capital for other (human and infrastructure) capital. Through natural resource and environmental accounting efforts are now being made to address these issues within other national accounts and welfare indicators.

Natural resource and environmental accounting and other efforts by economists to deal with environmental issues in economic decision making depend on valuation methodologies that attempt to assign a value to the drawdown and degradation of natural resources. Such valuation tools have become elements in environmental policy decision making. While they vary significantly in sophistication, these tools generally attempt to measure the "willingness to pay" by consumers for environmental services and use present value discounting to compare costs and benefits over time. The tools and the theoretical base that support them do not address resource and wealth distribution issues, and leave the preferences of many, including those of future generations, uncounted. Nevertheless, the use of environmental valuation techniques, even with serious flaws, opens an issue that is often completely unaddressed in economic policy decision making.

Monetary policies affect the supply of money and inflation rates. In economies with rapidly expanding money supply, low real interest rates, and inflation, uncertainty results in capital flight out of the country, short-term economic behavior, and resource mining. Investment in long-term resource management and conservation activities is discouraged because investors need the quick returns from trading rather than longer-term returns from activities such as forest management. Contractionary monetary policies, on the other hand, will in the short term increase unemployment and pressure on open-access resources.

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Macroeconomic Policies: Interaction with Other Policies

Macroeconomic policies affect the relative prices for natural resources, the ability of the government to manage or protect resources and the environment, and the pressure placed on resources due to general economic conditions.

Population

Population policies (or the lack of such policies) affect long-term economic growth and the use of resources. In many countries economic growth becomes economic shrinkage when calculated in per capita terms. Rapid increases in population result in a rise in total consumption and a reduction in per capita consumption. Successful population policies would contribute to an increase in per capita savings and investment and would reduce income inequality and social instability. Unfortunately, in most developing countries the obverse is generally the case. Rapid population growth, therefore, can override the potential economic and environmental benefits derived from good macroeconomic policies.

Land Tenure and Colonization

Land tenure and colonization policies effectively distribute population and define the ability of resource users to take advantage of changes in relative prices. If land ownership is concentrated in the hands of a few and there are no active land markets, the poor often settle on marginal land on hillsides and in forest areas. When macroeconomic policies result in high relatives prices this land is planted more intensively and open-access forestland is converted to agricultural uses. Better land markets would ameliorate this land use regime.

Energy

Energy and management of the country's forest resources affect the options available for macroeconomic policy. For example, if fuelwood collection is an important element in deforestation, then a move toward the use of fossil fuels may be warranted, but this will increase the need for foreign exchange. Providing energy through large-scale hydroelectric projects often requires increasing external debt, and promoting alternative fuels often requires subsidies and subsequent use of funds from the national treasury.

Trade and Investment

Trade and investment policies, while treated separately in the Green Book, are important elements of macroeconomic policies. Exchange rate reform will often not have the intended results if export promotion, trade liberalization, and policies to encourage foreign direct investment are not in place. Privatization of generally inefficient state-owned enterprises presents opportunities for the use of improved technology and more efficient resource use, if other environmental safeguards are in place.

Credit policies, whether to increase access or to provide subsidies for certain groups, have often supported short-term production activities and have favored large landowners who can meet strict collateral requirements. Further rationing generally occurs because the cost of credit may otherwise be high. While credit could conceivably support environmental objectives (such as integrated pest management), it is more frequently used for production of short-cycle, high-input crops. Nevertheless, credit policy (cost, availability, and distribution) can be a crucial

element in supporting the adoption of improved resource conservation technology.

During the last several decades many governments in developing countries have consistently overvalued their country's currency instead of allowing the value to float in response to world markets. Overvaluation results in an implicit tax on exports and an implicit subsidy on imports. This in turn results in a bias against the agriculture and rural sectors, causing higher levels of rural unemployment and poverty and underinvestment in conservation.

Many developing countries have recently devalued or floated their currencies, which has resulted in greater competitiveness for agricultural and forest products on the world market, but not necessarily in better resource management. While resource use may have been slightly less with an overvalued currency, devaluation could result in resource mining if not accompanied by appropriate policy and effective management safeguards. As with other policies that affect relative prices, exchange rate policies will have complex effects. Because market prices do not take into account resource degradation, other government policies will need to be in place to protect natural resources and the environment.

Fiscal policies directly affect the ability of the government to manage and protect resources, and also affect the options available in managing exchange rates. (The need for foreign exchange to pay foreign debt may result in overvaluation.) Large fiscal deficits and the decision to finance them domestically or externally have effects that ripple throughout economic and resource management decisions. Domestic financing crowds out private economic activity, increases unemployment, and increases pressure on open-access natural resources. External financing increases the country's need for foreign exchange, the pressure for exports, and the drawdown of natural capital. The long-term effect of debt will depend on the economic returns to the government from the investments made with the funds.

Governments have also responded to high debt levels by reducing capital expenditure in favor of politically more important current expenditures for jobs. Infrastructure is therefore poorly maintained and resource management and protection activities are unfunded. The problems are further compounded by a poorly managed tax system that does not collect taxes for government-owned resources in proportion to their value.

Creative solutions for meeting debt relief and environmental objectives have included debt-for-nature swaps. Debt is forgiven in return for designation and support for protected areas or other environmental objectives.

Structural adjustment loans (SALs) are made by the World Bank and other donors to effect a broad set of policy changes including exchange rate reform, debt reduction, trade liberalization, subsidy reductions, and tax and institutional reform. For any given policy change the effects on growth, welfare, and conservation will be complex and mixed. For a large scale set of activities is even more so.

While the theory behind the SAL approach is to achieve long-term economic growth and welfare, this approach does not address either the short- or long-term environmental effects of the constellation of policies. In many countries implementation of structural adjustment loan policy conditions created severe economic hardships on some elements of society, often the poor, and placed great pressure on open-access resources, at times resulting in their irreversible loss.

Accounting for, or at least addressing, natural resource and environmental effects before adopting macroeconomic policy changes is a precondition for sustainable development.

TRADE AND INVESTMENT

In the past tariff and trade policies had an antiagriculture and antiexport bias. Real prices for agricultural products were kept low, resulting in a decrease in rural incomes and migration from those areas. In addition, protectionist policies were highly correlated with inefficient and polluting industries. The international movement toward a free trade regime will affect developing countries' natural resources in a number of crucial ways.

Because many of these countries export resource-based commodities, free trade will increase economic activity. That activity will have both positive and negative effects on the environment. An increase in prices resulting from trade will increase the pressure to mine resources unless safeguards are in place. Environmentally friendly technology and better environmental management may result from free trade as inefficient industries are forced to compete. The increase in

Trade and Investment: Interaction with Other Policies

Environment

There is little effective environmental management for water , air, and land disposal policies in Central America and many other developing countries. Where such policies exist they usually depend on technology-based command-and-control systems. However, few countries have the institutional capacity to manage even this relatively easy to manage regulatory approach to pollution. Fines for polluting activities are generally economically insignificant to the polluter. Free trade policies may reduce the number of inefficient industries and associated pollution even if an overall increase in economic activity increases aggregate pollution.

Energy

Privatization of energy companies in developing countries is one method for reversing capital flight and improving the investment climate for foreign firms. However, privatization of natural resource-based enterprises requires safeguards to prevent resource mining. Benefits of privatization are improved efficiency and less waste as prices are raised to reflect the actual cost of the energy. Privatization is also likely to result in fuel substitution in reaction to price changes. These changes might, for example, increase the demand for fuelwood as an alternative to the now more costly alternative energy sources.

Agriculture and Livestock

Governments have often been direct participants in input and output marketing. Privatization of agricultural parastatals will reduce explicit and implicit subsidies for some agricultural activities and remove bias against other groups. In a free trade regime, market signals will be allowed to more freely determine what crops are grown. Whether the crops chosen will be more or less favorable to the environment is situation-specific and complementary policies to provide safeguards to resource management will depend on the situation. Greater economic activity in rural areas and the country in general may provide the resources to provide the needed safeguards.

Protected Areas and Wildlife

Trade in wildlife is difficult to control. High demand and prices and extreme poverty in some rural areas places great pressure on wildlife. The inability to guard parks and reserves and to stop trade at the border prevents effective management. Freer trade may allow more resources for wildlife trade enforcement by customs officials. In addition, a better rural economy from overall changes toward free trade will reduce pressure on wildlife capture and trade, and possibly provide funds for better protection. If other policies such as land tenure are not changed, however, greater pressure on wildlife may result.

economic activity will increase the absolute levels of pollution even if trade results in improved efficiency. Without policies that regulate or otherwise control resource user behavior, industries may relocate to pollution havens to take advantage of lax environmental laws. There is still some uncertainty in GATT and the side agreements to NAFTA about how environmental regulations will affect trade.

Export promotion activities have been associated over time with input-intensive activities. Examples include mariculture, cotton, and nontraditional agricultural exports such as like melons. Such policies have usually benefited a few wealthy individuals. Elimination of export promotion under a free trade regime will reduce benefits to some special interests, at least in the short term.

Privatization of state-owned industries has gained momentum as a means for eliminating inefficient enterprises and reversing capital flight. In theory, private operators would function in competitive markets and be more efficient. Environmental protection policies would have to be in place and implementable to prevent environmental costs that firms do not have to account for.

When utilities such as energy and water are privatized, one might expect an increase in prices and less inefficiency in resource use.

Foreign direct investment provides benefits of added capital, technology, and access to markets. Policies to induce such investment include tax holidays, reduced tax rates, and expedited paperwork. Where foreign investment is in natural resources, policies should ensure that the economic or resource rent is collected by the government and that environmental standards are in place and met. In many cases, foreign resource mining enterprises will bargain for special incentives and lower environmental standards in return for local employment. Bribery is also common.

ENVIRONMENT

Environmental policies that address water and air pollution and land disposal include regulations, effluent, and emission charges, subsidies and tax exemptions, among others. The effectiveness of any given approach depends on the particular resource.

Water pollution policies target effluent from point sources and use end-of-pipe standards, but governments often have inadequate financial resources to provide oversight for these requirements. The option has been to specify technology-based standards similar to those used in industrialized countries. For many developing countries, the standards are too ambitious and unenforceable. Options such as effluent charges require even more technical and institutional capacity. Subsidies and tax exemptions lower the

Environment: Interaction with Other Policies

Population

Population increases in developing countries has usually resulted in an exodus from rural areas into urban centers. The rapid expansion of urban areas has increased water and air pollution and land disposal needs. Urban slums often have no public services. Urban and industrial wastewater is frequently untreated. Population increases thus compound the lack of or lax enforcement of environmental policies.

Macroeconomic Policies

Macroeconomic policies and trade policies have in the past protected inefficient domestic industries that are often heavy polluters. For example, exchange rate policies have implicitly subsidized imports for urban consumers and implicitly taxed agricultural exports. This has lowered rural incomes and resulted in migration to urban areas as well as increased consumption and waste in urban areas. Fiscal policies often preclude development of effective environmental agencies, given other budget needs from politically powerful interests.

Energy

The type of energy sources in a country determines the kind of environmental regulations required. Most often developing countries depend on a combination of fossil fuels, hydroelectricity, and fuelwood. Environmental policies generally deal with pollution from energy plants fueled by fossil fuels. Strong environmental management policies would affect the choice of energy used by increasing the cost of fossil fuels to account for environmental problems associated with that source. This would occur either directly through emission charges or indirectly as each industry reacted to regulations.

Coastal Zone Management

Coastal zone management requires the enforcement of environmental policies on water discharges from upstream sources as well as coastal communities and industries such as tourism. Lax environmental controls affect the environmental and economic base of the coastal communities. Wastewater discharge destroys estuarine and marine habitat and limits the development of tourism. Coastal zone management efforts would need to have an implementable set of environmental policies in order to address wastewater discharge problems.

cost of adoption of new technologies, and may be initially easier to implement in developing countries. However, in the long-term such subsidies might actually encourage the expansion of the industry receiving them, thereby increasing the aggregate level of pollution.

Air quality policies often focus on the large stationary sources of air pollution such as electric power plants and industrial facilities. Technical standards take the form of emission limits. Taxes and emission charges can be used to create incentives to reduce air pollution by increasing the cost of pollution activities. Where these charges have been used they generally have been too low to affect behavior and have simply been used as a source of

revenue. More complex policy measures such as emissions trading are beyond the technical capacity of many environmental agencies.

Land disposal is generally addressed through direct regulations and fines. Successful implementation of regulations increases the cost of waste generation and reduces the amount. However, local governments seldom have the capacity and resources to adequately manage public and private land disposal activities. As population grows and more waste results, land disposal will become an even greater problem in developing countries. Financial resources will be needed to implement regulations and provide public land disposal services.

ENERGY

Policies affecting the use of fossil fuels, hydroelectricity, or alternative fuel sources are similar in design and intent. Pricing policies, subsidies, taxes, and regulations are common elements of policies affecting an individual energy source. In addition, the policies for one energy source are also important determinants on the use of other energy sources as one source substitutes for another.

Pricing policies should ideally reflect the cost of supplying the energy. In many countries energy is provided by parastatals or producers are otherwise subsidized. Energy-inefficient industries are thus subsidized. Prices are often controlled. Average cost pricing, while easier to administer, does not provide an incentive for efficient energy use. Marginal cost pricing is often recommended as a means to improve efficient utilization of energy but is more difficult to administer and meets political resistance from those who benefit from the current pricing structure. Fossil fuels and hydroelectric power have a history of being priced below the cost of production.

Subsidies in the form of reduced prices for a particular energy source are frequently given to special groups. In some countries lifeline rates price electricity below cost. Others receive targeted subsidies to guarantee access to electricity. Agricultural enterprises often get reduced rates for irrigation. These subsidies, while addressing welfare issues or granting an advantage to a favored group, increase the demand for energy and reduce the efficiency of its use. Privatization of energy provision will probably result in higher prices for fossil fuel and

Energy: Interactions with Other Policies

Environment

Weak environmental laws or lax enforcement of laws reinforces the development of energy-inefficient industries. On the other hand, application of technology requirements or ambient standards will feed back into decisions on energy use. Several problems are typical of pollution problems. First, they are extra-jurisdictional and require local, national, and sometimes international cooperation. This is administratively difficult in most countries. Second, the capacity to enforce any level of control or taxes is minimal in many countries.

Forest

Forests provide another, often crucial, form of energy in the form of fuelwood. Energy substitution among fossil fuels, hydroelectricity, and alternative fuels will be affected by the management of the country's forest resources. Controls on collecting fuelwood are seldom successful. Many programs have focused on improving the efficiency of wood burning stoves. Others have subsidized use of fossil fuels. If deforestation is taking place and the fuelwood supply becomes limited locally or nationally, then demand will be greater for other energy sources.

Water and Watershed Management

Watershed management policies affect the success of both large- and small-scale hydroelectric projects. Sedimentation resulting from soil erosion and runoff upstream from hydroelectric dams reduces the effective life of the dam. In addition, water pricing policies for irrigation can result in inefficient use of water and the electricity needed for some forms of irrigation. Subsidies for both electricity and water affect crop choices and the intensity of other input use.

Coastal Zone Management

Coastal areas suffer the downstream effects of pollution caused in part by energy pricing and supply policies. Fossil fuel use can increase the use of input-intensive agriculture and increase the presence of pesticides and fertilizers in coastal waters. Hydroelectric projects affect the quantity and flow pattern of coastal water sources. Coastal zone management issues would, therefore, need to address energy policy. In addition, the location of energy plants in coastal areas also has localized environmental effects that can be negative.

hydroelectric power. This will improve energy efficiency but may affect some groups more than others.

Regulations and taxes are also used to affect the efficiency of energy use. Regulations require more administration and institutional capacity than do taxes. Taxes, however, may also be difficult to manage because they apply to the use of different technologies. Taxes can raise the price of energy and decrease consumption. Taxes also perversely affect the choice of energy by providing breaks for one form over another. For example, tax breaks for exploration, depreciation, and provision of fossil fuels reduces the development of and demand for alternative sources of energy such as wind and solar power.

In many countries the development of a national energy supply policy will depend on large- and small-scale energy development and generation activities. Credit and subsidies may be needed to increase the demand for one energy source and to reduce the demand for others. In some cases, fossil fuels will need to be imported (and subsidized) to reduce the demand for fuelwood. In other cases, small-scale hydroelectric project development will need access to credit and the ability to sell excess energy to the local power grid.

AGRICULTURE AND LIVESTOCK

Governments frequently set policies to intervene in agricultural product markets to control prices for producers, consumers, or both. How these policies affect producer prices, agricultural production, and ultimately the use of natural resources is not well understood. Generally it is expected that policies that depress producer prices slow growth, lead to disinvestment, and reduce investment in conservation. Low agricultural product prices benefit urban consumers. On the other hand, production increases from price increases result in more intensive agriculture, expansion of the agricultural frontier, and a change in the type of crops grown.

Subsidies and price controls have been used by developing countries to encourage the use of pesticides, fertilizer, and farm machinery as well as the planting of specific crops. As incentives to what was perceived as improved or modern farming techniques they were often successful in changing agricultural production activities. Many subsidies, however, have remained in place for too long and resulted in inefficient use of inputs and biased decisions on crop choices.

Credit has been subsidized or made more accessible to agricultural enterprises, thus enabling them to more easily purchase inputs such as pesticides and fertilizers and encouraging specific activities such as raising cotton and cattle and clearing land. Subsidized credit is often directed to large borrowers and agricultural credit subsidies are biased in favor of capital-intensive agriculture, which leads to inefficient application of inputs. Production approaches such as integrated pest management, which uses less chemical inputs, receive little support from credit. The bias toward capital-intensive agriculture also contributes to deforestation and to further concentration of wealth through support for land clearing.

Agriculture and Livestock: Interaction with Other Policies

Macroeconomic Policies

Macroeconomic policies have often had a systematic bias against the agriculture sector. Overvalued exchange rates are an implicit tax against agricultural exports and reduce savings and investment in the agriculture sector. Inflationary pressures favor short-cycle crops over perennial crops. Agricultural product price controls reduce income in that sector. In response, governments have put in place many input subsidies on credit, pesticides, fertilizer, improved seeds, and machinery. The combination of policies in the macroeconomic and agriculture sectors is not a balanced set of policies but instead is a complex set of interactions. However, reducing macroeconomic bias against agriculture by increasing relative prices may lead to more rather than less pressure on resources given the rigidity of policies in other sectors, including tenure and trade and investment.

Trade and Investment

Trade and investment policies have also been biased against agriculture. Trade protection for domestic industries has resulted in negative rates of effective protection for the agriculture sector. This antiexport and antiagriculture bias has contributed to migration out of rural areas and increased poverty and pollution in urban areas. Promotion of nontraditional agricultural exports has been one of the recent aspects of trade promotion and reform. Effects on the environment from nontraditional agricultural exports depends on the crop and the specific situation. It is not possible to make generalizations about economic, welfare, and conservation goals.

Land Tenure and Colonization

Policies that reduce the potential profitability of agriculture have been buttressed by tenure policies that concentrate ownership in the hands of a small number of wealthy individuals and families. These individuals usually own the best land but underutilize it, often with livestock operations. Poorer elements of rural society are left to cultivate marginal land and frequently move into open-access forest areas to clear land. There are effectively no land markets. Therefore, reforms in macroeconomic, trade, and agricultural policies that increase prices for agricultural products lead directly to increased pressure on marginal lands, if the reforms are not accompanied by land tenure changes and increased availability of other inputs for sustainable agricultural practices.

Water and Watershed Management

Water and watershed management policies interact with agriculture in a number of crucial ways. Government irrigation systems provide water for agriculture at highly subsidized rates, which not only places a great fiscal drain on the government but also results in inefficient use of water. In addition, irrigation is highly correlated with the use (and overuse) of inputs such as pesticides and fertilizers, thus resulting in pollution and contamination of water bodies downstream. While setting the price of water closer to its value is favored by economic policymakers, this has rarely been done because there is strong political interest in maintaining the present allocation and pricing system.

Price subsidies on pesticides and fertilizer often occur as tax and tariff concessions, and with credit policies, can have a significant direct and indirect fiscal effects. They also result in a distortion of crop choices, low application efficiency of inputs, and a decrease in crop diversification. Machinery subsidies support intensive agricultural activities and less crop diversification. These choices

affect the health of both human and nonhuman species through contamination and reduce the level of biodiversity.

Direct government activities also support input-dependent agricultural cultivation methods. Parastatals market inputs, set production quotas, and set product buying standards. Again, overuse of pesticides and fertilizer and larger, single-crop activities are favored.

Government regulation of pesticides in developing countries is often ineffective and runs counter to the incentive system described above. Because many policies favor greater use of pesticides, the volume involved usually exceeds the ability and resources of regulatory agencies to effectively control. In contrast, standard enforcement by importing countries is very effective in controlling farmer pesticide use on export crops.

The health and environmental consequences of pesticide use have been shown to be severe. In addition, recent rethinking by international agencies responsible for the "Green Revolution" has resulted in recommendations to reduce the use of pesticides.

Expansion of the livestock sector has resulted from the combined effect of favorable markets and numerous government policies. Credit policies allow livestock to be used as collateral and the credit often goes to larger borrowers and fiscal incentives provide tax breaks, accelerated depreciation, and favorable export duties. In addition, tenure controls make expropriation of cattle operations difficult, infrastructure and veterinary support services are provided, and fees for grazing on public land are practically nonexistent. In the aggregate, these policies encourage and support the extensive use of land that could be more intensively cultivated and the conversion of forestland to livestock operations, irrespective of land use capability.

FOREST

In many developing countries the government is the de facto owner of most forestlands and resources. Commercial use, especially for timber extraction, is usually managed by a system of logging or forest management concessions or licenses. The duration of the concession is usually short or insecure, which provides a disincentive to long-term management of forests. Commercial timber operations often selectively harvest high-value species and leave the area open for land conversion to agricultural

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Forest: Interaction with Other Policies

Many policies contribute to deforestation. Often the policies that are most influential in causing behavior that results in deforestation are not forest management policies. While forest management policies do affect a resource user's willingness to invest or not invest in long-term forest management (or to account for environmental goods provided by forests), policies from other sectors affect the investment options available and their relative value.

Macroeconomic Policies

Macroeconomic policies determine the economic climate in which investment decisions are made. High inflation or high real interest rates reduce incentives for long-term investment. Sectors where economic returns are quicker, such as agriculture and livestock production, will be favored over the much longer-term investment horizon for forest management. Stagnant economies increase rural poverty and increase pressure on open-access resources. Trade and exchange rate policies may be biased against resource sectors such as agriculture and further increase rural poverty. On the other hand, policy changes that favor agriculture will result in resource depletion in the absence of other policy reforms. For example, increasing prices for agricultural products by exchange rate reform will spur increased production of export crops on open-access land if tenure reforms are not also implemented. In addition, a large fiscal deficit reduces the ability of the government to manage resources.

Agriculture and Livestock

Sector-specific policies for agriculture and livestock make these sectors more attractive than forest management. Why manage land as forests when subsidies exist for other activities? In combination with some macroeconomic policies, agriculture and livestock policies are generally the primary policies that lead to deforestation. These policies include credit subsidies, better collateral requirements, credit for "land clearing," and subsidies for agricultural equipment and livestock operations. In addition, government services and development projects generally favor agriculture and livestock activities.

Land Tenure and Colonization

Land tenure contributes to deforestation activities in a number of ways. Forests, whether de jure in public or private ownership, are often de facto open-access resources are easily invaded. Formal government colonization and settlement policies may make land clearing a requirement for proof of use. If the land is still forested, then it is considered idle and potentially subject to expropriation or idle-land taxes. The statute is often enough of an incentive to induce land clearing. However, the potentially greatest land tenure dynamic leading to deforestation is the skewed distribution of land. Large landowners own and frequently underutilize land suitable for more intensive uses. The skewed land distribution and the absence of land markets force poorer people onto marginal lands on hillsides or forests. Land use planning generally does not exist.

Energy

Energy policy also affects the use of forests. Fuelwood gathering by both urban and rural people and industries contributes to deforestation. Rural fuelwood collection is often not officially controlled; when controls exist, they are often unenforced. Laws designed to limit fuelwood use in urban areas have not been successful. The relatively high cost of alternative fuels favors the use of fuelwood from open-access forests in many urban-oriented industries.

and livestock uses. Reinvestment of timber profits into timber management does not occur because no benefits would accrue to the concession holder. In many countries opposition to long-duration timber concessions developed because of the cut-and-run behavior of foreign-owned timber firms. Ultimately, however, the duration of the concession may not significantly affect the behavior of firms if other policies encourage short-term economic activities instead of investment in long-term production activities or if other policies favor other sector activities such as agriculture or livestock.

Forest concessions (and in some countries management of timber on private land) are subject to conditions and restrictions and must fulfill the requirements of management plans that address those conditions and restrictions. These include allowable annual cut, prescribed and proscribed practices, and species and size cutting restrictions. In many cases these restrictions are not enforced and the technical resources needed to support management plans are not available. Concession management will remain ineffective if the public institutions responsible for implementing concessions and management plans have limited resources and the scale of the public forest estate is large.

The awarding of concessions is generally administrative and non-competitive. Non-price allocation of concessions based, for example, on political awards precludes the potential of a competitive process that would increase revenues to the state and promote long-term resource management.

The awarding of large tracts of land as forest concessions is usually for speculative purposes rather than forest resource management. The cumulative effect of these aspects of the concession system is to favor a few well-connected interests who have timber cutting permits with little or no management oversight. Without management and technical infrastructure and given the existence of economic incentives that favor short-term activities, concession systems do little to control resource depletion and conversion to other uses. For the concession management system to operate effectively, concessions must be awarded in open competition, be secure in some sense if managed well, and safeguards must be in place to assure good management. In addition, decentralization of resource management from the central government to local resource users and an increase in the participation of local residents in the management process will be needed.

There is a wide array of potential charges on public timber. In theory, the concept of economic rent (profit arising from natural limitations in supply) suggests that forest charges could be much higher than they generally are. Raising charges to capture more of the economic rent for the public treasury, and perhaps using those funds to improve forest management, also may improve long-term resource management by reducing or eliminating windfall profits. In addition, low forest charges have resulted in harvesting of marginal timber areas, have depressed prices for private timber, and have encouraged high-grading, among other effects. The exact effects on harvesting depend upon the type of charge. Issues to consider in reforming charges on timber include the amount of revenue produced, the ease of administration, the efficiency in the use of forest products, and who wins and loses from the changes. For example, assessing charges on timber removed rather than on timber in the stand encourages high-grading. Flat charges and ad valorem taxes, if differentiated by species, would reduce high-grading. However, such a system is more difficult to administer.

Typically, forest charges do not capture much revenue for the government. The result is an incentive system that promotes competition for economic rent and results in windfall profits for concession holders. Where the award of timber concessions is not transparent and not competitive, bribery may occur. Again, weak institutions limit the ability to establish forest charge systems that promote long-term resource management.

A common feature of forest policy is a set of export controls and taxes designed to encourage and protect domestic processing of timber. These may include log export bans, export taxes, differentiated rates for processed timber products, tax relief or subsidies, and direct public involvement in the timber industry through parastatals. Protective policy structure undervalues the timber resource, encourages inefficient processing industries, and encourages overly rapid resource use as governments allow timber cutting to support the domestic industry.

Arguments for freer trade contend that eliminating protective policies will raise resource values, encourage efficient processing as domestic industries respond to international competition, and lessen the need to support no longer inefficient industries. However, the history of boom-and-bust in logging suggests that higher prices will result in unsustainable forest management unless: the government has the capacity to manage the rate and location of harvesting and other policies exist, as noted above, to support a long-term sustainable resource management regime.

Overall economic development may be sustainable if the profits from timber activities are successfully invested in other sectors. But sustainable forest management would require both timber cutting and environmental controls beyond the capacity of most developing country forest management institutions. Therefore, short term environmental losses would result in long term economic and welfare losses. Freer international trade and presumably higher prices for timber will result in increased windfall profits unless firms have secure rights to manage forestland and the government is able to capture sufficient economic rent.

Regulations in many countries also undermine sustainable forest management on private lands especially when conditions and restrictions applied to cutting on public land are also applied to private land. Cutting permits are required; often a long, cumbersome, and corruptive process. The cumulative effect is to create an atmosphere of uncertainty surrounding the tenure and use rights to forestland. While many owners ignore and evade the requirements, they will also not invest in long-term management of a resource over which their control is uncertain.

Reforestation is defined as restoration of degraded stands, enrichment planting, or the establishment of plantations. There are two broad policy approaches to reforestation: fiscal incentives and government or donor-sponsored projects.

Fiscal incentives for reforestation may include tax breaks, subsidies for inputs, reimbursable deposit fees, and others and they may be applied to either public land concessions or licenses or private land management. The effectiveness of these incentives often depends on the effectiveness of the tax system, the size of the exemption or subsidy, and the target beneficiaries. If a tax is paid only by larger, easier to monitor corporations, then only they will use the incentive. If the relative importance or size of the benefit is small and/or the program is poorly implemented, then reforestation will not occur. While some reforestation incentives target smaller resource users, many favor larger, wealthier elements of society. In some cases, timber plantations are based on such subsidy systems. In other cases, the subsidies accrue to the wealthy, but reforestation does not occur because of ineffective management.

The second approach to reforestation entails a wide array of government and donor-sponsored projects. The government-managed projects have been disappointing. More success has been achieved where reforestation has been part of a process to

empower local communities and to support their management of reforested areas. In addition some new programs subsidize the management of natural forests.

LAND TENURE AND COLONIZATION

Land tenure policies have central importance in the appropriate use of land and the responsiveness of land markets to price changes for agricultural and forest products. In many cases governments have de jure ownership of land over which it has no de facto control. This results in an open-access resource where the incentives are to use the resource before someone else does so. There is no incentive for long-term resource management. Ownership patterns often are highly skewed. The wealthy control the best land and frequently underutilize it, for example, for livestock, when more intensive agricultural activities are more appropriate. The poor are forced to cultivate marginal lands with poor soils or expand the agricultural frontier into open-access publicly owned tropical forests.

Much debate has focused on the best form of ownership to improve production or increase conservation practices. No single ownership form is appropriate for all situations. Private property decisions on resource conservation will depend on overall economic conditions. Common property may be appropriate where the community can effectively control access to the resource. State ownership and effective control may be needed to protect crucial natural habitats. The property regime in a specific country usually has a complex combination of different ownership systems with varying degrees of success within and across categories in meeting both economic and environmental objectives.

Land markets support the exchange of private property and are a means, when successful, of capturing in land values the returns from investments in conservation practices. Land can be used as collateral to mortgage land to get the resources for better management. Many countries have poorly functioning land markets because of the aforementioned skewed land ownership distribution. In addition, land titles are often unclear, and ownership, therefore, is difficult to prove. Taxes applied to land have been ineffective in encouraging land transfers because it is so easy for owners to avoid paying taxes. Some land transfers from large holdings to individuals and groups have been facilitated by private and public sector land banks but have not had a significant influence on skewed land distribution.

Land Tenure and Colonization: Interaction with Other Policies

Tenure policy reform is often a necessary condition for appropriate land uses and the success of policies that affect relative prices. However, other policies affect the importance of tenure policies and the stability of existing tenure systems.

Population

Rapid population growth increases pressure on open-access resources because of the increases in income inequality. Private, public, and communal land ownership systems are placed under various stresses. Private and public land are subject to land invasions or spontaneous settlements. Communal property systems experience increased pressure on resources from population growth both within and outside the community. Government attempts to redistribute population often result in conversion of public forestland. Population growth control programs would reduce social and economic instability, decrease pressure on land and land tenure systems, and provide more security to investments made in land conservation.

Macroeconomic Policies

Macroeconomic policies can negate tenure policy reform in a number of ways. First, secure tenure may not result in resource conservation activities if the macroeconomy is uncertain, trade oriented, or biased against exports from rural areas. The ability to manage state-owned resources can be limited because of fiscal deficits. Poor tax administration and undertaxation of land as well as forest resources distorts resource use decisions related to land.

Protected Areas and Wildlife

Protected and reserved areas policies can be considered one form of tenure issue related to (generally) state-owned land. Establishment of protected areas often requires addressing land use capability in management plans. Few countries have the resources for this level of management. In addition, protecting this form of state-owned tenure is difficult because of its historical use as an open-access resource. Many newly established protected areas include private property. Expropriation of this private property often requires compensation that the government cannot afford.

Indigenous Peoples

Indigenous people's land rights are often unrecognized by governments or colonists because of the common property tenure system they generally use to manage their land. Lack of recognition of the rights and role of indigenous people in general contribute to a lack of recognition for the potential resource conservation role of indigenous peoples. While such conservation does not necessarily result from clearer recognition of indigenous land rights, many options exist to mix government support, regulations, protection, and incentives to support the sustainable uses of forests that are often practiced by indigenous peoples.

Government colonization projects have usually resulted in poor and inappropriate land uses and deforestation. Colonization projects are often located in forests and at times within designated protected areas. Inappropriate land uses result. In addition, resources to support better land management are not generally provided to colonists. In order to acquire land titles or

use rights the colonists are required to "improve" (clear the land of trees) and use the land for agricultural or livestock activities.

Land reform requirements by governments have defined forestland as "idle" and subject to expropriation. Owners of such tracts cut the trees even if the land is best suited to natural forest management. In other cases, governments have given land rights to squatters who have cleared the land.

Some developing countries have begun to implement land use capability and planning systems. While actual performance has not met objectives because of political and institutional resistance and limited institutional resources, some clear benefits can be derived from very simple and easily implemented systems. These include: delineation of national parks and forest areas (and concessions), appropriate land use information for public projects such as colonization and hydroelectricity, and credit tied to appropriate land uses.

INDIGENOUS PEOPLES

Most forestland in Central America is occupied by indigenous peoples who manage their land communally and whose rights are not legally recognized by governments, which often retain de jure ownership. Protection from invasion by colonists is negligible and does not have legal standing. The cultural identity and integrity of indigenous peoples is closely related to the security of their land tenure. Recognition, demarcation, and protection of indigenous land claims is an important element in retaining forest resources.

Indigenous groups have developed long-term, sustainable land use practices that maintain biodiversity and reduce over management of the area. Indigenous ownership and use, however, do not guarantee sustainable practices because those groups can also adopt unsustainable technology and practices.

A number of policies have been adopted in an attempt to maintain current resource use practices and to support maintenance of indigenous peoples in forest areas. The range of policies is wide. Some policies prohibit indigenous people from entering parks while other policies create Indian parks. Both extremes fail to recognize the positive role of indigenous people and the reality of lack of effective protection for parks. Within this range are policies that establish conditions for occupancy

Indigenous Peoples: Interactions with Other Policies

Population

Rapid population growth in rural areas increases pressure on open-access resources. Land occupied by indigenous peoples who do not possess political power becomes an easy target site to relieve population pressures in other regions of the country. Formal colonization programs, if not directly located on indigenous people's land, are located near enough to make indigenous land susceptible to spontaneous colonization. Studies, however, have shown that increasing land use intensity in already populated areas is better than expanding the agricultural frontier at the expense of forest and indigenous peoples.

Land Tenure and Colonization

Skewed land ownership distribution within a country, even with modest population increases, can result in migration into the agricultural frontier. When colonization does occur, the ability of colonists to get land titles has in many cases been dependent on clearing forests because forestland is classified as idle. Thus a series of laws reinforce a breakup of land into small privately owned parcels. This is often at the expense of officially unrecognized communal tenure of indigenous peoples.

Forest

Forest policies that result in short-term resource mining of timber undermine long-term resource use of nontimber forest products, which are sustainably collected by indigenous peoples. Examples of nontimber forest products include rubber, resin, essential oils, nuts, gum, and medicinal plants. In many cases timber concessions are awarded for areas occupied by indigenous groups, who have no legal standing. Even where community forest management projects exist, their rights are often secondary to politically more powerful logging interests.

Protected Areas and Wildlife

One approach to incorporating indigenous peoples and local communities into protected areas management is extractive reserves. A combination of subsidies, cash incentives, and credit supports communities that are allowed to perform traditional activities. The agreements are usually for thirty years and renewable based on performance. This allows long-term resource conservation behavior and capture of the benefits of such behavior.

such as the type of technology that can be used, incentives for maintaining current practices, regulations on allowable land uses, and compensation for losses. Biosphere reserves try to address both colonists and indigenous people's needs while reducing pressure on resources.

As with many other resource use issues, direct involvement by indigenous peoples and other local communities will improve the design, planning, and management of resources. This does not mean that conflicts in resource use do not exist and that policies do not create winners and losers. Instead it recognizes that ignoring those conflicts by focusing solely on national policies will result in poor policy design and implementation.

PROTECTED AREAS AND WILDLIFE

There is a wide range of protected and reserved areas, classified according to the degree of human intervention and the management objectives. While some countries have developed important tourism activities around national park systems, parks in most countries do not have the resources for proper management or protection. Establishment of parks is often a de jure change in tenure without the ability to control access or manage the park or reserve. There is often no government presence in the field. Parks and reserves are subject to human encroachment, often the result of increases in population. There are also frequent conflicts with other government agency mandates such as forest, energy, and agrarian reform departments. In other cases, parks are created on private land, which cannot be expropriated without compensation for which the agency lacks funds. While park legislation often requires a management plan, the implementing agency usually does not have the personnel and technical skills to create such a plan. In some countries private groups and individuals have conservation easements or a charter to manage publicly owned parks.

Involvement of local communities in park and reserve design, planning, and management is an important element in long-term success of the park or reserved area. In areas adjacent to parks, community support is sought through a mixture of incentives from direct cash, in-kind benefits such as the ability to extract certain forest products, and fiscal incentives such as tax exemptions. Many factors affect the success or failure of such efforts including: population pressure, government technical and fiscal resources, and the degree of community coherence and support, among others.

Financing park protection and community incentive systems is crucial to long-term success of newly established parks and park systems. Most park funding comes from the national treasury and will continue to do so. However, other sources of funds can supplement the national budget. The more popular parks can charge admission fees or reserve areas can charge user fees. For example, there can be special taxes for timber extraction, or water charges can be placed on irrigation systems that depend on protected areas for their water source.

Protected Areas and Wildlife: Interactions with Other Policies

Population

A rapid growth in population places greater pressure on the resource base. Population increase compounds existing problems associated with access to resources and rural poverty. Localized increases in population may exceed the carrying capacity of various resources such as water, soil, and forests. As population increases the ability of people to save and invest in conservation practices often declines. Internal migration policies of a country often support or allow people to migrate into or adjacent to protected areas, which compromises the integrity of the parks and reserves.

Macroeconomic Policies

The degree of pressure on protected and reserved areas depends, in part, on macroeconomic policies. If macroeconomic policies are biased against the agricultural sector, rural incomes and employment are negatively affected. Attempts to remove this bias, however, will increase pressure to use open-access resources in protected areas if other policy changes and effective park protection are not forthcoming. In addition, fiscal management frequently does not result in funds being available for park protection. While fiscal deficits often arise from inefficient government activities or subsidies, budget reduction results in fewer resources for essential environmental projects. Thus, macroeconomic policies can increase pressure on resources while reducing the ability of the government to protect parks and reserves.

Indigenous Peoples

Policies that address indigenous people's rights and the community property regime of indigenous peoples are crucially important to national parks and reserves, given the high degree of correlation between protected areas and reserves and indigenous communities in Central America. If indigenous peoples are excluded from parks, invasions are likely. In some cases, parks or adjacent areas have incorporated indigenous groups but have restricted the technology those groups could use (i.e., conditional occupancy in extractive reserves). In many other cases, parks and reserves are established in areas occupied by indigenous groups with little or no involvement by those groups in park design, planning, and management.

Forest

Forest concessions are frequently granted adjacent or in parks and reserves because of the lack of clear boundaries or conflicting institutional mandates between forest departments and, usually institutionally weaker, parks departments. Similarly, energy exploration and mining activities have sometimes been allowed in protected areas. Forest policies that do not encourage long-term resource management will result in spillover activities in terms of harvesting timber resources from parks.

Many other options for funding of parks and reserved areas have been developed by the international donor and NGO communities. Activities have included establishment of endowments and debt-for-nature swaps.

Concern about the implications of ozone depletion, loss of biodiversity, and destruction of unique natural areas has resulted in a series of international conventions addressing the preservation of habitat and natural areas. Signatories to such treaties have binding obligations, but national institutional and financial resources may be inadequate to meet treaty obligations.

Several countries in Central America have significant nature tourism industries. Such industries provide economic incentives to invest in the protection of parks and reserves at both the national and local community levels. Care must be taken, however, that the carrying capacity of natural areas is not exceeded.

Many countries have signed the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), but many of the prohibitions on trade and national prohibitions on hunting are unenforced. High demand and high prices in the face of poverty in rural areas and weak enforcement agencies limit the effectiveness of wildlife controls. In Central America porous borders allow for trade in wildlife throughout the region.

WATER AND WATERSHED MANAGEMENT

In many countries water is state-owned property. However, the government does not have the institutional capacity to manage the allocation of water or charge for its value. Both surface and groundwater are often de facto open-access resources where the incentive is to use the resource before someone else does. Water is considered a free good. Attempts by governments to charge user fees for water are usually ineffective. The fees are too low relative to the value of the water or they are not paid at all. This situation often exists because of institutional conflicts over the management of water. In most cases, there are no controls on the use of groundwater. This situation frequently benefits wealthy elements of society and, as with land, the resource is inefficiently used or wasted.

In the face of (or despite) the institutional weaknesses often found in management of water, various forms of water pricing options are frequently discussed by analysts and policymakers. Flat rate water charges are used to try to recover operation and maintenance costs of the water services. Realism by many water agencies keeps these charges very low so that users pay them; higher charges would be evaded. Similarly, meters can be used to charge by volume, and increase the cost of inefficient water use

Water and Watershed Management: Interaction with Other Policies

Forest

There are clear physical interdependencies between forests and water. Water management activities often focus on the use of forests in upper watersheds and reforestation on stream banks. Forest policies are crucial determinants in terms of the quantity and quality of water available and as elements of watershed management. If management of state-owned upstream forests results in short-term resource mining of trees or unsustainable collection of fuelwood, then downstream users will have more flooding and seasonal variation in stream flow, lower overall stream flow, and more sedimentation. Reforestation efforts that focus on planting trees for fuelwood or beside streams will be hindered if the state regulates the cutting of trees on private land (even if the attempted control is ineffective) because uncertainty reduces the incentive for long-term resource management.

Agriculture and Livestock

There are many complex interactions between agriculture and water policies. Agricultural product price controls lower returns to agriculture, reduce rural incomes and employment, and increase pressure on and use of marginal lands. This affects water retention and runoff in the watershed. In addition, subsidies for pesticides and fertilizers increase the agricultural demand for water and irrigation systems and increase the non-point source pollution of water. Input subsidies also reinforce tendencies for land clearing and monocultural agriculture and affect the water availabilty and quality in the watershed.

Energy

Energy policies affect two key elements of water availability and use. Energy supply policies affect the use of fuelwood relative to other forms of energy. Energy policies may promote fossil fuel options to fuelwood if subsidies are provided for fossil fuel alternatives. Subsidies for technology to more efficiently use fuelwood such as better wood stoves are also common. A reduction in the demand for fuelwood would improve the possibility of upper watershed management. Energy policy in some countries affects water through large-scale hydroelectric projects, which have a history of ignoring watershed management until sedimentation becomes a problem for the facility. Some large hydroelectric dams in Central America were forced to close after only a few years of operation.

Coastal Zone Management

Coastal zone management and watershed management are conceptually similar approaches to resource issues as well as interdependent activities. A successful management plan for coastal zones would have to address the upstream actions of associated watersheds. For example, mariculture operations suffer if upstream irrigation results in overuse of pesticides and fertilizers. On the other hand, subsidies for mariculture and tourist activities affect the quantity and quality of water available for other users in the coastal area. Both geographic and hydrological units have many government agencies and other organizations and individuals involved in determining the use of resources and the quality of the environment.

if the fees are high enough and actually paid. Average and marginal cost pricing address the relative cost and value of water to different users. Average cost pricing is easier to manage, while marginal cost pricing more accurately charges users relative to the value of water. Rarely do water charge systems reach this level of sophistication in developing countries. Whatever system

is in place it represents a conscious or unconscious choice between the interests of different users, which affects the efficiency of water use.

Watershed management is a development concept, supported by governments and donors, that use the hydrological, biophysical, and/or socioeconomic unit as a basis for planning and management. It attempts to provide a structure to work out issues of institutional conflict by providing a forum for collaboration such as integrated management plans. Many problems in lower watersheds—sedimentation, flooding, pesticide contamination—begin in upper watersheds with deforestation, erosion, and farming on marginal land. This physical and biochemical interdependence can be addressed by coordinated policies for both upstream and downstream resource users.

Sustainable farming practices can be supported by increasing the availability of credit, subsidies, cash transfers, and so forth. Part of the cost of such programs could conceivably be supported by downstream beneficiaries of such activities.

Both the institutional and biophsical complexity make watershed management programs difficult to implement. The recent inclusion of projects that support community participation in the design and implementation of watershed management makes ultimate success more probable but makes implementation more complex.

The provision and pricing of irrigation water for agriculture is an important subset of allocation, pricing, and watershed management issues. Subsidization of irrigation by charging little or nothing for its use affects the types of crops grown, the level of inputs used, and the relative welfare of different groups of farmers. Irrigation has been a crucial element of increases in agricultural production worldwide. However, the environmental and hence economic sustainability of irrigation is in doubt because of the poor management and inefficient uses to which it has been put. There are many on-site and off-site effects from irrigation. Environmental consequences include waterlogging, salinization, sedimentation, and the various effects of the overuse of fertilizer, among others. Because there has been little charged for irrigation projects, the demand by farmers for such projects is high. The systems are poorly maintained because governments have insufficient funds.

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Changes in this pattern are difficult to implement because of pressure for more agricultural production and from vested interests in the present system of allocation and charges. As with other aspects of water policy, charges based on value to the user would affect the eeficiency of water use, the types of crops grown, and the ability of government to maintain irrigation systems, assuming charges collected were returned to the management unit and not in the national treasury as is often the case.

COASTAL ZONE MANAGEMENT

Many policies interact to affect the quality of coastal resources. Examples include subsidies for pesticides and fertilizers, credit for cattle, cotton, and nontraditional agricultural exports, export subsidies and other advantages for mariculture, and investment incentives for tourism. The results have been often been contamination of coastal waters, degradation of coastal land, decreases in artisanal fisheries, destruction of mangroves, and destruction of wildlife. Coastal zone management attempts to address the complex physical and socioeconomic interdependencies by developing collaborative institutional solutions. A complex set of policy changes would have to be implemented in order to address the problems of coastal areas. Some development projects are in the initial phases of determining whether such a complex mission is achievable.

Coastal resource use will often have a complex mixture of state-owned, private, community and open-access resource property systems. Where the state has de jure ownership of many coastal resources, effective management is rare and the resource is effectively an open-access resource. It is very common for the state to own coastlines. Licenses or concession may be granted for various uses, including tourism. Such concessions are frequently awarded in a nontransparent way and are subject to corruption. Private ownership, however, does not guarantee resource protection behavior. Regulations and/or some incentive system would have to be in place to see that environmental objectives were addressed. Thus a mixture of government ownership and regulation, private property, and communal management will likely be needed to address coastal land use.

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Coastal Zone Management: Interaction with Other Policies

Land Tenure and Colonization

Coastal resource management is made more difficult by land tenure systems that have a skewed land ownership pattern. As in other areas of the country, where large landowners control the best land and use it inefficiently, the poor inhabit marginal land. In coastal areas mangrove forests are a source of income for many of the poor. In addition, agrarian reform agencies take over state-owned coastal resources as an easier alternative to expropriation.

Protected Areas and Wildlife

Many countries have included coastal resources such as mangroves, islands, and coral reefs in their protected area system. While there are cases where some of these resources are well managed both by government and private groups, many areas are not well delineated or protected. In many cases, effective protection has been highly correlated with participation by national and local conservation groups. However, the ineffectiveness of the government to provide the resources to manage or protect these resources has resulted in a steady loss of both quantity and quality of these resources.

Trade and Investment

Promotion of export crops grown in coastal areas has resulted in pesticide pollution and soil sedimentation and dispersion problems. Cotton was for many years a highly subsidized export crop. Subsidies for the exportation of shrimp has had many economic, welfare, and resource use effects in coastal areas. The benefits have often gone to wealthy domestic and foreign owners, while reducing resources available to other resource users.

Governments also provide incentives for foreign direct investment in tourism and agriculture. Tourist facilities can put pressure on public services and cause pollution. Orange plantations in Belize resulted in soil loss that ultimately harmed the coastal reef system.

Environment

Water quality regulations and standards are difficult to manage. While there has been some success at regulating newly established tourist facilities in some countries, many government and private sources of pollution are uncontrolled in coastal areas. Much of the potential for the range of water quality policies remains hypothetical given the scarce resources and lack of technical capacity for implementation. Coastal zone management will not be effective without some policies designed to control water quality from both point and non-point source pollution.

Coastal fisheries are often open-access resources. Generally, government agencies responsible for the management of fisheries are weak and unable to implement any control over the fishery. Regulations such as catch limits and mesh size have been ineffective. Potential regulations, taxes, or quotas simply cannot be used in countries with limited resources. In many cases these policies do not work in developed countries either. An alternative approach with both long historical experience and recent success support granting of fishery rights to communities, thus in some cases reinstituting a common property system. Such systems are, of course, subject to pressures from within and without.

Of special mention in coastal resource management is the effect on wildlife species that migrate across national boundaries, such as sea turtles. In these cases, the trouble of dealing with institutional barriers to resource depletion is compounded by the scope of the open-access resource regime.

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Problem-Policy Matrix

Environmental problems are caused by behavior, not by policies. Policies influence behavior by making some alternatives more attractive than others. Behavior is neither good nor bad. Policies are neither good nor bad. Policies may or may not structure behavior as intended by policymakers.

Behavior is the result of many individual decisions that are based on an assessment of the advantages and disadvantages of alternative actions. Much of that assessment is based on policy-created incentives that make some behaviors more attractive than others. In the real world, the incentives influence behavior in an interactive fashion. For example, decisions on whether to convert a steep slope to plantation forestry; to plant corn, fruit trees, or nontraditional agricultural exports; or to leave natural vegetation is the result of a collection of incentives established in several policy sectors, and perhaps in other countries.

When one group's behavior decreases the ability of a resource to provide goods and services to another group, policy change may occur. For such a policy change to occur, the group experiencing the problem must have information about the nature and extent of the problem, an understanding of how policy contributes to the behavior causing the problem, and access to the policymaking process.

The Problem-Policy matrix covers six problems areas—soil, water, air, forests, fisheries, and biodiversity—and identifies the probable impact that each policy sector has on behavior causing the problem. An environmental problem in the context of policy dialogue occurs when human behavior causes a reduction in a resource's ability to provide goods and environmental services.

Soil

Degradation of soil is the result of human activity that reduces the current and/or future capacity of the soil to support life. The behavior's that cause the problem are deforestation and overgrazing and poor agricultural practices.

Water

Pollution and a reduction in the quantity of available surface water and groundwater is caused by overpumping and depletion from the loss of watershed capability, and an increase in total and

per capita discharge of untreated wastewater, solid waste, and chemical pollutants.

Air

Pollution has negative impacts on human and plant health and is affected by the number of vehicles, poor vehicular maintenance, industrial growth, and the absence of effective control of emissions. Indoor air pollution from smoke and fumes from use of biomass fuel (wood, straw, dung) affect primarily women and children.

Forests

Deforestation is the change in land use from forest to agricultural, including shifting cultivation and pasture, or urban use. Most tropical deforestation is caused by resource extraction to provide foreign exchange to service foreign debt, as a consequence of slash-and-burn subsistence agriculture, or by fuelwood collection.

Fisheries

Ninety percent of the world's marine fish catch (by weight) reproduces in coastal breeding and nursery grounds. Declining catch of marine fish species is caused by pollution and destruction of coastal breeding and nursery grounds and by overfishing. Behavioral causes include clearing wetlands, mangroves, and salt marshes, and upstream activities (logging, agriculture, dam construction, and irrigation, urban growth, and industry) that contribute to pollution in coastal zones

Biodiversity

Biodiversity refers to the degree of genetic variety. The chances that an individual, species, or ecosystem will survive future environmental changes increase with the amount of genetic diversity, number of species, and variety of ecosystems. Biotic resources are valued for the environmental services they provide, their direct market value; as a store of genetic information; and in terms of existence values. These values are dependent on the technical possibilities and on competing human needs. Behavioral causes for the loss of biodiversity are population growth and increasing resource consumption and policies that promote investment behavior that destroys biodiversity.

Index: Problem-Policy Matrix

	Soil	Water	Air	Forest	Fishery	Biodiversity
Population	A1	B1	C1	D1	E1	F1
Macroeconomics	A2	B2	C2	D2	E2	F2
Trade and Investment	A3	B3	C3	D3	E3	F3
Environment	A4	B4	C4	D4	E4	F4
Energy	A5	B5	C5	D5	E5	F5
Agriculture and Livestock	A6	B6	C6	D6	E6	F6
Forest	A7	B7	C7	D7	E7	F7
Land Tenure and Colonization	A8	B8	C8	D8	E8	F8
Indigenous Peoples	A9	B9	C9	D9	E9	F9
Protected Areas and Wildlife	A10	B10	C10	D10	E10	F10
Water and Watershed Management	A11	B11	C11	D11	E11	F11
Coastal Zone Management	A12	B12	C12	D12	E12	F12

SOIL: POPULATION

Policies to Slow Population Growth

- Government policy on population control affects total and per capita demand for agricultural products and the intensivity and extensivity of agricultural production resulting in overuse of marginal land leading to erosion and depletion. Policies to slow population growth would increase per capita family savings, especially among the poor, increase public and private per capita investment in human capital, and reduce income inequality. All would reduce the rate of soil degradation.

- Policies that reinforce the low status of women contribute directly to high population growth rates and intensity of use of marginal land, leading to erosion and depletion. Not specifying and enforcing responsibilities of men decreases the status of women. Not promoting smaller families and providing fertility regulation and family planning services reduces individual and social welfare, especially among poor families leading to inefficient and overuse of soil resources in marginal areas. Incentives and disincentives enhance the effectiveness of other policy tools .

Redistributing Population

- There is no evidence that internal and external redistribution of population slows population growth rate. Although social and political tension may be reduced in the short term, colonization usually results in unsustainable mining of natural resources, especially deforestation and soil erosion. The total long-term financial and environmental costs of redistribution are often high, especially if population is redistributed into ecologically fragile areas.

Gender Discrimination

- There is a strong positive correlation between poverty and the number of households headed by women. When population growth causes severe pressure on natural resources, women's reproductive capacity is devalued, their rights and freedoms are reduced, and their status deteriorates. The poor are most likely to be penalized by rapid population growth, and women and children are the first to suffer when population growth severely stresses the carrying capacity of an area.

SOIL: MACROECONOMIC POLICIES

Natural Capital and the Economy

- Soil degradation results when its productive value is not included in investment decisions. Evaluation of soil (measured as the value of inputs required to yield the same level of productivity or the value of lost productivity as a result of soil degradation) will encourage improved soil conservation.

Economic Evaluation of Environmental Resources

- To the extent that nonmarket values of soil degradation are captured in policymaking (credit, taxes, land use capability zoning, etc.) use patterns will shift from short-term economic growth that maximizes local market return to intermediate- and longer-term growth that maximizes regional and national productivity, with growing emphasis on forestry, coastal zones, and fisheries.

Monetary and Credit Policies

- Expansion of the money supply and inflation causes the value of domestic currency to fall, discourages savings, and encourages people to invest in foreign markets rather than in the long-term productivity of domestic markets. The consequence is decreased concern with soil conservation, and increased poverty and unemployment, which in rural areas causes expansion into fragile soils and increased soil degradation.

- High interest rates make the present value of future consumption low, which encourages short-term, high-yield crops that often result in soil degradation.

- The impact on soil of government intervention in credit markets depends on the direction of the intervention. Subsidized credit for cattle, machinery, and agricultural production that is incompatible with land use capability encourages soil degradation, while subsidized credit for appropriate activities does the opposite.

Exchange Rates

- Overvalued exchange rates have resulted in under investment in soil conservation. Floating exchange rates shift production in favor of agricultural exports, which may push subsistence agriculture onto fragile slopes leading to increased soil erosion. Export crops often require increased chemical and mechanical inputs that cause physical and chemical degradation of soils.

Fiscal Management

- Fiscal deficits limit the ability of government to provide services that promote soil conservation.

- Foreign exchange required to pay interest on foreign debt encourages agricultural exports, which may increase soil degradation depending on the crop and production technology. Reducing government debt may also increase soil degradation because subsistence agriculture expands due to higher food prices and spontaneous colonization.

- Taxes and revenue sources influence soil degradation when governments do not collect the resource rents from forest exploitation, resulting in unsustainable harvests and soil degradation. Decreased revenue reduces government services in support of soil conservation.

Structural Adjustment Lending

- Structural adjustment loans are a mix of policies that may have positive or negative effects on soil degradation. When they increase poverty, soil degradation can result When they eliminate credit subsidies for machinery, inappropriate agriculture, input-intensive agriculture, and energy, positive impacts on soil conservation can result.

SOIL: TRADE AND INVESTMENT POLICIES

Export Promotion

- Tariffs contribute to soil degradation when they increase pressure on the forest cover because decreasing terms of trade reduce the profitability of agriculture per hectare and campesinos cut fuelwood and clear land to increase income.

- Increased trade and promotion of exports in developing countries increases the production of agricultural exports, timber, and minerals. All of these activities degrade the productive capacity of the soil unless other incentives are in place to encourage long-term management.

- Trade-generated economic growth brings more materials and energy through the economic system and places increased demands on productivity of forests and agricultural soils. It also provides resources to invest in management and soil conservation, but that depends on the government's capacity to collect revenue and provide oversight.

- When export promotion policies encourage the use of increased chemical inputs they may encourage chemical degradation of soils, and to the extent that subsistence agriculture is displaced into marginal areas they encourage soil erosion. The impact on soils of special incentives depends on which activities are favored. Trade liberalization favors development of particular sectors, and the impact depends on the sectors favored.

- Structural adjustment loans decrease public expenditure, tighten monetary policy and devalue exchange rates. This combination of policies often has recessionary effects that may increase poverty, which combined with rapid population growth can lead to degradation of soils on marginal lands. International trade agreements may have mixed impacts. GATT reduces the scope for environmental policy, while NAFTA potentially creates economic incentives for linking environmental protection with trade-generated economic growth.

Privatization

- The impact on soil of the privatization of natural resources depends on how it is managed. Overexploitation will result if royalties do not reflect global prices and are not reinvested in management.

- Privatization of utilities (energy, water, solid waste collection) offers a possibility for improved resource management, in terms of more rational pricing to reduce the necessity for better regulatory control. This will have a positive impact on soil degradation. Subsidized rural services may be reduced, along with price increases in transportation, water, and electricity, which may result in short-term expansion into marginal lands.

Foreign Direct Investment

- Foreign direct investment will create opportunities for resource mining, especially in the forest sector. Special incentives, depending on how they are structured, may open up natural areas and attract migrants and result in soil erosion. If royalties for natural resources do not capture resource rents and reflect local scarcity value, windfall profits will be provided to investors at the expense of government revenue and resources, including soil, will be used inefficiently and degraded.

SOIL: ENVIRONMENTAL MANAGEMENT

Protection of Environmental Quality

- Many environmental problems result from the free disposal of wastes into the air, surface water, and groundwater. Damage to soil is primarily caused by disposal of industrial waste, acidification by airborne pollutants, accumulation of agrochemicals, and poor drainage of irrigation water.

- Many environmental management policies raise the price of pollution disposal to encourage polluters to find their own cost-minimizing amounts of pollution. Analysis of available empirical evidence finds no data to support a negative relationship between environmental regulations and economic growth.

Water Quality

- Improved water quality indirectly contributes to reducing sources of soil contamination. Ambient standards can reflect local water quality needs better than uniform technology-based standards; however, they do not provide information on which point source to control when pollution exceeds tolerance levels, nor do they deal with downstream concerns.

- Effluent-based charges rather than direct regulation allow polluters to decide how to most efficiently reduce their level of pollution. Charges are often used initially to supplement a program of standards, and are oriented toward raising revenue for a water quality authority rather than as an incentive to change behavior.

Air Quality

- Soil quality is affected by airborne pollutants. Technical standards for stationary and mobile sources are usually established at the national level. Many standards force the adoption of certain technologies, which raises the costs of air pollution reduction. Market-based instruments tend to lower overall control costs. Delegation of regulatory authority to the local level increases the ability to adjust standards to local needs and therefore to keep overall protection costs down.

- Emission charges are designed to achieve target levels of pollution reduction while avoiding the inflexibility of direct regulation. General fuel taxes are a common but not well-targeted means for achieving pollution reduction, except in the case of differential taxes, such as those for leaded and unleaded gasoline.

Land disposal

- Land disposal policies have a direct impact on the pollution levels of soil around disposal sites, and on downstream soils when pollutants enter surface and ground water. Land disposal policies address remediation of past contamination and prevention of future contamination. Economic instruments are not used as significant alternatives to direct regulation of hazardous waste management, but are typically used to reinforce direct regulations or provide a source of public revenue. The impact of policy tools such as financial accountability, fees, product charges and liability is unclear because they exist within larger programs of direct regulation

SOIL: ENERGY

Fossil Fuels

- Energy generation using fossil fuels directly and indirectly affects the quality of soil. Fossil fuels are major consumers of foreign exchange, and as such promote the export of agricultural, forest and mineral resources, which depending on management, often results in soil degradation. As industrialization increases and per capita incomes rise, the demand for fossil fuels will increase unless alternative fuels are developed.

- Adoption of conservation measures and energy efficient technologies costs less than the investment required for developing new sources of supply.

- Greater energy efficiency and elimination of price distortions could lower total energy consumption in most countries by 20% or more, saving millions of dollars in foreign exchange with consequent reduction in pressure on natural resources.

- Pricing policies determine demand. In general, the lower the price of energy the more people consume. Price controls, average cost pricing and producer subsidies can run counter to energy efficient objectives. Marginal cost pricing will result in increased economic efficiency but result in relatively high prices for energy, especially electricity.

- Subsidies support the objective of social equity, however, they increase demand, may lead to spending a greater proportion of foreign exchange on importing fossil fuel, and tend to discourage adoption of conservation measures and utilization of renewable energy sources. Subsidies with positive environmental impacts hold promise.

- Greater energy efficiency can be achieved through regulations and codes that impose efficiency standards on appliances, industrial production, and building design. Taxes are most effective where the diversity of energy users and technologies make administration of regulatory solutions difficult.

- Investment policies are often designed to meet demand at peak loads resulting in excess generating capacity that represents a serious cost to the country and an inappropriate use of scarce investment capital and foreign exchange.

- Exploration for fossil fuel opens access to remote areas to colonization and may contribute to deforestation and subsequent soil degradation.

Hydroelectric Energy

- The general considerations cited for fossil fuels apply to hydroelectric energy. Hydroelectric energy can be generated without burning fuels and emitting contaminants into the air, and water stored behind dams can be used for irrigation. Construction of dams however results in flooding large areas, and resettlement is often controversial leading to further deforestation and soil degradation on fragile lands. Creation of a large reservoir promotes irrigation for production of commercial crops, which may lead to deterioration of the quality of soils.

Alternative Fuels

- The promotion of alternative fuels will require removing biases (taxes, subsidies, and other distortions) against the adoption of nonconventional technologies. Elimination of price subsidies for fossil fuel energy will make investment in alternative fuels attractive, as will guaranteed sales to centralized grids for energy derived from alternative sources.

SOIL: AGRICULTURE AND LIVESTOCK

Product Price Controls

- Price ceilings at the producer level create negative incentives for investment in long-term soil conservation activities. Price floors and support prices often benefit large farmers preferentially. Ceilings above the marginal production costs encourage overproduction and/or overuse of inputs, and contribute to soil erosion, depletion, salt accumulation, and compaction. Price bands reduce uncertainty and, if prices gradually increase, should encourage investment in soil conservation.

Input Subsidies

- Credit subsidies for agriculture and livestock encourage overuse of inputs and production of commodities that might not be profitable if subsidies were absent. Interest rate ceilings, which are often subsidized, limit access to credit, which impedes the adoption of soil conservation technology, and often promote capital-intensive agriculture that displaces farm labor onto marginal lands.

- Pesticide and fertilizer subsidies artificially lower costs to farmers and encourage excessive application, often degrading soil productivity. Indirect subsidies (favorable exchange rate; tariff and foreign exchange allocation for imported fertilizers; preferential pricing of energy, feedstocks, and transport service for domestic production; and subsidized credit) encourage less diversified and more chemical-dependent cropping patterns. The consequence is increased soil erosion, depletion, compaction, and displacement of rural populations onto marginal lands.

- Subsidies for agricultural machinery encourage farmers to use equipment even when it is uneconomical. This in turn promotes forest clearance that causes labor displacement and reduces rural employment opportunities. The consequence is increased soil erosion and displacement of rural populations onto marginal lands.

Direct Government Activities

- Government involvement in input and produce marketing has promoted input-dependent methods of cultivation and overuse of agrochemicals, which results in soil contamination.

Regulation of Pesticides

- Direct regulation of pesticides restricts pesticides that may be used in a country; however, soil and water contamination often result from improper application of approved pesticides. Indirect regulation such as tariff regimes that favor export crops and agricultural inputs in relation to other inputs encourage more pesticide use than would occur under a neutral tariff regime.

Livestock Policies

- Livestock policies include subsidized credit, fiscal incentives, tenure policies, and provision of infrastructure. They promote expansion of pastures at the expense of tropical forests. Preferential credit policies and fiscal incentives (accelerated depreciation, tax holidays, beneficial relative export duties, low property and land taxes) promote land conversion, compaction, and soil degradation.

- Tenure policies often stipulate that land must be cleared and frequently the only use once cleared is for extensive cattle operations.

SOIL: FOREST

Concessions and Licenses for the Use of Public Timber

- Short or insecure concessions that are not awarded through open competition and with a minimum bid; and management plans that do not promote easy compliance and are not technically based and well enforced, encourage conversion of forest land to other uses that are often inappropriate leading to erosion and nutrient depletion.

Forest Revenue Systems

- Forest charges on public timber that do not reflect market value increase the rate of harvesting and encourage high grading. In a policy context that makes it difficult to exclude settlers, this accelerates conversion to inappropriate land use.

- Charges on processed timber products reduce incentives for domestic processing and reduces the local value of timber. Charges on minor forest products discourages their development, reducing the value of the forest stand. Both make long-term management and exclusion comparatively less attractive and encourage conversion to other uses. Charges for services or user fees could improve resource management by providing funds, depending on how they are allocated.

Forest Industry and Export Policies

- Log bans or quotas unless supplemented with effective enforcement of forest management are unlikely to reduce deforestation as a vehicle for reducing soil erosion rates of soil erosion.

- Tax and tariff protection undermines incentives to minimize costs which increases pressures on forest resources, and depending on location contributes to soil erosion, nutrient depletion and compaction. Tax credits, preferential interest rates, credit lines for forest industries, import duty exemptions and accelerated depreciation have the same effect if carried on too long.

- Direct government involvement in forest-related industries has often led inappropriate forest use. Price controls on lumber products encourage purchase of high-value wood for inappropriate uses, discourage uses of secondary species, reduces the value of the resource and encourages inefficient use and long-term unsustainability.

- Direct government ownership or regulation of trees on private land creates incentives to convert the land to other uses. That may contribute to soil degradation.

Private and Community Forest Management

- Government control of trees on private land creates uncertainty and a disincentive for long-term resource management. Farm and community forest management show promise to reducing soil degradation due to deforestation.

Fuelwood and other Biomass

- Fuelwood extraction can contribute significantly to deforestation, watershed deterioration and soil erosion. Subsidies to promote fuel substitution shift demand from fuelwood to more efficient commercial sources such as natural gas.

Reforestation Policies

- Fiscal incentives have been successful in the short term but often benefit wealthier groups. Public reforestation projects are less efficient than small individual community-focused activities, and plantations are better targets than natural forest activities for reforestation activities.

SOIL: LAND TENURE AND COLONIZATION

Land Tenure and Markets

- Insecure and uncertain tenure of land ownership for large and small farmers promotes accelerated exploitation of resources. Many state-owned resource areas, such as forests, wildlands, and coastal zones, are subject to unchecked exploitation because governments lack the ability to enforce control over resources. Skewed land distribution also contributes to accelerated environmental degradation by forcing small untenured farmers to settle on fragile lands. All of these influences contribute directly to soil erosion and chemical and physical degradation.

- Private property may allow an individual to recoup benefits from sustained resource management. If, however, low resource endowments are combined with poverty the individual will rationally degrade the resource even when tenure is secure, leading to soil degradation.

- Lack of tenurial security for communally managed indigenous lands encourages invasion by colonialists and conversion to inappropriate uses, often causing erosion and depletion.

- Policies that support skewed land distribution tend to lead to intensive or extensive land use by the poor on land that is inappropriate for agricultural uses. A particularly acute problem is erosion of hilly slopes where small farmers often settle.

- Lack of active land markets and ability to transfer ownership rights prevents users from capitalizing investments in soil conservation and generally leads to conversion of land from more to less efficient uses. Lack of land markets also inhibits the willingness of lenders to accept land as collateral and thus reduces incentives to conserve resources. Taxes designed to promote redistribution such as taxes on idle land often have a negative effect on resource use; for example, when forested land is cleared for other uses.

Colonization and Reform

- Most government-sponsored colonization programs do not match land use capability with the proposed use, and colonization programs are often established on land types that are inappropriate for agricultural uses, resulting in deforestation and soil erosion. Deforestation of public and private land is encouraged by land clearing requirements for tenure and policies that grant rights to squatters for improvements they make to land. Indirect government policies to create infrastructure supporting formal colonization often results in spontaneous colonization, especially in an open-access resources. Spontaneous settlements increase tenure insecurity and degrade open access resources leading to soil erosion, depletion, and compaction.

Land Use Capability and Planning

- Land use capability systems provide a key policy tool for shifting from command-and-control regulatory policies to market based incentives to promote sustainable use. Such a system provides the basis for development programs, credit, zoning, taxes and subsidies, all of which have a direct impact on land use.

SOIL: INDIGENOUS PEOPLES

Indigenous Land Rights

- Most remaining forested wildland areas in Central America are occupied by indigenous groups. These groups have evolved usufruct strategies that have not exceeded the forest's regeneration capacity. The soil in most of these areas is not suitable for intensive agriculture and often these areas function as important watersheds. Communal management offers a cost-effective alternative for managing large tracts of forests in a sustainable fashion that protects and maintains the soils' productive capabilities.

- Attempts to establish private property rights have focused on individual ownership of small tracts of land, which has led to invasion of communal lands by landless colonists and the conversion of forest to unsustainable agriculture leading to soil erosion and chemical and physical deterioration.

- Old values and assumptions generated policies that attempted to integrate indigenous populations into modern social and economic development, ensuring the destruction of their culture and along with it the degradation of soil productivity as forests were converted to subsistence agriculture. Newer values and assumptions view diversity of all kinds (including cultural diversity) as a source of adaptive strength and resilience. These have led to increased emphasis on the protection of human rights (including communal tenure), decentralized management, local participation, and renewed interest in the convergence of conservation objectives with those of indigenous peoples.

Resource Management

- A clearly marked boundary, patrols for surveillance, and legitimate procedures for warning and evicting colonists are required to thwart invasions and prevent land conversion and subsequent soil degradation.

International Legal Instruments

- Reducing the rate of deforestation and soil degradation in the remaining forested areas in Central America will depend on the way in which the rights, projections, and responsibilities of the indigenous groups occupying them are specified. International human-rights agreements provide the initial legal basis for addressing the incursion of outside development interests.

Changing Values and moral persuasion

- New values that stress preservation of future options, resilience over efficiency, and the protection of cultural diversity are leading to policy guidelines to protect indigenous rights to traditional lands and resources and to promote the participation of indigenous peoples in the use and development of those areas. This will promote greater cultural diversity, preservation of existing forest cover and long-term sustainable use of soils and the downstream resources dependent on soil conservation.

SOIL: PROTECTED AREAS AND WILDLIFE

Types and Legal Basis of Protected and Reserved Areas

- Protected status contributes to the maintenance of soil stability within the area and in the surrounding buffer zone. Legal protected area systems in Central America are extensive, however, often there is no government presence in the field and most areas are being rapidly degraded through human encroachment. Population pressure and poverty are the main threats.

- Without the ability to protect these areas, integrated packages of incentives that alter individual decisions about the gains and losses associated with various uses will be required to change behavior. Management activities can increase the supply and/or reduce the demand for resources that exist within the protected area. Demand can be reduced by increasing penalties and improving enforcement and by creating alternative sources of income for that derived from the protected areas resources.

- Institutional resources are a limiting factor in adoption of land use capability systems and land use planning.

- Approaches for addressing conflicting uses of protected area resources (or environmental issues in general) include judicial, administrative, legislative, arbitration and popular action and denouncements. The effectiveness of the judicial role depends on the integrity of the judicial system. Institutional weakness limit the ability of resource management agencies to effectively implement regulations. Arbitration, mediation, and conciliation are promising but have had little use in Central America. Popular denouncements allow individuals and groups to bring to the attention of administrative or judicial authorities actions by private or public agencies that have illegal environmental consequences.

Resource Management and the Local Community

- Incentives are required to support institutional and legal mechanisms, They include direct cash, in-kind and fiscal incentives. In all cases incentives must reflect the management requirements of ecosystems, and be linked clearly to changes in behavior.

- Effectiveness of tax deductions, exemptions and credits presupposes the ability to levy and collect taxes. Disincentives include refundable damage deposits attached to forest concession in parks, and buffer zones, taxes as disincentives to environmentally destructive land development, or pollution taxes on industries located in environmentally sensitive areas in and around buffer zones.

Financing

- Protected areas should receive a fair return on the money they bring into the economy to be used to provide incentives for conservation and management of these areas.

International Conventions and Support

- International agreements provide binding, legal obligations that become the basis for national implementing legislation, however, in many cases have not been enforced.

Nature Tourism

- Tourism provides funds and promotes conservation and preservation of natural resources, however it must be controlled so that the carrying capacity of the resource is not exceeded.

Wildlife Protection and Trade

- No direct impact on soil.

SOIL: WATER AND WATERSHED MANAGEMENT

Water Control, Use, and Pricing

- Impact on soil occurs indirectly when the availability of irrigation promotes forest conversion and inappropriate agriculture, and directly through irrigation.

Watershed Management

- Watershed policy is a collection of policies from many sectors that have consequence for resource use in a geographically delineated unit that encompasses biophysical, socioeconomic, and political interactions.

- Treating the watershed as a unit of analysis and object of development encourages planners to treat management of multiple resources in an integrated manner.

- Watershed management policies must focus on upstream inhabitants and their behavior (especially soil conservation and forest management) because their actions will determine the quantity and quality of water arriving downstream from the watershed. Financial incentives can be used to compensate upstream watershed occupants for long-term management and soil conservation. Taxes can be placed on downstream areas of watersheds (on property, water use, agricultural inputs) to raise revenue and provide incentives for improved upstream land management, and to bring direct user costs more in line with the true costs of using these inputs.

- Well-defined private or communal property and usufruct rights for land and resources in the watershed protect the rights of resource users and promote improved soil conservation practices.

- Coordination among governmental institutions responsible for managing the resources in the watershed and public participation in the establishment of overall management goals and choice the incentives improves resource management and implementation.

Irrigation Provision and Pricing Policies

- Public sector irrigation is heavily subsidized and has become an enormous fiscal drain in many countries. The value of the water to farmers can greatly exceed its cost, which results in excess demand and nonprice rationing systems. Low charges contribute to the cultivation of relatively low-value or water-intensive crops and slow adoption of water-conservation technologies and practices.

- Charges based on volume used provide farmers an incentive for more efficient use. This will reduce excessive seepage into aquifers, reduce risks of waterlogging and reduce demand for additional large-scale and costly irrigation system expansion. Charges can also reflect the costs of mitigating pollution of other adverse environmental effects from irrigation.

SOIL: COASTAL ZONE MANAGEMENT

Policies Affecting the Quality of Coastal Resources

- One primary source of coastal zone degradation is that caused by sediments, nutrients, and toxins contained in runoff from agricultural areas and logged forests.

- Improving the quality of coastal waters can only be achieved by reducing these sources of contamination in upstream areas. Policies designed to improve coastal zone management imply multi-sectoral policies to improve soil management.

- Subsidies: (1) for cattle promote deforestation, land compacting, and erosion, and forces non-cattle agriculturalists onto steeper slopes where cultivation results in increased erosion; (2) for agricultural inputs can result in chemical and physical deterioration of soils; and (3) for energy tend to promote increased use of, machinery which leads to soil compaction. All contribute to downstream coastal zone problems.

- Integrated coastal zone management plans encompass a coastal ecosystem, and to the extent that policy integration takes place, will have a positive impact on soil conservation in relevant watershed areas.

Policies Affecting the Use of Coastal Resources

- The impact on soil is indirect. Policies that establish secure property rights and use rights, including community ownership, will create an identifiable interest group supporting better management of upstream resources and have beneficial consequences for soil conservation.

Policies Affecting the Management of Fisheries

- Effective management of fisheries will require integrated watershed management of upstream resources, having a beneficial impact on soil.

WATER: POPULATION

Policies to Slow Population Growth

- Government policy on population control affects total and per capita demand for agricultural products and the intensivity and extensivity of agricultural production, resulting in overuse of marginal land leading to deforestation, soil erosion and depletion, and sedimentation and chemical contamination of streams and rivers. Policies to slow population growth would increase per capita family savings, especially among the poor, increase public and private per capita investment in human capital, and reduce income inequality. All would reduce the rate of environmental degradation, especially the contamination of urban and rural water sources.

- Policies that reinforce the low status of women contribute directly to high population growth rates and intensity of use of marginal land, leading to soil erosion and reduction of downstream water quality. Not specifying and enforcing responsibilities of men decreases the status of women. Not promoting smaller families and providing fertility regulation and family planning services reduces individual and social welfare especially among poor families. Incentives and disincentives enhance the effectiveness of other policy tools.

Redistributing Population

- There is no evidence that internal and external redistribution of population slows population growth rate. Although social and political tension may be reduced in the short term, colonization usually results in unsustainable mining of natural resources, especially deforestation and soil erosion, leading to downstream loss of water quality and quantity. The total long-term financial and environmental costs of redistribution are often high, especially if population is redistributed into ecologically fragile areas.

Gender Discrimination

- There is a strong positive correlation between poverty and the number of households headed by women. When population growth causes severe pressure on natural resources, womens status deteriorates. The poor are most likely to be penalized by rapid population growth, and women and children are the first to suffer when population growth severely stresses the carrying capacity of an area.

WATER: MACROECONOMIC POLICIES

Natural Capital and the Economy

- Reduction in the quality, quantity, and availability of water results when the price users pay does not reflect the value of all the market and nonmarket services it provides. A systematic assessment of the value of water as a source and as a sink for wastes will lead to more appropriate water pricing and allocation of water to its most valuable use.

Economic Evaluation of Environmental Resources

- Decisions that rely exclusively on economic evaluation of water, even when non-market values are addressed, will be subject to biases in favor the status quo because willingness to pay to avoid a decrease in water quality or quantity is subject to budget constraints, which depends on the current distribution of resources. To the extent that nonmarket values of water are captured in pricing, policy will shift toward a "polluter pays" principle

Monetary and Credit Policies

- Expansion of the money supply and inflation causes the value of domestic currency to fall, discourages savings, and encourages people to invest in foreign markets rather than in the long-term productivity of domestic markets. The consequence is increased poverty and unemployment, which causes expansion of subsistence agriculture onto fragile soils, destruction of forest cover, and reduction in the soil's ability to absorb water, causing reduced stream flow in the dry season.

- High interest rates make the present value of future consumption low, which encourages short-term, high-yield crops that often result in soil degradation, especially salinization if irrigation water is underpriced.

- The impact of government intervention in credit markets depends on the direction of the intervention. Subsidized credit for water treatment and waste management facilities, watershed management, small hydroelectric generators and alternative energy sources, will increase the quality and quantity of water. Subsidized credit for industrial growth in the absence of enforced clean water standards, water-intensive crops, large dam construction and irrigation will lead to a reduction in quantity and quality of water.

Exchange Rates

- Floating exchange rates shift production in favor of agricultural exports, which requires high levels of irrigation and chemical inputs. Both may reduce the quantity and quality of available water, along with pushing subsistence agriculture onto fragile slopes leading to watershed deterioration.

Fiscal Management

- Fiscal deficits limit the ability of government to monitor and enforce water standards. If government deficits are financed with domestic credit, inflation and/or reduced availability of credit discourages public and private investment in water treatment facilities.

- Foreign exchange required to pay interest on foreign debt encourages agricultural exports, which may decrease the quantity and quality of water through erosion and chemical contamination of streams and rivers. In the long term reducing government debt should improve the quality and supply of water.

Structural Adjustment Lending

- Structural adjustment loans are a mix of policies that may have positive or negative effects on water.

WATER: TRADE AND INVESTMENT POLICIES

Export Promotion

- Tariffs contribute to water quantity and quality when they increase pressure on the forest cover because decreasing terms of trade reduce the profitability of agriculture per hectare and campesinos cut fuelwood and clear land to increase income.

- Increased trade and promotion of exports in developing countries encourages the production of agricultural exports, timber, and minerals. All of these activities may degrade the capacity of soils to absorb and store water and contaminate streams and rivers.

- Trade-generated economic growth brings more materials and energy through the economic system and places increased demands on water supplies and disposal capabilities. It also provides resources to invest in water treatment facilities and better pricing policies, but that depends on the government's capacity to collect revenue and provide oversight.

- When export promotion policies encourage production that requires increased chemical inputs, they may promote chemical contamination of water. The impact on water of special incentives depends on which productive activities are favored and their direct and indirect impact on water quantity and quality. Trade liberalization favors development of particular sectors, and the impact depends on the sectors favored.

- Structural adjustment loans that decrease public expenditure, tighten monetary policy, and devalue exchange rates have recessionary effects that may increase poverty. Combined with rapid population growth, this can lead to degradation of water supplies.

Privatization

- The impact on water of the privatization of natural resources depends on how it is managed. Reduction in water supplies and quality will result if resource royalties do not reflect global prices and are not reinvested in forestry and watershed management and implementation of regulatory policies.

- Privatization of utilities (energy, water, solid waste collection) offers a possibility for improved resource management and better pricing policies, which will have a positive impact on water supplies. Subsidized rural services may be reduced, along with potential price increases in consumer services.

Foreign Direct Investment

- Foreign direct investment creates opportunities for resource mining, especially in the forest sector, which has direct connection to water quality, quantity, and availability. The effect of special incentives depends on how they are structured; they may attract polluting industries or open up natural areas and attract migrants resulting in degraded watershed functions. If royalties for natural resources do not capture resource rents, then windfall profits will be provided to investors at the expense of government revenue and water will be used inefficiently and degraded.

WATER: ENVIRONMENTAL MANAGEMENT

Protection of Environmental Quality

- Water quality problems result from the free disposal of wastes into surface and groundwater. Many environmental management policies raise the price of pollution disposal to encourage polluters to find their own cost-minimizing amounts of pollution. Analysis of available empirical evidence finds no data to support a negative relationship between environmental regulations and economic growth.

Water Quality

- Technology-based standards for protecting water quality may not be a cost-effective means of pursuing water quality goals. Ambient standards can reflect local water quality needs better than uniform technology-based standards, however, they do not provide information on which point source to control when pollution exceeds tolerance levels, nor do they deal with downstream concerns.

- Effluent charges in place of direct regulation allows polluters to decide how to most efficiently reduce their level of pollution. They are often used initially to supplement a program of standards and are oriented toward raising revenue for a water quality authority rather than as an incentive to change behavior.

- Subsidies redistribute the burden of pollution control from polluters to society; they may facilitate the adoption of better pollution control by individual facilities, but pollution control will not be accomplished at cost-minimizing levels. Tax exemptions are a special form of subsidy.

Air Quality

- Water quality is affected by airborne pollutants. Technical standards for stationary and mobile sources are usually established at the national level. Delegation of regulatory authority to the local level increases the ability to adjust standards to local needs and therefore to keep overall protection costs down.

- Emission charges are designed to achieve target levels of pollution reduction while avoiding the inflexibility of direct regulation. In practice their use has been oriented toward raising revenue with little emphasis on providing incentives to reduce pollution. General fuel taxes are a common but not well-targeted means for achieving pollution reduction, except in the case of differential taxes, such as those for leaded and unleaded gasoline.

- Tradable pollution rights allow regulatory authorities to retain greater control over total pollution levels than do emission charges, and rely on economic incentives to reduce costs of control. This policy tool (1) increases the price of pollution disposal to encourage polluters to find their own cost-minimizing amounts of pollution, and (2) limits the number of emission permits and allows polluters to trade permits, which allows polluters to determine the price of pollution disposal.

Land disposal

- Land disposal policies have a direct impact on water pollution levels when pollutants enter surface and groundwater. The impact of policy tools such as financial accountability, fees, product charges, and liability is unclear because they exist within larger programs of direct regulation.

WATER: ENERGY

Fossil Fuels

- Energy generation using fossil fuels affects water quality through air pollution, fuel spills and run-off from urban and industrial areas. Fossil fuels are major consumers of foreign exchange. Water quality and quantity is affected to the extent that: (1) forests are unsustainable harvested to provide foreign exchange; (2) watersheds are degraded; and (3) input intensive agriculture is practiced inappropriately. As industrialization increases and per capita incomes rise, the demand for fossil fuels will increase unless alternative fuels are developed.

- Adoption of conservation measures and energy efficient technologies costs less than the investment required for developing new sources of supply.

- Greater energy efficiency and elimination of price distortions could lower total energy consumption in most countries by 20% or more, saving millions of dollars in foreign exchange. This would have a positive impact on water quality and quantity directly through reduced destruction of forest cover to generate foreign exchange and indirectly through reduced levels of air pollution.

- Pricing policies determine demand. In general the lower the price of energy the more people consume. Price controls, average cost pricing and producer subsidies can run counter to energy efficient objectives. Marginal cost pricing will result in increased economic efficiency but result in relatively high prices for energy, especially electricity.

- Subsidies support the objective of social equity, however, they increase demand, lead to spending a greater proportion of foreign exchange in importing fossil fuel, and tend to discourage adoption ofconservation measures and utilization of renewable energy sources. Subsidies with positive environmental impacts hold promise.

- Greater energy efficiency can achieved through regulations and codes that impose efficiency standards on appliances, industrial production, and building design. Taxes are most effective where the diversity of energy users and technologies make administrative of regulatory solutions difficult.

- Investment policies are often designed to meet demand at peak loads resulting in excess generating capacity that represents a serious cost to the country and an inappropriate use of scarce investment capital and foreign exchange.

Hydroelectric Energy

- The general considerations cited for fossil fuels apply to hydroelectric energy.

- Hydroelectric energy can be generated without burning fuels, and water stored behind dams can be used for irrigation. Resettlement is often controversial, and creation of a large reservoir promotes use of irrigation for production of commercial crops, which may lead to deterioration of the quality of soils and groundwater supplies.

Alternative Fuels

- The promotion of alternative fuels will require removing biases (taxes, subsidies, and other distortions) against the adoption of nonconventional technologies. Elimination of price subsidies for fossil fuel energy will make investment in alternative fuels attractive, as will guaranteed sales to centralized grids for energy derived from alternative sources.

WATER: AGRICULTURE AND LIVESTOCK

Product Price Controls

- Price ceilings create negative incentives for investment in long-term conservation activities for forests and soil. Depending on the area this may have negative downstream impacts of reduced stream flow, siltation, and contamination from chemical runoff. Price floors and support prices often preferentially benefit large farmers. Ceilings above the marginal production costs encourage overuse of inputs and contribute to sedimentation and chemical contamination of water.

Input Subsidies

- Credit subsidies for agriculture and livestock encourage land conversion and loss of watersheds. Interest rate ceilings are often subsidized, which limits access to credit, impedes the adoption of soil conservation technology, and often promotes capital-intensive agriculture that displaces farm labor onto marginal lands, contributing to negative impacts on downstream water supplies.

- Pesticide and fertilizer subsidies artificially lower cost to farmers and encourage excessive application, often contaminating surface and groundwater. Indirect subsidies (favorable exchange rate; tariff and foreign exchange allocation for imported fertilizers; preferential pricing of energy, feedstocks, and transport service for domestic production; and subsidized credit) encourage input-intensive activities and less diversified and more chemical-dependent cropping patterns. The consequence is increased levels of sediment, nutrients, and chemical pollution of water supplies.

- Subsidies for agricultural machinery encourage forest clearance and loss of watershed, displace labor, and reduce rural employment opportunities. The consequence is increased soil erosion, displacement of rural populations onto marginal lands, and increased levels of sediments, nutrients, and chemical pollution of streams and rivers.

Direct Government Activities

- Government involvement in input and produce marketing has promoted input-dependent methods of cultivation and overuse of agrochemicals, which results in water contamination.

Regulation of Pesticides

- Direct regulation of pesticides restricts pesticides that may be used in a country; however, soil and water contamination often result from improper application of approved pesticides. Indirect regulation such as tariff regimes that favor export crops and agricultural inputs in relation to other inputs encourage more pesticide use than would occur under neutral a tariff regime

Livestock Policies

- Livestock policies include subsidized credit, fiscal incentives, tenure policies, and provision of infrastructure, and promote expansion of pastures at the expense of tropical forests. When this leads to inappropriate land use, levels of sediment and nutrients in waterways increase.

WATER: FOREST

Concession and Licenses for the Use of Public Timber

- Short duration or insecure concessions; concessions that are not awarded through open competition and with a minimum bid; and management plans that do not promote easy compliance and are not technically based and well enforced, encourage conversion of forest land to other uses that are often inappropriate for soil classification. This leads to erosion, sedimentation and chemical pollution of streams and rivers.

Forest Revenue Systems

- Forest charges on public timber that do not reflect market value increase the rate of harvesting and encourage high grading. Charges on processed timber products reduce incentives for domestic processing and reduces the local value of timber. Charges on minor forest products discourages their development, reducing the value of the forest stand. In a policy context that makes it difficult to exclude settlers, these policies accelerate conversion to inappropriate land use leading to soil erosion, sedimentation and chemical pollution of streams and rivers.

Forest Industry and Export Policies

- Log bans or quotas unless supplemented with effective enforcement of forest management are unlikely to reduce deforestation as a vehicle for reducing soil erosion rates of soil erosion. Tax and tariff protection undermines incentives to minimize costs which increases pressures on forest resources, and depending on location contributes to soil erosion, nutrient depletion and compaction. Tax credits, preferential interest rates, credit lines for forest industries, import duty exemptions and accelerated depreciation have the same effect if carried on too long.

Direct government involvement in forest-related industries is usually characterized by corruption and inefficiency, and often encourages unsustainable forest uses. Price controls on lumber products encourage use of high-value wood for inappropriate uses, discourage uses of secondary species, reduce the value of the resource, and discourage long-term unsustainability. All contribute to generating downstream water quality and quantity problems from sedimentation and pollution.

Private and Community Forest Management

- Government control of trees on private land creates uncertainty and a disincentive for long-term resource management. Farm and community forest management reduces uncertainty and supports long-term returns from resource management which contributes to maintaining water quality.

Fuelwood and other Biomass

- Fuelwood extraction can contribute significantly to deforestation, watershed deterioration and soil erosion. Afforestation policies address both energy issues and watershed management concerns

Reforestation Policies

- Fiscal incentives have been successful in the short term but often benefit wealthier groups. Public reforestation projects are less efficient than small individual community-focused activities, and plantations are better targets than natural forest activities for reforestation activities.

WATER: LAND TENURE AND COLONIZATION

Land Tenure and Markets

- Insecure and uncertain tenure of land ownership for large and small farmers promotes accelerated exploitation of resources. Many state-owned resource areas, such as forests, wildlands, and coastal zones, are subject to unchecked exploitation because governments lack the ability to enforce control over resources. Skewed land distribution also contributes to accelerated environmental degradation by forcing small untenured farmers to settle on fragile lands. All of these influences contribute directly to watershed destruction, soil erosion, and chemical and physical degradation which causes downstream sedimentation and chemical contamination of streams and rivers.

- Private property may allow an individual to recoup benefits from sustained resource management. If, however, low resource endowments are combined with poverty the individual will rationally degrade the resource even when tenure is secure, leading to loss of vegetation, soil degradation, and contamination of local water sources. Lack of tenure security for communally managed indigenous lands encourages invasion by colonists and conversion to inappropriate uses.

- Policies which support skewed land distribution tend to lead to intensive or extensive land use by the poor on land that is inappropriate for agricultural uses, which, depending on the area, contribute to stream and river contamination from sedimentation and agricultural chemicals.

- Lack of active land markets and ability to transfer ownership rights prevents users from capitalizing on investments in forest management and soil conservation and generally leads to conversion of land from more to less efficient uses. Lack of land markets also inhibits the willingness of lenders to accept land as collateral and thus reduces incentives to conserve resources. Taxes designed to promote redistribution such as taxes on idle land often have a negative effect on resource use; for example, when forested land is cleared for other uses. The consequence is degraded watershed capabilities and reduced quality and quantity of local water sources.

Colonization and Reform

- Most government-sponsored colonization programs do not match land use capability with the proposed use, and colonization programs are often established on land types that are inappropriate for agricultural uses, resulting in deforestation and soil erosion and negative downstream impacts on water.

Land Use Capability and Planning

- Land use capability systems provide a key policy tool for shifting from command-and-control regulatory policies to market-based incentives to promote sustainable use practices having benefits for conservation of water quantity and quality. Such a system provides the basis for development programs, credit, zoning, taxes, and subsidies, all of which have a direct impact on land use.

WATER: INDIGENOUS PEOPLES

Indigenous Land Rights

- Most remaining forested wildland areas in Central America are occupied by indigenous groups. These groups have evolved usufruct strategies that have not exceeded the forest's regeneration capacity. Communal management by indigenous groups that have traditionally occupied these areas offers a cost-effective alternative for the management of large tracts of forestland, which function as watersheds and buffers for coastal breeding and nurseries grounds. It also allows government agencies to focus scarce financial and administrative resources on monitoring and enforcing environmental regulations and management plans.

- Old values and assumptions led to policies that attempted to integrate indigenous populations into modern social and economic development. In many cases this has caused the erosion of culture and along with it, an end to sustainable communal management of large forested areas. Attempts to establish private property rights have focused on individual ownership of small tracts of land, which has led to invasion of indigenous lands by landless colonists and the conversion of forest to unsustainable agriculture, soil erosion and sedimentation, and chemical contamination of streams, rivers, and coastal zones.

- New values and assumptions view diversity of all kinds (including cultural diversity) as a source of adaptive strength and resilience. In the context of growing rates of deforestation and soil degradation this has led to increased emphasis on the protection of human rights (including communal tenure), decentralized management and local participation in community management, of natural resources.

Resource Management

- A clearly marked boundary, patrols for surveillance, and legitimate procedures for warning and evicting colonists are required to thwart invasions and are crucial for sustainable use of forests and soils within traditionally managed indigenous areas.

International Legal Instruments

- Sustainable use and preservation of watersheds in many remaining forested areas in Central America will depend on the way in which the rights, projections, and responsibilities of the indigenous groups occupying them are specified. International human-rights agreements provide the initial legal basis for addressing the incursion of outside development interests.

Changing Values and Moral Persuasion

- New values that stress preservation of future options, resilience over efficiency, and the protection of cultural diversity are leading to policy guidelines to protect indigenous rights to traditional lands and resources and to promote indigenous peoples' participation in the use, development, and protection of those areas. This will be a key policy tool for promoting long-term sustainable use of these areas.

WATER: PROTECTED AREAS AND WILDLIFE

Types and Legal Basis of Protected and Reserved Areas

- Protected status contributes to water quality, quantity and availability through its role in preserving forest cover and decreasing sedimentation and pollution. Protected area systems in Central America are being rapidly degraded through human encroachment. Population pressure and poverty are the main threats.

- Without the ability to protect these areas, an integrated package of incentives that alter individual decisions about the gains and losses associated with various uses will be required to change behavior.

- Land use capability systems are a key policy reform for market based incentives for slowing the rate of land conversion, soil degradation, and subsequent reduction in water resources, however institutional resources are a limiting factor.

- Approaches for addressing conflict surrounding competing uses of protected areas (or environmental issues in general) include judicial, administrative, legislative, arbitration and popular action and denouncements. The effectiveness of the judicial role depends on the integrity of the judicial system. Institutional weakness limit the ability of resource management agencies to effectively implement regulations. Legislative actions, other than drafting legislation, is investigative in nature. Arbitration, mediation, and conciliation are promising but have had little use in Central America. Popular denouncements allow individuals and groups to bring to the attention of administrative or judicial authorities actions by private or public agencies that have illegal environmental consequences.

Resource Management and the Local Community

- Incentives (direct cash, in-kind and fiscal) are required to support institutional and legal mechanisms, and all cases must reflect the management requirements of ecosystems, and be linked clearly to changes in behavior. Tax deductions, exemptions and credits require the ability to levy and collect taxes. Disincentives include refundable damage deposits for forest concession, taxes as disincentives to environmentally destructive land development, and pollution taxes on industries located in environmentally sensitive areas.

Financing

- Protected areas should receive a fair return on the money they bring into the economy to provide incentives for conservation and management of these areas.

International Conventions and Support

- International agreements support water conservation indirectly by providing binding, legal obligations that become the basis for national implementing legislation.

Nature Tourism

- Tourism provides funds and promotes conservation and preservation of natural resources, however it must be controlled so that the carrying capacity of the resource is not exceeded.

Wildlife Protection and Trade

- The impact on water quality and quantity is very indirect. When forests lose their value for wildlife habitat, their total economic value is reduced, and they are more easily converted to other uses destroying their ability to provide watershed services.

WATER: WATER AND WATERSHED MANAGEMENT

Water Control, Use, and Pricing

- Water is generally considered the property of, or is controlled by, the state. Because government agencies often cannot manage the responsibility they have assumed, government ownership creates an open-access resource leading to overuse.

- Where water prices are too low, water is wasted or used as a reservoir for dumping pollutants. Subsidies promote overuse and waste and encourage use for less valuable alternatives. Elimination of subsidies leads to more efficient allocation. Tradable property rights allows water to be reallocated from low value to high value uses and also leads to a more decentralized approach to water use decision-making

- As water contamination increases, the availability of clean water decreases, and treatment for specific uses will add to the costs of obtaining adequate water supplies. Requiring the "polluter to pay" the costs of treatment can help limit pollution and pay for necessary remediation.

- Pump charges promotes lower pumping rates and taxes can be charged on inputs known to pollute (e.g., fertilizers and pesticides, and the revenue used to monitor discharge or invest in water treatment.

Watershed Management

- Watershed policy is a collection of multi-sectoral policies that have consequence for resource use in a geographically delineated unit that encompasses biophysical, socioeconomic, and political interactions. Establishing the watershed as a unit of analysis and object of development encourages planners to treat management of multiple resources in an integrated manner resulting in better management of downstream water supplies.

- Watershed management policies must focus on upstream inhabitants and their behavior because their actions will determine the quantity and quality of water arriving downstream from the watershed. Taxes can be placed on downstream areas of watersheds (on property, water use, agricultural inputs) to raise revenue and provide incentives for improved upstream land management that are used to compensate upstream watershed occupants.

- Well-defined private or communal property and usufruct rights for land and resources in the watershed protect the rights of resource users and promote long-term use, names direct positive effects on water resources.

Irrigation Provision and Pricing Policies

- Public sector irrigation is heavily subsidized and has become an enormous fiscal drain in many countries. The value of the water to farmers can greatly exceed its cost, which results in excess demand and nonprice rationing systems. Low charges contribute to the slow adoption of water-conservation technologies and practices.

- Charges based on volume provide incentives for more efficient use which will reduce excessive seepage into aquifers, risks of waterlogging, and reduce demand for additional large-scale and costly irrigation system expansion. Charges can also reflect the costs of mitigating pollution of other adverse environmental effects from irrigation.

WATER: COASTAL ZONE MANAGEMENT

Policies Affecting the Quality of Coastal Resources

- A primary cause of reduce productivity of coastal zone nursery and breeding grounds is the concentration of sediments, nutrients, toxins, and heavy metals contained in runoff from agriculture areas, logged forests, urban streets, and municipal industrial discharges. As the economy grows, even though the relative amount of water pollution is reduced by treatment facilities and improved management, the total amount of pollution will increase.

- Improving the quality of coastal waters can only be achieved by improving the quality of the water entering coastal areas. Integrated coastal zone management policy implies multi-sectoral policies to improve water quality flowing into coastal areas.

- Subsidies for activities that contribute to coastal zone degradation also usually contribute to water contamination in upstream areas. Subsidies: (1) for cattle promote deforestation, land compacting, erosion, and sedimentation, and forces non-cattle agriculturalists onto steeper slopes where cultivation results in increased erosion; (2) for agricultural inputs results in increased sedimentation and contamination of coastal waters: (3) for energy tends to promote increased use of fossil fuel.

- The impact of investment incentives depends on the activities and sectors favored. Promotion of tourism along the coast without adequate planning and control to deal with water supply and wastewater disposal contributes to water quantity and quality problems.

- Fiscal instruments such as taxes on effluent discharges and user fees for garbage disposal, and regulations to limit the amount of contamination in coastal waters and along the shorefront will improve the quality of water generally.

- Integrated coastal zone management plans encompass a coastal ecosystem, and to the extent that policy integration takes place will have a positive impact on water quality and flow in upstream areas.

Policies Affecting the Use of Coastal Resources

- Policies that establish secure property rights and use rights, including community ownership, will create an interest group supporting better management of upstream resources and have beneficial consequences for water quality.

Policies Affecting the Management of Fisheries

- Effective management of fisheries will require integrated watershed management of upstream resources, having a beneficial impact on water quality.

AIR: POPULATION

Policies to Slow Population Growth

- Government policy on population control affects total and per capita demand for agricultural and industrial products.

- The impact of population growth is roughly equal to the population size multiplied by the per capita affluence or consumption multiplied by the environmental damage done by the technology used to supply each unit of consumption.

- Policies to slow population growth would increase per capita family savings, especially among the poor, and increase public and private per capita investment. All contribute to providing the technical and institutional capabilities to regulate and improve air quality.

- Policies that reinforce the low status of women contribute directly to high population growth rates. Not specifying and enforcing responsibilities of men decreases the status of women. Not promoting smaller families and providing fertility regulation and family planning services reduces individual and social welfare, especially among poor families. Incentives and disincentives enhance the effectiveness of other policy tools.

Redistributing Population

- There is no evidence that internal and external redistribution of population slows population growth rate. Although social and political tension may be reduced in the short term, colonization usually results in unsustainable mining of natural resources, and urban migration results in increased urban pollution of air and water.

Gender Discrimination

- There is a strong positive correlation between poverty and the number of households headed by women. Policies that discriminate against women directly contribute to increasing poverty. The poor are most likely to be penalized by rapid population growth, and women and children are the first to suffer when population growth severely stresses the carrying capacity of an area.

AIR: MACROECONOMIC POLICIES

Natural Capital and the Economy

- Degradation in air quality in many cases has been the result of policies that did not take into account its cost in terms of human and plant health.

Economic Evaluation of Environmental Resources

- Economic valuation of costs of reduced human and plant health, and lost productivity due to soil and water pollution caused by air borne contaminants provides the basis for policies to reduce air pollution. Because valuation techniques are based on market measurements of lost productivity and willingness to pay for improved air quality, these values are much lower for developing countries than for industrialized countries, perhaps slowing the adoption of regulations and technology to reduce air pollution.

Monetary and Credit Policies

- Expansion of the money supply and inflation causes the value of domestic currency to fall and encourages "capital flight" and reduced investment in industry that may be a potential new source for air pollution. High interest rates also discourage capital investments in industrial development.

- The impact on air quality of government intervention in credit markets depends on the direction of the intervention. Credit that finances inefficient and highly polluting industries will decrease air quality. On the other hand, credit that finances efficient and highly competitive environmentally friendly technologies, when tied directly to compliance with environmental and efficiency standards, will improve air quality.

Exchange Rates

- Overvalued exchange rates implicitly subsidized imports. This has reduced the competitiveness of domestic production and encouraged capital-intensive and energy-intensive economies because capital imports have been favored, which depending on the industry, can lead to air pollution.

Fiscal Management

- Fiscal deficits limit the ability of government to monitor and control air pollution from stationary and mobile sources.

- A weak tax base and inability to use taxes as incentives for increased industrial efficiency are an unexploited policy tool and a cause of inadequate government revenue for implementing regulatory solutions.

Structural Adjustment Lending

- Structural adjustment loans are a mix of policies that may have positive or negative effects on air quality depending on whether the policies promoting freer trade result in importing more efficient environmentally friendly technology, or in creating pollution havens. The results will probably be mixed depending on the industry.

AIR: TRADE AND INVESTMENT POLICIES

Export Promotion

- Tariff policies were intended to encourage development of the local industrial sector through import substitution; however, overprotection resulted in lack of competitiveness and poor environmental controls for air pollution.

- Trade-generated economic growth brings more materials and energy through the economic system, and will contribute to air pollution unless safeguards are in place. It also provides resources to invest in technology to improve air quality and monitor compliance. Open trading creates competitive pressure to adopt the latest technology. The amount of air pollution relative to production will decrease with improvements in technology and regulatory capacity, but absolute levels of pollution may continue to rise.

- The impact of special incentives, as with trade liberalization in general, depends on the kinds of productive processes favored. International trade agreements have mixed effects. GATT reduces the scope for environmental policy, while NAFTA potentially creates economic incentives for linking environmental protection with trade-generated economic growth.

Privatization

- Privatization is expected to result in increased investment and adoption of new technology, which is often more environmentally friendly; however, without effective environmental control policies privatization can result in greater pollution. Privatization of utilities offers a possibility for improved resource management, in terms of more rational pricing to reduce use and in terms of better regulatory control of air pollution.

Foreign Direct Investment

- Foreign direct investment creates opportunities for creating the "pollution haven" effect if pollution-intensive industries are attracted through special incentives.

AIR: ENVIRONMENTAL MANAGEMENT

Protection of Environmental Quality

- Air pollution results from the free disposal of wastes into the air. Air currents and precipitation later deposit pollutants on soil and in surface water. Many environmental management policies raise the price of pollution disposal to encourage polluters to find their own cost-minimizing amounts of pollution. Analysis of available empirical evidence finds no data to support a negative relationship between environmental regulation and economic growth. Policies to manage waste can focus on limiting free disposal or on mitigating exposure once wastes accumulate in the environment.

Water Quality

- Improved water quality has little relationship to level of air pollution, except indirectly through general efficiency gains in production processes.

Air Quality

- Technical standards for stationary and mobile sources are usually established at the national level. Many standards force the adoption of certain technologies, which raise the costs of air pollution reduction. Market-based instruments tend to lower overall control costs. Delegation of regulatory authority to the local level increases the ability to adjust standards to local needs and therefore to keep overall protection costs down.

- Emission charges are designed to achieve target levels of pollution reduction while avoiding the inflexibility of direct regulation. In practice their use has been oriented toward raising revenue with little emphasis on providing incentives to reduce pollution. General fuel taxes are a common but not well-targeted means for achieving pollution reduction, except in the case of differential taxes, such as those for leaded and unleaded gasoline.

- Tradable pollution rights allow regulatory authorities to retain greater control over total pollution levels than do emission charges, and rely on economic incentives to reduce costs of control. This policy tool (1) increases the price of pollution disposal to encourage polluters to find their own cost-minimizing amounts of pollution, and (2) limits the number of emission permits and allows polluters to trade permits, which allows polluters to determine the price of pollution disposal.

Land disposal

- Land disposal policies have a direct impact on air pollution through open burning at disposal sites and incineration. Economic instruments are not used as significant alternatives to direct regulation of hazardous waste management, but are typically used to reinforce direct regulations or provide a source of public revenue. The impact of policy tools such as financial accountability, fees, product charges, and liability is unclear because they exist within larger programs of direct regulation

AIR: ENERGY

Fossil Fuels

- Energy generation using fossil fuels affects air quality through pollution emission. As industrialization increases and per capita incomes rise, the demand for fossil fuels will increase unless alternative fuels are developed.

- Adoption of conservation measures and energy efficient technologies costs less than the investment required for developing new sources of supply.

- Greater energy efficiency and elimination of price distortions could lower total energy consumption in most countries by 20% of more.

- Pricing policies determine demand. In general the lower the price of energy the more people consume. Price controls, average cost pricing and producer subsidies can run counter to energy efficient objectives. Public sector intervention is warranted in energy markets to address poverty, negative environmental impacts.

- Marginal cost pricing will result in increased economic efficiency but result in relatively high prices for energy, especially electricity.

- Subsidies support the objective of social equity, however, they increase demand, lead to spending a greater proportion of foreign exchange in importing fossil fuel, and tend to discourage adoption of conservation measures and utilization of renewable energy sources. Subsidies with positive environmental impacts hold promise.

- Greater energy efficiency can achieved through regulations and codes that impose efficiency standards on appliances, industrial production, and building design. Taxes are most effective where the diversity of energy users and technologies make administration of regulatory solutions difficult. Taxes on gasoline and other fosil fuel products raise the price and decrease consumption levels.

- Investment policies are often designed to meet demand at peak loads resulting in excess generating capacity that represents a serious cost to the country and an inappropriate use of scarce investment capital and foreign exchange.

Hydroelectric Energy

- The general considerations cited for fossil fuels apply to hydroelectric energy, except that hydroelectric energy can be generated without burning fossil fuels.

Alternative Fuels

- The promotion of alternative fuels will require the removal of biases (taxes, subsidies, and other distortions) against the adoption of nonconventional technologies. Elimination of price subsidies for fossil fuel energy will make investment in alternative fuels more attractive, as will guaranteed sales to centralized grids for energy derived from alternative sources.

- Subsidies artificially reduce the price of fossil fuels and make alternative fuels less attractive. Tariffs on imported equipment such as solar panels, batteries, and other electrical generating or storage devices make their use less attractive compared with traditional energy sources.

AIR: AGRICULTURE AND LIVESTOCK

Product Price controls

- Price floors and support are often preferentially beneficial to large farmers. If these prices are above production costs, farmers overuse inputs. When the additional inputs are produced by polluting industries, the result is increased air pollution.

Input Subsidies and Prices

- Credit subsidies for agriculture and livestock activities encourage overuse of inputs and production of commodities that might not be profitable in the if subsidies were absent. Interest rate ceilings are often subsidized and promote capital-intensive forms of agriculture Pesticide and fertilizer subsidies: (1) artificially lower costs to farmers and encourage excessive application. Indirect subsidies (favorable exchange rate; tariff and foreign exchange allocation for imported fertilizers; preferential pricing of energy, feedstocks, and transport service for domestic production; and subsidized credit) encourage less diversified and more energy- and chemical-intensive cropping patterns that require less rural labor. Subsidies for agricultural machinery prompt forest clearance by lowering the financial cost of land preparation. In all cases the demand for energy and production inputs is increased. Depending on which fuel sources and production processes are encouraged, this may increase air pollution.

Direct Government Activities

- The impact on air pollution is very indirect. Government involvement in distribution of agricultural and livestock inputs tacitly promotes input-dependent methods of cultivation and overuse of agrochemicals. The types of inputs and production processes determine the contribution to reduced air quality.

Regulation of Pesticides

- Indirect impact on air quality.

Livestock policies

- Subsidized credit, fiscal incentives, tenure policies, and provision of infrastructure promote expansion of pastures. Fiscal incentives include accelerated depreciation, tax holidays, beneficial relative export duties, and low property and land taxes. Provision of infrastructure and livestock services support livestock operations including grazing on public lands. To the extent that these policies increase the demand for fossil fuel they contribute to air pollution.

AIR: FOREST

Concession and Licenses for the Use of Public Timber

- To the extent that forest sector policies contribute to the demand for fossil-fuel burning energy sources or promote urban migration, they contribute to air pollution, however the link is indirect. Their role is more global in terms of providing environmental services with respect to concentration of greenhouse gasses.

Forest Revenue Systems

- No direct impact.

Forest Industry and Export Policies

- No direct impact.

Private and Community Forest Management

- No direct impact.

Fuelwood and other Biomass

- Subsidies to promote fuel substitution to shift demand from fuelwood to more efficient commercial sources such as natural gas will contribute to indoor air quality as well as urban air quality. The collection and enforcement of taxes is probably costly and impossible at household level, however regulations could promote efficiencies in industrial fuelwood industries.

Reforestation Policies

- No direct impact.

Forest management

- No direct impact.

Biodiversity

- No direct impact.

AIR: LAND TENURE AND COLONIZATION

Land Tenure and Markets

- No direct causal connection to urban air pollution.

Colonization and Reform

Land Use Capability and Planning

AIR: INDIGENOUS PEOPLES

Indigenous Land Rights

- No direct relationship to air quality.

Resource Management

- No direct relationship to air quality.

International Legal Instruments

- No direct relationship to air quality.

Changing Values and Moral Persuasion

- No direct relationship to air quality.

AIR: PROTECTED AREAS AND WILDLIFE

Types and Legal Basis of Protected and Reserved Areas

- Protected area status contributes to air quality indirectly. When protected areas extend the life of hydroelectric generation facilities, they reduce the demand for fossil fuels, and when they protect downstream areas from soil degradation, additional energy inputs are not needed to maintain productivity or to treat contaminated water. Protected area systems in Central America being rapidly degraded through human encroachment. Population pressure and poverty are the main threats.

- Without the ability to protect these areas, an integrated package of incentives that alter individual decisions about the gains and losses associated with various uses will be required to change behavior.

- Land use capability systems are a key policy reform for market based incentives for managing within and around protected areas, however Institutional resources are a limiting factor.

- Approaches for addressing conflict surrounding competing uses of protected areas (or environmental issues in general) include judicial, administrative, legislative, arbitration and popular action and denouncements. The effectiveness of the judicial role depends on the integrity of the judicial system. Institutional weakness limit the ability of resource management agencies to effectively implement regulations. Legislative actions, other than drafting legislation, is investigative in nature. Arbitration, mediation, and conciliation are promising but have had little use in Central America. Popular denouncements allow individuals and groups to bring to the attention of administrative or judicial authorities actions by private or public agencies that have illegal environmental consequences.

Resource Management and the Local Community

- Incentives (direct cash, in-kind and fiscal) are required to support institutional and legal mechanisms, and all cases must reflect the management requirements of ecosystems, and be linked clearly to changes in behavior.

- Tax deductions, exemptions and credits require the ability to levy and collect taxes. Disincentives include refundable damage deposits for forest concession, taxes as disincentives to environmentally destructive land development, and pollution taxes on industries located in environmentally sensitive areas.

Financing

- Protected areas should receive a fair return on the money they bring into the economy to provide incentives for conservation and management of these areas.

International Conventions and Support

- Impact very indirect and tenuous.

Nature Tourism

- Impact very indirect. Nature tourism depends on the protected areas system and in turn provides funds for protection and management.

Wildlife Protection and Trade

- The impact is very indirect. When wildlife disappear from protected they lose their value for wildlife habitat and their appeal to tourists is diminished, reducing their total economic value, and making and conversion to other uses more likely.

AIR: WATER AND WATERSHED MANAGEMENT

Water Control, Use, and Pricing

- Impact on air quality is indirect through: (1) water pricing policies that encourage energy intensive cropping patterns and (2) management of watersheds to provide hydroelectric energy as a substitute for fossil fuel to reduce air pollution.

Watershed Management

- Watershed policy is a collection of policies from many sectors that have consequence for resource use in a geographically delineated unit that encompasses biophysical, socioeconomic, and political interactions.

- To the extent that these policies contributes to extending the life of hydroelectric power generation facilities, they contribute to slowing air pollution from increased use of fossil fuels.

Irrigation Provision and Pricing Policies

- The impact on air quality is indirect occurring as a result of more input intensive agriculture encouraged by irrigation.

AIR: COASTAL ZONE MANAGEMENT

Policies Affecting the Quality of Coastal Resources

- Any activity that degrades the ability of watersheds to buffer coastal zones from sedimentation and contamination can negatively affect coastal zone productivity. The reverse is also true. Any effective long-term integrated coastal management scheme will require reduced contamination from upstream areas, including improvements in air quality.

- The impact of investment incentives depends on the activities and sectors favored. Incentives to increase tourism, especially in coastal areas, also generate increased demand for energy, and, depending on the fuel source, may contribute to air pollution. Because large hydroelectric facilities are usually financed by debt, the need for foreign exchange may then drive other types of development that are pollution intensive.

Policies Affecting the Use of Coastal Resources

- The impact is indirect. Policies that establish secure property rights and use rights, including community ownership, will create an identifiable interest group supporting better management of upstream resources, including reduction of emissions into the air.

Policies Affecting Management of Fisheries

- Impact is very indirect. Effective management of fisheries will require integrated watershed management of upstream resources, having a beneficial impact on air pollution.

FOREST: POPULATION

Policies to Slow Population Growth

- Government policy on population control affects total and per capita demand for agricultural products and the intensivity and extensivity of agricultural production, resulting in overuse of marginal land leading to deforestation.

- Policies to slow population growth would increase per capita family savings, especially among the poor, increase public and private per capita investment in human capital, and reduce income inequality. All would reduce the rate of deforestation.

- The impact of population growth is roughly equal to the population size multipled by the per capita affluence or consumption multiplied by the environmental damage done by the technology used to supply each unit of consumption.

- Policies that reinforce the low status of women contribute directly to high population growth rates and intensity of use of marginal land. Not specifying and enforcing responsibilities of men decreases the status of women. Not promoting smaller families and providing fertility regulation and family planning services reduces individual and social welfare, especially among poor families. Incentives and disincentives enhance the effectiveness of other policy tools.

Redistributing Population

- There is no evidence that internal and external redistribution of population slows population growth rate. Although social and political tension may be reduced in the short term, colonization usually results in unsustainable mining of natural resources, especially deforestation. The total long-term financial and environmental cost of redistribution are often high, especially if population is redistributed into ecologically fragile areas.

Gender Discrimination

- There is a strong positive correlation between poverty and the number of households headed by women. When population growth causes severe pressure on natural resources, women's reproductive capacity is devalued, their rights and freedoms are reduced, and their status deteriorates. The poor are most likely to be penalized by rapid population growth, and women and children are the first to suffer when population growth severely stresses the carrying capacity of an area.

FOREST: MACROECONOMIC POLICIES

Natural Capital and the Economy

- Deforestation in many cases has been the result of policies that did not take into account the value of natural capital, and the environmental services provided by forests, including their contribution to downstream productivity.

Economic Evaluation of Environmental Resources

- Overreliance on economic valuation of forests may lead to extinction of forests whose marginal productivity (as measured in marketable products) is less that the rate of return. Even when nonmarket values are addressed, the estimation procedures do not capture difficult to measure values, and are biased against the preferences of many downstream users and traditional forest dwellers. To the extent that nonmarket values are captured in policymaking, use patterns would shift to intermediate- and longer-term growth with emphasis on forestry as it contributes to downstream productivity in other sectors.

Monetary and Credit Policies

- Expansion of the money supply and inflation causes the value of domestic currency to fall, discourages savings, and encourages the mining of forest resources to invest the profit in foreign markets, especially in the context of low royalties that do not capture resource rent. High interest rates encourage the harvesting of forests. To leave them as standing timber means forgoing the interest on the capital their harvest would generate in the present.

- The impact on forests of government intervention in credit markets depends on the direction of the intervention. Credit that finances short-term agricultural inputs and subsidized credit for cattle and machinery encourages forest conversion, as do credit policies that do not recognize forests as collateral. Credit dependent on environmental impact assessments, subsidized credit for natural forest and watershed management, and small hydroelectric facilities do the opposite.

Exchange Rates

- Overvalued exchange rates skew relative prices against agriculture and forestry, which has probably reduced exploitation of forests and at the same time reduced incentive to invest in their maintenance. It also increases unemployment in these sectors putting pressure on open-access forests. Floating exchange rates shift production in favor of agricultural exports, which may increase pressure on forests.

Fiscal Management

- Fiscal deficits limit the ability of government to manage protected and reserved areas, monitor and enforce management plans for forest exploitation, and provide technical assistance to forest owners and watershed inhabitants.

- Foreign exchange required to pay interest on foreign debt encourages mining of forests and agricultural exports, which may promote forest conversion.

Structural Adjustment Lending

- Structural adjustment loans are a mix of policies that may have positive or negative effects on deforestation. When they increase poverty, deforestation can result. Positive impacts can result when they eliminate credit subsidies for machinery, inappropriate agriculture, input-intensive agriculture, and energy.

FOREST: TRADE AND INVESTMENT POLICIES

Export Promotion

- Tariffs contribute to deforestation when they increase pressure on the forest cover because decreasing terms of trade reduce the profitability of agriculture per hectare and campesinos cut fuelwood and clear land to increase income. Increased trade and promotion of exports in developing countries increases the production of agricultural exports, timber, and minerals. All of these activities degrade forest resources if managed poorly.

- Trade-generated economic growth places increased demands on exhaustible resources, especially forests. It also provides resources to invest in forest management depending on royalty structure and capability of the government to provide technical services and enforce management plans

- The impact on deforestation of special incentives and trade liberalization depends on which productive activities and sectors are favored. Structural adjustment loans decrease public expenditure, tighten monetary policy, and devalue exchange rates. In the face of needed foreign exchange to pay foreign debt, this may increase pressure on open-access resources, especially forests.

- The impact of international trade agreements varies. GATT reduces the scope for environmental policy, while NAFTA potentially creates economic incentives for linking environmental protection with trade-generated economic growth.

Privatization

- The impact of privatization of natural resources depends on how it is managed. Overexploitation of forests will result if royalties do not reflect global prices and are not reinvested in management and implementation of regulatory policies. Privatization of utilities (water and energy) offers a possibility for improved integrated watershed management, which would result in slowed rates of deforestation.

Foreign Direct Investment

- Foreign direct investment creates opportunities for resource mining, especially in forestry, unless other policies are in place. The effect of special incentives will depend on how they are structured and policies in other sectors, especially macroeconomic policy, forestry, tenure, and agriculture policy.

FOREST: ENVIRONMENTAL MANAGEMENT

Protection of Environmental Quality

- Many environmental problems result from the free disposal of wastes into the air, surface water, and groundwater. Damage to forests is primarily caused directly through acidification by airborne pollutants and indirectly through insect damage that often follows air pollution damage.

- Many environmental management policies raise the price of pollution disposal to encourage polluters to find their own cost-minimizing amounts of pollution. Analysis of available empirical evidence finds no data to support a negative relationship between environmental regulation and economic growth.

Water Quality

- Improved water quality contributes directly to the health of forested areas. Reduced pollution levels in streams and rivers increases the number and variety of aquatic organisms that support the forest food chain.

- Technology-based standards for protecting water quality may not be a cost-effective means of pursuing water quality goals. Ambient standards can reflect local water quality needs better than uniform technology-based standards; however, they do now provide information on which point source to control when pollution exceeds tolerance levels, nor do they deal with downstream concerns. Effluent charges in place of direct regulation allows polluters to decide how to most efficiently reduce their level of pollution. They are often used initially to supplement a program of standards and are oriented toward raising revenue for a water quality authority rather than as an incentive to change behavior.

- Subsidies redistribute the burden of pollution control from polluters to society; they may facilitate the adoption of better pollution control by individual facilities, but pollution control will not be accomplished at cost-minimizing levels. Tax exemptions are a special form of subsidy.

Air Quality

- Forests in Europe and North America are increasingly being affected by airborne pollutants, however, the direct threats to forests in Central America are from expanding agriculture, fuel collection, unsustainable forestry, and slash-and-burn agriculture.

Land disposal

- Land disposal policies have a very indirect impact on the health of forests through general water pollution that decreases the number and variety of aquatic organisms that support the forest food chain.

FOREST: ENERGY

Fossil Fuels

- As industrialization increases and per capita incomes rise, the demand for fossil fuels will increase unless alternative fuels are developed. Fossil fuels are major consumers of foreign exchange, and forests are often mined to generate foreign exchange.

- Adoption of conservation measures and energy efficient technologies costs less than the investment required for developing new sources of supply. Greater energy efficiency and elimination of price distortions could lower total energy consumption in most countries by 20% of more, saving millions of dollars in foreign exchange.

- Pricing policies determine demand. In general the lower the price of energy the more people consume. Marginal cost pricing will result in increased economic efficiency but result in relatively high prices for energy, especially electricity. Subsidies support the objective of social equity, however, they increase demand, may lead to spending a greater proportion of foreign exchange in importing fossil fuel, and tend to discourage adoption of conservation measures and utilization of renewable energy sources. Subsidies with positive environmental impacts hold promise.

- Greater energy efficiency can be achieved through regulations and codes that impose efficiency standards on appliances, industrial production, and building design. Taxes are most effective where the diversity of energy users and technologies make administrative of regulatory solutions difficult.

- Policies that promote substitution of renewable energy sources for fossil fuels would decrease demand for fossil fuels. Efforts to substitute natural gas or kerosine for fuelwood will result in greater energy efficiencies, and reduced demand for fuelwood.

- Investment policies are often designed to meet demand at peak loads resulting in excess generating capacity that represents a serious cost to the country and an inappropriate use of scarce investment capital and foreign exchange.

- Exploration for fossil fuel opens access to remote areas to colonization and may contribute to deforestation.

Hydroelectric Energy

- The general considerations cited for fossil fuels apply to hydroelectric energy. Hydroelectric energy can be generated without burning fuels and emitting contaminants into the air, and water stored behind dams can be used for irrigation. Resettlement is often controversial, and creation of a large reservoir promotes use of irrigation for production of commercial crops, which may lead to further deforestation.

Alternative Fuels

- The promotion of alternative fuels will require the removal of biases (taxes, subsidies, and other distortions) against the adoption of nonconventional technologies. Elimination of price subsidies for fossil fuel energy will make investment in alternative fuels more attractive, as will guaranteed sales to centralized grids for energy derived from alternative sources.

- Subsidies artificially reduce the price of fossil fuels and make alternative fuels less attractive for consumers and investors. Tariffs on imported equipment such as solar panels, batteries, and other electrical generating or storage devices make their use less attractive compared with traditional energy sources.

FOREST: AGRICULTURE AND LIVESTOCK

Product Price Controls

- Price ceilings at the producer level reduce returns to agricultural activities, creating negative incentives for investment in long-term conservation activities for forests. Price floors and support prices reduce risk and encourage agricultural investment, but if these prices are above the marginal production costs, they encourage overproduction, which may result in deforestation. When price bands reduce uncertainty and prices gradually increase, the result will probably be increased investment in conservation, which will have beneficial effects on forest management.

Input Subsidies and Prices

- Credit subsidies for agriculture and livestock activities encourages over use of inputs and production of commodities that might not be profitable in their absence, often leading to extensive deforestation. Interest rate ceilings are often subsidized promote capital-intensive forms of agriculture which displaces farm labor putting pressure on marginal lands. In two separate ways this promotes conversion of forests to unsuitable land uses. Pesticide and fertilizer subsidies artificially lower cost to farmers and encourage excessive application creating incentives for converting forests to unsuitable land uses that would not be profitable in the absence of the subsidy.

- Indirect subsidies (favorable exchange rates; tariff and foreign exchange allocation for imported fertilizers; preferential pricing of energy, feedstocks, and transport service for domestic production; and subsidized credit) distort the choice of crops toward less diversified and more chemical-dependent cropping patterns that require less rural employment. This often encourages: (1) conversion of forests to inappropriate uses that would not be profitable in the absence of indirect subsidies, and (2) conversion of forests on fragile slopes to subsistence agriculture as a result of increased pressure on marginal lands

- Subsidies for agricultural machinery can (1) prompt forest clearance by lowering the financial cost of land preparation; (2) cause labor displacement and reduce rural employment opportunities, thus promoting conversion of forests on fragile slopes to subsistence agriculture as a result of increased pressure on marginal lands.

Direct Government Activities

- Government involvement in input marketing and produce marketing promotes input-dependent methods of cultivation that may promote deforestation depending on the specific inputs, the scale and location.

Regulation of Pesticides

- Little impact.

Livestock Policies

- These policies include subsidized credit, fiscal incentives. tenure policies, and provision of infrastructure. They promote expansion of pastures at the expense of tropical forests. Credit policies establish credit preferences for livestock production promoting land conversion. Fiscal incentives for livestock include accelerated depreciation, tax holidays, beneficial relative export duties, and low property and land taxes that do not encourage the use of land according to its productive capability and often encourage conversion of tropical forests to pasture.

- Tenure policies often stipulate that land must be cleared to be occupied.

FOREST: FOREST

Concession and Licenses for the Use of Public Timber

- Short duration or insecure concessions on public land do not provide incentives for sustainable forest management. Management plans that do not promote easy compliance, and are not technically based, or well enforced do not promote sustainable resource use. Other existing institutional conditions and restrictions interact with unenforceable management requirements to promote conversion to other agricultural uses. When concessions are not awarded through open competition and with a minimum bid, economic rent is not collected by he government. This encourages rapid depletion of the resource and conversion to other uses.

Forest Revenue Systems

- Forest charges on public timber that do not reflect global scarcity prices: 1) increase the rate of harvesting and the selection of species utilized leading to high grading; and 2) promote the accumulation of large concessions and inappropriate and inefficient use. In a policy context that creates high exclusion costs for harvested areas, this opens up a forest to settlers and degradation and deforestation of forest stands.

  Charges on processed timber products reduce incentives for domestic processing and reduces the local value of timber. Charges on minor forest products discourages their development, reducing the value of the forest stand making long-term management and exclusion comparatively less attractive. Both encourage conversion to other uses.

Forest Industry and Export Policies

- Log bans or quotas unless supplemented with effective enforcement of forest management are unlikely to reduce deforestation. Tax and tariff protection weakens competitive pressure and undermines incentives to minimize costs which increases pressures on forest resources. Tax credits, preferential interest rates, credit lines for forest industries, import duty exemptions and accelerated depreciation have the same effect if carried on too long.

  Direct government involvement in forest-related industries is usually characterized by corruption and inefficiency. Price controls on lumber encourage inefficient use and long-term unsustainability. Direct government ownership of trees on private land creates incentive to convert the land to other uses.

Private and Community Forest Management

- Attempts by government to own or control trees on private land creates uncertainty and a disincentive for long-term forest management. Farm and community forest management can reduce uncertainty and supports long-term returns from forest management.

Fuelwood and other Biomass

- Fuelwood demand and extraction can contribute significantly to deforestation. Subsidies to promote fuel substitution shift demand from fuelwood to more efficient commercial sources such as natural gas. Afforestation policies address both energy issues and watershed management.

Reforestation Policies

- Fiscal incentives for reforestation often benefit wealthier groups and are provided at the cost of other social services such as basic education and health that may have a greater impact on changing land use practices.

  Public reforestation projects are less efficient than small individual community-focused activities that address the short-term needs of individuals and communities.

FOREST: LAND TENURE AND COLONIZATION

Land Tenure and Markets

- Insecure and uncertain tenure of land ownership for large and small farmers promotes accelerated exploitation of resources. Many forested areas are state-owned and subject to unchecked exploitation because governments lack the ability to enforce control. Skewed land distribution also contributes to deforestation by forcing small untenured farmers to settle on uncleared land. All of these influences contribute directly to soil erosion and to chemical and physical degradation.

- Private property may allow an individual to recoup benefits from sustained resource management. If, however, low resource endowments are combined with poverty the individual will rationally degrade the resource even when tenure is secure, leading to loss of tree cover.

- Most remaining forested areas in Central America are inhabited by indigenous groups. Lack of tenurial security for communally managed indigenous lands encourages invasion by colonists and conversion of forests to inappropriate agricultural uses.

- Policies that support skewed land distribution tend to lead to invasion of forested areas and to intensive or extensive land use by the poor on land that is inappropriate for agricultural uses. Lack of active land markets and ability to transfer ownership rights prevents users from capitalizing on investments in forest management. Lack of land markets also inhibits the willingness of lenders to accept land as collateral and thus reduces incentives to leave "capital" in the form of standing forests. Taxes designed to promote redistribution, such as taxes on idle land, often have a negative effect on resource use; for example when forested land is cleared for other uses.

Colonization and Reform

- Colonization programs are often established on land types that are inappropriate for agricultural uses or in and around protected areas, resulting in deforestation. Deforestation of public and private land is encouraged by land clearing requirements for tenure and policies that grant rights to squatters for improvements they make to land. Indirect government policies to create infrastructure supporting formal colonization often results in spontaneous colonization especially in open-access resources. Spontaneous settlements increase tenure insecurity and encourage clearing of land to demonstrate ownership.

Land Use Capability and Planning

- Land use capability systems provide a key policy tool for shifting from command-and-control regulatory policies to market-based incentives to promote appropriate and sustainable land use. Such a system provides the basis for development programs, reforestation incentives, credit, zoning, taxes, and subsidies, all of which have a direct impact on protecting forested areas and developing a sustainable forest industry.

FOREST: INDIGENOUS PEOPLES

Indigenous Land Rights

- Most remaining forested wildland areas in Central America are occupied by indigenous groups. These groups have evolved usufruct strategies that have not exceeded the forest's regeneration capacity. Communal management by indigenous groups that have traditionally occupied these areas offers a cost-effective alternative for the management of large tracts of forestland. It also allows government agencies to focus scarce financial and administrative resources on monitoring and enforcing environmental regulations and management plans.

- Old values and assumptions led to policies that attempted to integrate indigenous populations into modern social and economic development. This caused the erosion of their culture and along with it an end to their sustainable communal management of large forested areas. Attempts to establish private property rights have focused on individual ownership of small tracts of land, which has led to invasion of indigenous lands by landless colonists and the conversion of forest to unsustainable agriculture and massive deforestation.

- New values and assumptions view diversity of all kinds (including cultural diversity) as a source of adaptive strength and resilience. In the context of the rapid loss of remaining forested areas, this has led to increased emphasis on the protection of human rights (including communal tenure), decentralized management, and local participation in community forest management as a way to promote sustainable use of tropical forests.

Resource Management

- Any protectionist policy requires controlling technology within the protected area. As protected areas become exposed to development pressures, it is increasingly difficult to exclude nontraditional technologies and limit people's life choices. Management must incorporate new ways to establish market value, allocate and delimit use rights, and choose among competing uses. This will promote growth in nontimber products and use of secondary species.

- A clearly marked boundary, patrols for surveillance, and legitimate procedures for warning and evicting colonists are required to thwart invasions and crucial for successful forest management.

International Legal Instruments

- Sustainable use of the remaining forested areas in Central America will depend on the way in which the rights, projections, and responsibilities of the indigenous groups occupying them are specified. International human-rights agreements provide the initial legal basis for addressing the incursion of outside development interests.

Changing Values and Moral Persuasion

- New values that stress preservation of future options, resilience over efficiency, and the protection of cultural diversity are leading to policy guidelines to protect indigenous rights to traditional lands and resources and to promote the participation of indigenous peoples in the use, development, and protection of those areas. This will be a key policy tool for promoting long-term sustainable forest management.

FOREST: PROTECTED AREAS AND WILDLIFE

Types and Legal Basis of Protected and Reserved Areas

- Protected status contributes to the maintenance of existing forests and preserves sources of genetic diversity for future forest stands. Protected area systems in Central America being rapidly degraded through human encroachment. Population pressure and poverty are the main threats.

- Without the ability to protect these areas, an integrated package of incentives that alter individual decisions about the gains and losses associated with various uses will be required to change behavior. Land use capability systems are a key policy reform for market based incentives for slowing the rate of deforestation, however Institutional resources are a limiting factor.

- Approaches for addressing conflicts surrounding competing uses of protected areas (or environmental issues in general) include judicial, administrative, legislative, arbitration and popular action and denouncements. The effectiveness of the judicial role depends on the integrity of the judicial system. Institutional weakness limit the ability of resource management agencies to effectively implement regulations. Legislative actions, other than drafting legislation, is investigative in nature. Arbitration, mediation, and conciliation are promising but have had little use in Central America. Popular denouncements show promise and allow individuals and groups to bring to the attention of administrative or judicial authorities actions by private or public agencies that have illegal environmental consequences, however other supporting policy tools are required.

Resource Management and the Local Community

- Incentives (direct cash, in-kind and fiscal) are required to support institutional and legal mechanisms, and all cases must reflect the management requirements of ecosystems, and be linked clearly to changes in behavior. Tax deductions, exemptions and credits require the ability to levy and collect taxes. Disincentives include refundable damage deposits for forest concession, taxes as disincentives to environmentally destructive land development, and pollution taxes on industries located in environmentally sensitive areas.

Financing

- Protected areas should receive a fair return on the money they bring into the economy to provide incentives for conservation and management of these areas. Sources include: entrance fees, diversified endowment portfolios, water fees from irrigation projects or hydroelectric installations that benefit from the area, special taxes on timber extraction, wildlife, and wildlife products and concession rights..

International Conventions and Support

- International agreements support sustainable management of forests by providing binding, legal obligations that become the basis for national implementing legislation.

Nature Tourism

- Tourism provides funds and promotes conservation and preservation of natural resources, however it must be controlled so that the carrying capacity of the resource is not exceeded.

Wildlife Protection and Trade

- The impact is very indirect. When forests lose their value for wildlife habitat, their total economic value is reduced and conversion to other uses more likely.

FOREST: WATER AND WATERSHED MANAGEMENT

Water Control, Use, and Pricing

- The impact on forests is indirect. Policies designed to improve the quality, quantity, and availability of water will necessarily address the management of forests in watershed areas.

- Where water is treated as an open access resource, or where water prices are too low, water is wasted or used as a reservoir for dumping pollutants. Subsidies promote overuse and waste and encourage use for less valuable alternatives. More realistic water pricing will generate revenue for watershed management and generate a demand for better watershed management.

- Sedimentation from erosion in upper watersheds adds to the contamination problem and affects reservoir storage. As contamination increases, the availability of clean water decreases, and treatment for specific uses will add to the costs of obtaining adequate water supplies. Requiring the "polluter to pay" the costs of treatment can help limit pollution and pay for necessary remediation.

Watershed Management

- Watershed policy is a collection of policies from many sectors that have consequence for resource use in a geographically delineated unit that encompasses biophysical, socioeconomic, and political interactions. Policies to manage watersheds will by definition contribute to sustainable forest management.

- Watershed management policies must focus on upstream inhabitants and their behavior because their actions will determine the quantity and quality of water arriving downstream from the watershed. Financial incentives can be used to compensate upstream watershed occupants for long-term management and conservation. Taxes can be placed on downstream areas of watersheds (on property, water use, agricultural inputs) to raise revenue and provide incentives for improved upstream land management, and to bring direct user costs more in line with the true costs of using these inputs.

- Well-defined private or communal property and usufruct rights for land and resources in the watershed protect the rights of resource users and promote long-term use including management of forest resources.

- Coordination among governmental institutions responsible for managing the resources in the watershed and public participation in the establishment of overall management goals and choice the incentives improves resource management and implementation.

Irrigation Provision and Pricing Policies

- The impact on forests is indirect. (1) Public sector irrigation is heavily subsidized and has become an enormous fiscal drain in many countries. Forests are affected if they are unsustainable harvested to generate foreign exchange to pay the interest on dept. (2) They are also affected when the agricultural practices promoted by irrigation lead to conversion of forests to other uses. Charges based on volume used provide incentives for more efficient use and reduce demand for expended irrigation systems.

FOREST: COASTAL ZONE MANAGEMENT

Policies Affecting the Quality of Coastal Resources

- One primary source of coastal zone degradation is that caused by sediments, nutrients, and toxins contained in runoff from agricultural areas and logged forests. Improving the quality of coastal waters will depend on improving watershed management, especially forest cover on fragile slopes.

- Subsidies that favor activities that contribute to coastal zone degradation are often the same ones that lead to unsustainable use of forestland. Subsidies: (1) for cattle promote deforestation and force non-cattle agriculturalists onto steeper slopes where cultivation results in degradation of watersheds and increased erosion; (2) for agricultural inputs often make agriculture a more attractive investment than managed forestry and leads to land conversion.

- Integrated coastal zone management plans encompass a coastal ecosystem, and to the extent that policy integration takes place will have a positive impact on reforestation, natural forest management, plantation forestry, and watershed management.

Policies Affecting the Use of Coastal Resources

- Policies that establish secure property rights and use rights, including community ownership, will create an identifiable interest group supporting better management of upstream resources and have beneficial consequences on forests.

Policies Affecting the Management of Fisheries

- Effective management of fisheries will require integrated watershed management of upstream resources, having a beneficial impact on forests.

FISHERIES: POPULATION

Policies to Slow Population Growth

- Degradation of coastal zone breeding and nursery grounds is the ultimate downstream pollution problem.

- The impact of population growth is roughly equal to the population size multipled by the per capita affluence or consumption multiplied by the environmental damage done by the technology used to supply each unit of consumption.

- Government policy on population control affects total and per capita demand for agricultural products and the intensivity and extensivity of agricultural production, resulting in overuse of marginal land and destruction of watersheds leading to soil erosion, siltation, sedimentation, and chemical contamination of water flowing into coastal breeding areas and hatcheries.

- Policies that reinforce the low status of women contribute directly to high population growth rates. Not specifying and enforcing responsibilities of men decreases the status of women. Not promoting smaller families and providing fertility regulation and family planning services reduces individual and social welfare, especially among poor families, leading to inefficient and overuse of soil resources in marginal areas. Incentives and disincentives enhance the effectiveness of other policy tools .

Redistributing Population

- There is no evidence that internal and external redistribution of population slows population growth rate. Although social and political tension may be reduced in the short term, colonization usually results in unsustainable mining of natural resources, especially deforestation and soil erosion, which, depending on location and scale, may have downstream impacts on the productivity of hatcheries and coastal nurseries. A strong positive correlation exists between the amount and type of coastal contamination and the population density and development activities in the watersheds feeding coastal areas.

Gender Discrimination

- The poor are most likely to be penalized by rapid population growth, and women and children are the first to suffer when population growth severely stresses the carrying capacity of an area, further driving a vicious cycle of increased poverty and environmental degradation.

FISHERIES: MACROECONOMIC POLICIES

Natural Capital and the Economy

- Loss of productivity of fisheries results when the value of that loss is not counted as a cost of upstream activities such as agriculture, forestry, and industrial and urban development. A systematic evaluation of the value of fisheries may contribute to integrated management of watersheds and coastal zone development.

Economic Evaluation of Environmental Resources

- To the extent that nonmarket and market values of coastal zones and fisheries are captured in policymaking (credit, taxes, land use capability zoning, etc.), use patterns may shift from short-term economic growth that maximizes local market return to intermediate- and longer-term growth that maximizes regional and national productivity, with growing emphasis on forestry, coastal zones, and fisheries.

Monetary and Credit Policies

- Expansion of the money supply and inflation causes the value of domestic currency to fall, discourages savings, and encourages people to invest in foreign markets rather than in the long-term productivity of domestic markets. The consequence is decreased concern with forest management and soil conservation, leading to downstream contamination of coastal zones. High interest rates encourage short-term resource mining (including over fishing), which has the same impact.

- The impact on fisheries of government intervention in credit markets depends on the direction of the intervention. Subsidized credit for cattle, machinery, and agricultural production encourages degradation of watersheds and contamination and destruction of wetlands, mangroves, salt marshes, seagrass beds, estuaries, and coral reefs. Subsidized credit for mariculture encourages mangrove destruction and with it the destruction of important breeding grounds for commercially valuable fish.

Exchange Rates

- Overvalued exchange rates have resulted in underinvestment in forest and soil conservation with negative downstream impacts on coastal breeding and nursery grounds. Floating exchange rates shift production in favor of agricultural exports, which may also reduce forest cover and increase water contamination, having similar consequences for fisheries.

Fiscal Management

- Fiscal deficits limit the ability of government to provide services that promote conservation of upstream resources and development and implementation of coastal zone management plans.

- Foreign exchange required to pay interest on foreign debt encourages exploitation of fisheries, conversion of mangroves for mariculture, exploitation of forests, and increased amounts of agricultural exports, which all contribute to destruction of coastal breeding grounds and hatcheries. Reducing government debt may also increase soil degradation in the short term because subsistence agriculture will expand in response to higher food prices and with spontaneous colonization.

Structural Adjustment Lending

- Fisheries are the ultimate downstream resource user problem. The impact of structural adjustment loans depends on their effect on all the intermediate resources: forests, mangroves, wetlands, soil, and water.

FISHERIES: TRADE AND INVESTMENT POLICIES

Export Promotion

- Increasing trade and promoting exports in developing countries means increasing the production of agricultural exports, timber, and minerals. All will have negative downstream impacts on coastal breeding and nursery grounds. Trade-generated economic growth brings more materials and energy through the economic system, and places increased demands on exhaustible resources unless safeguards are in place. It provides resources to invest in integrated resource management and environmental protection; however, even though pollution intensity decreases with improvements in technology and regulatory capacity, absolute levels of coastal zone pollution and habitat destruction will probably continue to rise.

- Export promotion policies have encouraged nontraditional agricultural exports, especially mariculture, which has led to the destruction of mangroves that are breeding grounds for many commercially valuable fish. The impact of special incentives and trade liberalization generally depends on which activities are favored, where they are located, and what kinds of pollution control regulations and technologies are in place. Structural adjustment loans often have recessionary effects that increase poverty, which, combined with rapid population growth, leads to environmental degradation of open access resources, especially fisheries, mangroves, and coastal areas.

- The impact of international trade agreements on fisheries is variable. GATT reduces the scope for environmental policy, while NAFTA potentially creates economic incentives for linking environmental protection with trade-generated economic growth

Privatization

- Privatization is expected to result in increased investment and adoption of new technology, which is often more environmentally friendly. Without effective environmental control policies, privatization can result in greater pollution, which will have negative downstream impacts on coastal zone resources and fisheries. The impact of privatization of natural resources depends on how it is managed. Overexploitation and associated downstream contamination and destruction of habitat will result if royalties do not reflect global prices and are not reinvested in management and implementation of regulatory policies and integrated watershed and coastal zone management.

- Privatization of utilities (water, energy, solid waste collection) will improve management of the key activities that directly affect coastal areas. However, for privatization to be effective, the market for services must be created by well-designed and implemented regulations.

Foreign Direct Investment

- As the ultimate downstream resource, coastal zones will absorb the full environmental impact of foreign (and domestic) investment in all sectors, and the impact will depend on special incentives and policies in other sectors. In general any environmental cost that is not absorbed by the sector that produces it will be passed on to coastal zones and result in diminished productivity of the market and nonmarket goods and services provided by marine habitats.

FISHERIES: ENVIRONMENTAL MANAGEMENT

Protection of Environmental Quality

- Degradation of freshwater and coastal fisheries is caused by damage to habitat and overharvesting. Damaging levels of sediments, nutrients (nitrogen and phosphorus), and toxins (synthetic organic compounds heavy metals) in coastal water are created by pollutants in runoff from agriculture, logged forests, urban streets, and municipal industrial discharges.

- Water pollution results from the free disposal of wastes into the surface and groundwater. Many environmental management policies raise the price of pollution disposal to encourage polluters to find their own cost-minimizing amounts of pollution. Analysis of available empirical evidence finds no data to support a negative relationship between environmental regulation and economic growth.

Water Quality

- Technology-based standards for protecting water quality may not be a cost-effective means of pursuing water quality goals. Ambient standards can reflect local water quality needs better than uniform technology-based standards; however, they do not provide information on which point source to control when pollution exceeds tolerance levels, nor do they deal with downstream concerns.

- Effluent charges in place of direct regulation allows polluters to decide how to most efficiently reduce their level of pollution. They are often used initially to supplement a program of standards and are oriented toward raising revenue for a water quality authority rather than as an incentive to change behavior.

Air Quality

- The impact on fisheries of air quality is very indirect in terms of airborne pollutants contained in runoff.

Land Disposal

- Land disposal policies have a direct impact on water pollution levels when pollutants enter surface and groundwater. The downstream impact on coastal breeding and nursery areas depends on the quality of water entering these areas. The impact of policy tools such as financial accountability, fees, product charges, and liability is unclear because they exist within larger programs of direct regulation.

FISHERIES: ENERGY

Fossil Fuels

- The direct impact of fossil fuel use on fisheries is from oil spills, contamination of streams, rivers, and coastal zones from industrial and urban run-off, leaking storage facilities and improper disposal. The indirect impact occurs through degradation of watershed capabilities as forests are harvested to generate foreign exchange to purchase fossil fuels, and producers shift to more energy intensive agricultural cropping patterns.

- Adoption of conservation measures and energy efficient technologies costs less than the investment required for developing new sources of supply. Greater energy efficiency and elimination of price distortions could lower total energy consumption in most countries by 20% of more, saving millions of dollars in foreign exchange.

- Pricing policies determine demand. In general the lower the price of energy the more people consume. Marginal cost pricing will result in increased economic efficiency but result in relatively high prices for energy, especially electricity. Subsidies support the objective of social equity, however, they increase demand, may lead to spending a greater proportion of foreign exchange in importing fossil fuel, and tend to discourage adoption of conservation measures and utilization of renewable energy sources. Subsidies with positive environmental impacts hold promise.

- Taxes are most effective where the diversity of energy users and technologies make administrative of regulatory solutions difficult. Taxes on gasoline and other fossil fuel products raise the price and decrease consumption levels.

- Investment policies are often designed to meet demand at peak loads resulting in excess generating capacity that represents a serious cost to the country and an inappropriate use of scarce investment capital and foreign exchange.

- Exploration for fossil fuel opens access to remote areas to colonization and may contribute to deforestation, and downstream pollution of coastal zone breeding and nursery areas.

Hydroelectric Energy

- The general pricing considerations cited for fossil fuels apply to hydroelectric energy. Hydroelectric energy can be generated without burning fuels and emitting contaminants into the air, and water stored behind dams can be used for irrigation. Creation of a large reservoir promotes use of irrigation for production of commercial crops, which may lead to further deforestation and inappropriate land use having downstream negative consequences for coastal breeding and nursery grounds.

Alternative Fuels

- The promotion of alternative fuels will require the removal of biases (taxes, subsidies, and other distortions) against the adoption of nonconventional technologies. Elimination of price subsidies for fossil fuel energy will make investment in alternative fuels attractive, as will guaranteed sales to centralized grids for energy derived from alternative sources. Tariffs on imported equipment such as solar panels, batteries, and other electrical generating or storage devices make their use less attractive compared with traditional energy sources.

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FISHERIES: AGRICULTURE AND LIVESTOCK

General Comment

- Depending on the location and scale of activities, all of these policies promote behavior that leads to contamination of streams and rivers, which at threshold levels reduces the productivity of fish breeding habitats in streams, rivers, estuaries, and along coastal reefs.

Product Price Controls

- Price floors and support prices are often preferentially beneficial to large farmers. If these prices are above the marginal production costs, they encourage over production and/or overuse of inputs.

Input Subsidies and Prices

- Credit subsidies for agriculture and livestock activities encourage overuse of inputs. Interest rate ceilings are often subsidized and promote capital-intensive forms of agriculture that displace farm labor and put pressure on marginal lands. Pesticide and fertilizer subsidies artificially lower the cost of agrochemicals relative to other more labor-intensive control methods that are less likely to lead to soil degradation and water contamination. Indirect subsidies (favorable exchange rate; tariff and foreign exchange allocation for imported fertilizers; preferential pricing of energy, feedstocks, and transport service for domestic production; and subsidized credit) encourage less diversified and more chemical-dependent cropping patterns.

  Subsidies for agricultural machinery prompt forest clearance by lowering the financial cost of land preparation; causing labor displacement and reducing rural employment opportunities. The consequence is increased erosion, depletion, and compaction of soil and displacement of rural populations into marginal lands.

Direct Government Activities

- Government involvement in distribution of agricultural and livestock inputs tacitly promotes input-dependent methods of cultivation and overuse of agrochemicals. Depending on the inputs distributed, it shapes land use by influencing crop choice and the choice between agriculture and livestock.

Regulation of Pesticides

- Indirect regulation exists through import tariffs and other import regulations that favor agricultural inputs, encourage more pesticide use, and favor export crops that rely heavily on pesticides.

FISHERIES: FOREST MANAGEMENT

Concession and Licenses for the Use of Public Timber

- These general policies promote behavior which depending on location contribute to water siltation, reduction in stream flow, and chemical run-off causing pollution of coastal breeding and nursery grounds.

- Short duration or insecure concessions; concessions that are not awarded through open competition and with a minimum bid; and management plans that do not promote easy compliance, are not technically based, and well enforced, encourage conversion of forest land to other uses that are often inappropriate for soil classification.

Forest Revenue Systems

- Forest charges on public timber that do not reflect global scarcity prices increase the rate of harvesting and lead to highgrading. Charges on processed timber products reduce incentives for domestic processing and reduces the local value of timber. Charges on minor forest products discourages their development, reducing the value of the forest stand.

Forest Industry and Export Policies

- Log bans or quotas unless supplemented with effective enforcement of forest management are unlikely to reduce deforestation. Tax and tariff protection undermines incentives to minimize costs which increases pressures on forest resources. Tax credits, preferential interest rates, credit lines for forest industries, import duty exemptions and accelerated depreciation have the same effect if carried on too long.

  Direct government involvement in forest-related industries is usually characterized by corruption and inefficiency and subsidized by other revenues. Price controls on lumber products encourage purchase of high-value wood for inappropriate uses, discourage uses of secondary species, reduce the value of the resource and encourage inefficient use and long-term unsustainability. Direct government ownership or regulation of trees on private land creates disincentive to invest in forest management and to convert the land to other uses.

Private and Community Forest Management

- Attempts by government to own or control trees on private land creates uncertainty and a disincentive for long-term forest management. Farm and community forest management reduces uncertainty and should help to slow the rate of degradation of coastal zone marine resources.

Fuelwood and other Biomass

- Fuelwood demand and extraction can contribute significantly to deforestation, watershed deterioration and downstream reduction in water quantity and quality. Policies that address fuelwood supply will have a positive effect on coastal zone water quality

Reforestation Policies

- Fiscal incentives for reforestation need to be part of a larger coastal zone management plan to have a direct impact on marine resources.

FISHERIES: LAND TENURE AND COLONIZATION

Land Tenure and Markets

- Insecure and uncertain tenure of land ownership for large and small farmers promotes accelerated exploitation of resources. Many state-owned resource areas, such as forests, wildlands, and coastal zones, are subject to unchecked exploitation because governments lack the ability to enforce control over resources. Skewed land distribution also contributes to accelerated environmental degradation by forcing small untenured farmers to settle on fragile lands. All of these influences contribute to reduced productivity of coastal zone breeding and nursery grounds including wetlands, mangroves, salt marshes, seagrass beds, estuaries, and coral reefs through damaging levels of sediments, nutrients, and toxins in coastal water created by pollutants in runoff from agriculture, logged forests, and municipal industrial discharges.

- Private property may allow an individual to recoup benefits from sustained resource management. If, however, low resource endowments are combined with poverty the individual will rationally degrade the resource even when tenure is secure, degrading water flowing into coastal waters.

- Lack of tenurial security for communally managed indigenous lands encourages invasion by colonialists and conversion to inappropriate uses, often causing downstream contamination of streams and rivers. Tenure security for lowland coastal forests traditionally managed by indigenous groups will be important for the sustained management of habitat that provides coastal breeding and nursery grounds.

- Lack of active land markets and ability to transfer ownership rights prevents users from capitalizing on investments in forest management and soil conservation, and generally leads to conversion of land from more to less efficient uses. Lack of land markets also inhibits the willingness of lenders to accept land as collateral and thus reduces incentives to conserve capital as standing timber.

Colonization and Reform

- Most government-sponsored colonization programs do not match land use capability with the proposed use, and colonization programs are often established on land types that are inappropriate for agricultural uses, resulting in deforestation and soil erosion. Deforestation of public and private land is encouraged by land clearing requirements for tenure and policies that grant rights to squatters for improvements they make to land. Indirect government policies to create infrastructure supporting formal colonization often results in spontaneous colonization, especially in open-access resources. Spontaneous settlements increase tenure insecurity and degrade open-access resources leading to deforestation, soil erosion, depletion, and compaction, and increasing levels of pollutants in runoff from agriculture and logged forests.

Land Use Capability and Planning

- Land use capability systems provide a key policy tool for shifting from command-and-control regulatory policies to market-based incentives to promote sustainable use. Such a system provides the basis for development programs, credit, zoning, taxes, and subsidies, all of which have a direct impact on land use and on its downstream impacts on water quality and coastal fisheries.

FISHERIES: INDIGENOUS PEOPLES

Indigenous Land Rights

- Protection of indigenous land rights in many areas has a direct connection with protection and sustainable use of the coastal zone breeding and nursery grounds used by many species of commercially valuable fish. Most remaining coastal forested wildland areas in Central America are occupied by indigenous groups that have sustainable used and managed coastal wetlands and fishing grounds. These groups have evolved usufruct strategies that have not led to soil erosion, sedimentation, and chemical contamination of coastal waters and overexploitation of local fisheries. They offer a cost-effective alternative for managing large tracts of coastal lowland forests and coastal marine systems.

- Attempts to establish private property rights on land have focused on individual ownership of small tracts of land, which has led to invasion of communal lands by landless colonists and the conversion of forest to unsustainable agriculture, soil erosion and sedimentation, and chemical contamination of streams and rivers flowing into estuaries and coastal zones.

- Old values and assumptions led to policies that attempted to integrate indigenous populations into modern social and economic development, ensuring the erosion of their culture and along with it an end to their sustainable communal management of large watersheds that feed coastal zone areas. New values and assumptions view diversity of all kinds (including cultural diversity) as a source of adaptive strength and resilience. These have led to increased emphasis on the protection of human rights (including communal tenure), decentralized management, and local participation in integrated coastal zone management and development.

Resource Management

- A clearly marked boundary, patrols for surveillance, and legitimate procedures for warning and evicting colonists are required to prevent invasion and use of apparently open-access resources.

International Legal Instruments

- To the extent that the productivity of coastal breeding and nursery grounds depend on a healthy upstream watershed (including mangroves) they will also depend on the way in which the rights, projections, and responsibilities of the indigenous groups occupying them are specified. International human-rights agreements provide the initial legal basis for addressing the incursion of outside development interests.

Changing Values and Moral Persuasion

- New values that stress preservation of future options, resilience over efficiency, and the protection of cultural diversity are leading to policy guidelines to protect indigenous rights to traditional lands and resources and to promote the participation of indigenous peoples in the use and development of those areas. This will promote greater cultural diversity and help to sustainable manage coastal zone areas along the Atlantic coast of Central America.

FISHERIES: PROTECTED AREAS AND WILDLIFE

Types and Legal Basis of Protected and Reserved Areas

- Protected and reserved areas contributes to the productivity of fisheries by reducing the level of sedimentation and pollution that would other wise arrive in coastal zone breeding and nursery grounds. Protected area systems in Central America being rapidly degraded through human encroachment. Population pressure and poverty are the main threats.

- Without the ability to protect these areas, an integrated package of incentives that alter individual decisions about the gains and losses associated with various uses will be required to change behavior.

- Land use capability systems are a key policy reform for market based incentives for slowing the rate of soil degradation, however Institutional resources are a limiting factor.

- Approaches for addressing from conflicting surrounding competing uses of protected areas (or environmental issues in general) include judicial, administrative, legislative, arbitration and popular action and denouncements. The effectiveness of the judicial role depends on the integrity of the judicial system. Institutional weakness limit the ability of resource management agencies to effectively implement regulations. Arbitration, mediation, and conciliation are promising but have had little use in Central America. Popular denouncements allow individuals and groups to bring to the attention of administrative or judicial authorities actions by private or public agencies that have illegal environmental consequences.

Resource Management and the Local Community

- Incentives (direct cash, in-kind and fiscal) are required to support institutional and legal mechanisms, and in all cases must reflect the management requirements of ecosystems, and be linked clearly to changes in behavior. Tax deductions, exemptions and credits require the ability to levy and collect taxes. Disincentives include refundable damage deposits for forest concession, taxes as disincentives to environmentally destructive land development, and pollution taxes on industries located in environmentally sensitive areas.

Financing

- Protected areas should receive a fair return on the money they bring into the economy to provide incentives for conservation and management of these areas. Sources include: entrance fees, diversified endowment portfolios, water fees from irrigation projects or hydroelectric installations that benefit from the area, special taxes on timber extraction, wildlife, and wildlife products and concession rights..

International Conventions and Support

- International agreements support soil observation indirectly by providing binding, legal obligations that become the basis for national implementing legislation.

Nature Tourism

- Tourism provides funds and promotes conservation and preservation of natural resources, however it must be controlled so that the carrying capacity of the resource is not exceeded.

Wildlife Protection and Trade

- The impact is very indirect. When forests lose their value for wildlife habitat, their total economic value is reduced and conversion to other uses more likely.

FISHERIES: WATER AND WATERSHED MANAGEMENT

- Water and watershed management policies directly affect the productivity of fisheries. Declining catch of marine fish species is caused by pollution, destruction of coastal breeding and nursery grounds, and overfishing. Damaging levels of sediments, nutrients (nitrogen and phosphorus) and toxins (synthetic organic compounds and heavy metals) in coastal water are created by pollutants in runoff from agriculture, logged forests, urban streets and municipal industrial discharges. Policies that slow the destruction of watershed capacities and reduce the pollution of water entering critical coastal zone habitats will positively affect fisheries productivity.

Water Control, Use, and Pricing

- Where the price of water is zero because it is treated as an open access good or is too low, water is wasted or used as a reservoir for dumping pollutants. Subsidies promote overuse and waste, encourage use for less valuable alternatives, and discourage conservation. Sedimentation from erosion in upper watersheds adds to the contamination problem. As contamination increases, the availability of clean water decreases, and treatment for specific uses will add to the costs of obtaining adequate water supplies. Requiring the "polluter to pay" the costs of treatment can help limit pollution and pay for necessary remediation.

- Pump charges on individuals who extract from the aquifers promotes lower pumping rates. Taxes can be charged on inputs that are known to pollute, such as fertilizers and pesticides, and the revenue used to monitor discharge or invest in water treatment.

Watershed Management

- Watershed policy is a collection of policies from many sectors that have consequence for resource use in a geographically delineated unit that encompasses biophysical, socioeconomic, and political interactions. Treating the watershed as a unit of analysis and object of development encourages planners to include impact on fisheries.

- Watershed management policies must focus on upstream inhabitants because their actions will determine the quantity and quality of water arriving in coastal zones from the watershed.

- Well-defined private or communal property and usufruct rights for land and resources in the watershed protect the rights of resource users and promote long-term use to reduce downstream pollution.

- Coordination among governmental institutions responsible for managing the resources in the watershed and public participation in the establishment of overall management goals and choice the incentives improves watershed management and will be essential for coastal zone management.

Irrigation Provision and Pricing Policies

- Public sector irrigation is heavily subsidized which results in excess demand and nonprice rationing systems. Low charges contribute to the cultivation of relatively low-value or water-intensive crops and slow adoption of water-conservation technologies and practices. Charges based on volume provide incentives for more efficient use and will reduce excessive seepage into aquifers, risks of waterlogging and reduce demand for additional large-scale and costly irrigation system expansion.

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FISHERIES: COASTAL ZONE MANAGEMENT

Policies Affecting the Quality of Coastal Resources

- Coastal breeding and nursery grounds include wetlands, mangroves, salt marshes, seagrass beds, estuaries, and coral reefs. Any activity that degrades the ability of watersheds to buffer coastal zones from sedimentation and contamination can negatively affect the population of fish for commercial markets and domestic use.

- Subsidies for certain activities can contribute to coastal resource degradation. Subsidies: (1) for mariculture destroy the breeding habitat for commercially valuable fish; (2) for cattle promote downstream sedimentation and contamination of breeding and nursery areas; (3) for agricultural inputs results in increased sedimentation and contamination of coastal waters.

- The impact of investment incentives depends on the activities and sectors favored. Intensive shrimp culture destroys breeding areas. Promotion of tourism along the coast without adequate planning and control to deal with appropriate land use and contamination from wastewater can lead to destruction of reefs and other breeding areas. Fiscal instruments such as taxes on effluent discharges and user fees for garbage disposal, and regulations to limit the amount of contamination in coastal waters and along the shorefront will improve the quality of breeding areas.

- Integrated coastal zone management plans encompass a coastal ecosystem, and to the extent that policy integration takes place, will have a positive impact on breeding and nursery areas.

Policies Affecting the Use of Coastal Resources

- Policies that establish secure property rights or use rights will probably be the most effective. Ownership by the state creates an open-access resource leading to rapid overharvesting and destruction of coastal habitat. Legislation that prohibits or controls use of coastal zone resource is ineffective because the implementing institutions are generally weak. Under private ownership, the value of the resource in terms of wildlife habitat and environmental maintenance will not necessarily influence decisions about their use. Regulations such as zoning, licensing, concessions, and other controls on resource use are effective only with adequate administrative capacity. Community ownership and use rights shows promise.

Policies Affecting the Management of Fisheries

- Fisheries are open-access resources, and government declarations of ownership and establishment of regulations and controls seldom yield beneficial results. Without the ability to exclude unauthorized users, fisheries management is problematic.

- Subsidies and credits to support the fishing industry result in harvesting of greater numbers of fish and damage to marine ecosystems. Regulations have not been effective. Biological management measures such as mesh size regulations, closed areas, and quotas are difficult to implement and have resulted in an increase in the number of users. Controls on equipment and fishing methods are easier to monitor and enforce; however, to be successful they must be coupled with a mechanism to limit the number of fishermen. Taxes and other fiscal incentives limit the number of fishermen as well as the size of the catch in order to preserve stock sizes.

- Use rights are an alternative to open access, and community-based management with individual transferable quotas that can be sold or transferred appears most promising.

BIODIVERSITY: POPULATION

Policies to Slow Population Growth

- The impact of population growth is roughly equal to the population size multipled by the per capita affluence or consumption multiplied by the environmental damage done by the technology used to supply each unit of consumption.

- The impact of population growth is roughly equal to the population size multiplied by the per capita affluence or consumption multiplied by the environmental damage done by the technology used to supply each unit of consumption. Increases in consumption and pollution directly affect biodiversity.

- Government policy on population control affects total and per capita demand for agricultural products and the intensivity and extensivity of agricultural production, resulting in the destruction of natural habitat. Policies to slow population growth would increase per capita family savings, especially among the poor, increase public and private per capita investment in human capital, and reduce income inequality. All would reduce the rate of environmental degradation and positively affect conservation of biodiversity in remaining wilderness protected areas and in agricultural production areas.

- Policies that reinforce the low status of women contribute directly to high population growth rates. Not specifying and enforcing responsibilities of men decreases the status of women. Not promoting smaller families and providing fertility regulation and family planning services reduces individual and social welfare, especially among poor families. Incentives and disincentives enhance the effectiveness of other policy tools.

Redistributing Population

- There is no evidence that internal and external redistribution of population slows population growth rate. Although social and political tension may be reduced in the short term, colonization usually results in unsustainable mining of natural resources, especially the degradation and destruction of forest and coastal habitats. The total long-term financial and environmental costs of redistribution are often high, especially if population is redistributed into ecologically fragile areas.

Gender Discrimination

- There is a strong positive correlation between poverty and the number of households headed by women. The poor are most likely to be penalized by rapid population growth, and women and children are the first to suffer when population growth severely stresses the carrying capacity of an area.

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BIODIVERSITY: MACROECONOMIC POLICIES

Natural Capital and the Economy

- Loss of genetic species and habitat diversity results when the value of the ecological services provided is not included in investment decisions.

Economic Evaluation of Environmental Resources

- Biotic resources are valued for the environmental services they provide, their direct market value, as a store of genetic information, and in terms of their existence values. All of these estimated values are completely dependent on human-centered values, on the technical possibilities, and on competing human needs. Without decision rules that guarantee minimum safe standards for preserving biodiversity, economic evaluation will gradually lead to the extinction of all resources whose value is not measured by the human economy.

Monetary and Credit Policies

- Expansion of the money supply and inflation causes the value of domestic currency to fall, discourages savings, and encourages people to invest in foreign markets rather than in the long-term productivity of domestic markets. The consequence is decreased concern with long-term management and more rapid mining of natural resources. High interest rates make the present value of future consumption low which encourages short-term, high-yield investments that often directly destroy natural habitat and/or reduce species diversity through input-intensive cultivation of a few high-yield crops.

- The impact on biodiversity of government intervention in credit markets depends on the direction of the intervention. Subsidized credit for cattle, mariculture, machinery, large-scale agricultural production, investment in infrastructure in isolated areas or near protected areas, encourages loss of habitat. Subsidized credit for extraction of nontimber products and community management of coastal zones and forests will probably slow the rate of biodiversity loss.

Exchange Rates

- Overvalued exchange rates have resulted in underinvestment in sustained management of most natural resources. Floating exchange rates, in the absence of other protective policies will shift production in favor of agricultural exports, which will continue to put pressure on remaining areas of high biodiversity—forested areas and coastal zones.

Fiscal Management

- Fiscal deficits limit the ability of government to provide management and conservation services. Foreign exchange required to pay interest on foreign debt is generated by increased exports of timber and agricultural commodities. Both may contribute directly to loss of habitat and to reduced species diversity within agricultural areas. Reducing government debt may also increase pressure on important habitats as poverty drives expansion of subsistence agriculture and spontaneous colonization. In the long term reducing government debt should decrease the rate of biodiversity loss.

Structural Adjustment Lending

- Structural adjustment loans are a mix of policies that may have positive or negative effects depending on how investment incentives are directed.

BIODIVERSITY: TRADE AND INVESTMENT POLICIES

Export Promotion

- Tariffs generally have had an antiagriculture and antiexport bias, which diverted resources to less competitive activities and resulted in inefficient use and degradation of the most easily accessible resources, including biotic resources. Increased trade and export promotion in developing countries will mean increasing the production of agricultural exports, timber, and minerals, which will put pressure on less accessible resources, threatening remaining areas of rich biodiversity.

- Trade-generated economic growth brings more materials and energy through the economic system and places increased demands on exhaustible resources. Export promotion policies have encouraged nontraditional agricultural exports, especially mariculture, that use increased chemical inputs and reduce the species diversity within the crop. The impact on biodiversity of special incentives and trade liberalization in general will depend on the activities and sectors favored and on their impacts on remaining natural habitats and the upstream natural resources they depend upon.

- Structural adjustment loans have decreased public expenditure, tighten monetary policy, and devalued exchange rates. This set of policy reforms has had recessionary effects that have in many cases increased poverty. When combined with rapid population growth this has lead to degradation of open-access resources, which in most cases are the last remaining areas of high biodiversity.

- International trade agreements will have axed impact on biodiversity conservation. GATT reduces the scope for environmental policy, while NAFTA potentially creates economic incentives to link environmental protection with trade-generated economic growth, especially the requirement to comply with international treaties such as the Convention on the Preservation of Biodiversity.

Privatization

- Privatization is expected to result in increased investment and adoption of new technology, which is often more environmentally friendly. However, without effective environmental control policies, privatization can result in greater pollution. The impact of privatization of natural resources and utilities (water, energy, and waste disposal) could have a positive impact on biodiversity in coastal zones and forested areas through improved resource management and more rational pricing.

Foreign Direct Investment

- The two resource areas of highest biodiversity—forests and coastal zones—are vulnerable to foreign investment. Remaining forest habitats will be degraded and destroyed unless royalties collect resource rent, concessions are allocated in an open and competitive manner, and management plans are enforced. As the ultimate downstream resource, coastal zones will absorb the full environmental impact of foreign (and domestic) investment in all sectors, and that impact will depend on special incentives and policies in those sectors. In general any environmental cost that is not absorbed by the sector that produces it will be passed on to coastal zones and result in degradation of marine habitats.

BIODIVERSITY: ENVIRONMENTAL MANAGEMENT

Protection of Environmental Quality

- Biodiversity is threatened directly by exposure to pollution and destruction of habitat, especially freshwater and coastal habitats, and indirectly through the accumulation of toxins in the food chain. The accumulation of damaging levels of pollutants results from the free disposal of wastes into the air, surface water, and groundwater.

- Many environmental management policies raise the price of pollution disposal to encourage polluters to find their own cost-minimizing amounts of pollution. Analysis of available empirical evidence finds no data to support a negative relationship between environmental regulation and economic growth.

Water Quality

- Water quality affects biodiversity when water pollution reduces populations of aquatic organisms that provide the first levels of forest and marine food chains. Technology-based standards for protecting water quality may not be a cost-effective means of pursuing water quality goals. Ambient standards can reflect local water quality needs better than uniform technology-based standards; however, they do not provide information on which point source to control when pollution exceeds tolerance levels, nor do they deal with downstream concerns.

- Effluent charges in place of direct regulation allow polluters to decide how to most efficiently reduce their level of pollution.

- Subsidies redistribute the burden of pollution control from polluters to society; they may facilitate the adoption of better pollution control by individual facilities, but pollution control will not be accomplished at cost-minimizing levels. Tax exemptions are a special form of subsidy.

Air Quality

- Air quality indirectly affects biodiversity through the deposition of airborne pollutants onto soil and water bodies. Technical standards for stationary and mobile sources are usually established at the national level. Delegation of regulatory authority to the local level increases the ability to adjust standards to local needs and therefore to keep overall protection costs down, but does not address downstream pollution.

- Emission charges are designed to achieve target levels of pollution reduction while avoiding the inflexibility of direct regulation.

- Tradable pollution rights allow regulatory authorities to retain greater control over total pollution levels than emission charges, and rely on economic incentives to reduce costs of control.

Land disposal

- Land disposal policies have a direct impact on the pollution levels of soil around disposal sites, and on downstream soils when pollutants enter surface and groundwater. When pollution reaches threshold levels, it kills individual animals and destroys habitat. Economic instruments are not used as significant alternatives to direct regulation of hazardous waste management, but are typically used to reinforce direct regulations or provide a source of public revenue. The impact of policy tools such as financial accountability, fees, product charges, and liability is unclear because they exist within larger programs of direct regulation.

BIODIVERSITY: ENERGY

Fossil Fuels

- The demand for and use of fossil fuels affects biodiversity primarily through its impact on forests and aquatic habitats. Damage to freshwater and marine habitats occurs from oil spills, improper disposal and urban and industrial run-off. An indirect impact occurs through destruction of forest habitat as forests are harvested to generate foreign exchange to purchase fossil fuels.

- Adoption of conservation measures and energy efficient technologies costs less than the investment required for developing new sources of supply. Greater energy efficiency and elimination of price distortions could lower total energy consumption in most countries by 20% or more, saving millions of dollars in foreign exchange.

- Pricing policies determine demand. In general the lower the price of energy the more people consume. Marginal cost pricing will result in increased economic efficiency but result in relatively high prices for energy, especially electricity. Subsidies support the objective of social equity, however, they increase demand, may lead to spending a greater proportion of foreign exchange in importing fossil fuel, and tend to discourage adoption of conservation measures and utilization of renewable energy sources. Subsidies with positive environmental impacts hold promise.

- Greater energy efficiency can achieved through regulations and codes that impose efficiency standards on appliances, industrial production, and building design. Taxes are most effective where the diversity of energy users and technologies make administrative of regulatory solutions difficult. Taxes on gasoline and other fossil fuel products raise the price and decrease consumption levels.

- Investment policies are often designed to meet demand at peak loads resulting in excess generating capacity that represents a serious cost to the country and an inappropriate use of scarce investment capital and foreign exchange.

- Exploration for fossil fuel opens access to remote areas to colonization and may contribute to deforestation.

Hydroelectric Energy

- Creation of a large reservoir promotes use of irrigation for production of commercial crops, which may lead to further deforestation and inappropriate land use having downstream negative consequences for biodiversity in coastal breeding and nursery grounds.

Alternative Fuels

- The promotion of alternative fuels will require removing biases (taxes, subsidies, and other distortions) against the adoption of nonconventional technologies.

- Elimination of price subsidies for fossil fuel energy will make investment in alternative fuels attractive, as will guaranteed sales to centralized grids for energy derived from alternative sources. Tariffs on imported equipment such as solar panels, batteries, and other electrical generating or storage devices make their use less attractive compared with traditional energy sources.

BIODIVERSITY: AGRICULTURE AND LIVESTOCK

Product Price Controls

- Price ceilings at the producer level reduce returns to agricultural activities, creating negative incentives for investment in long-term conservation activities for forests, soil, and water. If price floors are above the marginal production costs, they encourage overproduction and/or overuse of inputs. Depending on the location and scale, this reduces forest cover and has negative downstream impacts on fish breeding habitats in streams, rivers, estuaries, and along coastal reefs. The cumulative effect is the reduction in the number and diversity of species and aquatic habitats.

Input Subsidies and Prices

- Credit subsidies for agriculture and livestock encourage overuse of inputs. Subsidies for agricultural machinery prompt forest clearance by lowering the financial cost of land preparation. Interest rate ceilings are often subsidized and promote capital-intensive forms of agriculture. Pesticide and fertilizer subsidies encourage excessive application and lower the cost of using pesticides relative to other more labor-intensive control methods that are less likely to degrade soil and water resources. Depending on the location, production technology, scale of activities, and threshold contamination levels, the result may be a reduction in the number and diversity of species and aquatic habitat.

- Direct subsidies such as a favorable exchange rate; tariff and foreign exchange allocation for imported fertilizers; preferential pricing of energy, feedstocks, and transport service for domestic production; and subsidized credit distorts the choice of crops toward less diversified and more chemical-dependent cropping patterns.

Direct Government Activities

- Direct government involvement in distribution of agricultural and livestock inputs tacitly promotes input-dependent methods of cultivation and overuse of agrochemicals. Depending on the inputs distributed, it shapes land use be influencing crop choice and the choice between agriculture and livestock. The cumulative effect may be a reduction in the number and diversity of species in forest and aquatic habitats.

Regulation of Pesticides

- Direct regulation of pesticides restricts the types of pesticides that may be used in a country; however, soil and water contamination often results from improper application of approved pesticides rather than from use of banned pesticides.

- Indirect regulation exists through import tariffs and other import regulations. Tariff regimes that (1) favor agricultural inputs in relation to other inputs encourage more pesticide use than would occur under a neutral tariff regime; (2) favor export crops that rely heavily on pesticides encourage greater pesticide use. Both reduce biodiversity within the agricultural system and have negative downstream impacts on biodiversity in aquatic habitats.

Livestock Policies

- Livestock policies include subsidized credit, fiscal incentives, tenure policies, and provision of infrastructure. Fiscal incentives for livestock include accelerated depreciation, tax holidays, beneficial relative export duties, and low property and land taxes. All promote expansion of pastures at the expense of tropical forests and can have negative impacts on soil and on water quantity and quality. The cumulative effect is a reduction in the number and diversity of species, especially in forest and aquatic habitats.

BIODIVERSITY: FOREST

Concession and Licenses for the Use of Public Timber

- The destruction of tropical forests and coastal zone habitats are the prime cause of biodiversity loss. Short duration or insecure concessions on public land encourage conversion of land; management plans that do not promote easy compliance, and are not technically based, or well enforced encouraged conversion of land. Concessions awarded non-competitively that do not collect economic resource rent encourages rapid depletion and conversion to other uses. Depending on location all these contribute to loss of biodiversity directly in forests and through downstream impacts on biodiversity in coastal habitats.

Forest Revenue Systems

- Forest charges on public timber that do not reflect global scarcity prices encourage inefficient use. Charges on processed timber products reduce incentives for domestic processing and reduces the local value of timber. Charges on minor forest products discourages their development, reducing the value of the forest stand making long-term management and exclusion comparatively less attractive. Depending on location and scale these policies promote behavior which sets in motion a chain of environmental down stream negative impacts culminating in destruction of biodiversity in forest and coastal habitats.

Forest Industry and Export Policies

- Log bans or quotas unless supplemented with effective enforcement of forest management are unlikely to reduce deforestation. Tax and tariff protection undermines incentives to minimize costs which increases pressures on forest resources. Tax credits, preferential interest rates, credit lines for forest industries, import duty exemptions and accelerated depreciation have the same effect if carried on too long. Depending on location and subsequent land use patterns, these policies contribute to loss of natural forest habitat, to loss of coastal zone habitat, through downstream pollution.

- Direct government involvement in forest-related industries is usually characterized by corruption and inefficiency and subsidized by other revenues. Price controls on lumber products encourage purchase of high-value wood for inappropriate uses, discourage uses of secondary species, reduce the value of the resource and encourage inefficient use and long-term unsustainability.

Private and Community Forest Management

- Community forest management reduces uncertainty and should help to slow the rate of deforestation and degradation of coastal zone marine resources.

Fuelwood and Other Biomass

- Fuelwood demand and extraction can contribute significantly to deforestation, watershed deterioration and downstream reduction in water quantity and quality. Policies that address fuelwood supply will have a positive effect on protecting remaining areas of high biodiversity.

Reforestation Policies

- To have a direct impact on protection of biodiversity, fiscal incentives for reforestation need to be part of a larger watershed and coastal zone management plans.

BIODIVERSITY: LAND TENURE AND COLONIZATION

Land Tenure and Markets

- Insecure and uncertain tenure of land ownership for large and small farmers promotes accelerated exploitation of resources. Many state-owned resource areas, such as forests, wildlands, and coastal zones, are subject to unchecked exploitation because governments lack the ability to enforce control over resources. These areas also have the richest biodiversity. Skewed land distribution in the context of rapid population growth rates also contributes to loss of biodiversity by forcing small untenured farmers to settle in remaining wilderness areas.

- Private property may allow an individual to recoup benefits from sustained resource management. If, however, low resource endowments are combined with poverty the individual will rationally degrade the resource even when tenure is secure.

- Lack of tenurial security for communally managed indigenous lands encourages invasion by colonists and conversion to inappropriate uses often causing downstream contamination of streams and rivers. Tenure security for lowland coastal forests traditionally managed by indigenous groups will be important for the sustained management of habitat that provides coastal breeding and nursery grounds.

- Lack of active land markets and ability to transfer ownership rights prevents users from capitalizing on investments in forest management and soil conservation, and generally leads to conversion of land from more to less efficient uses. Lack of land markets also inhibits the willingness of lenders to accept land as collateral and thus reduces incentives to conserve capital as standing timber.

Colonization and Reform

- Most government-sponsored colonization programs do not match land use capability with the proposed use, and colonization programs are often established on land types that are inappropriate for agricultural uses, resulting in deforestation and soil erosion. Deforestation of public and private land is encouraged by land clearing requirements for tenure and policies that grant rights to squatters for improvements they make to land. Indirect government policies to create infrastructure supporting formal colonization often results in spontaneous colonization especially in open-access resources. Spontaneous settlements increase tenure insecurity and degrade open-access resources, leading to deforestation, soil erosion, depletion, and compaction, and increasing levels of pollutants in runoff from agriculture and logged forests.

Land Use Capability and Planning

- Land use capability systems provide a key policy tool for shifting from command-and-control regulatory policies to market-based incentives to promote sustainable use. Such a system provides the basis for development programs, credit, zoning, taxes, and subsidies, all of which have a direct impact on land use and on its downstream impacts on water quality and coastal fisheries.

BIODIVERSITY: INDIGENOUS PEOPLES

Indigenous Land Rights

- Most remaining forested wildland areas in Central America are occupied by indigenous groups. These areas are also important habitats for a rich array of biodiversity. Indigenous groups have evolved usufruct strategies that have not exceeded the forest's regeneration capacity, and they currently offer a cost-effective alternative for managing and protecting large tracts of tropical forests.

- Attempts to establish private property rights have focused on individual ownership of small tracts of land, which has led to invasion of communal lands by landless colonists and the massive destruction of habitat as forests are converted to unsustainable agriculture.

- Indigenous models of land use and management in tropical rain forests maximize the number of crops produced in order to minimize the risk of crop failure, which directly contributes to preserving biodiversity.

- Old values and assumptions led to policies that attempted to integrate indigenous populations into modern social and economic development, ensuring the destruction of their culture and along with it an end to their sustainable communal management of large forested areas. Newer values and assumptions view diversity of all kinds (including cultural diversity) as a source of adaptive strength and resilience. These have lead to increased emphasis on the protection of human rights (including communal tenure), decentralized management, local participation, and renewed interest in the convergence of conservation objectives with those of indigenous peoples.

Resource Management

- A clearly marked boundary, patrols for surveillance, and legitimate procedures for warning and evicting colonists are required to thwart invasions.

International Legal Instruments

- Sustainable use of the remaining forested areas in Central America and the conservation of biodiversity within those areas will depend on the way in which the rights, projections, and responsibilities of the indigenous groups occupying them are specified. International human-rights agreements provide the initial legal basis for addressing the incursion of outside development interests.

Changing Values and Moral Persuasion

- New values that stress preservation of future options, resilience over efficiency, and the protection of cultural diversity are leading to policy guidelines to protect indigenous rights to traditional lands and resources and to promote the participation of indigenous peoples in the use and protection of those areas. This will promote greater cultural diversity, preservation of biological diversity, and long-term sustainable resource management.

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BIODIVERSITY: PROTECTED AREAS AND WILDLIFE

Types and Legal Basis of Protected and Reserved Areas

- A main objective or protected and reserved areas is to protect biodiversity. Tropical forests have more different species than any other terrestrial habitat. Marine environments surpass tropical forests, with most of that diversity concentrated in coastal waters. Protected areas in Central America are being rapidly degraded through human encroachment. Population pressure and poverty are the main threats.

- Without the ability to protect these areas, an integrated package of incentives that alter individual decisions about the gains and losses associated with various uses will be required to change behavior.

- Land use capability systems are a key policy reform for market based incentives for slowing the rate of land conversion, soil degradation, and subsequent reduction in water resources, however institutional resources are a limiting factor.

- Approaches for addressing conflicting surrounding competing uses of protected areas (or environmental issues in general) include judicial, administrative, legislative, arbitration and popular action and denouncements. Arbitration, mediation, and conciliation are promising but have had little use in Central America. Popular denouncements allow individuals and groups to bring to the attention of administrative or judicial authorities actions by private or public agencies that have illegal environmental consequences.

Resource Management and the Local Community

- Incentives (direct cash, in-kind and fiscal) are required to support institutional and legal mechanisms, and all cases must reflect the management requirements of ecosystems, and be linked clearly to changes in behavior. Tax deductions, exemptions and credits require the ability to levy and collect taxes. Disincentives include refundable damage deposits for forest concession, taxes as disincentives to environmentally destructive land development, and pollution taxes on industries located in environmentally sensitive areas.

Financing

- Protected areas should receive a fair return on the money they bring into the economy to provide incentives for conservation and management of these areas. Sources include: entrance fees, diversified endowment portfolios, water fees from irrigation projects or hydroelectric installations that benefit from the area, special taxes on timber extraction, wildlife, and wildlife products and concession rights.

International Conventions and Support

- International agreements provide binding, legal obligations that become the basis for national implementing legislation, and in the case of the North American Free Trade Agreement ties accession to compliance with major international treaties.

Nature Tourism

- Tourism provides funds and promotes conservation and preservation of natural resources, however it must be controlled so that the carrying capacity of the resource is not exceeded.

Wildlife Protection and Trade

- International trade in wildlife has contributed significantly to the extinction of wildlife species of flora and fauna. Because wildlife trade results from high demand and high prices in combination with extreme poverty it has been difficult to implement national and international treaties like CITES.

BIODIVERSITY: WATER AND WATERSHED MANAGEMENT

Water Control, Use, and Pricing

- Water policy and watershed management policies directly affect the level of biodiversity in forests and coastal zones. Tropical forests have more different species than any other terrestrial habitat. Marine environments surpass tropical forests, with most of that diversity concentrated in coastal waters. Damaging levels of sediments, nutrients (nitrogen and phosphorus) and toxins (synthetic organic compounds and heavy metals) in coastal water are created by pollutants in runoff from agriculture, logged forests, urban streets and municipal industrial discharges. Policies that slow the degradation of watershed capacities and reduce the water and pollution entering critical coastal zone habitats will positively affect level of biodiversity of tropical forests and coastal zones.

- Where the price of water is zero, because it is treated as an open access good, or is too low, water is wasted or used as a reservoir for dumping pollutants. Subsidies promote overuse and waste, encourage use for less valuable alternatives, and discourage conservation. Requiring the "polluter to pay" the costs of treatment can help limit pollution and pay for necessary remediation.

Watershed Management

- Watershed policy is a collection of policies from many sectors that have consequence for resource use in a geographically delineated unit that encompasses biophysical, socioeconomic, and political interactions.

- Policies that improve watershed management will also contribute to protecting biodiversity in the watershed and in downstream coastal zones. Financial incentives can be used to compensate upstream watershed occupants for long-term management and conservation. Taxes can be placed on downstream areas of watersheds (on property, water use, agricultural inputs) to raise revenue and provide incentives for improved upstream land management, and to bring direct user costs more in line with the true costs of using these inputs.

- Well-defined private or communal property and usufruct rights for land and resources in the watershed are an important policy tool to protect the rights of resource users and promote long-term use.

- Coordination among governmental institutions responsible for managing the resources in the watershed and public participation in the establishment of overall management goals and choice the incentives improves resource management and implementation.

Irrigation Provision and Pricing Policies

- Public sector irrigation is heavily subsidized in many countries. To the extent that it promotes intensive agriculture, deforestation and contamination of marine breeding and nursing area, it contribute to loss of biodiversity. Low charges contribute to the cultivation of relatively low-value or water-intensive crops, slow adoption of water conservation technologies and practices, increased charges based on volume provide incentives for more efficient use. This will reduce excessive seepage into aquifers, reduce risks of waterlogging and reduce demand for additional large-scale and costly irrigation system expansion.

BIODIVERSITY: COASTAL ZONE MANAGEMENT

Policies Affecting the Quality of Coastal Resources

- Biodiversity of marine habitats surpass that of tropical forests, with most of that biodiversity concentrated in coastal waters. Any activity that degrades the ability of watersheds to buffer coastal zones from sedimentation and contamination can negatively affect coastal zone productivity, and at some threshold level can reduce coastal zone biodiversity. The reverse is also true. Any policy that improves the management of upstream resources to reduce contamination of coastal areas will have positive impacts on biodiversity in natural forests and agriculture.

- Depending on the activity favored, subsidies can contribute to coastal resource degradation or encourage activities that contribute to sustainable use of upstream and downstream resources.

- The impact of investment incentives depends on the activities and sectors favored.

- Integrated coastal zone management plans encompass a coastal ecosystem, and to the extent that policy integration takes place will benefit biodiversity in coastal areas and watersheds.

Policies Affecting the Use of Coastal Resources

- Licensing, concessions, and other resource use controls are often ignored, and thus have little impact on biodiversity protection.

- Policies that establish secure property rights or use rights will probably be the most effective. Ownership by the state creates an open-access resource leading to rapid overharvesting and destruction of biodiversity. Legislation prohibiting or controlling use of coastal zone resources has been ineffective. Where private ownership regimes hold, the value of the resource in terms of wildlife habitat and environmental maintenance will not necessarily influence decisions about their use.

- Regulations such as zoning, licensing, and concessions are effective only with adequate administrative capacity. Community ownership and use rights shows promise.

Policies Affecting the Management of Fisheries

- Without ability to exclude unauthorized users, overfishing puts increasing pressure on biodiversity.

- Subsidies and credits to support the fishing industry result in harvesting of more fish and damage to marine ecosystems.

- Biological management measures (mesh size regulations, closed areas, and quotas) have proved difficult to implement and resulted in an increase in the number of users. Controls on equipment and fishing methods are easier to monitor and enforce; but must be coupled with a mechanism to limit the numbers of fishermen. Taxes and other fiscal incentives can limit the number of fishermen and the size of the catch.

- Use rights and community-based management with individual transferable quotas that can be sold or transferred is promising for limiting the impact of overharvesting on biodiversity.

Population

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Population

Policies to Slow Population Growth

Key Points

- Population policies are shaped by the beliefs and assumptions about behavior.
- A strong government position on population growth is the most influential policy tool.
- Population multiplies the impact of a set of poorly understood relationships among policy, human behavior, and natural processes.
- Population policies buy time to develop solutions to the immediate causes of resource degradation. Policy formulation in all sectors must take into account the impact of demographic trends.
- For a given amount of resources, a slower rate of population growth helps promote economic and social development.
- The poor are most likely to be penalized by rapid population growth, and women and children are the first to suffer when population growth severely stresses the carrying capacity of an area.
- The problem, as experienced locally, is not population density, but carrying capacity—the number of people in an area relative to the capability of the environment to sustain the human activity.
- According to Abernethy (1993) the most powerful factor in overcoming large-family-size norms is the perception that children have a net economic cost.
- A population policy that successfully reduces growth rates will have little immediate impact on reducing stress on natural resources.
- The demand for family planning information and fertility regulation services will increase dramatically during the next decade. Present estimates indicate that resources from donors and host countries will be inadequate to meet this demand.

Likely Impacts of Slowing Population Growth

GROWTH

- Increased per capita family savings, especially among the poor.
- Increased public and private per capita investment in human capital (health, education, and training) leading to increased per capita productivity and income.
- Increased quality of the labor force and increased productivity (measured in increased real wages) as per capita savings and capital stock accumulation increase.

WELFARE

- A slower rate of population growth would promote economic and social development.
- Reduced income inequality will result if the slower rate of population growth results in higher per capita savings and capital stock accumulation.
- Relative status of women should rise with reduced population growth, and the percentage of the population in poverty should be reduced.
- Decreased political and social instability caused by population-induced environmental degradation and environmental scarcity.

CONSERVATION

- There will be little immediate impact toward reducing pressure on natural resources because it will take 25 years for the population to stabilize after replacement fertility is reached.
- Positive short-term improvement in protection of biodiversity in and around protected areas, and long-term reduction of the pressure on natural resources.
- Increased welfare accompanying lower growth rates should increase the demand for conservation of remaining resources.

Population Growth Issues

Population is the multiplier for the cumulative impact of the many poorly understood relationships among policy, human behavior and natural processes. Thus, the per capita benefits of any policy intervention in Central America that "improves" the situation by 20 percent will be equalized in less than 10 years due

to Central America's 2.55 percent per year average population growth rate. A 1 percent improvement will be equalized in less than six months (United Nations 1991).

Impact (I) of population growth is roughly equal to the population size (P) multiplied by the per capita affluence or consumption (A) multiplied by the environmental damage done by the technology (T) used to supply each unit of consumption: $I = P \times A \times T$. The problem is not population density, but carrying capacity—the number of people in an area relative to the capability of the environment to sustain the human activity (Erlich 1991).

Carrying capacity links three concepts: (1) population size, (2) population wealth, and (3) population location and distribution. Carrying capacity is the number of people with a given standard of living that can be supported sustainably in an area with a given resource base and level of technology. Critics of this concept claim that it underestimates the capacity for technological innovation and does not take into account trade or government intervention (de Sherbinin 1993).

The relationship between population density and resource degradation is complicated by property and land tenure policies. Land tenure policies become population and resource policies when they promote large-scale migration into marginal frontier areas. Economic policies that depress wages and employment change demographic patterns. The absence of policies to relieve poverty or regulate population growth become natural resource policies (Cruz 1992).

Population issues (growth rates, age structure, size, distribution and migration) influence and are influenced by policies in other areas. Solid empirical work is limited and based largely on global aggregate statistical measures. There is little consensus on the exact causal links among population and other policy variables (United Nations 1991).

Declining mortality and high birth rates caused rapid population growth during the first two decades following World War II. Economic policies biased against agriculture, archaic land tenure, and policies promoting import substitution resulted in rapid urbanization and reduced the ability of rural areas to absorb increased population. This led to the congestion of employment markets and government services and to the displacement of agriculture into marginal lands.

Growth rates began to slow in the mid-1960s as modern contraceptive methods became available through family planning programs. Increased use of contraception accounts for 76 percent of the decline in population growth rates (Merrick 1986).

In 1990, the population of Central America (excluding Mexico) was 29 million, with an average growth rate of 2.55 percent per year and an average doubling time of 25 years (Merrick 1986). It will take an additional 25 years for the population to stabilize after replacement fertility rate is reached (Tietenberg 1988). Because 40 percent of the population is under fifteen years old, their fertility will determine population growth rates in the next several decades (Population Reference Bureau 1991).

The demand for family planning services will increase dramatically in the next 20 years as this cohort of females enters reproductive age. The costs of meeting this increased demand, assuming decreasing costs accompany economies of scale, will be about $15 per user per year (Destler et al. 1990, p. 10).

Population growth affects economic growth in two ways: (1) corporate and government savings are not systematically related to population growth rates, but per capita household savings are reduced by high dependency burdens, especially among the poor; (2) the relationship between capital invested per person and per capita income is probably nonlinear because of economies of scale and efficiency gains achieved through innovation. The amount of capital invested per person, especially human capital (health, education, and training) must be maintained in order to maintain constant income. As population grows, available capital is spread over more people. A slower growth rate allows increased capital investment per person, leading to increased per capita productivity and income. For income to rise, investment must grow faster than the labor force (Birdsall et al. 1984).

Mini-Case

If fertility remains the same in Central America, the budget for education must double in 25 years to maintain the same level of coverage and quality. To increase the enrollment rate and/or standards, governments will have to:

- Generate more national savings.
- Curtail investments in other sectors.
- Spread spending over a larger group of children.
- Exclude a growing number of children.

As long as an additional person's marginal product is positive, it will contribute to total economic output. Population growth increases average welfare only when the marginal product of an additional person is greater than the average product. Given sufficient resources (including waste assimilation capabilities), population growth creates additional wealth and drives development processes.

Focusing attention on the positive marginal product of population growth ignores its impact on the average person (i.e., distributional and equity issues). High population growth results in greater income inequality when it lowers per capita savings and capital stock accumulation, leading to lower productivity per worker. It directly reduces the quality of the labor force when it lowers the per capita amounts of family and public resources available for long-term investments in human and natural capital, thus slowing the growth in wages of unskilled workers relative to skilled labor and wealth holders (Birdsall et al. 1984).

When the rate of population growth equals or surpasses economic performance (including the normally uncounted costs such as drawdown of the resource base, pollution, soil degradation, etc.), additional people reduce per capita income and welfare, resulting in environmental degradation and an increase in poverty and income inequality.

Beliefs and Assumptions

The population policy debate has revolved around three major viewpoints, each of which relies on a different set of assumptions and beliefs leading to different policy guidelines. These three views are summarized in Birdsall (1989), Ridker (1992), Shaw (1989), and King and Kelley (1985). In each case, beliefs and assumptions define the problem, which leads logically to policy guidelines.

View 1: Population Growth Causes Environmental Degradation

Beliefs

- Man is part of a finite and interdependent biosystem.
- The increasing scale of the human economy can cause irreversible changes in the capacity of the biosphere to provide life support services.
- Productivity gains from increasing efficiency, innovation, recycling, and substitution are limited in the face of rapid population growth. The likelihood is small that we can develop backstop technologies and manage or control their consequences.
- Market prices will not allocate resources with respect to the carrying capacity of the biosphere on a sustainable scale.

Assumptions

- An increase in the labor force relative to land supply and capital causes wages to fall and rents and profits to rise. This leads to concentration of wealth with property owners and less equal distribution of income.
- The savings rate will not keep pace with the increased population growth rate, causing capital to grow at a slower per capita rate and investment to decline.
- The higher proportion of young people requires an increasing proportion of investment to be devoted to health education and infrastructure.
- Mitigating forces (price changes, substitution, recycling, and innovation) will not offset increasing scarcity, and depletion of natural resources will limit economic development.

Problem Definition

- Rapid population growth combined with growth in per capita income puts pressure on a fixed supply of natural resources, causing prices to rise.
- The winners are those who own resources and their close substitutes. When resources are vital or close substitutes are limited, most people will be made worse off by population growth, especially the poor. Diminishing returns eventually set in as each person has a smaller share, and quality of life declines.
- Technical innovation will not be sufficient to compensate for diminishing returns from limited resources.

Policy Guidelines

- The social cost of individual fertility choices has long-term consequences for broad measures of per capita welfare.
- The most efficient point of intervention is with individuals and their fertility choices.

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View 2: Policy Failure Causes Environmental Degradation

Beliefs

- There are no intrinsic limits to man's ingenuity and ability to manage natural processes.
- Growth is progress. Mitigating forces such as price changes, substitution, recycling and technical innovation will offset increasing scarcity and depletion of natural resources.
- The likelihood of irreversible catastrophic changes in the capacity of the biosphere to provide long-term life support services is not significant.

Assumptions

- Agricultural production can be sustainably increased; land availability is not the constraint. It is poor management and lack of incentives and mechanisms for generating investment.
- There is no evidence to substantiate the impact of demographic change on the share of government spending and little historical correlation between population growth and growth of per capita income.
- The long-run trend in the price of raw materials is downward due to technological progress; elasticities of substitution in consumption and production are high.
- The market's inability to disaggregate and price the natural resources that provide environmental services can be solved by policy intervention.
- The fact that prices guide market adjustments only when resources can be owned exclusively and bought and sold in the market can be solved by assigning property rights.

Problem Definition

- The immediate cause of population growth is policy failure. The problem is unrealized potential, not diminishing returns.
- As resources become scarce, prices rise stimulating technical innovation and the search for substitutes. Population growth is conducive to development and economic growth by providing the stimulus for innovation.

Policy Guidelines

- Aggregate measures, especially of economic growth, are what is important, not its distributional consequences for individuals or localities.
- Economic growth and development are the best contraceptives. Government should not target individual decisions about fertility except to provide education and possibly contraceptive supplies.
- Given limited resources, it is counterproductive to allocate resources to family planning programs rather than to social development.

View 3: Population Growth and Policy Failure Share the Blame

Beliefs

- The short-term consequences for individuals and local communities are the most important.
- The distributional consequences for individuals, especially women and children, override efficiency considerations. Fertility regulation and child spacing are human rights.
- Population policy is an essential stop-gap measure until population growth slows as a response to increased welfare brought about through policy reform. It is unlikely that wide-ranging policy reform can be implemented in the time frame needed.

Assumptions

- View 2 may be correct in the long term, but the short-term consequences of population growth will limit or preclude long-term policy corrections that can lead to sustainable development.
- Development efforts are slowed by rapid population growth, which in turn depletes natural resources and further limits economic development.
- A finite and interdependent biosystem imposes limits to growth and to scale.
- Technical innovation leading to efficiency gains, recycling and substitution can extend those limits, but not indefinitely.

Problem Definition

- Population change is the result of individual decisions made at the micro level in response to a wide range of signals provided by the larger system.
- Population change is one of the components of "vicious" and "virtuous" cycles in which policy intervention is possible at any number of points, each having a different set of winners and losers.

Policy Guidelines

- The issue is where to intervene in a series of interconnected "vicious cycles" to turn them into "virtuous" cycles.
- Socioeconomic development and family planning programs are mutually reinforcing.
- Buying time is an essential strategy.

Fertility Regulation

The discussion of policy tools in this section and the mini-cases are drawn from studies by Harriet Destler et al. (1990) and Stephen L. Isaacs et al. (1991).

Fertility regulation and family planning services can be provided through public- and private-sector delivery systems. These services are increasingly being integrated into broad-based maternal care, health, and nutrition programs that emphasize increased family welfare from child spacing.

When state subsidies are financed appropriately (i.e., the tax system is not highly regressive) and programs are voluntary, public involvement in family planning will improve individual and social welfare. Lowered fertility rates induced by subsidized family planning services reduce inequality in two ways: (1) as a direct form of income to poor households and (2) through the impact on per capita household income. The adverse effects of high fertility on children's health and education are greater in poor families.

A dollar spent on family planning services leads to more fertility reduction than does a dollar spent on education, health, or other programs. One study observed a sevenfold difference in fertility reduction attributable to family planning programs, nutrition programs, or education schemes for rural women.

Studies indicate that over one-third of the women in the developing world who became pregnant in the last twelve months did not want another baby. It costs $10 to $20 per year to provide one woman with the means to control her own fertility, to safeguard her own health and that of her children, and result in lower births in Latin America by 35 percent.

Government support for fertility regulation

In the absence of government support for slowing population growth, access to family planning information and fertility regulation is determined by the market and sociological factors. Market mechanisms alone lead to higher fertility rates among rural and poor populations, which in resource-poor areas contributes to poverty, concentrated disproportionately among women and children (Paolisso and Yudelman 1991), and to environmental degradation. A lack of institutional capabilities to

implement and enforce environmental protection policies, to deliver social services, and to redistribute wealth will result in increasing income inequality, short-term investment horizons among the poor, and mining of natural resources.

A strong government position on population growth is the most influential policy tool. According to Wolfson (1986), government efforts to slow growth rate are best achieved when three conditions exist: (1) visible leaders at high levels clearly state and promote a national policy and social consensus favoring smaller families; (2) there is a national population council (within the Ministry of Interior or Ministry of Planning) to coordinate and monitor population programs; and (3) knowledge about family planning and fertility regulation services is broadly disseminated through the educational system, communications media, and public and private organizations.

Targets

Targets establish measurable qualitative and quantitative goals as an expression of the strength of the government's position. They are a powerful implementation tool to measure progress but must be tied to an evaluation component.

Mini-Case

Before 1972, Mexico had a pronatalist policy. The country had a growth rate of 3.09 percent and a total fertility rate of 6.7 children per female. In 1972, government family planning programs were implemented, and in 1973 the population law was revised "with the object of . . . stabilizing the growth of the population." In 1976, President Lopez Portillo established a target growth rate of 2.5 percent to be achieved by 1982 and further reduced to 1 percent by 2000. The government expanded and promoted family planning services through the Ministry of Health and the Institute of Social Security.

By 1982, the public sector supplied 53 percent of the contraception used by women reporting, compared with 31 percent for pharmacies and 15 percent for private clinics, hospitals, and physicians.

These population control efforts were successful: in 1990, Mexico's population growth rate of 2.01 percent and total fertility rate was 3.11 children per female (Merrick 1986, p. 43).

Promoting smaller families

A variety of methods have been used to change community family size norms. Some examples from Isaacs et al. (1991) include the following:

- Mass media education of the public on population issues and family planning, including the use of traditional folk media.
- Including population dynamics and sex education in school curricula and teacher training.
- Providing population education and information to government workers, health care personnel, and others involved in social services.
- Providing incentives that lower the cost of using fertility regulation techniques and increase the benefit of delaying or limiting pregnancies.

Incentives and disincentives

Incentives are any payments (cash or in-kind) given to individuals, couples, or groups to use contraceptives or to delay or limit childbearing. Examples are payments for attending a community meeting providing information on contraception; compensation for time and travel costs for visits to a family planning clinic; and entitlements designed to change the relative costs of having children and thus directly reduce the demand for children.

Disincentives withhold benefits from those who exceed the desired family size norm. Although the use of incentives and/or disincentives has been common in Asia, it has been considered inappropriate in Latin America, where the voluntary nature of fertility regulation programs has been stressed.

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Mini-Case

Ghana allows only three paid maternity leaves per employee and pays government officers child allowance and travel expenses for only three children.

Thailand pays delivery costs for couples undergoing postpartum sterilization, provides scholarships and housing assistance for smaller families, and ties community incentives such as agricultural credit and animal husbandry to achieving particular fertility targets.

Korea provides medical care and education allowances to two-child families if one parent has been sterilized.

Nepal gives a 20 percent increment in pension for government employees who have two or fewer living children at the time of retirement; a nonnegotiable development bond with a ten-year maturity period to couples with two living children or fewer at the time of sterilization; and free education for all children of parents who have undergone sterilization after having two children.

China provides paid leave for fertility-related operations. Some provinces provide a monthly subsidy for one-child families. To overcome preferences for sons, medical and educational entitlements are in some cases granted preferentially to parents of a single female child. Some provinces require that parents return bonuses obtained for the first child when they have a second child. Some areas impose a 10 percent tax on income on parents who have a third child.

Incentives can be provided by private development organizations. A private group in Thailand offers technical assistance to contraceptive users. Benefits include credits for agricultural inputs such as livestock, feed, construction materials, fertilizer, and seeds.

Incentives also can be targeted to entire communities.

Mini-Case

Indonesia gives prizes and popular recognition to communities that meet fertility targets.

Thailand rewards villages that achieve population targets with development projects such as biogas plants or cooperative stores.

Programs to increase the status of women

In subsistence economies, population pressure is probably the most damaging to women and children. When population growth causes severe pressure on natural resources, women's reproductive capacity is devalued, their rights and freedoms shrink, and their status deteriorates.

Lower fertility rates are positively correlated with the status of women. Higher educational levels, increased income, better nutrition and health, and lower infant mortality rates are all correlated positively with lower fertility rates (Turchi et al. 1991). Fertility reductions resulting from increased status are realized over the long term. The relationship between status and excess fertility is interactive. Any reduction in fertility allows women to make better use of programs for improving status and increases their cost effectiveness.

When the human population exceeds the carrying capacity of the land, high fertillity rates are negatively correlated with the status of women. The causal direction of these relationships is unclear.

Programs to improve the status of women increasingly promote access to fertility regulation as a human right.

Where female education is low, family planning programs have minimal effect; conversely, female education has little effect where family planning services are unavailable (Birdsall et al. 1984, p. 81).

Specifying and enforcing responsibilities of men

Policy statements are increasingly recognizing the importance of specifying men's responsibilities for family planning.

Mini-Case

Nigeria's policy, adopted in 1988, states: "Appropriate information and education programmes shall be designed and implemented to promote awareness by men of their responsibility for adequate caring and for having appropriate family sizes. . . . Appropriate legislation shall be promulgated to discourage and punish men who put underage females in the family way . . . and to ensure that men provide paternal support for any children they father (Isaacs et al. 1991)."

Legal reform

Existing laws, regulations, directives, and informal procedures often affect population growth, composition, distribution, or migration even though they are not intended to do so. Reviewing, analyzing, and identifying needed changes in regulations issued by ministries; codes of medical ethics; labor and tax codes; civil and family codes, and so on, are essential for an effective population policy.

Information collection and evaluation

Fertility regulation and family health policies are strengthened when responsibility for collecting information, establishing targets and indicators, and evaluating programmatic activities is assigned to a specific agency.

The Demographic Transition Model

Current population policy is guided by the demographic transition model. This model underlies most foreign aid programs and current population policies and programs, and postulates that modernization, urbanization, prosperity, education, and declining infant mortality all reduce fertility. That is, if people are better off, they have fewer children.

Recent studies based on assessment of historical trends are questioning the causal direction implied in this model. They suggest that perception of economic oppportunity—new trading partners, cheap land, improved technology, popular revolutions that are expected to redistribute resources, and emigration—stimulates fertility. In many of the cases cited in these studies, deteriorating economic conditions preceded declines in fertility and expectation for a better life in the future preceded increases in fertility (Abernethy 1993).

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Mini-Case

Land distribution to Turkish sharecroppers in the middle of the twentieth century was quickly followed by a baby boom. Some who received land had so many children born after the land redistribution that their family size rose to twice the usual number for that part of Turkey.

A project in Khanna, India, provided an entire village with education, nutritional supplements, public health, and direct medical care. Eventually everyone knew about contraception, villagers had positive attutudes toward the health care providers and family planning, and infant mortality had decreased signficantly. Fertility rates, however, remained high (Wyon and Gordon 1971). Eventually Wyon's group determined that the Khanna people liked large familes; that they were delighted that now, with lower infant mortality and more village services, they could have the six surviving children they had always wanted.

Indonesian farmers on the most crowded islands, eking out a living from the most eroded mountain slopes, have smaller than average Indonesian families. Similarly, the poor in nineteenth-century Sweden were more likely than others to limit fertility (Abernathy 1993).

Indicators: Policies to Slow Population Growth

Problem Indicators

- Changes in rates of population growth, literacy, mortality, and morbidity.
- Change in per capita income, savings, private and public investment in human capital.
- Changes in productivity attributable to deforestation, soil erosion, water and air contamination, fisheries yields, and so forth.
- Access to maternal and child health care.
- Rate of pregnancy and child delivery in high-risk age groups (younger than 20 years and older than 35 years).
- Rate of use of family planning methods.

Policy/Process Indicators

- Policies and programs take into account: (1) The impact they will have on local population growth on local carrying capacity; (2) the impact of population growth on the likelihood of achieving programmatic objectives.
- Availability of fertility regulation information and techniques.
- Government position on population growth rates; targets established and met; incentives and disincentives established; men's responsibilities specified and enforced.
- Policies and programs to increase women's education levels, income, nutrition, and health.
- Other existing policy is harmonized to support the right of couples to choose family size and have access to family planning information and methods.
- A specific agency is responsible for collecting information, establishing targets and indicators, and evaluating programmatic activities.

REDISTRIBUTING POPULATION

KEY POINTS

- There is no evidence that internal and external redistribution of population slows population growth rate.
- Social and political tension may be reduced in the short term, but colonization usually results in unsustainable mining of natural resources.

Rapid growth in the younger age groups combined with unemployment creates a large pool of potential migrants and increases the likelihood of social or political unrest. When rapid population growth degrades the quality of renewable resources and leads to an increasingly inequitable distribution of resources within the country, it could result in resource scarcity, provoke violent conflict, and promote an increasing flow of environmental refugees (de Sherbinin 1993).

Environmental degradation and resource scarcity caused by rapid local population growth contributes to population displacements. Recent research findings suggest that environmental change is one of the many determinants of migration and refugee flows (Suhrike 1993, Homer-Dixon et al. 1992).

"Scarcities of renewable resources are already contributing to violent conflicts in many parts of the developing world. These conflicts may foreshadow a surge of similar violence in coming decades, particularly in poor countries where shortages of water, forests and, especially, fertile land, coupled with rapidly expanding populations, already cause great hardship" (Homer-Dixon et al. 1993).

Internal Redistribution

Urban growth provides economies of scale and differentiated labor markets that accelerate the pace of technical innovation. However, unemployment tends to be higher, and air pollution, congestion, social disturbance and crime increase disproportionately with city size (Birdsall et al. 1984, p. 59).

Efforts to slow rural to urban migration have focused on redistributing population. There is no evidence that these

Likely Impacts of Redistributing Population

GROWTH

- Total long-term financial and economic cost of redistribution are often high, especially if population is redistributed into ecologically fragile areas.
- Some short-term growth associated with provision of new infrastructure (e.g., roads, communications) but at the opportunity cost of (1) investing in more cost-effective improvements in national productivity; (2) improving productivity in the sending areas; (3) investing in family planning and fertility regulation.
- Short-term growth in the receiving area, but long-term decline in productivity.

WELFARE

- Short-term increase in welfare of those relocating as they have access to land. Long-term loss in welfare for the indigenous groups that occupy many of the areas being actively colonized.
- Short-term welfare achieved from reduced social and political tension associated with localized population pressure.
- When displacement to urban areas occurs, general welfare declines because unemployment tends to be higher and air pollution, congestion, social disturbance, and crime increase disproportionately with city size.

CONSERVATION

- Often results in unsustainable mining of natural resources.
- Decrease in conservation of biodiversity because the receiving areas are often on the borders of protected areas.

strategies slow population growth rates. The social, environmental and financial costs of these policies have often been high, and few have achieved their demographic objectives (Birdsall et al. 1984, p. 58).

The colonization of undeveloped areas has been viewed as a solution to problems of population redistribution, political instability, lack of jobs, and inequitable access to land. While demographic pressure and associated social and political tensions are released or redirected in the short term, colonization has often resulted in unsustainable mining of natural resources. A review of World Bank–assisted schemes concluded that it is usually more

efficient to intensify production in already-settled areas than to move people to new areas (Birdsall et al. 1984, p. 58).

Developing new urban centers without establishing the institutional capabilities for managing development activities may displace the deleterious impact of population growth to new areas, which may be even less capable of sustaining high populations.

External Redistribution

According to Abernethy (1993) the most powerful factor in overcoming large-family-size norms is the perception that children have a net economic cost. The effect on fertility of the opportunity to emigrate appears to function as a form of ecological release that relieves population pressure in the sending country and reflects anticipation of opportunity. For example, in some rural areas of Mexico "remittances" constitute more than 80 percent of monthly cash incomes; in El Salvador remittances from Salvadorans living abroad are estimated to be $700 million annually, more than the country earns from coffee and sugar exports (Johnson 1991). Country-of-birth tables published by the U.S. Immigration and Naturalization Service indicate that fertility in high-immigration countries has been slow to decline.

Policies that redistribute population are counterproductive because they falsely signal that population pressure against sources is a local problem (Abernethy 1993).

Indicators: Redistributing Population

Problem Indicators

- Rate of rural to urban migration, and migration into fragile areas from main sending areas.
- Fertility rate in high sending areas.
- Remittances sent home as a percentage of family income and as a percentage of total GNP.
- Per capita spending of family planning and fertility regulation in the sending areas.
- Rate of employment and new investment in job creation in sending areas.

Policy/Process Indicators

- Reform of formal and informal policies that promote internal migration into areas that cannot sustain the new population.
- Resolution of conflict between policies designed to protect biodiversity and to relieve population pressure.
- Investment levels for improving productivity and family planning in sending areas.
- Change in percentage of the population that emigrates from the country and from key sending areas.

GENDER DISCRIMINATION

KEY POINTS

- There is a strong positive correlation between poverty and the number of households headed by women.
- When population growth causes severe pressure on natural resources, women's reproductive capacity is devalued, their rights and freedoms are reduced, and their status deteriorates.

United Nations data indicate that women in subsistence economies work an average of 12 to 18 hours per day compared with an average of 8 to 12 hours per day for men. Women provide goods and labor that are a direct substitute for cash income. Because this work is not valued in terms of money flowing through the economy, their work is often undervalued and unrecognized by economists and development experts.

Women are particularly vulnerable to consequences of environmental degradation because they are responsible for home and agricultural activities that become more difficult as resources are depleted and as local environments are contaminated. Rapid population growth within subsistence economies exacerbates environmental degadation. The health of women and girls is more affected by environmental degradation than the health of men and boys because of the roles females play (Jacobson 1991; 1992).

The declining status of women in subsistence economies is a direct result of gender bias that is manifested in unequal allocation of resources—wages, food, credit, education, jobs, information, or training. Gender bias contributes to poverty because it prevents women from obtaining education, training, health services, child care, training, and legal status. It is an important cause of rapid population growth because as women's access to resources diminishes, the longer hours they must work further lowers their status compared with that of men and keeps birth rates high because women need to rely more on children, especially girls, to augment their efforts.

Likely Impacts of Reducing Gender Bias

GROWTH

- Increased short- and long-term growth as women's productivity increases.

WELFARE

- Increased short- and long-term improvement in the health, nutrition, and education of women and children.

CONSERVATION

- Reduced pressure on natural resources in the short and long terms.

Women suffer disproportionately from overpopulation. Country studies show that status accorded to women, as well as the control women have over their bodies and lives, varies inversely with population pressure (Abernethy 1993; Jacobson 1992).

Mini-Case

Population pressure and treatment of women contrast in two New Guinea societies. The Enga warred constantly over insufficient land, and overpopulation was an unrelenting threat. Enga women and their reproductive capacity were severely devalued. The Enga demanded premarital virginity of both men and women, made every agricultural, hunting, or warlike event an occasion for abstinence, and strangled widows within 24 hours of bereavement. Funerary rituals honored men and pigs but not women or children.

The Fore were chronically underpopulated because Kuru, a fetal neurologic disorder transmitted through a virus, was endemic among women and children. With replacement numbers continually threatened, the Fore intensely valued every person, equally mourned a man, woman, or child's death, encouraged premarital sex, used fertility rituals to encourage growth in their gardens, and dramatized the reproductive role of women. Young girls and widows were enthusiastically courted (Abernethy 1993).

Men are more likely to have access to land and credit and to earn cash wages for their work than are women, and they are less likely than women to spend it on family maintenance. Women who retain control over income and expenditures spend more of it on food, health care, school expenses, and clothing for their children than do men. The relative nutrition of children is

determined by the mother's production of food or generation of cash income and the degree of control she has over her income. Control over income is also correlated with the power to make independent decisons about their fertillity (Jacobson 1991; 1992).

Differences in work loads of men and women shape their economic interests and have implications for the environment and family welfare. Studies show that women, because of their responsibilities for securing food, fuel, and water, tend to have a greater interest in preserving and conserving croplands, forests, and other natural resources for perpetual use, whereas men are more often concerned with converting these resources into cash.

Reducing Gender Bias in Policies and Programs

Due to a lack of education and skills, women in the formal employment sector tend to have jobs that offer little potential for training or advancement and more women are found in the service sector than in the industrial sector.

Women have less access to land, credit, and technologies, and women farmers work longer hours and have fewer assets and lower incomes than men farmers. Women lack the capital necessary to hire workers, have lower literacy levels, and less access to extension services. The number of women working as wage laborers in export agriculture is increasing, and in general they are paid less than men. Farm households headed by women rely more heavily on root crops, subsistence agriculture, and on local rather than export sales of produce. Agricultural development programs often encourage expansion of cash crops by offering market incentives, improved agricultural technologies, credit, and seeds. When access to these resources is dependent on the use of land as collateral, women are further disadvantaged.

The indirect impacts of policies and development programs on the demand for women's labor, the income received for their labor, and the competitiveness of their crops may be unanticipated and run counter to the stated intention. Development strategies that shift control of resources to men or to profit-making enterprises in general often contribute to a decline in the productivity of women, and an increase in the short-term consumption of resources at the expense of long-term sustainability.

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Mini-Case

Agrarian reform laws often make special provisions for women. While the laws usually fail to recognize that women can be the "head of household" (by granting land only to the father figure) they do allow for women to show that the father has abandoned the family. In this case, the woman can receive benefits as the main breadwinner and the head of household.

In civil code jurisdictions, women usually have inheritance rights equal to those of men. However, local groups that decide disputes often give all the real property to the sons irrespective of the law. Also, upon marriage in many societies under customary tenure systems, sons often receive the real estate assets, while daughters get personal property, which they can take with them to their husband's land (Hendrix 1993).

Indicators: Reducing Gender Bias

Problem Indicators

- Average level of education and literacy of women compared with that of men.
- Life expectancy and rates of mortality and morbidity of women compared with that of men.
- Average number of hours worked per day for women compared with that of men.
- Average wage rate for similar work received by women compared with that of men.
- Women's access to land and credit.

Policy/Process Indicators

- Women included as beneficiaries of policies at a level proportionate to their representation in the total population.
- Policies do not implicitly shift control of resources to men.
- New policy creates the same opportunities for women as for men.
- Given gender difference in roles and resources, the impact of the policy on women is analyzed and stated explicitly.
- Policies and programs give access to credit and land to women at same rate as to men..
- Monitoring of policy and program impacts based on sex-disaggregated data.
- Current policies or economic conditions create/reduce barriers to more rapid growth or higher income in the sectors where women's activities are concentrated.
- Policies and programs that improve women's productivity.
- Social security systems.

RESEARCH QUESTIONS

High fertility rates are a function of child mortality rates, per capita family income, economic status of women, education of women, maternal health, contraceptive use, abortion, and age of marriage and perceived reso ·ce limits. For rapidly growing urban populations, rural populations in resource-poor areas, and rural populations in well-established agricultural areas:

1. What is the power of each of these independent variables in terms of changes in fertility rate?

2. Where is it most cost effective to intervene?

3. What are the distributional impacts of intervention at these different points?

If measures of economic growth included an expanded system of national accounts to include drawdown of the value of natural resource capital, what would be the marginal product of an extra person compared to the average product?

Which sectors of the population gain and lose by population growth in economies where it is likely that the social costs of high fertility exceed the private costs, and where market failures such as lack of property rights or distortions are likely to heighten any negative effect of rapid population growth?

What is the relationship between population growth and changes in social and political institutions, status of women, development of democratic processes, and the creation and adaptation of new technology?

If population grows at the current rate, what must the total investment be in five, ten, fifteen, or twenty years to maintain the same per capita investment in human capital? How does this compare to the rate of growth in GNP corrected for resource drawdown?

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Macroeconomic Policies

NATURAL CAPITAL AND THE ECONOMY

KEY POINTS

- Natural resources are the fundamentally important inputs into the economic system.
- Accounting for and valuing the changes in natural assets, as for man-made economic assets, can clarify the interdependency between good resource management and a healthy economic system.

Nature as Capital

Systematic study of the interactions between economic policies and natural resource and environmental outcomes is a relatively new area of inquiry. International acknowledgment of the need to recognize natural resources and environment as economically productive inputs and to integrate this into national accounting systems is quite recent.

The natural environment has traditionally been considered separate from economic life, when in fact they are entirely interdependent. Natural resources are important inputs into production, and the natural environment must absorb the waste that economic production creates. As the world economy grows, the limits to natural resources and the potential of the environment to absorb the wastes from production becomes clear.

National balance sheets may currently reflect accumulating government debts to finance government purchases, but rapidly declining stocks of natural forests and productive soils may not be properly viewed as a potential economic crisis. Although it may be a proper investment to develop natural resources and reinvest the returns in potentially more productive economic assets such as human capital or infrastructure, the transaction should be properly recognized as an asset reallocation.

Likely Impacts of Adoption and Use of Natural Resource and Environmental Accounting

GROWTH

- Increased ability to use resources sustainably, as natural resource depletion issues are addressed.
- Short-term economic losses as policies are adopted to address resource depletion.

WELFARE

- Changes in employment away from depletion activities and toward conservation.
- Improved welfare for future generations.

CONSERVATION

- Sustainable resource use.
- Creation of reserves.
- Preservation of biodiversity.

Likewise economists have traditionally considered the effects of macroeconomic policy on labor and capital inputs, while often ignoring the impact on land or natural resources. Only recently have theoretical studies been initiated to examine the impacts of macroeconomic policy on the environment. But, because many of the inputs that the natural environment offers are public goods, it is particularly important that macroeconomic policy anticipate environmental and natural resource effects.

Natural Resource and Environmental Accounting

The systems of national accounts are an obvious entry to reorganize macroeconomic policy to include environmental assets. The United Nations has just completed the preparation of the *Handbook of Integrated Environmental and Economic Accounting*, which provides guidelines for producing "satellite" integrated

environmental and economic accounts. The accounts are "satellite" in the sense that they are separate from the core economic accounts but entirely compatible with them.

Environmental information was not included in the core accounts because there are methodological and conceptual problems in trying to account for sustainable income. The depletion of resources that have market prices (e.g., timber and mineral resources) can be readily included, but degradation of air and water quality is much more difficult to value. The depreciation of soils—so important for economic production in developing countries—should be included; but is it depletion or degradation? Because techniques for valuing environmental degradation are speculative it is often difficult to distinguish between resource depletion and resource degradation; thus environmental accounts remain in an experimental stage for the present.

The system of integrated environmental and economic accounts described in the U.N. handbook was tested and revised following case studies in Mexico, Papua New Guinea, and Thailand. Guidelines are provided for the treatment of natural capital depletion (especially minerals and timber) and the costs of degradation (of land, water, air). For goods or services that have no market prices, alternative valuation methods are suggested to impute the cost of depletion or degradation. The system allocates environmental impacts to the economic activities that cause (or bear) them and thus can make environmental information available for integration into the economic policy and management analyses that national accounting systems serve.

In addition to the U.N. case studies mentioned above, case studies of natural resource and environmental accounting are currently under way by public and private institutions and individuals in many developing countries to incorporate natural resource and environmental accounting into the systems of national accounts. Industrialized countries such as the United States, France, the Netherlands, and Germany have also invested resources in the preparation of accounting systems that integrate economic and environmental accounting.

Mini-Case

The Tropical Science Center in San José, Costa Rica, collaborated with the World Resources Institute to adjust national income for the depletion of natural resources—especially timber and soil resources. Timber was valued at market prices and soil resources were valued at the replacement cost of fertilizer. The average reduction in income over the ten-year period (1980-89) was about 5 percent. In 1989, resource depletion accounted for almost one half of total agricultural product (Tropical Science Center and World Resources Institute 1991).

Mini-Case

The U.N. Statistical Office and the World Bank worked together with the Instituto Nacional de Estadística, Geográfica e Informática in Mexico to integrate economic and environmental data bases and analyses within the framework of the existing national accounts of Mexico (Van Tongeren et al. 1991). Data availability and financial resources limited the study to oil extraction, deforestation and land use, and environmental degradation such as air and water pollution. The results show that natural resource depletion alone reduced national income by 5.7 percent for the year of the study. When both natural resource depletion and degradation were considered, income was reduced by 13 percent. Further work is under way by Mexican public institutions on environmental accounting.

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Indicators: Natural Capital and the Economy

Problem Indicators

- Rate of resource use for nonrenewable resources.
- Drawdown on renewable resources.
- Quality of biodiversity.
- Quality of water, air, and land.
- Availability of environmental amenities.

Policy/Process Indicators

- Incorporation of natural resource and environmental accounting into national economic analyses and decision making.
- Policies adopted to address resource depletion effects shown by natural resource environmental accounting.
- Improved understanding of economic and environmental interdependencies.

ECONOMIC EVALUATION OF ENVIRONMENTAL RESOURCES

KEY POINTS

- Natural Resource Accounting systems require a better understanding of the change in economic value that will result from an activity or policy change.
- Many laws and regulations also require economic evaluation of environmental impacts of projects and policies, and economic evaluation methods are being used with increasing frequency as a major tool for analysis and decision-making.
- The basic analytical task is to estimate the present discounted value of the stream of benefits and costs that flow from various scenarios.
- Evaluation methods provide information about change in total economic value. They provide no information about the distribution of those changes, and they strongly favor the preferences of groups who participate in the market or have resources that can be traded in the market.
- These methods assume the existence of conditions that allow perfectly competitive markets. When such conditions do not exist, overreliance on economic valuation techniques can lead to an implicit decision-rule that allocates resources so that their marginal productivities are equal as measured by the rate of return or the discount rate.
- Such a decision-rule will lead to total depletion or extinction of a resource if the growth rate of the resource is less than the discount rate, and if it is profitable to harvest the last unit.

Because market prices do not reflect the total value of benefits provided by natural resources, ecological economics is creating and refining ways to measure the value of resource characteristics that are not captured in market prices. For example, the market price of timber does not include the value of environmental services provided by forests, the survival value of resilience provided through species diversity, nor the value associated with averting irreversible or catastrophic events.

Likely Impacts of Economic Evaluation of Environmental Resources

GROWTH

- To the extent that nonmarket values are captured and used in development decisions, short-term economic growth may be slower but long-term economic growth will be more constant. Short-term local growth may be traded for long-term national or regional growth.

WELFARE

- To the extent that inherent biases in economic evaluation are not corrected, the preferences of future generations, the poor, indigenous groups, women, children, and old people will be undervalued, and the estimates will favor the tastes and preferences of the better off who have access to marketable resources.
- To the extent that nonmarket values are captured, those who have traditionally borne dispersed environmental costs will benefit.

CONSERVATION

- Increased protection of biodiversity.
- Increased preservation of future options.

The basic analytical task is to identify and compare the present discounted value of the stream of benefits and costs that flow from various alternative scenarios. That value is based on estimates of a person's "willingness to pay" to receive a benefit or "willingness to accept" to bear a cost.

"Willingness to pay" and "willingness to accept" estimates are based on available information about impact, social values and prevailing attitudes toward risk, and budget constraints. In this context it provides a useful (and limited) tool for assessing preferences; it should not establish preferences.

The validity of the "willingness to pay" measurement (derived directly from market prices or indirectly from contingency valuation studies) is based on the theory that the total well-being of society (the sum of individual well-being) will be maximized if resources are exchanged at their real value to society. This assumes general competitive equilibrium.

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Competitive Equilibrium

The general conditions for competitive equilibrium require that:

- Consumer tastes and preferences are set.
- There are many potential consumers and producers, and markets exist for all commodities.
- Prices for all commodities are such that supply equals demand or, if supply is greater than demand the price is zero.
- All agents are small and their activities do not affect price.
- Consumers are maximizing utility.
- Producers are maximizing profits.
- Full information on prices and commodities is available.
- Initial resource endowments are set.
- Property rights are universal, exclusive, enforceable, and transferable.

The conditions of competitive equilibrium are not met because:

- Ecological systems are characterized by discontinuities, interdependencies, and irreversibility.
- Tastes and preferences are created by culture.
- A full set of markets does not exist for many natural resources.
- Monopolies and oligopolies exist.
- Lack of information exists about the value of the ecological services provided by the biosphere.
- The initial allocation of endowments is inequitable.
- Exclusive, secure, and transferable property rights do not exist for many environmental endowments.

When the assumptions of general competitive equilibrium are not met, a policy process that allocates natural resources so that their marginal productivities are equal (as measured by rate of return or the discount rate) will lead to extinction of the resource if: (1) the regeneration rate is less than the discount rate and if (2) it is profitable to harvest the last unit. Physical extinction may not result from present value maximization if harvest costs increase to reflect scarcity, however, the resulting stock could still be to too low to maintain the resource's role in an environmental or social production function.

As long as capital is mobile, profit-maximizing investors will convert renewable resources that regenerate more slowly than the discount rate into money and invest it in the most rapidly growing international mutual fund. When prices are exogenous to the local market they will not reflect local scarcities.

All valuation techniques estimate value by developing various measurements on "willingness to pay" or "willingness to accept" either directly or indirectly. Both measurements contain a systematic bias against groups that do not or cannot participate in the market economy. These groups include old people, children, women, the poor, indigenous peoples, and future generations.

An evaluation methodology biased against the preferences of old people undervalues wisdom, patience, longer-term perspective, and transmission of culture. One biased against children undervalues future productivity, hope, and unanticipated invention. One biased against women undervalues the preferences of half the population and the importance of preparing children for life. A methodology biased against poor people overvalues the preferences of those with generous resource endowments, which in the absence of policy corrections contributes to further endowment concentration, which is in itself a market distortion. A methodology biased against indigenous groups ignores the views and preferences of those who manage resources communally and are opposed to participation in the market and contributes to the destruction of cultural diversity. One biased against future generations discounts uncertainty and the value and distribution of future benefits and costs.

The value of the many services provided by natural resources is not captured by the market. A policy process that exclusively allocates scarce resources to their most economically productive uses will have the following general consequences:

- It substitutes a market model of choice for a political model of choice.

- It substitutes the norms of economic efficiency for the democratic values of public participation.

- It justifies taking resources away from inefficient users (as measured by market exchange) and giving them to those who can maximize the present discounted value of wealth.

- The use of present value discounting means that any long-term costs and benefits will be treated virtually as zero.

- Efforts to estimate monetary values for costs and benefits when the true value of natural capital is unknown tend to exclude from the calculations goods that are not easily measured or are poorly understood.

- Attempts to value nonmarket goods on estimates using "willingness to pay" are based on budget constraints, preexisting market inequalities, and imperfect information. These estimates favor the tastes and preferences of the better-off and are biased in favor of projects for which the benefits are concentrated and the costs are widely dispersed in time and space.

The entire package of values and assumptions driving economic evaluation leads to a paradox described by Colby (1991, p. 198), "Depleting or degrading resources increases their measured value, but it often eventually decreases people's quality of life and degrades the functionality of the ecosystem on which it rests, making it and them more vulnerable. This paradox of generating value by creating scarcity results from a narrow definition of efficiency within modern economics' exchange theory of value. Only exchangeable resources that are considered scarce must be used efficiently, so that non-scarce items inexorably become scarce, and therefore valuable."

This paradox, to the extent that it drives policy decisions, will undermine the ability to achieve larger national or regional development objectives when those objectives depend on spatial and temporal sequencing of resource uses. For example, forested land can function in a variety of ways to support a development strategy. Each will have a different present discounted value and distribution of benefit and costs. Forests can be converted into agricultural land. They can be managed publicly or privately as plantations or as managed forests, multiple-use forests,

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watersheds, buffer zones for protected areas, reservoirs for biodiversity, to protect cultural integrity, and as corridors connecting protected areas to expand gene pools. The value of a forest's function as a corridor connecting reservoirs of biodiversity precludes its use for agriculture, but not as a multiple-use forest or watershed (or commercial plantation given other policy conditions), even though its return may be greater in agriculture than for these other uses.

The value of a resource depends on the user's time preference, or discount rate. The time preference reflects how quickly a resource user needs a return on the investment. It is the interest rate at which a person would be willing to give up a present benefit in exchange for a future benefit. When people or nations have large resource endowments, they can easily set aside resources as investments for the future. Their time preference is long and they have a low discount rate. When people have no ability to set anything aside for the future, their time preference is very short, their discount rate is very high, and the interest rate at which they would be willing to give up a present benefit in exchange for a benefit in the future is very high. As poverty increases, the value of present benefits increases relative to the value of future benefits and people have shorter and shorter time preferences and higher discount rates.

Interest or discount rates provide a means for comparing different streams of benefits and costs through time; that is, for comparing outcomes in terms of their present values even though they may occur at different times. Lower interest rates place greater weights on future outcomes; high interest rates favor current consumption. Time preferences, and hence interest rates, vary widely among individuals, groups, and societies (Johnston 1988).

When economists and planners use a discount rate they assume that future consumption is worth less than present consumption because incomes will be greater in the future and people will be better off due to technological progress. In Central America, real productivity must double in 25 years to keep pace with population growth, which means that technological and management innovations must more than double productivity to maintain the same level of poverty. The assumption that future consumption is worth less than present consumption may not hold.

Indicators: Use of Economic Evaluation of Environmental Resources in Planning and Decision Making

Problem Indicators

- Cost estimates do not include nonmarket values of resources.
- Estimation of nonmarket values is not corrected for inherent biases, which favors those with access to marketable resources.
- Overemphasis on the use of discount rates when the primary concerns are for preserving future options.
- Decision-rules that allocate resources so that their marginal productivities are equal as measured by rate of return or discount rate.

Policy/Process Indicators

- Requirements for economic evaluation of natural resources as part of planning and decision making.
- Participatory processes for evaluating resources that include the preferences of those usually excluded from the market.
- Development of methods for comparing the present discounted value of alternative spatial and sequential combinations of resource uses.

MONETARY AND CREDIT POLICIES

KEY POINTS

- Expansion of the money supply and inflation can cause real interest rates to be very low or even negative, which discourages savings and inhibits long-term growth.

- Inflationary conditions and low real interest rates encourage "capital flight" as investors move capital to safer investments overseas. As the domestic currency is traded for foreign currency to invest abroad, the value of domestic currency falls, creating further havoc in the exchange market and further inflationary pressures.

- Uncertain financial conditions caused by inflation distort investments and encourage short-term trading activities that result in resource mining.

- High interest rates make the present value of future consumption very low and discourage investment in conserving resources for the future. Expansion of the money supply and inflation discourage long-term investments and encourage short-term trading activities that result in resource mining.

- Government intervention in credit markets distorts the operation of market forces in allocating credit funds. This can increase or decrease investment depending on the sectors involved and on the availability of attractive alternatives.

- Subsidized credit encourages borrowing from credit agencies. At times, credit is provided at negative interest rates; thus, in the long run, subsidized credit has negative effects on the accumulation of funds (savings), especially if borrowed funds are not used in productive investments.

- Delinquencies reduce availability of funds in banks and other credit markets. Large borrowers are often a significant share of the delinquencies.

- For price and trade reforms to have their full effects, financial institutions must provide credit that enables the rural smallholder to reap the benefits of enhanced export programs.

Likely Impacts of Less Government Intervention in the Credit Market

GROWTH

- Greater capital for long-term investments and hence a long-term increase in economic activity.
- Decreased government financial costs associated with credit subsidies.

WELFARE

- Better health as a result of better pesticide management as credit subsidies are eliminated for pesticides.
- Increased employment.
- Increased food production as subsidies for livestock production are removed.
- More diversified food production and local food security as subsidies on machinery and credit to large handholders are reduced.

CONSERVATION

- Less forest destruction from livestock activities.
- Fewer incursions into protected areas because of more intensive production on existing, currently underutilized, land.

Monetary Policies

Monetary policies have major impacts on interest rates and the climate for investment. They affect not only the management of monetary capital but also the management of natural resource capital. Although scant attention has been paid to the effect of monetary policy and other macroeconomic policies on natural resources, their effects can no longer be overlooked.

The purpose of monetary policy is to maintain a balance between the supply and demand for money in order to ensure available savings for investment in the long term and to avoid inflation or stagnation in the near term. The real interest rate is the price of savings. Positive real interest rates encourage people to save so that this capital will be available for long-term investments. High inflation, however, reduces the incentive to save; thus the real interest rate is equal to the "nominal" or recorded rate minus

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the rate of inflation. If inflation is rapid, real interest rates can be negative even when nominal interest rates are quite high. Under this situation both savings and economic growth will be low in the long term.

An inflationary environment also encourages the phenomenon of "capital flight." When the domestic financial situation is unstable, investors move currency out of the country to safer investment opportunities abroad. As the domestic currency is traded for foreign currency to invest abroad, the domestic currency loses value in real terms in relation to other currencies. This can cause further inflationary pressure as imports become more expensive or can cost the government further foreign exchange when efforts are made to prop up the failing currency (Sachs 1989).

The resulting investment climate is risky and distorted. Long-term growth-oriented investments will be discouraged, especially the long-term investments needed for conservation and improvement of the resource base. Investors will move instead to short-term trading or other speculative activities. This frequently will involve real estate or land, driving up the price of land for speculative purposes and keeping it out of reach for those who would put it to more rational and productive use with better resource management. Speculative landholders are less inclined to carefully manage the resource because they may not intend to hold it for the long term and are not in a position to visit it frequently (Johnson 1989).

Contractionary monetary policy, on the other hand, can increase real interest rates, lowering the value of future consumption and making long-term investments more costly. High real interest rates encourage the consumption of natural resource stocks because to leave them as standing timber or in the ground would mean forgoing the interest on the capital their harvest would bring in the present. The expected future return must be much higher to justify leaving natural resources intact when the interest rate on capital is high.

When contractionary policy stifles economic activity, the resulting stagnation and unemployment increase the level of poverty. In some Central American countries, inflation has been less of a problem than the increasing rate of unemployment in both rural and urban areas and general economic stagnation despite a rapidly increasing population. Under these conditions, open-access or easily invaded natural resources suffer as they are exploited to supplement inadequate incomes.

Credit Policies

The development of any economic activity depends on the availability of financial resources. Interest rates represent the cost of financial resources. The availability and cost of credit influences the use and management of natural resources by promoting and facilitating the development of new activities and the adoption of new technologies that can have positive or negative impacts on the natural resource base. Interest rate and credit policy has often been highly controlled by government regulations. These controls can take the form of maximum lending and deposit rates. Other characteristics include lines of internal and external financing and agricultural credit at subsidized rates.

Mini-Case

In Honduras, the National Agricultural Development Bank (BANADESA) is the state bank that handles agricultural credit. The bank deals mainly with the agrarian reform cooperatives and small and medium-sized private farmers. This institution has a limited capacity to serve the agricultural sector due to the high arrears of its portfolio, high operating costs, and lack of autonomy in its operations because it is expected to finance other semi-public institutions. Private Honduran banks are conservative and have limited participation in financing agriculture due to the high risk of those operations and the lack of confidence in the law that regulates rural collateral. Their clients are the commercial farmers and ranchers, and their participation has increased through use of the special rediscount funds of the Central Bank.

Collateral requirements

Collateral requirements tend to favor landowners and wealthy investors. Landless peasants and smallholders are basically cut off from the official banking system because they have no collateral. Peasants cannot accumulate capital to use as collateral because of poverty and lack of investment opportunities. Thus, a vicious cycle has developed. This "collateral syndrome" in credit markets suppresses the investment potential of smallholders and thereby accelerates resource use and environmental degradation.

Interest rates

Interest rate policies, in general, are aimed at promoting the development of the economy. However, interest rate and credit policy has constrained long-term credit for investment in developing permanent crops and improving the farm through activities such as conservation. The large bulk of agricultural credit has financed short-term inputs which, while essential for production, in some cases have had deleterious environmental effects (e.g., use of fertilizers and pesticides).

Subsidized credit

Subsidized credit for agriculture has generally gone to wealthier farmers as has favorable reserve requirements for agriculture and livestock portfolios. This has influenced crop selection and in the long term has resulted in the inefficient use of inputs. The lack of access to credit by small producers has had an impact primarily in basic grains production and made some countries increasingly dependent on grain imports. The reactivation of the agricultural sector requires timely credit that would allow small producers to improve their productivity through the adaptation of appropriate technology.

Subsidized credit for livestock has promoted extensive ranching, with the resulting inefficient use of grazing land and its degradation. Subsidized credit for other crops is mainly used for export crops that use high proportions of pesticides and fertilizers to increase productivity. This can decrease the natural capacity of the soil to regenerate, thus requiring ever higher amounts of fertilizers to maintain the level of productivity. Short-cycle export crops, such as melons and pineapples, require high levels of pesticides. The type and quantity of pesticides used are often controlled so that the toxic residues in the fruit are within the limits allowed for imports into the United States. However, this is not the case with pesticide concentration in the soil, which can be cumulative. Pesticides also filter into the groundwater, where their presence can lead to irreversible or very long-term contamination (World Bank 1987).

Indicators: Monetary and Credit Policies

Problem Indicators

- Use of conservation technologies.
- Rate of resource use among and across sectors.
- Productivity and production of resource-based sectors.
- Efficiency in the use of inputs and level of outputs.

Policy/Process Indicators

- Amount of government intervention in credit markets and level of credit subsidies.
- Rate of credit delinquencies.
- Rate of savings and long-term investment.

EXCHANGE RATE POLICIES

KEY POINTS

- Overvalued exchange rates essentially tax exports and subsidize imports. As a major exporter, agriculture has been disadvantaged, resulting in rural unemployment and underinvestment in resource conservation.
- Devaluation and floating of exchange rates will shift production in favor of exports including agricultural exports and potentially contribute in the short term to increased pressure on the resource base under more intensive agricultural production. Counterbalancing policies should be considered to prevent unsustainable resource mining.
- Export crops will be encouraged relative to subsistence crops with mixed effects on the environment. Prices of implicitly subsidized imports such as pesticides should rise and discourage use although exports crops may require more pesticides. More or less erosion or other environmental effects may be experienced as cropping patterns change.

Overvalued Exchange Rate

The exchange rate regimes in many countries have been represented by overvalued currencies during most of the past two decades. Thus, the trade and exchange rate regimes implicitly subsidized and hence encouraged imports, and implicitly taxed and hence reduced exports. In addition, the competitiveness of domestic products was reduced in international markets.

The primary effect of the overvalued currency has been to skew relative prices against agriculture in comparison to other sectors of the economy. This has resulted in reduced investments and savings in the agricultural sector. For both agriculture and forestry, the implicit tax may have at the margin reduced exploitation of the resource; however, it also reduces the incentive to invest in the maintenance of the underpriced resources. Reduced employment within these sectors would have also placed pressure on the resource base, especially open-access resources.

Likely Impacts of Exchange Rate Reform

GROWTH

- Increase in GNP in the short term.
- Increase in exports in the short term.
- Long-term decreases in production if resource activities are not sustainable.

WELFARE

- Increase in employment in the short term.
- Increase in agricultural production in the short term.

CONSERVATION

- Increased pressure on soil and forest resources in the short term.
- Greater pressure on open-access resources.

Overvalued currency has also worked to encourage capital intensity in the economy as a whole because capital imports have been favored. Unfortunately the favored industrial sector has thus provided much less employment than had been earlier envisioned. In the same manner energy imports have been encouraged, creating a more energy-intensive economy than would otherwise have existed.

Floating Exchange Rates

Devaluing and floating the exchange rate has resulted in increasing exports and decreasing imports. The prices received by farmers increase and agricultural production shifts in favor of export crops. If export crops (e.g., coffee and cacao) are less environmentally damaging than subsistence crops (beans and root crops) both the environment and rural employment can benefit (Pearce and Warford 1993). Pesticide imports should decline and higher prices should discourage their use, although some export crops may require greater pesticide use than subsistence crops.

The added incentive to export can also work to deplete forest stocks and overtax the soil with increased agricultural production.

Compensating policies may be necessary to ensure that resource use is sustainable. Better returns to agriculture may also expand the agricultural frontier because many forests and frontier lands are open to invasion by squatters.

Mini-Case

The exchange rate is the price that links domestic tradable goods with foreign goods. An overvalued exchange rate discourages exports and encourages imports. This reduces pressure on the natural resources stock to the extent that exported commodities use natural resources as inputs. In Thailand, most of the resource-based commodities are internationally tradable (e.g., tin, fish, rice, cassava, rubber, logs) or are substitutes for tradable commodities (e.g., natural gas, lignite, hydropower). Hence an overvalued exchange rate reduces their depletion by reducing their price relative to that of nontradable goods.

Thailand maintained a fixed exchange rate from 1960 to 1984, but the rising strength of the U.S. dollar in the early 1980s and the 1980-1981 inflation caused the exchange rate to be overvalued. In November 1984, the baht was devalued and the fixed exchange rate system abandoned, with the baht pegged to a basket of currencies. Through a combination of a strong economy, low inflation, and successive exchange rate adjustments, Thailand managed to maintain a fairly realistic exchange rate. Consequently, damage to its export performance from overvalued exchange rates was minimized, with the exchange rate policy affecting the natural resource sector fairly neutral (Reed 1992).

Indicators: Exchange Rate Policies

Problem Indicators

- Production of exports and domestic crops.
- Efficiency in use of inputs such as pesticides.
- Rate of resource use.
- Employment in affected sectors.

Policy/Process Indicators

- Changes in the level of domestic and export production.
- Relative rate of imports to exports.
- Relative prices of tradable to nontradable goods.

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FISCAL MANAGEMENT

KEY POINTS

- The fiscal deficit limits the ability of the government to provide the services needed to protect the environment and foster effective natural resource management.
- Government deficits cannot be financed with domestic credit without increasing inflation or reducing the availability of credit for private sector activities.
- The need for foreign exchange to pay interest on the foreign debt causes pressure for increased exports. The domestic currency becomes overvalued as foreign exchange leaves the country to make interest payments. At overvalued official exchange rates, importing the quality technology needed to improve efficiency and increase production becomes difficult.
- Current expenditures (for salaries and wages) have expanded at the expense of capital expenditures for the necessary infrastructure needed for economic development. Cuts in capital expenditures result in lower productivity, food deficits, reduction of exportable commodities, and a decline in foreign exchange earnings.
- Resource management–related taxes and fees can be increased to capture the true rents. Fiscal deficits could be reduced while reducing incentives to overexploit natural resources. Pollution taxes and charges can also be used for better fiscal balance and environmental management.

Fiscal Deficits

Fiscal policies include not only government receipts, expenditures, and debts, but also efforts directed at increasing revenue through taxes or user fees. Fiscal deficits and imbalances in external accounts result in part from policies that favor cheap food, low agricultural prices with subsidies for agricultural inputs, and direct involvement in production, importation, and marketing.

Likely Impacts of Reducing Government Debt

GROWTH

- Short-term economic contraction.
- Lower inflation.
- Long-term increase in the availability of capital for investment.

WELFARE

- Short-term increase in unemployment.
- Higher food prices.

CONSERVATION

- Greater short-term spontaneous colonization.
- Better resource management and investment decisions in the long term.

The fiscal deficit reduces the economic activity of the private sector and/or increases inflation, unemployment, and poverty and, consequently, the pressure on the hillsides and forests. The population with the lowest income is forced to seek alternatives for its subsistence, which often means turning to the forests for farmland to grow food and for fuelwood that will provide enough income to satisfy basic needs.

Inflation tends to rise in the presence of large fiscal deficits, particularly when governments resort to printing more money to cover the deficits. This can be exacerbated by reductions in external sources of funding. There are no easy solutions to lower deficits. In attempts to bring down the deficit, the government might resort to cutting essential programs, including agricultural and environmental programs.

High current public sector expenditures have been difficult to reduce. Efforts undertaken to reduce them have only slowed down their rate of growth.

The main component of public expenditures (defined as current expenditures plus capital expenses, without including the internal debt amortization) is current expenditures. In the 1980s, current expenditures were a significant percentage of total expenditures

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because of the high cost of the military, education, health, park services, and salaries and wages in some countries. Capital expenditures have gradually declined as a percentage of total public expenditures. At the same time, due to the generally high investment rate in the 1970s and early 1980s in some countries, the annual amortization of the internal debt has increased substantially.

A general scenario is as follows. Governments have reduced public capital expenditures in response to serious problems in the balance of payments and large fiscal deficits. In general, it has been more politically feasible to reduce capital expenditures because current account expenditures tend to be controlled by pressures from labor unions and the perceived need for governments to create more employment for political reasons. In such a situation, the least controversial expenditure is cut, even though that action damages the country's productive capacity.

The allocation of public expenditures is relevant to the overall functioning of a country's economy because the construction and maintenance of infrastructure (e.g., roads, electricity networks, ports) depend on those allocations to give adequate support to the production activities. The level of public expenditures also affects the government's ability to address its resource management responsibilities.

Taxes and Revenue Sources

Most countries in Central America have a relatively weak tax base. Wiser use of taxes and charges on natural resources, land, energy, and pollution can improve the fiscal situation and income distribution while also improving incentives for sustainable resource use and environmental management (Repetto et al. 1992).

National governments may often provide companies or individuals access to natural resources for fees that are much less than the rent from the resource. That is, governments sell their coffers short, while encouraging private producers to overexploit resources and achieve above normal profits. This situation is typical of national forests and may also be true of minerals and fishery resources. Increasing taxes and fees can improve resource management while alleviating fiscal burdens.

Subsidized energy may increase fiscal deficits in many countries. Reducing subsidies and potentially levying taxes to pay for the pollution cleanup can help reduce both deficits and environmental degradation. Charges on other sources of pollution can also help broaden the tax base and avoid regressive tax structures.

Increasing property taxes on land will also affect resource management. Depending on the institutions and land tenure patterns already in place environmental management may or may not be improved.

Debt Financing

Deficits are financed from both external and domestic funds. The fiscal deficit cannot be financed with domestic credit without increasing inflation. Domestic deficit financing must use resources from the commercial banking system or the Central Bank, thereby increasing the money supply and the pressure on prices. Excessive borrowing by the government might crowd out other investments. In particular, financing fiscal deficits with internal resources decreases the availability of resources for the private sector, thus slowing activities in that sector. The resulting decrease in investments for long-term improvements such as irrigation, drainage, and soil conservation affects the productive capacity in the country.

Fiscal deficits are also financed by external borrowing from institutions such as the World Bank and the International Monetary Fund, through bilateral agreements between governments, and by private institutions. The external debt is a key factor determining the behavior of the economy, especially in Central American countries. Because these countries have little domestic savings capacity, both the public and private sectors and all branches of the economy are involved in foreign borrowing. The interest on the external debt has been a determining factor in the balance-of-payments deficits in some countries because it absorbs substantial portions of the export earnings.

The external debt may have positive or negative effects on the economy, depending on its size and how it is used. If used in an efficient and adequate manner, it can generate beneficial effects for the whole population. Inappropriate use of the external debt, however, can bring the economy almost to a full stop by limiting the net availability of foreign exchange for imports. This is

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especially true when the industrial sector depends heavily on imported inputs. A decrease in the net availability of foreign exchange thus means a direct loss of production.

A high level of external debt and the interest on the debt reduce the possibility of acquiring more funds for use in development programs. The government's investment capacity is thus limited by the need to earmark a certain percentage of the gross domestic product (GDP) to pay the interest on the external debt. The payment of this interest has been one of the determining factors in the foreign exchange shortage in recent years and, consequently, of the overvaluation of domestic currencies.

The external debt burden reduces the government's possibilities for investment, forcing it to cut back its programs for conservation, especially if these programs are linked to the granting of loans or subsidies. It also reduces agricultural growth overall because of the lack of investment in marketing and production infrastructure. The costs are thus increased, promoting the overexploitation of the soil in order to obtain maximum yields. The decrease in investment also results in an increase in unemployment, rural and urban poverty, and in increased pressure on the forests. When the government's expenditures are limited, the portion of those expenditures destined for forestry control and monitoring is reduced, resulting in more depletion of the forest resource through inefficient use. Some problems may also develop when industries are unable to import technology that would increase the efficiency of their operations.

Debt-for-Nature Swaps

One response to the external debt burden is debt swaps, which are intended to reduce the effects of debt burdens on developing countries. Three common programs are: debt-equity, debt-nature, and debt-debt swaps. Debt-for-nature swaps involve the purchase of a country's debt at a discounted value in the secondary debt market, and canceling the debt in return for environment-related action in the debtor nation. Debt-for-equity swaps can be used to reduce external debt and also provide priority projects for the country. There has been relatively little activity on this issue in some countries. Such transactions would provide support to natural resource protection activities while reducing debt-related pressures. Debt-for-debt swaps are transactions between creditors who interchange foreign loans.

At least four types of debt-for-nature swaps have been proposed:

- Donation of debt to a local environmental organization for investment in environmental projects.
- Official debt relief tied to supporting environmental management.
- Conversion of debt by the central bank into local currency or local debt (bonds) to be held by a local environmental organization for investment in environmental projects.
- Purchase of debt by an environmental organization and discounted sale to a multinational corporation to support environmentally sound corporate investments.

Indicators: Fiscal Management

Problem Indicators

- Rate and efficiency of resource use.
- Levels of contamination and pollution.
- Level of biodiversity.

Policy/Process Indicators

- Levels of government deficit.
- Ratio of current to capital expenditures.
- Funding for operation and maintenance of infrastructure.
- Funding for resource management and protection.

STRUCTURAL ADJUSTMENT LENDING

KEY POINTS

- Although the results of structural adjustment loans (SALs) on the environment may be mixed, when implemented successfully, a primary benefit for sustainable development is the alleviation of poverty.
- Most SALs include measures to reduce government expenditures (which generally includes reducing subsidies for credit, energy, and agricultural inputs), liberalize trade, reform taxes and other institutions, and encourage privatization and foreign investment. Many of these measures can have direct and positive benefits on the environment, others might have mixed or negative effects.
- The strong mix of policy measure can mean major shifts in the economy. In the short-term, some sectors will be disadvantaged and increased poverty and environmental degradation can result.
- Complementary measures can help ensure that structural reforms minimize the burden for low income groups and achieve environmental objectives.

Structural adjustment lending involves a broad mix of policy variables and varies widely among cases. Many structural adjustment loans (SALs), however, are characterized by reductions in government spending, trade liberalizing measures including exchange rate devaluation, reducing credit and input subsidies, encouraging foreign investment, and tax and institutional reforms.

Mixed environmental results can occur from a single policy variable; when applied all at once, the precise outcome either for the economy or the environment is impossible to predict. Although there is little evidence that SALs damage the environment, it is clear that SALs provide more opportunities to improve environmental management than have been taken advantage of thus far. By anticipating environmental impacts SALs can be much better used for long-term sustainable development.

Likely Impacts of a Structural Adjustment Loan

GROWTH

- Short-term and long-term growth shifts between sectors.
- Reduced government expenditures in the short term.
- Long-term increase in investment.

WELFARE

- Short-term increase in poverty in some sectors.
- Potential long-term increase in employment.
- Increase in prices for some commodities.

CONSERVATION

- Short-term increases in resource exploitation resulting from increases in relative prices.
- Short-term redirection in government ability to manage resources.
- Long-term ability to support resource managment.
- Mixed effects by sector on conservation and biodiversity.

In the short term, stabilization and structural adjustment loans have caused severe economic hardships. Decreases in public expenditures combined with tight monetary policy and exchange rate devaluations can have powerful recessionary effects. During the world recession in the early 1980s stabilization and structural adjustment led to long periods of stagnation for many countries. The increased poverty in many cases took a sharp and perhaps irreversible toll on open-access or invadable frontier lands and forests.

Even when long periods of stagnation are avoided, SALs involve substantial structural changes to the economy, which means that although new opportunities may be opening up, others are closing and temporary unemployment for many groups can result. These

increases in poverty can also lead to environmental degradation.

When successfully applied, SALs result in an increase in growth (particularly in the export sector) and in incomes, a reduction in budget deficits and balance-of-payment difficulties, and a much more stable and attractive investment environment. Growth and the alleviation of poverty reduce pressure on open-access resources and free resources for investment in improved environmental management. On the other hand, rapid growth can have negative environmental outcomes, such as pollution.

Mini-Case

The London Environmental and Economics Centre examined the case of structural adjustment in Thailand based on a study of the Thailand Development Research Institute (Reed 1992). It concluded that the SALs in 1982 and 1983 in Thailand were instrumental in furthering impressive recent growth rates of over 12 percent per year, alleviating poverty, and diminishing income differentials. Given the many linkages between poverty and environmental degradation, it is clear that environmental benefits resulted. On the other hand, in the presence of rapid growth, market failures, lack of infrastructure, and institutional weaknesses contributed to a deteriorating environment.

The growth in Thailand was led by industry, and adequate policies were not in place to control the negative effects such as air and water pollution and generation of solid waste. Researchers conceded that waste per unit of output might be lower under the liberalized market and trade regime but noted that the major increase in output had meant much larger waste generation. Although the SALs had included eliminating energy subsidies, which had environmental benefits, other mechanisms could have been put in place to control pollution. Infrastructure has also been a bottleneck in Thailand and negative environmental effects have been felt through urban crowding, congestion, and pollution resulting from the inadequacy of investments in public transport and waste disposal facilities.

Mini-Case

A study of migration and environmental degradation offers insight into the effect of debt crisis on Costa Rican forests and soils (Cruz et al. 1992). Costa Rica, like much of the developing world, entered into debt crisis and recession after the oil price shock of 1979. Although industrial sector expansion had led growth in the early 1970s, by the late 1970s GDP continued to grow due to a swelling government sector financed by external debt. Foreign exchange was used up on rising oil prices and interest rates. Due to the weakening global economy and falling commodity prices, debt service soon became impossible. By 1981, inflation was rampant and the currency had devalued over 400 percent. A stabilization program was imposed in 1982 and reforms followed.

Drastic cuts in government spending plunged the country into recession. Real wages dropped 30 percent, as did domestic demand, and unemployment doubled—in just two years. The number of people below the poverty line increased by 50 percent. Migration patterns changed dramatically as migrants moved toward the rural sector and more squatters exploited marginal lands (Cruz et al. 1992).

Nevertheless even during the recession agriculture expanded, and by 1986 poverty levels had declined to their prerecession levels. The agriculture led recovery benefited the poorest groups the most. Exports, especially in agriculture, have increased throughout the 1980s and 1990s. Foreign investment has increased dramatically, particularly in bananas and tourism. Fiscal deficits have become surpluses (IDB 1993).

Although further analysis is required to determine all of the environmental implications of the SAL in Costa Rica, the economic benefits are clear. Certainly the decrease in poverty diminished pressure on open access and invadable lands and forests. While the brief recession brought environmental degradation as squatters cleared forests on marginal lands, high quality agricultural land attracted more migrants as rural employment increased.

Cruz and Repetto (1992) studied the effects of stabilization and structural adjustment programs in the Philippines. Although the reasons for debt crisis were similar in the Philippines and Costa Rica, recovery was not nearly so swift in the Philippines. The 1980s were characterized by stagnation. Millions more migrants searching for livelihoods surged into the fragile upland areas officially recognized as public forests.

Although stabilization and structural adjustment programs were implemented in the early 1980s, the programs were sidetracked by the severity of the recession. Researchers found that the environmental effects of the programs were felt through an increase in poverty and pressure on forestlands.

The research also showed that had the reforms been fully implemented income and balance of payment conditions would have improved and employment would have increased (lessening frontier migration pressure). But simulation also demonstrated that because environmental safeguards were not in place, increased logging, agriculture, and overfishing also would have increased. As it was, domestic production on timber, minerals, and most other resource based products actually fell due to the collapse of world commodity prices and restrictive stabilization prices (Cruz and Repetto 1992).

Indicators: Structural Adjustment Lending

Problem Indicators

- Rate of resource exploitation primarily for export purposes.
- Level of dependence by poorer groups on open-access resources.
- Levels of pollution.
- Efficiency in resource utilization.

Policy/Process Indicators

- Levels of government funding for resource management.
- Tightness of monetary policy.
- Changes in structure of economy.
- Short-term unemployment.
- Level of budget deficits.
- Establishment of policies which require subsidies for or direct involvement in certain economic activities.

RESEARCH QUESTIONS

Who are the beneficiaries of existing credit subsidies? If subsidies were eliminated, how would agricultural production change?

What are the nominal and real interest rates? What other policies should be addressed if interest rate reforms are established?

How has the need to increase foreign exchange influenced the policy mix within a country? Who benefits and who loses from such activities? What are the environmental trade-offs?

Reduction of fiscal deficits can in the long term increase the ability of the government to support both development and conservation. Does the existing fiscal situation present long-term resource management obstacles that inhibit both investment and conservation?

What are the most acceptable valuation methodologies for accounting for various kinds of resource degradation? What are the most effective steps that can be taken toward incorporating environmental information into macroeconomic analysis?

What measures can be taken to make tax policy improve resource and environmental management? To what extent are gasoline taxes regressive in developing countries? What are the effects of increased property taxes on resource management?

Is the depletion of environmental and natural resource assets accounted for in policy decisions by the government?

If resource depletion were considered in national accounts, what do you believe the results would show?

What is the economic investment horizon and is there evidence of capital flight?

Is the exchange rate undervalued or overvalued? How has the exchange rate regime affected imports and exports? Have there been any recent changes in exchange rate policies? If so, what have been the effects on relative prices in the import and export sectors? Is there any evidence of resource mining or resource conservation resulting from changes in exchange rate policies?

What is the ratio between current and capital expenditures over the last decade? Is their any evidence that operation and maintenance of infrastructure has been insufficiently funded?

What alternatives does the government have in terms of increasing revenue or reducing expenditures? How would these alternatives affect natural resource use and the environment?

What are the potential economic, welfare, and conservation effects of a specific structural adjustment loan when disaggregated?

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Trade and Investment

Export Promotion

Key Points

- Exports from developing countries are still largely commodity based; thus, encouraging exports may mean exploiting natural resources.
- Safeguards—especially the appropriate pricing of natural resources—should be in place to ensure that growth policies are sustainable.
- In the long term, free trade is expected to increase economic activity and employment, but this may have both positive and negative effects on the environment.
- The international relationships established with trade can encourage the diffusion of environmental technology and provide worldwide pressure for better environmental management.
- Protectionist trade policies biased toward industry create an inefficient industrial sector, with respect to both materials and energy.
- Policies that promote exports to increase foreign exchange may encourage inappropriate input use and mining of resources.

Tariff Policies

Although tariff structures in Central America have varied over time and among countries, generally tariffs have been highest for finished industrial goods and much lower for agricultural goods. The disparity in protection among sectors has been exacerbated by relatively low tariffs on imported inputs and preferential exchange rates for industry.

The tariff policies were intended to encourage development of the local industrial sector through import substitution. In practice, however, the privileges and overprotection resulted in lack of competitiveness, poor-quality products, and higher costs. The

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Likely Impact of Export Promotion Policies

GROWTH

- Short-term growth in new or renewed sectors.
- Long-term economic growth when the export sector is well connected to the rest of the economy and resources are managed sustainably.
- Long-term reduction in productive potential with unsustainable resource use.

WELFARE

- Redistribution of income from suppliers of domestic services to exporters.
- Employment generation in export sectors.

CONSERVATION

- Increased exploitation of natural resources that support export goods.

resultant inefficiencies encouraged the waste of raw materials and has made Central America's industrial sector one of the least competitive in international markets. In order to obtain foreign exchange, some of the products that can be exported are subsidized, others receive fiscal incentives that almost offset the exchange rate distortions.

Tariff policy has had an antiagriculture and antiexport bias, which diverts resources to less competitive activities and results in a loss of economic efficiency and lower living standards. These trade regimes have also encouraged capital-intense production methods and done little to alleviate unemployment. The rural population has been directly affected by the low prices for agricultural products and the resulting lack of production incentives. Migration from rural areas to urban areas is increasing, creating more unemployment, and thus increasing overall poverty. Subsidies on wheat imports (via tariff exemptions and the previously overvalued exchange rate) have adversely affected basic grains production, especially corn, thus increasing dependence on food imports.

By applying very low import tariffs to agricultural products, the real prices on domestic crops are lowered, thus discouraging national production while demanding an increase in yields in order to compete in the international market. Import tariffs, while

discouraging the production of staples and increasing rural unemployment, also increase the pressure on the forest. Campesinos cut fuelwood to increase their income and clear more land as the decreasing terms of trade reduce the profitability per hectare of the land already cultivated. The environment also suffers from the effects of an inefficient industrial sector that effectively has no environmental controls; industries do not take into consideration the damage that toxic residues cause to the atmosphere, soil, and water.

"Policy liberalization causes an expansion of the traded goods sector and, at the same [time], contraction of its home goods sector. Consequently, as efficiency prices begin to prevail in the domestic economy, resources are drawn into the traded goods sectors. But, it is the growth of these sectors that place increased demands on a country's exhaustible resources. Moreover, if the increased pressure on exhaustible resources is not addressed, then the supply response from the early stages of liberalization is not likely to be sustainable!" (Roe 1991). Lutz (1990) concluded that higher international prices and less price instability would lead to economic benefits for developing countries, but that the associated environmental effects would be negative.

Increasing trade and promoting exports in developing countries means increasing the production of primary products. Agricultural exports together with natural resources such as timber, minerals, and oil often make up over 60 percent of export earnings in many developing countries (Pearce and Warford 1993). Thus, trade policies quickly become resource policies.

Unless safeguards are in place increased exports can mean exploitation and destruction of natural resources. For example, subsidies for cattle production or underpricing of timber can lead to resource degradation. These kinds of policies, combined with policies that promote exports, can result in severe environmental degradation and mining of natural resources.

Some have hypothesized that because commodity prices over the long term follow a downward trend, commodity exporters will have to export more and more, causing increasing resource depletion, just to maintain earnings of foreign exchange. Although there is little empirical support for this hypothesis—indeed high prices for timber are linked to increased deforestation—trade policies can accelerate resource depletion.

Trade-Generated Economic Growth

Increased trade may provide benefits, although the gains from trade may have environmental costs (Pearce and Warford 1993). Outward-oriented policies have proved much more successful in furthering economic growth than inward-oriented policies. Liberalizing trade should promote economic growth and provide goods to consumers at the lowest possible cost.

Increased economic activity with free trade will also bring more materials and energy through the economic system. As economic production increases so does pollution and waste. Lucas et al. (1992) found evidence of an "inverted U" relationship between pollution intensity (emissions per output) and the kind of economic growth that would be brought on by increased trade. In the early stages of growth, pollution intensity would increase, and then would decrease in later stages. However, although pollution intensity may decrease with improvements in technology and regulatory capacity, absolute levels of pollution may continue to rise.

Increased trade can also involve reorganization of industrial and agricultural structures to capture economies of scale, which will alter the effects of these sectors on the environment. An increase in the scale of agricultural production can be more damaging to the environment because fence rows would be removed, and monoculture and increased use of pesticides would replace mixed cropping patterns. On the other hand, an increase in the scale of industrial production would make it easier to regulate pollution. It is difficult to predict if the environmental effect of larger-scale industrial production would be positive or negative.

Free trade may provide the financial resources that developing countries need to invest in environmental protection. An open trading environment also creates the competitive pressure to adopt the latest technology—potentially also the most environmentally friendly (Wheeler and Martin 1992). Poverty should be reduced and with it pressure on open-access resources. Employment opportunities that are preferable to further degrading an already degraded land base should be made available. These outcomes will depend on population growth and equitable distribution of trade-generated economic benefits.

Export Promotion Policies

Many export promotion policies in Central America have encouraged nontraditional agricultural exports such as melons, pineapple, and shrimp. Such policies generally benefit commercial farmers and producers and the labor they employ, but poor farmers may be marginalized. As income is redistributed the poor may be hit the hardest and may turn to the resource base to replace their losses. Export policies should also aid small- and medium-sized farmers with improved infrastructure and financial systems to facilitate farm-to-market movement of agricultural commodities, and increased funding for research and extension services.

Melons and pineapple are short-cycle crops that require extensive use of agrochemicals, which have a negative effect on the soil and water supply. Other export crops, however (e.g., coffee), are often superior environmentally to subsistence crops (e.g., maize), so analysis of the environmental effects of a shift to agricultural exports should be done on a case-by-case basis.

Central American countries have a substantial relative advantage in the production of high-quality coffee and opportunities for expansion may be substantial. Production increases in banana and other nontraditional exports have also been achieved in recent years. Major constraints to further market expansion include difficulties expanding domestic and regional markets and acquiring the investments required to develop new nontraditional exports.

Special incentives

In addition to the liberalization of exchange rates and reduction of export duties, special incentives may often be used to promote exports. Subsidized credit for export sectors, special tax relief provisions, and technical assistance in export market development are examples of policies that may be used. Also, export duties may be reduced selectively on particular products, duty-free zones may be established, or licensing requirements on imports and exports may be eased. These kinds of incentives are often combined with incentives to encourage foreign investment and foster international partnerships among firms.

Specialized incentives have an opportunity cost associated with them. Subsidized credit reduces the cost of capital to some sectors

and not to others. To the extent that credit is limited, this reduces the amount available for investment in domestic productivity. Differentially reduced export duties function in a similar fashion. Tax relief is an implicit subsidy at the expense of the public services that would be provided had the taxes been levied. Duty-free zones act as population growth poles and require infrastructure which, if not paid for by taxes collected from those who benefit from the duty-free zones, must be subsidized by taxes on productivity in other parts of the country.

Mini-Case

Policies to encourage beef exports from Costa Rica from the late 1960s to the early 1980s contributed to a major conversion of forestland to pasture. Between 1950 and 1984, pastureland in Costa Rica increased from 34 percent to 54 percent of the total land area of the country even though only about 10 percent of the total land area is best suited to pasture. The Tropical Science Center in San José estimated that in 1984 65 percent of the land in pasture should have remained forested according to land use capability. Subsidized credit to ranchers and high delinquency rates encouraged cattle ranching that would not otherwise have been profitable. While beef exports increased rapidly, forest resources were wasted—literally going up in smoke or left to rot in the fields, especially in earlier years before timber prices rose (Cruz et al. 1992).

Mini-Case

John Browder (1987) studied the effect of Brazil's export promotion policies between 1980 and 1984 on the Amazon's industrial wood sector. One of the primary incentives was subsidized credit. Results of the study indicated that the policies favored the merchant class of trading companies and led to a concentration of production on mahogany lumber, sometimes at the expense of domestic demand. In 1983 mahogany constituted over 30 percent of all Brazilian lumber exports. When prices collapsed in 1985, the merchants escaped the financial disaster that producers suffered. Browder argues that rather than being a catalyst for economic growth in the Amazon, Brazil's export promotion policies encouraged an exploitation of logger yeoman by a merchant oligopoly.

Mini-Case

An examination of nontraditional agricultural exports (NTAE) in Ecuador found that in many ways the new sector was inequitable and potentially unsustainable. Services in marketing and technical assistance were biased toward larger producers and the risks involved in the business were overwhelming for the small producer. On the positive side, the volume of NTAE trade increased very rapidly, creating many jobs (especially for women, who not only were willing to work for lower wages but also were much more productive in some cases than men). But the crops grown relied extensively on fertilizer and pesticides for the export market, which demands blemish-free produce, while training for pesticide use was minimal. The costs of pollution have not been calculated.

Incentives to foster international partnerships

Promoting trade also means promoting special relationships between trading partners. These relationships may include firm-to-firm linkages, special access to markets, and sharing of information and technology. Although there may be many benefits to developing countries from these relationships, the benefits are likely to be distributed inequitably among different sectors within those countries. In addition, there may be unanticipated negative environmental consequences.

On the other hand, enhanced sharing of information and technology can benefit developing countries. Trading relationships are often tied to aid programs and for many donor countries—including the United States, Japan, and the Netherlands—environmental aid has emerged as a key focus. Support for environmental research, training, and technical cooperation may be provided, as well as financing for environmental infrastructure (U.S. Congress, OTA 1993).

Trade Liberalization

When trade is liberalized, exports are encouraged and restrictions on imports are loosened. Many policies are changed, not only those that affect trade, but also those that affect foreign investment and the development of the domestic private sector. Many of these policies may reduce privileges to special interests while others favor the development of particular sectors.

Policymakers should keep in mind the distributional and environmental consequences of these changes.

Principal measures to liberalize trade in Agentina, Brazil, and Mexico in recent years included reducing the number of goods under import quotas, abolishing import permits for many items, reducing tariffs on imported goods, eliminating requirements for company- and sector-specific annual import budgets, eliminating import licenses for computers and pharmaceuticals, and liberalizing policies targeted at specific sectors such as electronics or automobiles (Birch and Primo Braga 1992).

Mini-Case

A study of wood pulp production illustrates some environmental advantages of open trade policies. New technologies in the production of paper—thermomechanical pulping (TMP), developed initially in Europe and North America under strict environmental regulations—efficiently uses materials, thus reducing costs and producing less waste while at the same time producing a high-quality product. Wheeler and Martin (1992) found that across developing countries, the most open economies faced the greatest competitive pressure to adopt the newest technologies and as a result adopted the most environmentally friendly technology as well.

Structural adjustment loans (SALs)

Structural adjustment loans are a powerful policy tool promoting trade and investment. Most SALs include reduction of government spending, trade liberalization measures (e.g., exchange rate devaluation and reducing credit and input subsidies), encouragement of foreign investment, and tax and institutional reform. In the short term SALs cause severe economic hardships in some places. The decrease in public expenditures combined with tight monetary policy and exchange rate devaluations have powerful recessionary effects. The increase in poverty combined with rapid population growth can lead to environmental degradation of marginal lands.

Mini-Case

The European Community has a special beef connection with countries in southern Africa including Botswana, Kenya, and Swaziland. Because beef prices are supported in Europe, the special trade relationship allows these countries to obtain much better prices from the EC than on the world market. Essentially the arrangement acts as a subsidy to cattle production in these southern African countries. In Botswana, for example, the national herd approximately doubled in size between 1964 and 1984. Overgrazing is further encouraged by tax benefits and subsidized services. With the EC as a guaranteed market, there are political incentives to encourage overproduction, which results in degradation of marginal savannah lands (Pearce and Warford 1993).

The GATT and the environment

The purpose of the General Agreement on Tariffs and Trade (GATT) is to promote liberal trade in the interest of economic growth. Although within GATT there is a "Group on Environmental Measures and International Trade" (since 1972), it did not convene until 1991, and consideration and analysis of the relationship between trade policies and international environmental issues has been minimal.

In pursuit of free trade objectives, GATT may reduce the scope for environmental policy. Because GATT prohibits limiting exports except with fees or taxes and diminishes the rights of governments to impose import controls, environmental programs have come under attack as nontariff trade barriers. Although article XX allows for environmental exceptions, it is ambiguous and subject to differing interpretations. In general, however, the burden of proof is on the defender of the trade restriction. Any trade restriction is presumed wrong unless proved otherwise—that is, the restriction must be primarily for conservation motives rather than commercial motives and the restriction must be necessary for conservation (Pearce and Warford 1993).

Mini-Case

Cassava was not regularly traded internationally until recently. Thailand now exports some 8 million tons annually to the European community—especially Belgium, Germany, and the Netherlands—where it is used to feed hogs. An annual crop that grows well on poor soils, cassava can be environmentally damaging and is often grown on lands that might otherwise remain forested. Some authorities have cited cassava exports as a major cause of deforestation and soil depletion in Thailand (Pearce and Warford 1993).

North American Free Trade Agreement (NAFTA)

The environmental side agreement of NAFTA provides a legal and institutional framework for linking trade-driven economic growth with environmental concerns, and may provide incentives for improving environmental protection as part of accession to NAFTA.

The NAFTA environmental debate identified the direct connection between environmental and trade policy issues. Those issues include cross-border pollution; fears of creating "pollution havens"; concern that large discrepancies among trading partners in standards for environmental protection or ability to implement standards would be harmonized downward to a lowest common denominator; and distress over the lack of opportunities for the environmental community to shape trade policy.

The preamble to NAFTA calls on the parties to pursue trade liberalization in a manner to promote "sustainable development" and to "strengthen the development and enforcement of environmental laws and regulations" and to pursue all of the trade goals enunciated in the preamble "in a manner consistent with environmental protection and conservation." The preamble promotes the goal of integrating environmental and trade aspirations, and the NAFTA package provides a concrete example of the systematic coordination of economic growth and environmental protection efforts.

Protection from environmental costs is also a kind of "protectionism" that distorts market processes and leads to inefficient allocation of resources; however, this kind of protectionism can only be eliminated through the integration of trade and environmental policy and the development of the

Mini-Case

- Indonesia has used article XX to defend its ban on log exports, although environmentalists have recognized that the log export ban has done little to protect domestic forests (Pearce and Warford 1993).

- Mexico claimed that a U.S. ban on tuna imports—the Marine Mammal Protection Act—violated GATT, and their position was upheld (U.S. Congress, OTA 1992)

- The United States has a long-standing controversy with the European Community over the issues of beef treated with growth hormones. The United States maintains that the European ban on beef treated with hormones is only a disguised barrier to trade. GATT consultations have failed to resolve the issue.

- The GATT policy bias in favor of free trade at the expense of environmental policy has been defended on the grounds that trade policies are a blunt and indirect tool for environmental management. Policies that are more targeted can more efficiently combat environmental degradation (World Bank 1992).

- The GATT secretariat has recognized that environmental policy has become a multilateral issue and, after the conclusion of the Uruguay round, it was suggested that the next round of GATT deal entirely with environmental issues.

- While free trade pacts may not explicitly address environmental issues, they may help provide the necessary political pressures for international cooperation on environmental problems. Although NAFTA evaded pressures from environmentalists, environmental goals were pursued on a separate parallel track as the U.S. Environmental Protection Agency (EPA) and its Mexican counterpart (SEDUE) together issued a broad environmental plan. Both countries worked to ensure passage of the agreement by cooperating in measures to limit negative environmental effects and raise environmental standards in Mexico.

capabilities required for compliance with agreements such as the side agreements to NAFTA.

Accession to NAFTA requires much more than eliminating barriers to free trade. The most difficult part will be to identify and develop the legislative, institutional, and technical capabilities to comply with responsibilities and requirements specified under the NAFTA side agreements (environment,

worker's rights, intellectual property rights). Because behavior cannot be monitored closely, the agreements can only provide a predictable stable investment and trade climate when countries have confidence in the likelihood that all participants comply most of the time at comparable levels.

Indicators: Trade and Export Promotion

Problem Indicators

- Rate of exploitation of natural resources.
- Levels of contamination or pollution.
- Changes in production between export and domestic crops.
- Level of unemployment and poverty.
- Income distribution measures.
- Relative and average incomes of men and women in export sector.
- Quality of life measures, such as education levels and mortality and morbidity statistics.
- Rate of population growth.

Policy/Process Indicators

- Elimination of disincentives to exports and imports and adoption of free trade policies.
- Linkages between trade promotion policies and environmental protection.
- Reduction in targeted trade barriers.
- Use of environmental protection policies as trade barriers.
- Adoption of environmentally benign technologies.
- Harmonization of environmental standards.
- Institutional capability for implementing environmental and trade-related dispute resolution.

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PRIVATIZATION

KEY POINTS

- Privatization can remove from government the burden of inefficient state enterprises. It can increase economic efficiency and, with the sale of the enterprises, reduce the public debt.
- Steps should be taken to diminish the social costs of the economic restructuring and probable layoffs, and the potential concentration of assets in the hands of the elite.
- Before privatization of state enterprises can take place, the institutional capacity must exist to re-regulate the market, particularly for natural monopolies such as water supply.
- Privatization without environmental control policies in place can result in greater pollution.

The privatization of state-owned enterprise has proceeded rapidly in Latin America, Eastern Europe, and other developing countries. Two principal reasons for privatization are (1) to repatriate dollars lost to capital flight during the debt crisis and to reduce the government debt and (2) many state enterprises have been economically inefficient and have worked as a drag on the economy. Primary candidates for privatization have been in the financial and telecommunications sectors, transportation, public utilities and solid waste, petrochemicals, sugar and other state agricultural enterprises, and mining (IDB 1993; Birch and Primo Braga 1992).

In addition to alleviating government budget difficulties and improving the macroeconomic environment, privatization is expected to result in more efficient use of resources and an increase in productivity. Increased investment and the adoption of new technology, which is often more environmentally friendly, are also expected benefits. Increased efficiency is not only good for economic growth, but also typically leads to wiser use of natural resources. Prices for water and electricity would rise, reducing demand and encouraging efficiency.

On the other hand, privatization is expected to have a number of social costs. As companies are restructured, layoffs or wage

Likely Impacts of Privatization

GROWTH

- Reduced burden of public sector debt and improved macroeconomic growth leading to decreased rates of inflation and increased real interest rates.
- Increased investment.

WELFARE

- Short-term increases in unemployment as industries restructure.
- Potential price increases in consumer services such as transportation, water, and electricity.
- Potential increases in income inequality.

CONSERVATION

- Potential efficient use of resources—including natural resources—under private sector management, especially if market-based environmental protection policies are implemented.
- Improved possibilities for environmental regulatory control because the state is now an agent outside of industry.

decreases are inevitable. Owners, especially those who are well connected politically, may benefit at the expense of labor. Some researchers also fear that women may be hurt more than men in terms of lost jobs and wages (Mulhern and Mauzé 1992). Regional differences or rural/urban differences may also be exacerbated; for example, subsidized rural services may be reduced. In addition, economic growth may negatively affect the environment.

Privatization of State-Owned Enterprises (SOEs)

There is insufficient evidence to determine if privately owned or state-owned enterprises (SOEs) are more polluting; but there are indications that privatization may reduce pollution intensity.

As SOEs are privatized and subject to competitive pressures, it is expected that newer and cleaner technology will replace older, more-polluting technology. Because SOEs are government

operated they may be less accountable to the government than an outside company. The high levels of pollution in the former U.S.S.R. and Eastern Europe support this view. Protected SOEs tend to be more materials- and energy-intensive and as a result, more pollution-intensive (Kikeri et al. 1992).

On the other hand, SOEs may leave idle valuable assets (e.g., large tracts of land), which private owners would use for profit. Private companies can more easily conceal information from regulators and are more likely to bribe them to avoid compliance (Kikeri et al. 1992). Policymakers should be sensitive to the circumstances specific to each country and adjust policy accordingly.

Mini-Case

- In Cubatao, Brazil, state-owned steel, fertilizer, petrochemical, and cement plants caused a state of emergency in September 1984 when nine industries were shut down and an evacuation was ordered. Only a few months later massive amounts of ammonia gas were released when a pipe ruptured at a fertilizer plant.

- In Katowice, Poland, pollution from state-owned steel and chemicals plants, power stations, and metal smelters resulted in extremely poor air quality in the area throughout the 1980s. Although the state set exceptionally high fees for emissions in the area to resolve the problem, many enterprises were exempted from paying the fees.

The situation has improved significantly in both cases, still under public ownership. In Cubatao a public crisis was necessary and in Katowice the prospect of privatization helped bring environmental problems under control (World Bank 1992).

Re-regulation

Experience indicates that privatization of state enterprises in competitive markets (e.g., agriculture and manufacturing) is more likely to be successful than for enterprises that are natural monopolies (e.g., power and water) (Kikeri et al. 1992). Another important factor for successful privatization is the institutional capacity to re-regulate the market. Privatization of enterprises that are natural monopolies, especially, will require a sophisticated legal and regulatory system to protect consumers.

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It is often necessary to restructure large firms prior to sales—best done under a competitive bidding process. This encompasses organizational, managerial, and legal changes as well as financial restructuring and the layoff of excess workers.

When privatization is not well managed, the outcome can be unfavorable. Excessive "sweeteners in the terms and conditions of sale" often favor a small elite and work to the disadvantage of the majority (Kikeri et al. 1992). To ensure a fair process and public support and confidence, all transactions should be transparent.

Mini-Case

In a study of privatization in Mexico, Bazdresch and Elizondo (1992) emphasize the process of "re-regulation" necessary. The following are among the measures taken to support the privatization process:

1. Trucking was re-regulated to allow free passage on federal highways.
2. New legislation was written to protect intellectual property rights.
3. Regulations in the petrochemical sector were changed to allow greater participation of private domestic and foreign investment.
4. Regulations covering foreign investments were simplified and technology transfer was also liberalized.
5. Telecommunications, airlines, railroads, the movie industry, packaging regulations, publicity, fisheries, sugar, cocoa, coffee, the match industry, and corn, among others, were re-regulated.

Privatization of Natural Resources

Competitive industries (e.g., mining and petroleum companies) as well as agricultural enterprises (e.g., large sugar estates) are primary targets for privatization. If the privatization of natural resource assets is poorly managed and the well connected obtain cheap access to the national wealth, overexploitation could quickly result. In all cases, royalties for resources should reflect global prices, and be reinvested by the government in resource

management and implementation of regulatory policies. This implies an open competitive bidding process.

Minerals and agriculture

Many countries in Latin America nationalized mining, petroleum, and agricultural enterprises in the 1950s and 1960s to prevent foreign exploitation of natural resources. Policymakers must take care as these resources are privatized that exploitation by the domestic and foreign interests who buy the companies does not occur. These kinds of enterprises can be auctioned under competitive bidding to obtain the highest value for the resource.

Energy and water

Privatization of utilities such as water, energy, or solid waste collection offers the possibility for improved resource management, both in terms of more rational pricing to reduce use and in terms of better regulatory control. However, as already pointed out, such natural monopolies must be re-regulated carefully.

Water is typically supplied to the public sector at subsidized rates. Ironically, the rich receive the best water services, and the poor rely on the private sector. In Karachi, poor people buy water from private vendors at a higher price than that paid by people who own houses that are connected to the public water supply (Roth 1987). Privatization can bring more rational rates and better provision of services to more people.

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Mini-Case

"Private management—rather than full ownership—may be an interim solution, particularly for water, where the private sector may be reluctant to invest in infrastructure. The Côte d'Ivoire Water Distribution Company (SODECI) was created thirty years ago and began to bid on urban and rural water supply contracts throughout the country. Water losses were reduced and collection rates were raised, although some problems persisted because of government-controlled pricing policies. In 1988 the private company was made responsible for future investments in urban water supply" (Kikeri et al. 1992, p. 51).

Although the transmission and distribution of electricity can be considered a natural monopoly, electricity generation is not. A distributor of electricity can acquire power from various sources. In the United States, for example, public distribution networks must buy electricity from private producers who generate power from renewable energy sources.

Some experts emphasize that private companies, individuals, and cooperatives can provide energy in rural areas that otherwise might not be served. Likewise small private sources might complement energy provision in urban areas. Windpower, biogas, and photovoltaics have been used with much success in many areas.

- Windpower is exploited by the private sector in Kenya.
- Solar-powered pumping systems for water supply and irrigation have an active market in Brazil.
- The exploitation of biogas for energy has been particularly successful in China.

Privatization of electricity generation may well yield increased prices and reduce the subsidies for household consumption and services in rural areas. More reliable electricity provision, however, may be a major benefit for small and large businesses alike. When electricity blackouts are frequent, the small businesses that cannot afford private generators may be the hardest hit (Roth 1987).

Environmental regulatory control

Environmental regulatory control can also improve with privatization. In England and Wales, for example, when the river basin authorities were responsible for the management of water

resources, environmental protection, and services, violators were seldom prosecuted. Better environmental quality resulted when private companies took over the delivery of water and sewerage services while the public agency retained regulatory authority (World Bank 1992, p. 110). It has also been found that because the need for regulatory oversight is so conspicuous with a private agency, community involvement may also increase.

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Indicators: Privatization

Problem Indicators

- Efficiency of resource use such as energy and water.
- Rate of resource use such as timber harvesting.
- Pricing structure and number of competing suppliers.
- Pollution levels in streams and groundwater.

Policy/Process Indicators

- Number of state-owned enterprises and rate of privatization.
- Adoption of environmentally benign technology.
- Transparency of privatization.
- Returns from sales of government resources.

FOREIGN DIRECT INVESTMENT

KEY POINTS

- Foreign investment generally is welcomed as a means to obtain new technology, expertise, and access to world markets.
- Policies must maximize the benefits of foreign investment and minimize the associated costs.
- Natural resources at subsidized prices should not be used to attract foreign investors.
- Increased environmental standards should be enacted and enforced so that developing countries do not become "pollution havens."

Developing countries have begun to welcome foreign direct investment. The perceived benefits (in addition to foreign capital) include technology transfer, managerial expertise and technical skills, and access to world markets (Gillis et al. 1987). Increased employment does not necessarily result from foreign investment, it depends on the labor intensity of the incoming industries.

Foreign investment was viewed skeptically for many years because it generally took advantage of special conditions in developing countries—cheap labor and natural resources—to send profits home. Firms were attracted by low tax rates or lax environmental regulations.

Creating an attractive investment climate for foreign investment will require regulatory reform as well as liberalization of the macroeconomic and financial environment. Foreign investors also may have concerns about discriminatory legislation, the threat of expropriation, and controls on foreign exchange (Meier 1989, p. 259). For example, reforms undertaken in Argentina to provide a more hospitable investment environment include the deregulation of road transport, the elimination of monopolies in port activities, and the decontrol of prices, salaries, and foreign exchange transactions (Birch and Primo Braga 1992).

Side agreements to the North American Free Trade Agreement suggest that improvements in the legal and judicial environment,

Likely Impacts of Foreign Direct Investment

GROWTH

- Increased growth as a less burdensome regulatory environment encourages both foreign and domestic investors.
- Decreased long-term growth if foreign investors are allowed to overexploit domestic resources.

WELFARE

- Significant restructuring and shifts in employment.
- Potential increases in human capital growth with improved technology.

CONSERVATION

- Opportunities for resource mining.
- A potential "pollution haven" effect as heavy pollution-intensive industries move to developing countries.

including the protection of intellectual property, workers' rights, and the development of a stable environmental protection policy will also be required.

Special Incentives

A wide variety of special incentives may also be provided to particular investors, but these kinds of subsidies can work to the detriment of the resource base and may be ultimately unproductive for the host country.

Tax holidays or reduced tax rates on profits are principal inducements to foreign investment. Multinational investors can then shop for low tax rates and shift their profits to the country with the lowest tax rates (Meier 1989). Input subsidies may be attractive to investors but they can also result in overexploitation of natural resources. Duty-free zones may be established or special infrastructure and public services may be provided to facilitate the needs of foreign investment. Some of these inducements open up natural areas and attract migrants, resulting in resource degradation. Some kinds of investments

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(e.g., in tourism) may require more sophisticated demands for water, sewerage, and electricity than generally provided in the country. Other incentives may include assistance with information on investment opportunities, monopoly rights in the local market, and exemptions from import duties on necessary equipment and materials.

The opportunity cost of these incentives along with the direct costs from environmental pollution and resource degradation may be very significant. Investors should pay the full cost of resource use and waste disposal. All incentives for foreign investment should be examined carefully on an individual basis to assess the effects on the environment and to maximize local employment benefits.

Foreign Exploitation of Natural Resources

Particular caution should be exercised with regard to foreign investments in natural resources such as agricultural investments, forests, oil and minerals, and tourism. When royalties for natural resources do not capture resource rents and reflect local scarcity value, windfall profits are provided to the investor at the expense of government revenue, and resources are used inefficiently.

To avoid these problems, land or mineral rights should be allocated through a transparent competitive bidding process that is open to all. This will also diminish the opportunity for corruption that may be present when resource rights are assigned. Short-term leases of government land and forests can encourage overexploitation of the soil and forests because the holder has no long-term interest in the value of the resource. The length of the lease may not be as important, however, as other policies that may establish higher relative values for other uses for the same land.

Agricultural enterprises should be held accountable for the negative effects associated with soil erosion and agrochemical use. Soil washed into rivers can fill up dams downstream, imposing costs on the public sector. Improper use of pesticides can damage the health of agricultural laborers and pollute the water supply. Agribusiness should be monitored and proper practices enforced, actions that may at times exceed the regulatory capacity of the host country.

Foreign investment in tourism also can exploit the natural beauty of the host country while returning few resources to preserve and maintain the natural environment. As with exploitation of other natural resources, resource rents from unique locations should not remain with the hotel industry. Substantial tourism revenues should be reinvested in maintaining the country's biological wealth and government fees should be set at levels to capture rents and to limit tourism to sustainable levels.

Mini-Case

In the 1960s and early 1970s timber harvesting boomed in the Philippines. Many of the timber concessions were awarded to multinational corporations dealing in forest products—among them were subsidiaries of U.S. companies such as Weyerhauser, Georgia Pacific, Boise Cascade, and International Paper. Timber production increased from 3.8 million cubic meters in 1955 to 11 million in 1968. Opportunities for excessive profits with relatively low fees and little supervision encouraged the destruction of millions of hectares of forests (Boado 1988).

Technology Transfer and Human Capital Development

A principal motivation for encouraging foreign investment is the transfer of technology and the potential for foreign technical personnel to come train local personnel. Policies should be established to encourage the maximum training of the local workforce. Indonesia, for example, requires that within three years all unskilled jobs be filled by local labor. Skilled jobs have different requirements: 50 percent of technical and managerial positions and 75 percent of skilled and supervisory jobs must be filled by Indonesians after a specified period (Gillis et al. 1987, p. 386). Thus, skills can be gradually transferred and managerial ability developed. Administrative organization and many other innovations and ideas that are not subject to intellectual property protection become part of the benefits to the host country.

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Mini-Case

Merck Chemical has agreed to contribute $1,135,000 toward a cataloguing of all species in Costa Rica in exchange for species samples to be screened for potentially valuable chemicals. INBio, a local nonprofit organization devoted to identifying and preserving biodiversity, is a partner in this investment. INBio's agreement with Merck maximizes the transfer of technology and furthers human development in Costa Rica. INBio has involved the intellectual community of the nation's scientists and museum curators, and the rural communities for the collection of field samples. INBio subcontracts out much sample processing, extracting, chemical analysis, and so on to Costa Rican university laboratories.

Pollution Havens

Evidence that open trade regimes encourage the adoption of cleaner technologies has been presented above (Wheeler and Martin 1992). Birdsall and Wheeler (1992) also examined economies in Latin America and found that pollution-intensive industries are most often associated with economies that are relatively closed to trade and foreign investment. Nevertheless, developing countries do show an increasing share of "dirty industry" trade (Low 1992).

Although it is not clear that differences in environmental policy fully account for this rising trend, as countries open their doors to foreign investment, lax environmental standards should not be used as a measure to entice foreign investment. Most studies indicate that the "pollution haven" effect is modest and that other factors are generally more important in the decision to invest in another country (U.S. Congress, OTA 1993). On the other hand, industries that produce large amounts of toxic waste may be more likely to relocate where environmental regulation is least costly.

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Mini-Case

What of the "pollution haven–industrial flight" hypothesis? According to this hypothesis, industries will relocate to nations with the least stringent environmental policies to minimize compliance costs. Empirical evidence, however, unambiguously refutes this hypothesis. For example, H. Jeffrey Leonard of Cambridge University, in a case study of trade and investment flows, found little evidence that pollution control measures have a systematic effect on international trade. James A. Tobey at the University of Maryland, in an econometric study of international trade patterns in "pollution-intensive" goods, also could not identify any negative effects of stringent domestic environmental policies. Michael Porter, professor of economics at Harvard University, contributes even more surprising evidence. His seminal study of the comparative advantage of nations found not only that environmental protection does not hamper economic competitiveness but also that those nations with the most stringent environmental laws also had the highest rates of economic growth and job creation. Maureen L. Cropper and Wallace E. Oates, both of the University of Maryland and Resource for the Future in Washington, D.C., in the most extensive recent review of the literature, report that "in short, domestic environmental policies, at least to this point in time [June 1992], do not appear to have had significant effects on patterns of international trade."

It thus appears that the concept of "net" job creation by environmental protection is nebulous. At the least, the evidence shows that, in the short term, the number of jobs created and lost from environmental protection may be equal, although the weight of evidence is that, even in the short term, environmentalism may create more jobs than it eliminates. In the long term, however, industries, regions, and nations must compete for environmental protection–related growth and jobs. Indeed, any short-term job gains that may result from a lessening of environmental standards will be overwhelmed by the negative consequences in the long term. This is a classic case of being able to do well by doing good and refutes the notion that economics is inevitably a "dismal science."

Mini-Case

Contradictory evidence has been presented on the *maquiladora* plants near the Mexico–United States border. Some researchers using econometric studies have found no significant relationship between the low level of environmental regulation and U.S. investment. But case studies and surveys of firms suggest the opposite. One study showed that for 26 percent of *maquiladora* operators in Mexicali, lax environmental enforcement was an important reason for their relocation. Another showed that both high labor costs and strict environmental standards in the Los Angeles area sent many wood furniture manufacturers across the border (U.S. Congress, OTA 1993).

Indicators: Foreign Direct Investment

Problem Indicators

- Efficiency and rate of resource use.
- Degree of pollution and contamination.
- Health indicators such as morbidity and mortality.
- Toxicity of outputs of industries.

Policy/Process Indicators

- Domestic employment generated by resource extraction or use.
- Degree of environmental regulation and monitoring.
- Degree of foreign involvement in resource use.
- Availability of new technologies.

RESEARCH QUESTIONS

Liberalization of trade has many potential effects on both the rural and the urban environment. As with exchange rate reform, there are likely to be some negative effects. What will be the most severe negative effects? Does the government have the ability to regulate or control negative effects?

Export promotion of both traditional and nontraditional crops has many different effects on the types of employment generated and the resource consequences of their cultivation. Some crops require more pesticides. Others cause less erosion than domestic food crops, while also increasing income and employment in rural areas. What are the environmental effects of the current crop mix, and what environmental effects should be expected from policy changes that promote exports? Are there ameliorative policies that can be established with limited requirements for government regulation or enforcement?

Does pesticide enforcement at the U.S. border constitute sufficient control of banned pesticides?

What have been the effects of protectionist trade policies on the environment? Is there evidence of inefficient industrial sectors?

Have environmental policies functioned as nontariff barriers to trade? How?

If there has been privatization of state-owned enterprises, what have been the effects on energy use and the environment? How has privatization affected the operations of resource users? For example, if there has been privatization of agricultural input or marketing operations, has there also been a change in crops produced?

Does privatization result in more or less pollution in the various resource sectors of the economy?

Does privatization of public utilities constitute a realistic approach to improving resource pricing?

What are the current impacts of direct foreign investment on the economy and on the environment? Who wins and who loses from incentives provided for foreign investors? Are resources mined as a result of these incentives? Have polluting industries moved into

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the country because of incentives or lax environmental laws or lax enforcement of laws?

How much technology transfer of more efficient and/or environmental technology has resulted from direct foreign investment?

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Environment

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Environment

PROTECTION OF ENVIRONMENTAL QUALITY

KEY POINTS

- The demand for environmental management policies increases as the scale of waste generation exceeds assimilative capacity and environmental and health damages become apparent.
- Contrary to conventional wisdom that environmental regulation has a negative economic effect, analysis of available empirical evidence finds no data supporting a negative relationship between environmental regulation and economic growth.

A large class of environmental problems results from the free disposal of wastes into the air, surface water, groundwater, or on the land. At early stages of development, it may be feasible to allow unregulated accumulation of waste emissions because the assimilative capacity of the environment exceeds the level of waste generation. As development progresses, however, the scale of waste generation increases correspondingly, disposal exceeds the assimilative capacity, and environmental and health damages follow. At this stage of development it is necessary to implement environmental management policies.

Policies can be directed at the source of the waste or at the environmental or human endpoint where the damage occurs. In the first case, environmental management focuses on limiting free disposal, such as through policies that change the generation, emission, storage, treatment, and recycling of wastes. These policies may intervene directly in how activities are carried out through regulations or indirectly through policies that address the contributing factors. Examples of indirect policy intervention are pricing and taxation policies for raw material inputs.

Likely Impacts of Environmental Protection

Growth

- Growth in the environmental technologies sector.
- Savings from increased efficiency available for investment.
- Positive growth and job formation, although at a slower rate in the short term.

Welfare

- Transfer of wealth from polluters to pollution controllers and abaters and to less polluting firms.
- Improved health in the general population, especially among poor and marginalized groups who traditionally have been the most affected by declining environmental quality.

Conservation

- Improved water and air quality.
- Decreased loss in biodiversity.

Alternately, environmental management can focus on mitigating exposure once wastes get into the environment. Such policies are necessary because environmental capacity constraints are seldom acknowledged until after damages have begun to manifest themselves. An example is environmental cleanup of uncontrolled hazardous waste sites. When remediation costs are high, insulating the environment or humans from contamination may be the next best alternative. This option is typically used when large-scale contamination occurs, such as at Love Canal, New York, and Times Beach, Missouri, where hazardous waste contamination eventually forced residents to move out of these areas.

What is the net impact of environmental protection on jobs and the economy? Roger Bezdek (1993) reviewed the evidence drawn from theoretical, anecdotal, econometric/simulation, and empirical/statistical sources. His review is summarized below. The standard argument that environmental policies have negative economic effects is as follows: "Businesses invest capital goods and services for a profit. Each firm seeks to minimize capital and operating expenses and to maximize sales and profits. As more environmental restrictions on production are enacted, the cost of production increases. This increase raises the price of the product

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and, depending on the product's price elasticity, reduces its sales. Reduced sales decrease employment. When regional or international considerations are taken into account, it is argued, economic activities, pollution, and jobs are exported to those regions and nations with relatively lax environmental standards ("pollution havens"). Thus, environmental regulations and standards impose nonproductive expenses on the economy that reduce economic growth and eliminate jobs.

"However, does the empirical evidence available indicate a negative or positive relationship between environmental protection and economic growth?" (Bezdek 1993)

Stephen Meyer (1992) of the Massachusetts Institute of Technology, in the most comprehensive recent study tested the "hypothesis that pursuit of environmental quality hinders economic growth and job creation by ranking the 50 U.S. states on the basis of the stringency of their environmental laws and then comparing the rankings with measures of economic growth and job creation between 1973 and 1989. His findings are striking: Not only did Meyer find no evidence to support a negative relationship between environmental regulation and economic growth, but his results showed just the opposite. States with the most ambitious envionmental programs had the highest levels of economic growth and job creation over the period. Although Meyer's study does not necessarily prove that environmental regulations cause economic growth or create jobs, it does repudiate the hypothesis that environmental regulations reduce economic growth and job creation" (Bezdek 1993).

The empirical evidence cited by Bezdek questions the hypothesis that industries will relocate to nations with the least stringent environmental policies to minimize compliance costs.

- H. Jeffrey Leonard (1988) of Cambridge University, in a case study of trade and investment flows, found little evidence that polution control measures have exerted any systematic effect on international trade.

- James A. Tobey (1990) at the University of Maryland, in an ecnometric study of international trade patterns in "pollution-intensive" goods, also could not identify any negative effects of stringent domestic environmental policies.

- Michael Porter (1990), a professor of economics at Harvard University, contributes even more surprising evidence. His seminal study of the comparative advantage of nations found not only that environmental protection does not hamper

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economic competitiveness but also that those nations with the most stringent environmental laws also have the highest rates of economic growth and job creation.

- Maureen L. Cropper and Wallace E. Oates (1993), both of the University of Maryland and Resources for the Future in Washington, D.C., in the most extensive recent reveiw of the literature, report that "in short, domestic environmental policies at least to this point in time (June 1992) do not appear to have had significant effects on patterns of international trade."

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Indicators: Improved Environmental Protection

Problem Indicators

- Quality of air, water, and land resources.
- Degree of biodiversity.
- Health of people, represented by mortality and morbidity.
- Rate of resource usage and efficiency.

Policy/Process Indicators

- Movement toward market-based policy instruments.
- Growth of environmental protection spending and jobs.
- Economic benefits from investment in environmental and conservation programs.
- Efficiency of industries with stringent environmental regulations compared with the efficiency of those without.
- Rate of job growth in environment-related technologies compared with that in other sectors.

WATER QUALITY

KEY POINTS

- Technology-based standards may not be a cost-effective means of pursuing water quality goals.
- Ambient standards accommodate the circumstances of a given location's water quality needs better than uniform, technology-based standards. They do not, however, provide adequate guidance on which point sources should be controlled when tolerances are exceeded.
- Standards that are customized to the environmental and economic circumstances of individual point sources may be the most efficient. But the high transaction costs for establishing such a system may put such an approach beyond the reach of governments with limited resources.
- Setting priorities for the most important point sources that can be controlled cost effectively could be the best starting point for improving water quality.
- Effluent charges provide polluters with monetary signals that can lead to changes in wastewater disposal practices. Imposing charges rather than direct regulation allows polluters to decide how to most efficiently reduce their level of pollution.
- It is difficult to determine the level of effluent charge that will send the right monetary signal to achieve a water quality target.
- It is also difficult to set an administratively feasible charge that is not so high as to cause financial burden and not so low as to be disregarded.
- Rather than serve as the key element of a program to improve water quality, effluent charges may best be used initially to supplement a program of standards, but oriented more toward raising revenue for a water quality authority than as an incentive to change behavior.
- Subsidies redistribute the burden of pollution control from polluters to society.
- Although subsidies may facilitate the adoption of better pollution control by individual facilities, pollution control will not be accomplished at cost-minimizing levels.
- Tax exemptions, a special form of subsidy, may benefit most the polluters who are in the best position to pay for pollution control themselves (i.e., the most profitable firms).

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Likely Impacts of Adoption and Enforcement of Water Quality Standards

GROWTH

- Increased costs and decreased employment in polluting industry in short term.
- Increased employment in environmental protection, and in firms specializing in environmental technology.
- Increased costs of government and increase in government employment.
- Long-term improvement in economic competitiveness.

WELFARE

- Improved water quality.
- Improved health of population.
- Transfer of wealth and jobs from polluting industries to other sectors.

CONSERVATION

- Decrease in loss of biodiversity.
- Sustainable long-term resource use.

Direct Regulation

Regulations to protect surface waters initially tend to target the effluent from a finite number of point sources. Such end-of-the-pipe regulation is a common, but not cost-effective, means of pursuing water quality goals, in part because it is implemented in many circumstances through uniform, technology-based standards. Such standards restrict emissions to the levels achievable under the "best available" or "best practicable" pollution control technology. In the case of municipal and industrial discharges, the inefficiency results from failure to consider the levels of control needed to achieve a given level of quality in the receiving water body.

End-of-pipe standards that are customized to the discharger's circumstances can reduce the cost of pollution control without sacrificing environmental protection. This can be achieved by setting performance standards on the basis of water quality needs of the receiving water body. This ambient standard approach

requires more complete monitoring of each point source than is required under a technology-based approach, where visual inspection may be sufficient to ensure that the technology is operating properly.

Although ambient standards may also be uniform, they at least recognize that variations in local conditions can affect the capability of a water body to assimilate wastes. Consequently, the pollution control requirements can be set at the levels necessary to attain ambient conditions for specific locales. When ambient standards are exceeded, however, it is uncertain if government authorities have the capability to identify the responsible individual point sources. Uniform requirements have an advantage in that they relieve the authorities of proving that an individual polluter must carry out additional control efforts.

Focusing on one environmental objective, such as water quality targets, may create other environmental problems because many pollution control technologies transform rather than destroy pollutants. For example, treating wastewater to reduce the concentration of a toxic substance is likely to generate sludges with higher concentrations of this toxic. Because these sludges must also be managed, a more integrated view of management must include more than the water quality problem alone.

Limited budgets limit government oversight capabilities and the degree to which regulations can be established and implemented for individual point sources. Consequently, authorities may rely on command-and-control approaches to regulatory standards based on technologies used in industrialized countries. For some developing countries, however, such standards are overly ambitious and cannot be enforced.

Effluent Charges

Environmental economics points to the existence of socially optimal levels of pollution. Assuming that the social damages (in terms of negative impacts on the environment and human health) can be estimated, imposing a tax equivalent to this damage on polluters will give the polluter the ideal incentive to mitigate the damage.

Typically, polluters are given little financial incentive to change their wastewater disposal practices. To dispose of wastewater an industrial facility need only invest in conduits to the nearest

water body. Households have limited access to sewage infrastructure in terms of hookups or handling capacity, and municipal sewage systems, to the extent they exist, serve merely as a means to collect domestic and other wastewater that eventually is dumped untreated into surface water bodies. Although these industrial, household, and municipal practices are tolerable on a small scale given the environment's assimilative capacity, wastewater increases from urban and industrial growth have long exceeded such a scale.

In theory, a charge on wastewater effluent could be structured to provide an incentive for polluters to alter waste disposal practices. To set this charge at an optimal level, a government authority must have extensive information: pollution emissions by point source, resulting concentrations of each pollutant in the environment, physical damages that result from these increases in concentration, and the monetary value of the damage.

Given these requirements, it is not surprising that few countries have used such charges as the primary means to control wastewater effluent. Still, several countries have used effluent charges to raise revenues to provide wastewater treatment facilities, oversee water quality protection, and subsidize industrial investments in wastewater treatment

Although intended primarily to raise revenue, these charges do provide incentives for polluters to change disposal practices even though they are poorly targeted and their effects tend to be small because charges are set low to lessen opposition from industry and households. Effluent charges can be coupled with a system of standards and are analogous to fines if the charges are triggered when standards are exceeded.

Using effluent charges exclusively in place of direct regulation is unlikely. Achieving specific environmental targets with behavioral instruments, such as an effluent charge, would require extensive monitoring of effluent sources and the resulting water quality. Charges would have to be frequently adjusted to reflect changes in effluent discharges and environmental conditions in order to send the right behavioral signals to polluters.

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Subsidies and Tax Exemptions

Subsidies appear to fit the circumstances of developing countries better than direct regulation or effluent charges. Subsidies lower the financial burden that pollution control imposes and possibly encourage faster adoption of new technologies. Furthermore, subsidies have a certain logic in that the cost of retrofitting manufacturing facilities with end-of-pipe treatment should be borne by the government because it is generally the public that benefits from pollution control, not the polluter.

Subsidies, however, have been criticized on both economic and environmental grounds. Even if subsidies are one of the best uses of limited government funds, unless conditions are adequately imposed on awarding subsidies, they will not provide correct incentives to minimize pollution control costs. The environmental argument against subsidies is that they may encourage expansion of the industry receiving them, which can actually increase the aggregate level of pollution.

Tax exemptions, a special form of subsidy, are intended to encourage investment in environmental protection by granting accelerated depreciation for the pollution control equipment needed to meet water quality objectives. These tax incentives favor profitable firms, which may not be the class of polluters needing the greatest inducement to invest in pollution control. Polluters of marginal profitability may need greater support before they will choose voluntarily to invest in greater pollution control.

Experience with one large-scale subsidy program for public wastewater treatment facilities indicates that the high subsidy share in investment costs (30% to 75%) led to capital-intensive solutions with excess capacity. Because subsidy shares increased over time, wastewater treatment plant operators may have delayed investment. Economies of scale may make wastewater treatment unaffordable for smaller communities, which are unable to build wastewater treatment plants without financial assistance.

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Indicators: Water Quality

Problem Indicators

- The quality of surface and groundwater sources.
- Quality of point source discharges into water bodies.
- Amount and types of contaminants from non-point sources.
- The number of environmental and sanitary health problems related to contaminated water.

Policy/Process Indicators

- Increase in the level of treatment provided to water supply systems.
- Establishment of water quality standards with emphasis on the water quality needs of the receiving body of water.
- Establishment of water quality standards for drinking water.
- Increased budgets and personnel dedicated to oversight and enforcement of water quality regulations.
- Creation of incentives to promote the construction of water treatment facilities, but within certain guidelines to prevent overcapacity.
- Establishment of effluent charges or taxes that can be reinvested in wastewater treatment facilities and monitoring.
- Establishment and enforcement of effluent discharge standards.
- Creation of regulations, combined with fiscal incentives, to curb the discharge of untreated effluent.

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AIR QUALITY

KEY POINTS

- Technical standards for stationary and mobile sources tend to be set nationally, but those standards can vary by region and source. Many standards force the adoption of certain technologies, which raises the costs of air pollution reduction.

- Ambient standards typically are uniform and established nationally, but are implemented at the subnational level. Delegating regulatory authority to the local level increases the ability to adjust standards to local needs and therefore to keep overall protection costs down. Local authorities, however, may be inclined to compromise more with vested interests who oppose more stringent requirements.

- Many air pollution problems are extra-jurisdictional, and thus local, regional, and state authorities may not adequately address what are basically national problems.

- Putting less emphasis on rigid command-and-control regulatory practices and more emphasis on flexible approaches such as market-based instruments can lower overall control costs.

- Emission charges are a relatively simple way to influence the behavior of polluters. In theory, emission changes can be designed to achieve target levels of pollution reduction while avoiding the inflexibility of direct regulation. In practice, their use has been oriented toward raising revenue, with little emphasis on providing incentives to polluters.

- Other financial instruments can be used to change air polluting activities. General fuel taxes are a common but not well-targeted means for achieving pollution reduction, except in cases of differential taxes, such as those for leaded and unleaded gasoline.

- Other taxes such as vehicle taxes can be structured to influence consumers' choices of cars, with different pollution implications.

- Trading pollution rights approaches offer regulatory authorities the opportunity to retain greater control over the final environmental outcome than emission charges do while still drawing upon the power of economic incentives to reduce costs of control.

- Despite these advantages, the number of trading schemes actually implemented has been limited. Policy uncertainty, high transaction costs, and institutional resistance have seriously impeded air pollution emissions trading.

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- More experience with this approach could reduce some of the impediments. The United States is about to implement a major emissions trading program that could open up new possibilities.

Direct Regulation

In many countries, air quality regulations focus on major stationary sources of air pollution, especially electric power generation and industrial facilities. Only as automotive traffic has increased significantly have countries begun to address air pollution from mobile sources

Standards are set nationally and tend to be uniform, but they can be allowed to vary by region or, especially where agreements are negotiated, by point sources with individual polluters. The more that standards can be customized to local environmental and economic circumstances, the more cost effective air pollution regulations are likely to be. However, local environmental and public health considerations do not always provide a comprehensive basis for setting standards because many air pollution problems cross local, regional, and state boundaries.

Likely Impacts of Air Pollution Regulations

GROWTH

- Short-term costs associated with technology adoption that are generally small but can be significant for dirty industries.
- Long-term increase in efficiency and competitiveness.

WELFARE

- Improved air quality.
- Reduced morbidity and mortality and other health effects.
- Welfare transfers away from polluting industry.

CONSERVATION

- Possible increases in other forms of pollution such as solid wastes.
- Decrease in resource deterioration, both flora and fauna, caused by air pollution.

Technical standards take the form of emission limits for mobile and stationary sources, as well as reduction requirements for stationary sources. Existing sources tend to be treated more leniently than new sources, which protects existing polluters from higher costs (for equivalent control) but discourages the adoption of technologies that may be more efficient.

The technical standards for automobiles typically imply a specific technology (e.g., catalytic converters) to control pollution, or imply wholesale design changes, such as those necessitated by fuel efficiency standards. As currently structured, mobile source standards limit pollutant emissions per unit of travel. Although each car may pollute less, total air pollution continues to increase as the number of cars increases.

Ambient air quality standards are concerned with such common pollutants as carbon monoxide, sulfur dioxide, nitrogen oxides, total suspended particulates, ozone (from emissions of volatile organic compounds and nitrogen oxides), and lead. When these standards are implemented by subnational governmental authorities, a greater degree of flexibility and accommodation to local environmental and economic conditions can be achieved than under a program administered at the national level. In regions

where these standards are not met, radical restrictions have been established. For example, construction of new plants might be prohibited until existing plants reduce their emissions enough to offset any additional emissions from the new facilities. In some cases, radical steps have been taken at the national level, such as dramatic restrictions on lead additives to gasoline.

Although noncompliance with air quality standards provides the basis for national authorities to mandate more stringent steps, this does not guarantee action. Delays in addressing significant air pollution may persist in large, growing urban areas unless authorities at the regional, state, or national level can apply sanctions. Withholding national funds for large construction projects in regions that do not meet emissions standards has provided leverage in some instances.

Air pollution problems must be addressed in the context of other related environmental issues. For example scrubbers to reduce sulfur dioxide emissions also generate solid wastes that must be disposed of. As toxic air emissions are controlled to a greater degree, the retention of toxic wastes formerly emitted to the air may instead contaminate surface waters in wastewater effluent.

Air pollution regulations are often perceived by regulated industries as imposing undue costs on their operations. In practice, industrialized countries have found that pollution control and abatement expenditures add only a small amount to total costs of production. There are exceptions to this with particularly "dirty" industries, such as arsenic smelting and steel production, where high capital expenditures are necessary if old facilities are to meet current standards. In developing countries, this can be avoided if new capital investment takes advantage of environmental protection technologies.

Placing less emphasis on rigid command-and-control regulatory practices and more attention to market-based instruments can lower the overall costs of air pollution control.

Emission Charges and Environmental Taxes/Tax Differentials

Emission charges can be used to create incentives to reduce air pollution emissions and to provide a source of revenue, especially for environmental programs.

Some countries are considering substituting emission charges for other revenue sources (e.g., income taxes) in a revenue-neutral fashion. This would reorient taxation away from a focus on desirable commodities (e.g., labor) and toward a focus on undesirable by-products of economic activity (e.g., pollution). It may reduce the "excess burden" imposed on society by suboptimal taxation, as welfare economics points out.

Charges on emissions of air pollutants have been used in few countries. Because these charges are usually too small to have an incentive effect, they function primarily as a revenue source. One program, now suspended, used the revenue from charges on sulfur dioxide emissions to compensate victims of illnesses related to these emissions. These charges were highest in the most-polluted regions.

A tax on fuel is a price incentive that government authorities can use where fossil fuel–based energy consumption is involved. This serves as an implicit environmental tax, although it is not well targeted because it focuses on energy use rather than on pollution generation. In some countries, gasoline taxes double the price to consumers.

In several European countries, taxes differentiated for leaded and unleaded automobile fuel are used to encourage the use of unleaded gas. Also, a few countries apply differential vehicle taxes based upon the air pollution characteristics of different cars. These tax differentials may be transitional instruments because direct regulations also exist.

Revenues from emission charges can be used to provide a wide range of incentives. For example, Sweden is planning to institute a nitrogen oxide charge applied to emissions from large furnaces. The charge will be rebated to the facilities on the basis of differences in emissions per unit of electricity generated, thus rewarding more efficient electricity generators.

Despite the ease of implementing a charge-based system relative to a regulatory or a marketable permits approach, emission

charges are used infrequently, and if used, are primarily for revenue purposes. By keeping the charges low, authorities can create a reliable and substantial source of revenues without encountering serious opposition from the regulated community.

Other Economic Instruments

Economic instruments attempt to provide a signal to polluters, constraining their options enough so that they have an incentive to change behavior while at the same time leaving enough room to achieve the most cost-effective means for change. By raising the price of pollution disposal (via an emissions charge for pollution), an environmental agency induces polluters to find their own cost-minimizing amounts of pollution. By limiting the number of emission permits and allowing polluters to trade permits, the agency allows polluters to determine the price of pollution disposal.

Using either method, it should be possible to reduce pollution to a specified target level. However, the environmental agency is likely to prefer the marketable permit approach because it allows direct control over the quality of emissions.

A few quantity-based emissions trading approaches have been implemented. One, known as the "bubble" concept, allows a plant with several air pollution sources that would otherwise be subject to emissions limits to meet an overall aggregate limit, consistent with those limits. This provision gives the plant the flexibility to choose which sources to control and to what extent, as long as the aggregate requirement is met, and creates the possibility of saving costs relative to the source-by-source approach.

An extension of this approach allows emissions from new sources at a plant as long as emissions from other sources are reduced. Another trading approach, "offsets," allows trades between emissions from a new source and those from an existing source, even though the two sets of sources are not internal to the same plant; the two sources must, however, be in the same air quality nonattainment area. The "banking" approach allows firms to earn credits for controlling emissions more than is called for under required emissions limits.

Although the above are called market-based approaches, the true market experience embodied in them has been very limited. Most of the trades have been internal to plants with multiple sources.

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In this sense, these trading programs have been relatively small, but they nonetheless have generated notable cost savings. Also, it has been noted that policy uncertainty, high transaction costs, and institutional resistance have seriously impeded air pollution emissions trading. Whether a major emissions trading scheme can have comparable success remains to be seen.

Experience with another environmental trading program provides insights into how well a market for newly created rights can develop. During the phasedown of lead in gasoline in the United States, refiners were allowed to trade the restricted rights to lead additives in gasoline. By the end of the program, about 50 percent of all lead additives in gasoline was obtained through the trade of lead rights. This program was successful because it was nearly free of government intervention and because well-established markets in refinery inputs already existed, so refinery personnel began the lead trading process with considerable experience in similar transactions.

Trading approaches attempt to reduce the social and private costs of reducing pollution. They supplement rather than substitute for direct regulation and take environmental goals as given. Although they are economic instruments, it does not mean that they are used to achieve economically efficient outcomes. Setting the level of total emission reductions implicit in trading programs is the domain of decision makers who may variously consider or ignore economic factors.

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Mini-Case

In 1993, the largest application of a market-based approach to environmental protection took effect. At that time, the trading of SO_2 emission allowances began. After more than two decades of trying to regulate these emissions through "command-and-control" approaches that set emissions standards for individual pollutant sources, the United States Environmental Protection Agency (EPA) is implementing a more flexible approach that will save costs while still reducing overall emissions.

The trading scheme derives from the latest U.S. initiative to tighten controls on pollution from fossil-fuel electric power generation, as called for in the 1990 Amendments to the Clean Air Act. This step will cap national emissions of SO_2 at 8.95 million tons per year by the year 2000, which is 10 million tons below 1980 levels.

Through the market-based allowance trading system, the utilities rather than a governing agency decide the most cost-effective way to comply with the acid rain requirements of the Clean Air Act. An allowance authorizes a power generation unit within a utility to emit one ton of SO_2 during or following a given year. At the end of each year, the utility must hold at least as many allowances as there were tons of SO_2 emitted from the unit.

The initial allocation of allowances will be calculated in part on the basis of each utility's average fossil fuel consumption in the period 1985–1987. Additional allowances will be made available to selected units in the three states most affected by SO_2 restrictions (Illinois, Indiana, and Ohio) employing demand-side energy conservation measures, and additional units will be made for auctions and sales by EPA. First priority in sales will go to independent power producers. The total number of allowances nationwide will be limited to 8.95 million in the year 2000.

The allowances can be bought, sold, traded, or banked for use in future years. In theory, anyone is entitled to buy, sell, or trade allowances, including brokers, municipalities, environmental groups, and private citizens. Utilities that are able to reduce their emissions relatively inexpensively can sell their surplus allowances to other utilities that otherwise would have to take more expensive steps to comply with the emission allowances they are allocated.

EPA estimates that the allowance trading program will produce cost savings of about 50 percent ($10–$14 billion) above the conventional "command-and-control" approach.

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Indicators: Air Quality

Problem Indicators

- Levels of environmental pollutants in the air.
- Levels or morbidity resulting from air contamination.
- Air quality effects on flora and fauna.

Policy/Process Indicators

- Number of industries and vehicles not subject to pollution.
- Creation of emission charges or other disincentives to pollution.
- Establishment of environmental tax schemes differentiated on the basis of the overall environmental impact.
- Systems in place whereby revenue from taxes and charges is directly invested in greater poilution control and monitoring.

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LAND DISPOSAL

KEY POINTS

- Land disposal policies need two interlinked components: one to remediate past contamination and one to prevent future contamination.
- Management practices for hazardous wastes that seem appropriate at a particular time can lead to substantial and serious contamination when conducted over many years. Waste regulations that increase in stringency over time could avoid this outcome.
- Stringent waste regulations provide incentives for minimizing wastes, but they may leave too little leeway for waste generators to adopt waste minimizing practices.
- Economic instruments are not used as significant alternatives to direct regulation of hazardous waste management. Rather, they are typically used to reinforce direct regulations or provide a source of public revenue.

Direct Regulation

Policies aimed at addressing contamination from the disposal of hazardous wastes on land have two interlinked components: one remedial and one preventive. In the last decade, industrialized countries have initiated large-scale efforts to clean up contamination that resulted from past management practices and to implement policies to prevent future contamination. In developing countries, hazardous wastes present a growing problem not only because industrial wastes increase as manufacturing increases, but also because these countries accept and handle wastes exported from industrialized countries.

The sites that are the focus of remediation tend to be the most flagrant examples. Many of the practices that led to contamination were considered acceptable at the time they took place. In some cases waste management practices are tolerable on a small scale but are not tolerable if they are continued for several years. In other cases, such as those dealing with concentrated PCB- or dioxin-tainted wastes, even small-scale land disposal practices are not acceptable.

Likely Impacts of Policies to Regulate Hazardous Waste Disposal

GROWTH

- Increased costs and decreased employment in polluting industries.
- Increased costs to government to implement and monitor regulations.
- Long-term increase in efficiency and competitiveness.

WELFARE

- Decrease in incidence of off-site health problems.
- Employment decreases in polluting industry and employment increases in pollution prevention industries.

CONSERVATION

- Decrease in loss of biodiversity.
- Long-term improvement in resource management.
- Reduction in potentially irreversible environmental losses associated with land contamination.

The new policies to prevent contamination tend to mandate very specific measures. In several industrialized countries, any facility managing hazardous wastes must be issued a permit that may include explicit technical requirements for the design and operation of each unit handling hazardous wastes. This approach is complicated because the waste stream is heterogeneous; it may be solid or liquid, and may contain one or more of hundreds of chemical constituents. The waste can be managed in different ways: it can be disposed of in landfills and in surface impoundments, stored in containers, incinerated, injected into deep wells, treated, or recycled. It can be managed on-site, where the wastes are generated, or off-site, in some cases out of state and even out of country. Tracking wastes "from cradle to grave" with a manifest system has been used to try to prevent hazardous wastes from escaping regulation.

Stringent regulation of hazardous wastes, adopted in several countries over the past decade, encourages waste generators to minimize their wastes. Although direct regulations are not

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economic instruments per se, they do translate into higher costs, which waste generators would rather avoid.

Higher waste management costs can be avoided by capturing usable products in the waste stream, recycling and reusing inputs, and substituting inputs that generate less hazardous wastes. Some waste regulations are so broad that they preclude important opportunities for waste minimization and recycling, the very things the regulatory program should encourage.

The disposal of municipal solid wastes in landfills has traditionally been the responsibility of local governments, even though county or state authorities set the standards. This was a logical procedure because municipal wastes were managed locally. Municipal waste landfills, however, have been poorly managed, and federal standards in the United States now regulate the design and operation of municipal solid waste facilities.

This example illustrates the trade-off between the increased flexibility achieved from local responsibility for environmental management and the need for ensuring consistency (especially minimum levels of protection) achieved by centralizing responsibility at the national level. Flexibility provided by local control may compromise environmental protection if vested interests prevail. Consistency provided by national control may be too heavy-handed, setting uniform standards that impose high costs.

Another example from the United States shows that the evolution of waste management regulations is far from complete. The U.S. Environmental Protection Agency has found that funding priorities do not correspond with priorities based upon risks. For example, programs to remedy hazardous waste contamination and to prevent future contamination impose relatively high costs for relatively small aggregate risks (although there may be local "hot spots" that present significant risks).

The funding priorities reflect at least partially the relative ranking that the public gives to environmental problems. The public is concerned about hazardous wastes, and these concerns have been translated into major programs. The task for the future is to realign these programs by eliminating poorly targeted regulations while still addressing well-identified sources of significant risks.

Economic Instruments

Land disposal in industrialized countries is addressed by a large number of economic instruments. Policies for the disposal of hazardous wastes in these countries include several features:

Financial accountability. A requirement that a company show financial viability can be imposed in anticipation of potential liabilities from the operation of a hazardous waste facility. This financial test may not be carried out rigorously, however, especially when the facilities are subsidiaries of large companies with significant assets. The effectiveness of this requirement may be limited further by the fact that injured parties may have difficulty proving economic damage, thereby reducing the likelihood that the hazardous waste facility would actually be held financially accountable.

Fees. Waste generators face higher waste management costs the more stringent hazardous waste regulations are. In some cases, additional licensing or operations fees may be imposed for the hazardous waste management facility, and fees can vary with the degree of hazard of the waste handled. Unless such fees vary with quantities, they may provide only limited incentive to change hazardous waste generation and management practices. Fees per unit of waste do exist, but they are often too small to provide an economic incentive, and act primarily as a source of public revenue.

There is at least one instance in the United States where a hazardous waste fee has been designed like an import tariff and is meant to curb wastes destined for disposal. One state, trying to stem the influx of wastes from other states, imposed a fee that varied with origin in an attempt to reduce the economic gain that came from disposal within its borders rather than in the state of origin. This fee was implemented explicitly because direct regulation of imported wastes (such as a ban) was prohibited by the U.S. Constitution.

For developing countries, prohibiting waste imports might be allowed under GATT because there are provisions for countries to take the necessary steps to protect human health and resources. Plus, an international agreement on transboundary movements of hazardous wastes under discussion is intended to restrict waste imports where these may damage the environment.

Product charges. In the United States, a tax on chemical feedstocks and petroleum was created to fund the cleanup of existing contamination from hazardous wastes. Too small to provide an incentive effect, the charge also suffers from a poor linkage to the problem of concern—improper management of hazardous wastes—although the taxed substances may eventually be improperly disposed of. This tax effectively treats all uses of the taxed substances equally, regardless of their environmental implications. Attempts to replace this product charge with a waste end tax have failed.

Liability. In addition to the financial accountability that can be imposed on hazardous waste management facilities, all entities that generate, handle, or transport hazardous wastes, and even banks that are substantially involved in the management of these entities, can be held liable for any past, present, or future contamination, even if it arises in waste practices that were allowed at the time. This blanket liability has induced firms to clean up existing contamination, to make waste management practices more thorough, and to reduce waste generation—all on a "voluntary" basis (i.e., without explicit regulatory requirements).

Whether liability creates a significant incentive is unclear; the evidence is more anecdotal than conclusive. Furthermore, it is possible that the threat of liability may cause excessive steps to be taken, especially in view of the U.S. experience that firms and municipalities are being held liable for the cleanup of contamination that, in several cases, does not pose significant risks.

Whether the cumulative effect of these various economic instruments influences hazardous waste generation, management, and cleanup is unclear, partly because each instrument influences only a small portion of the problem and partly because these instruments coexist with large programs of direct regulation.

For consumer waste destined for land disposal, other economic instruments have been tried, but they generally are used only on a small scale. For example, deposit-refund systems for bottles, batteries, and tires have been implemented in a few countries and are under consideration in others.

Mini-Case

The Mochito mining operations in the northwest sector of the Lake Yojoa watershed in Honduras, managed now by the American Pacific Mining Company, has since 1972 disposed of the mine's solid and liquid wastes in large settling ponds. The condition of the retaining walls of the lagoons has been unsatisfactory and in heavy rains mine wastes have spilled into local streams, many of which drain into Lake Yojoa. Both the streams and Lake Yojoa provide drinking and irrigation water to rural families downstream and along the lakeshore. A significant percentage of the population in this area have blood lead levels above the recommended minimum of the World Health Organization.

Claiming imminent bankruptcy, the Rosario Mining Company, which has operated the Mochito Mines since 1947, withdrew in 1986, leaving thousands of residents of the Lake Yojoa watershed unemployed. This became a great political concern of the congressmen from this region, who became active in the search for solutions to the socioeconomic problems created by the company's withdrawal.

A buyer was eventually found for the interests in the mine, the American Pacific Mining Company, and the transaction was aided by a debt-for-equity swap. However, significant economic concessions had to be worked out with the company in order to make their investment attractive. These concessions consist of significant economic reforms to the Mining Code that substantially reduce the land concession fees, sales taxes, and other fees established previously for the other mining companies. These concessions have made it very attractive for the company to continue mineral exploitation and exploration and provide employment to approximately 1,000 workers. The contract, which was agreed upon by the company and the Ministry of Natural Resources through the General Directorate of Mines and Hydrocarbons, indicates the responsibilities of the two parties.

While consideration of contamination problems are covered in the contract with fines of up to 10,000 Lempiras for the company if it is proven that it discards toxic or poisonous substances into the water resources, no specific consideration is given as to how the land that is exploited under the concession's terms will be left after the exploitation or exploration is finished. If the General Directorate of Mines and Hydrocarbons does not dictate specific means for environmental protection, the topic is not considered. The General Directorate of Renewable Natural Resources has the power to demand such protection measures, but they must be specific and must be capable of enforcement; so far this has not been the case. The Fisheries Law has given the ministry the power to assess fines up to 300 Lempiras when habitat contamination is proved, yet this fine, which has always been paid by the Rosario Mining Company, is so small that there is no real economic incentive to mitigate or eliminate environmental contamination.

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Indicators: Land Disposal

Problem Indicators

- Amount of hazardous waste entering landfills, waterways, and land in general from unauthorized dumping.
- Levels of overall land and water contamination.
- Morbidity and mortality.

Policy/Process Indicators

- Establishment of risk assessment analysis procedures at the national and regional levels for planning and economic analysis purposes.
- Increase in the number of special hazardous waste disposal sites established.
- Establishment of appropriate incentives and sanctions to induce companies to recycle and to adopt processes to minimize wastes.
- Adoption and enforcement of strict hazardous waste regulations in conjunction with effective sanctions to limit the dumping of hazardous wastes.
- Establishment of systems that track wastes from cradle to grave.
- Creation of consumer education programs on the dangers of hazardous waste disposal and offer alternatives to unsafe disposal practices.

RESEARCH QUESTIONS

Which level of government (national or local) should establish water quality and drinking water regulations? Which level should implement and enforce them? Which authority within a level of government should have responsibility for water quality protection?

What is the best point of intervention?

Can priority water quality needs be established, especially in terms of location within the country?

What information is available that would allow an initial review of potential water quality improvement priorities, especially with regard to identifying point sources that can be controlled cost effectively?

Are there any charges for the disposal of domestic or industrial sewage? If so, who collects these charges?

What is the current financial basis for existing investment in and operation of public and private wastewater treatment? Are they funded from general revenues or bond sources?

In cases where little or no wastewater treatment exists, what institutions are best suited to establishing and administering a system of effluent charges?

To what extent are fines currently used to enforce existing systems of water quality standards?

Are there explicit or implicit subsidies for controlling wastewater discharges? How large are they? Are they directed at economic agents who otherwise would not invest in pollution control? Has the use of subsidies been rationalized? Do the subsidies come with conditions, or are they merely distributed until funds are depleted?

Are there tax exemptions or allowances to encourage wastewater treatment control? How large are they? Which polluters take advantage of the exemptions? Are these polluters the ones whose behavior it is most important to change?

What institutional mechanisms exist for evaluating environmental impacts from potential policy decisions targeted primarily at socioeconomic issues other than environmental management?

What mechanisms exist for integrating environmental concerns into actual decision making?

How can the linkages between economic, population, and other important social policies and the environment be quantified in a way that can realistically support policy analysis? For example, should larger models be developed (such as one that adapts pollution coefficients to economic input-output models to predict the pollution consequences of different output configurations) or should these linkages be examined on a case-by-case basis as important policies are considered?

What are the relative environmental and public health risks associated with water quality deficiencies? Can these be assessed in a common unit of measure, such as through monetary valuation?

What are the likely economic impacts from different levels of effluent charges? For households? For industry?

What behavioral responses can be expected from different levels of effluent charges? By households? By industry?

Can a subsidy scheme be effectively coupled with an effluent charge mechanism to provide adequate financing? What are the incentive effects for investing in wastewater generation and management?

How much information is there about the relative seriousness of different air pollution problems? What additional research is needed to establish a relative ranking among air pollution problems so that regulatory priorities can be risk-based? Can these problems be assessed in a common unit of measure, such as through monetary valuation?

What are the behavioral responses by polluters to different levels of emission charges for alternative air pollutants? How reliable are they as a revenue source? What are the economic impacts from different levels of charges? What are the likely environmental impacts? What are the ideal uses of the revenues from these charges?

What range of pollution control options is appropriate for addressing air pollution problems in the country? How much can be learned from the experience of industrialized countries, such as the costs of controls and the array of technological alternatives? How much must be customized for the circumstances of the country?

How effective might a market-based approach be in a given country, in light of the state of market development and the adequacy of public and private institutions that would be called upon to implement such an approach? Are the transaction costs likely to be too high to warrant experimenting with a market-based approach? Is there adequate oversight and monitoring to ensure the approach is operating as anticipated?

What are the proximate causes of the most important air pollution problems? What policies are connected to these proximate causes? Can a screening analysis be constructed to identify alternatives to the current policies that meet current policy objectives but with less environmental damage? What additional information is needed to evaluate the feasibility of these alternatives, and what does it take to obtain this information?

How can developing countries avoid the pattern of mistakes that has characterized industrialized countries' approaches to hazardous waste regulation (i.e., to allow lax handling of wastes until very serious contamination makes expensive remediation a necessity)?

Is it possible to have regulatory stringency and oversight increase as the scale of hazardous waste generation and management increases?

Would establishing better information on hazardous waste generation and management now place developing countries in a better position to regulate more stringently as necessary? What kind of information would be collected and how?

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Energy

FOSSIL FUELS

KEY POINTS

- Energy conservation is desirable for most countries because the adoption of conservation measures and energy efficient technologies costs much less than the investment required for developing new sources of supply.
- Greater energy efficiency and elimination of price distortions could lower total energy consumption in most countries by 20 percent or more, saving millions of dollars in foreign exchange for fossil fuel imports and in investment capital for plant construction.
- Movement toward greater energy self-reliance will require a mix of decentralized energy sources, which are best suited to meet rural demands, and centralized sources, which meet the demands of urban concentrations and large-scale energy-intensive industries.
- The introduction of fuel efficiency standards or policies to update automobile fleets will reduce overall fuel consumption and diminish levels of air contamination. The benefits will be enhanced if the newer vehicles run on unleaded gasoline only, thereby reducing lead emissions.
- Subsidies and differential pricing are difficult to target and often benefit unintended groups or result in the substitution of the subsidized fuel.
- A combination of regulation and taxation will be required to limit the environmental impacts of fossil fuel.

Most developing countries import fossil fuels to meet their energy needs for electricity generation and transportation. Guatemala is the only country in Central America that has significant fossil fuel reserves. As industrialization increases and per capita incomes rise, the demand for fossil fuels will increase unless alternative fuels are developed.

For most countries fossil fuels are major consumers of foreign exchange and often sources of environmental pollution. Severe air pollution can result where emissions from factories and automobiles are not controlled, having negative effects on health,

Likely Impacts of Improvements in Energy Efficiency and Conservation (e.g., Fossil Fuel Management)

GROWTH

- Less capital investment required for expansion of generating plants, freeing up capital for other long-term productive investments.
- Decreased short-term growth to undertake energy efficiency improvements and invest in retrofitting, giving way to faster growth resulting from large savings in energy costs.
- Savings in foreign exchange from forgone imports of petroleum products.

WELFARE

- Increased availability and more efficient provision of energy to satisfy basic needs for lighting, cooking, and other services.
- Improved health through elimination of sources of contamination.

CONSERVATION

- Improvements in air quality from elimination of dirty technologies.
- Protection of biological diversity in remote sites through adoption of environmental criteria for decisions on exploration.

particularly among children and the elderly, and especially when fuel containing lead is burned. Greenhouse gases and emissions that contribute to acid rain are expelled into the air having cross-border and global consequences. Surface water is contaminated by indiscriminate dumping of petroleum products and particulate settling; coastal waters are contaminated by discharges from tankers and refineries, which affects wildlife, fish, and shellfish populations.

Despite these environmental problems fossil fuels will continue to play a major role in developing countries' economies. Strategies and policies that mitigate the effects of these environmental consequences can be devised and countries can reduce their reliance on fossil fuels through improvements in energy efficiency.

Policies Affecting the Demand for Fossil Fuels

Pricing policies

In general, the lower the price of energy the more people consume. Governments can develop pricing policies that either increase or decrease the rate of growth in demand for fossil fuels. Pricing policies are generally established to meet the sometimes conflicting objectives of economic efficiency, social equity, financial viability and environmental quality.

The choice of the policy tool will depend on the objectives established and the trade-offs among the various approaches. Pricing and other market mechanisms offer the advantages of administrative ease. Policies that impede efficient operation of the market such as price controls, average cost pricing, and producer subsidies can run counter to energy efficient objectives. Market mechanisms, however, have limitations and public sector intervention is warranted in energy markets to address problems of poverty, negative environmental impacts, research and development for alternative technologies, and information dissemination.

Marginal cost pricing. Long-run marginal cost pricing directly supports the objective of economic efficiency. It promotes efficient allocation of resources within the energy sector and between it and the rest of the economy. Long-run marginal pricing takes into account the real value of the resources required to generate another unit of energy, including the costs of future investment in plant and equipment as well as operating costs and the cost of pollution and environmental degradation. While it can lead to greater economic efficiency, it will result in relatively high prices for energy, especially electricity, and may raise the price of energy beyond the reach of poor urban and rural consumers. Higher prices for kerosene or gas for cooking may increase the demand for firewood, which would contribute to deforestation and watershed deterioration.

Subsidies. Governments often provide subsidies to lower the price of a particular energy source and increase access of poorer households to energy. Subsidies support the objective of social equity, which assumes that all citizens have a right to energy to meet their minimum needs.

Subsidies on fossil fuels increase demand and may lead to expending a greater proportion of foreign exchange on importing fossil fuel to meet the increased demand. Subsidies also tend to discourage adoption of conservation measures and utilization of renewable energy sources. Subsidies on equipment (e.g., stoves) rather than on fuels may offer a more efficient way to provide equitable access to energy. Subsidies with potential positive environmental impacts also hold promise. For example, fuel subsidies could be provided only for buses that have regular inspections and can demonstrate maintenance and retrofitting to limit air pollution.

Where fossil fuels traditionally have been subsidized and where incomes are generally low, raising prices to achieve greater levels of efficiency is usually difficult, and prices may need to be increased gradually.

Targeted subsidies. Targeted subsidies generally involve promotion of a particular fuel such as natural gas or kerosene, differential pricing by region or income group, and subsidies on diesel or fuels used by businesses providing local transportation. Governments may also subsidize cooking gas or kerosene (or stoves) to encourage people to use fossil fuels or natural gas rather than fuelwood as a way to address deforestation issues.

Subsidies are very difficult to target. Fuel subsidies may directly benefit unintended groups or result in substitution of the subsidized fuel throughout the economy in general. For example, subsidies on kerosene could encourage motorists or transportation companies to mix kerosene with gasoline or diesel to lower their fuel costs. This action in turn could cause supply shortages of kerosene, and ultimately limit access to the fuel by the intended target group.

Cost recovery. Pricing decisions need to take into account the objective of financial stability for the utility. This implies pricing to obtain cost recovery, permit the energy sector to earn a fair rate of return on assets, and to finance investment for future supplies. If marginal cost pricing is not adopted, a pricing system that ensures financial viability of the utility and adequacy of energy supplies can be adopted to cover financial costs. Inadequate revenue generation often leads to poor system operation and maintenance and to problems with energy delivery. The type and extent of subsidies provided may result in revenue shortfalls.

Policies Promoting End Use Efficiency

Greater energy efficiency can reduce demand for energy. For example: (1) regulations and codes that impose efficiency standards on appliances sold in the domestic market can decrease demand for electricity at the household level; (2) building codes that promote energy efficient designs lower demand for air conditioning and heating; and (3) improvements in industrial energy efficiency from improved housekeeping measures and retrofitting also can lower overall demand for electricity.

Designing and implementing policies that promote greater efficiency usually require establishing cooperative mechanism between economic development ministries, energy planning authorities, and the largest consumers of energy.

In the automotive sector, fuel efficiency standards for cars and trucks have the dual effect of improving per kilometer gasoline consumption rates and ensuring a newer fleet of automobiles. Newer cars can be required to run on unleaded gasoline to eliminate lead emissions. Lower income groups who depend on imported older cars that burn only leaded gasoline will find this unpopular, but phasing in the standards over a relatively long time period can help in the transition.

Taxes

Taxes are a market-like instrument for allocating resources among energy-consuming and energy-producing activities and across economic sectors. Taxes are most effective where the diversity of energy users and technologies make administrative or regulatory solutions difficult. They have the disadvantage of raising prices for energy, which if applied across the board are regressive and present concerns about social equity. Also taxes are hard to calibrate, and the amount of the tax can be somewhat arbitrary because it is difficult to estimate how much a tax should be to modify behavior appropriately. Taxes, however, are also a good source of revenue that can be used to implement regulatory instruments.

Taxes on gasoline and other fossil fuel products raise the price and decrease consumption levels. They can be used to ensure that only target groups benefit from a subsidy. For example, where diesel is subsidized taxes can be levied on diesel cars; where kerosene is subsidized taxes can be levied on kerosene generators.

Taxes can also serve as a transfer payment from wealthier classes to those who require energy to satisfy basic needs.

Regulation

Government has the option to regulate energy-intensive processes and establish efficiency standards for industry. Regulations can promote efficiency, limit atmospheric emission levels, or promote the use of specific fuels or energy sources. Compliance must be monitored and effective sanctions implemented. Monitoring and enforcement are difficult in developing countries due to lack of technical and financial resources. Also low salary levels of inspectors and monitoring personnel create fertile conditions for corruption. Governments can choose taxation, regulation, or a combination to obtain desired levels of fossil fuel use throughout the economy. If the cost of enforcement is high, or logistically difficult, governments will need to determine if the desired outcomes can be achieved through taxation rather than regulation.

Fuel substitution policies

Efforts to substitute natural gas or kerosene for fuelwood by providing credit for stoves will result in greater energy efficiencies, but will also increase demand for fossil fuels. Evidence indicates that subsidies on equipment rather than on fuels are more efficient and effective in stimulating substitution and extending access to more efficient energy supplies. However, because natural gas, for example, is a more efficient energy source, a country could be better served by subsidizing its use, especially if wood supplies are low or deforestation is a problem.

Policies that promote substitution of renewable energy sources (e.g., solar and biomass) for fossil fuels through support for research and development and credits should decrease the demand for fossil fuels. Governments must make trade-offs when they promote certain energy sources over others. If the major objective is to decrease reliance on fossil fuels, policies that promote decreases in fossil fuel demand will be the most appropriate. If energy-related equity considerations and desires to limit deforestation prevail, increased use of fossil fuels may be desirable. The impacts of substitution policies must be evaluated in the context of a country's long-term energy and development goals. In many cases, a combination of fuel uses for specific regions or activities will be an effective part of an energy strategy.

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Policies to create awareness

Public education programs can promote conservation and provide consumers with ideas on how to limit their consumption of energy without significantly affecting lifestyles. Programs aimed at all consumers can be implemented and special programs can be undertaken in schools as part of a larger conservation education program. If the goal of government is to decrease reliance on fossil fuels and to promote conservation the public needs to be informed about the economic savings available to individuals and to the country by adopting energy conservation measures. The public also needs to know how, and through what actions, it can contribute to energy conservation.

Environmental policies

Contamination from the transportation and burning of fossil fuel represents a serious threat to human health and to terrestrial and coastal ecosystems. Governments can regulate the emissions of fossil fuels through a variety of instruments: energy taxes, specification of acceptable technology, taxing pollution sources, and assigning tradable pollution rights. Generally, a combination of approaches is used.

Regulation. Regulations on emissions and/or technology are useless unless governments have the ability to monitor compliance. The administrative costs of regulation tend to be higher than those for taxation.

Taxation. Taxes can be levied on firms that use contaminating technologies, and tax credits can be provided to promote investment in clean technologies. Taxes on refineries and environmental fees charged to tankers entering ports, coupled with fines for noncompliance, help raise funds for clean-up and improved monitoring, while sending a firm message about the government's commitment to control discharges.

Tradable pollution rights. Where governments have the ability to monitor discharges, they may set overall industrial emission standards, assign pollution rights, and allow industry to trade their pollution allotment on the market. Firms that can reduce their emissions at a cost equal to or less than the market value of their pollution rights will sell their rights and invest directly in pollution control technology. Firms that can reduce emissions only at a cost greater than the market value of their allotment will purchase pollution rights. In this way firms reduce pollution where

it is the most cost effective. This approach reduces pollution efficiently but requires sophisticated monitoring, which may be beyond the capability of most developing countries.

Policies Affecting the Supply of Fossil Fuels

Investment policies

Investments in generating capacity are often designed to meet demand at peak loads. Serious economic inefficiencies result from supply-based designs and investments and from the construction of extremely large plants to satisfy peak load demand and/or national pride. For example, exaggerated demand projections can be used to justify construction of generating capacity far in excess of average demand. New plant development requires use of foreign exchange and scarce investment capital. Electricity prices may increase significantly to cover the financial costs of a new plant. Price increases may then lead to decreased demand, lower than expected revenue, and subsequent financial problems for the utility. Excess generating capacity represents a serious cost to the country and may be an inappropriate use of scarce investment capital and foreign exchange. Meeting peak load demand can be more efficiently accomplished through a pricing structure that reflects use rates and time, and reduces demand during times of peak loads and increase demand at other times.

Energy management policies

When fossil fuels are used to generate electricity, inefficiency in transmission caused by technical problems and in distribution caused by unmetered consumption of energy may result in losses of up to one-third the power generated. Eliminating these losses would reduce the need for capital investment to meet growth in demand. To minimize losses, governments can provide economic incentives to energy authorities. Examples include tax breaks for investment in newer technology and installation of meters, and surcharges or taxes when power provision does not meet efficiency standards. Fines for pirating electricity can be established and levied against businesses and individuals at high enough levels to discourage the practice. In addition the national budgeting process needs to ensure that adequate funds are available for the government to pay its energy bills.

Policies promoting decentralization

To meet energy needs, a mix of centralized and decentralized systems will be required. Local small-scale fossil fuel plants may be feasible in rural areas. These plants can be efficiently run by private operations overseen by a public utility board. As part of an integrated energy and development strategy governments could provide tax credits to private operators to promote small-scale plants and energy diversification.

Exploration policies

When global oil prices rise it may become financially attractive to exploit certain domestic petroleum reserves. Exploration and drilling contribute to deforestation, loss of habitat, and to soil and water contamination from spills. Exploration also opens access to remote areas to colonization. Even though a financial analysis is positive, an economic analysis that includes an assessment of the magnitude and distribution of environmental and social costs may well indicate that long-term growth and welfare criteria will be better served by importing additional fossil fuel and developing alternative energy sources.

Mini-Case

In India the State Electricity Boards have supplied electricity at subsidized rates to agricultural, industrial, and other consumers. The results of this policy of subsidized rates are:

The revenues of the State Electricity Boards have been insufficient to cover operation costs and as a result, they incur losses. The losses limit their ability to invest in additional generating and transmission capacity and in modernization of existing equipment. Shortfalls in revenue have been made up from public taxation resulting in a transfer of resources from taxpayers to consumers of subsidized electricity.

Low tariffs charged to certain groups of consumers are made up by higher charges for others. This cross-subsidization has resulted in the transfer of resources between different categories of consumers (e.g., agricultural consumers subsidized by domestic urban consumers). (Siddayao 1985).

Indicators: Fossil Fuels

Problem Indicators

- Efficiency in fossil fuel use.
- Rate of growth in the use of fossil fuel products.
- The rate of petroleum imports.
- Utilities earning inadequate revenues to cover operation and maintenance costs.

Policy/Process Indicators

- Demand management for fossil fuels in the country including an analysis of pricing policies and their impact on fossil fuel.
- Improved use of pricing structures, including subsidies, to promote efficient fuel use and to better reach targeted socioeconomic groups.
- Introduction of policies that address air pollution and other contamination problems that affect human health resulting from the use of fossil fuels.
- Creation of an energy strategy that considers the use of both fossil and alternative fuels in an effort to reduce reliance on fossil fuels. Strategy would include an analysis of the costs and benefits resulting from alternative energy use scenarios.

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HYDROELECTRIC ENERGY

KEY POINTS

- Increased energy self-reliance requires a mix of decentralized energy sources, which are best suited to meet rural demands, and centralized sources, which serve urban concentrations and large-scale energy-intensive industries. Small-scale hydroelectric systems can contribute to this goal of decentralization.

- Investment in large-scale hydroelectric plants requires balancing the benefits of additional power against the economic, environmental, and social costs resulting from upstream flooding.

- Planning for hydropower generation must be incorporated into an integrated development planning mechanism to ensure that relevant watershed management, irrigation, health, conservation, and other development issues are addressed and that energy generation is compatible with long-term development objectives.

Hydroelectric energy accounts for most of the electricity consumed in Central America, and the potential for hydropower in the region is high because only a fraction of it is currently exploited. Hydroelectric energy can be generated without burning fuels and emitting contaminants into the air, and water stored behind dams can be used for irrigation. In many countries agricultural production has increased in regions with hydroelectric and irrigation schemes.

Although hydropower offers important benefits and can contribute positively to meeting the demand for electricity, the costs in environmental, agricultural, and human terms must be weighed against these benefits before construction takes place. Dams lead to the displacement of human settlements and the consequent disruption of farming practices and established life styles. Often the lakes forming behind a dam cover a region's best agricultural land and upset the region's agricultural economy.

The social, economic, and environmental disruption that occurs as a result of dam construction is not always easily resolved. Resettlement alternatives, especially in countries where land is scarce, may become controversial especially if settlement occurs on less fertile lands. Ecological change is also a consequence. Many types of vegetation are destroyed and wildlife and fisheries

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Likely Impacts of Conservation and Improved Energy Efficiencies on Hydroelectric Power

GROWTH

- Less capital investment is required for generating plant expansion, freeing up capital for other long-term productive investments.
- Decreased short-term growth to undertake energy efficiency improvements and invest in retrofitting, giving way to faster growth resulting from savings in energy costs.

WELFARE

- Satisfaction of basic needs for lighting, cooking, and other services realized at a lower cost at all levels of society.
- Increased levels of national self-reliance that can weather the vagaries of international petroleum markets.

CONSERVATION

- Less destruction of habitat resulting from better decision-making criteria regarding dam construction.
- Improved management of watersheds, conservation of hillside soils and vegetation, and control of erosion that will mitigate sedimentation problems and ensure long-term storage capacity of reservoirs.

displaced. Standing water may enhance the spread of diseases and lead to changes in rainfall patterns.

The creation of a large reservoir may also promote the use of irrigation for the production of commercial crops. Irrigation may also lead to deterioration in the quality of soils and groundwater supplies. As land values increase, smaller farmers may be forced from the land to make way for larger landholdings. Downstream benefits from irrigation may compensate for these losses, but benefits may accrue to different groups, and equity questions arise.

Policies Affecting the Demand for Hydroelectric Energy

Pricing policies

Pricing policies are an important tool for demand management. In general, the lower the costs of electricity the more people consume. Governments can develop pricing policies that increase or decrease the demand for electricity or attempt to stabilize or slow the rate of growth in demand. Pricing policies are generally established to meet the sometimes conflicting objectives of economic efficiency, social equity, financial viability, and to an increasing degree, environmental quality.

Marginal cost pricing. Economic efficiency is achieved through pricing systems that take into account the long-run marginal costs of providing electricity. Long-run marginal costs are defined as the real value of additional resources required to generate another unit of energy and they take into account costs of future investment in plant and equipment as well as operating costs. Costs of generating and delivering electricity as well as the costs that would be incurred to increase generating capacity to meet growing demand are considered. Pricing at long-run marginal costs will help ensure economic efficiency, but will result in relatively high prices for electricity and may increase the cost beyond the reach of many poor urban and rural consumers. Higher costs may also extend the useful life of currently installed hydroelectric generating capacity.

Subsidies. Governments often provide subsidies to lower the price of electricity to make it available to consumers at most economic levels of society. When prices are subsidized demand for electricity tends to increase. Subsidization of electricity generated from hydropower is common and is often intended to increase access to energy for all social groups; governments often target subsidies so that poorer members of society can afford electricity. Subsidies, however, tend to discourage conservation measures and may lead to demand outstripping supply. This may be especially true in years when rain levels are less than normal and electric supplies are more limited due to lower generating capacities. Spiraling demand can lead to pressure to invest in plant construction.

Lifeline rates. Lifeline rates for energy represent charges for electricity below the marginal cost of producing it. They provide

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lower rates for electricity for certain "blocks" of customers who are generally poor and for reasons of social equity are given access to energy. These rates represent a form of price discrimination and are usually justified in cases where the costs of energy consumption are high relative to incomes of poor households. Larger consumers or wealthier blocks are charged higher rates and effectively cross-subsidize poorer users. Another form of lifeline rate is to base the charge on the number of units of energy consumed. As use goes up so does the price per unit. Lifeline pricing is easier to achieve for metered forms of energy such as gas and electric.

Pricing decisions need to take into account the revenue required by the utility to operate and maintain the energy supply system. If marginal cost pricing is not adopted, a pricing system that covers financial costs and thereby helps to ensure the financial viability of the utility and adequacy of energy supplies is recommended. If subsidies for electricity exist, it is possible that revenue from energy sales will be less than expected, thereby hampering the utility's ability to provide adequate service.

Policies Promoting End Use Efficiency

Greater energy efficiency can reduce demand for electricity. For example: (1) regulations and codes imposing efficiency standards on appliances sold in the domestic market can decrease demand for electricity at the household level; (2) building codes that promote energy efficient designs lower demand for air conditioning and heating; and (3) improvements in industrial energy efficiency from improved housekeeping measures and retro-fitting also can lower overall demand for electricity.

Designing and implementing policies that promote greater efficiency usually require establishing cooperative mechanism between economic development ministries, energy planning authorities, and the largest consumers of energy.

Taxes

Taxes are a market-like instrument for allocating energy among users and uses. They are most effective where the diversity of energy users and technologies make administrative or regulatory solutions difficult. They have the disadvantage of raising prices for electricity, which present concerns about social equity.

However, lifeline rates can be designed to provide electricity to low-income households. Taxes are also hard to calibrate, and the amount of the tax can be somewhat arbitrary because it is difficult to estimate how much a tax should be to modify behavior appropriately. Taxes, however, are also a good source of revenue to implement regulatory instruments.

Taxes on gasoline and other fossil fuel used in the production of electricity raise the price of electricity and decrease consumption levels. They can be used to ensure that only target groups benefit from a subsidy, and can also serve as a transfer payment from wealthier classes to those who require energy to satisfy basic needs.

Regulation

Government has the option to regulate energy-intensive processes and to establish efficiency standards for industry. Compliance must be monitored and effective sanctions implemented. Monitoring and enforcement are difficult in developing countries due to lack of technical and financial resources. Also low salary levels of inspectors and monitoring personnel create fertile conditions for corruption. Governments can choose taxation, regulation, or a combination to obtain desired levels of electricity use.

Policies to create awareness

Public education programs can promote conservation and provide consumers with ideas on how to limit their consumption of electricity without significantly affecting lifestyles. Programs aimed at all consumers can be implemented and special programs can be undertaken in schools as part of a larger conservation education program. If the goal of government is to decrease reliance on fossil fuels and to promote conservation the public needs to be informed about the economic savings available to individuals and to the country by adopting energy conservation measures. The public also needs to know how, and through what actions, it can contribute to energy conservation.

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Policies Affecting the Supply of Hydroelectric Power

Investment policies

Investment decisions regarding construction of additional generating capacity need to be based on realistic projections of demand and take into account the effects of conservation measures. Investment in generating capacity are often based on meeting peak load demand projections. Excess generating capacity represents a needless cost to the country and an inappropriate use of scarce investment capital. Rather than invest in capacity for which there is uncertain demand or infeasibility of delivery, countries may need to develop pricing structures that reduce peak load demand and assess the trade-off between investment in large, centralized capacity and small-scale hydroelectric or alternative fuel plants. The impact of large-scale hydroelectric plants on human settlement, agriculture, and on the environment may limit their feasibility in the future.

Policies may be developed to promote small-scale hydroelectric plants to meet regional and local demand. Small-scale hydroelectric facilities generally have lower financial costs and involve less dramatic social and environmental costs. Problems of excess capacity are also less likely to arise. Making credit available and providing tax incentives to industry are possible incentives for promoting small-scale hydroelectric power facilities. Requiring large utilities to purchase excess capacity from these small-scale plants may also provide incentives for investment.

Financing, especially from international sources, for new construction of hydroelectric plants will require environmental assessments. Many countries already require such assessments. Actions outlined in environmental assessments to mitigate environmental effects could raise the cost of investment in hydroelectric power and some projects will never come to fruition due to insurmountable environmental impacts and opposition from local community and environmental groups.

Energy management policies

Inefficiencies in transmission and distribution may result in losses of up to one-third the power generated. Eliminating them would reduce the need for capital investment to meet growth in demand. To minimize losses governments can provide incentives

to energy authorities through tax breaks for investment in newer technology and for metering or can institute surcharges or taxes where power provision does not meet efficiency standards. Fines for pirating electricity can be established and levied against businesses and individuals at high enough levels to discourage the practice. In addition the national budgeting process needs to ensure that adequate funds are available for the government to pay its energy bills.

Policies promoting decentralization

Small-scale hydroelectric plants may be feasible in many rural areas throughout the region to meet the energy demands of consumers living in small communities. These plants will be less ecologically and culturally disruptive than larger plants. Development of decentralized hydropower can be promoted through credits made available through local banks or through funds collected from energy tariffs. In countries where decentralized hydropower is feasible a surcharge on electric sales can be used to create a loan and investment fund to stimulate decentralized hydropower systems.

Energy development policies

The satisfaction of total energy demand for all sectors of society (from basic household needs to those of energy-intensive industries) at the lowest possible cost to both the consumer and to the environment is the goal of planning investment decisions—rather than on creating supply. Investment in plant size and choice of fuel source should be based on meeting the growth in demand, achieving some level of energy self-reliance, and meeting overall national development objectives. Hydroelectric power can play an important role in this scenario.

Land management policies

Watershed planning and hydroelectric power generation are closely linked and require mutual consideration. Destruction of hillside vegetation, inadequate land management, and poor farming practices in watersheds often lead to erosion and downstream sedimentation. Much of this sediment ends up in reservoirs, lowers their water storage capacity, and limits energy generating capacity. The result is the diminution of the useful life of the hydroelectric facility. Also additional expenditures are required to mitigate the siltation problem through intervention in

the watershed, dredging of the lake, or construction of additional capacity.

Governments may consider a surcharge on energy generated from hydropower plants that can be used for investments in improved watershed management. In effect, electric consumers would subsidize improved watershed management through this surcharge to ensure the longevity and effective service of the hydroelectric plants.

Mini-Case

In the Dominican Republic much of the energy used by urban consumers and industry is generated by hydropower. Brownouts due to problems with generation and inadequate maintenance are frequent. Generating capacity is insufficient to meet current needs, and poor watershed management has led to reservoir siltation. Due to shortfalls in revenue caused largely by the government's inability to pay for the electricity it uses, the Dominican Electric Corporation does not have sufficient funds to address these problems. In government offices in Santo Domingo, air conditioners keep offices very cool, computers whir and lights glare, but no one is responsible for paying the cost of running the equipment and there are no incentives for workers to conserve electricity. Because the government does not pay for the service, or pays for only part of the service, the energy has become almost a free access good. The results are revenue shortfalls, inadequate funds to cover operation and maintenance (not to mention investment), and poor service.

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Indicators: Hydroelectric Energy

Problem Indicators

- Efficiency in the delivery and use of electricity in both industry and households and adoption of demand side management strategies.
- Amount of sediment entering reservoirs behind dams as a measure of soil conservation and watershed management practices.
- Biodiversity within watersheds.

Policy/Process Indicators

- Programs to promote conservation of energy.
- Involvement of hydroelectric energy planners in watershed planning and management.
- Development of pricing mechanisms for hydroelectric energy that collects additional funds that are destined to watershed management improvements. As a result, greater budgets for watershed management.
- Establishment of pricing and revenue collection regimes that at a minimum finance the long-term operation and maintenance of the hydroelectric system and avoid revenue shortfalls on the part of the utility.
- Creation of mechanisms and incentives to finance smaller scale and decentralized hydropower plants where feasible.

ALTERNATIVE FUELS

KEY POINTS

- Greater energy self-reliance will require a mix of decentralized energy sources, which are best suited to meet rural demands, and centralized sources, which serve urban concentrations and large-scale energy-intensive industries.
- Alternative fuel sources can be developed to meet demand in rural areas where the extension of coverage is unlikely.
- The removal of biases (taxes, subsidies, and other distortions) against the adoption of nonconventional technologies will be required to promote the use of alternative fuels. Elimination of price subsidies for fossil fuel energy will make investment in alternative fuels attractive, especially if investment and venture capital is made available.
- Guaranteed sales to centralized grids for energy derived from alternative sources will provide an important incentive to their development.

Exploitation of alternative sources of energy may represent an important long-term energy strategy for many developing countries. Already most countries exploit biomass in the form of fuelwood for energy, albeit inefficiently, and the potential for greater biomass use from agricultural products is high. Wind power, solar power, cogeneration, and other technologies have the potential to satisfy the energy needs of growing populations, especially in a region where only 15 percent of the rural population has electricity. In addition to these sources of energy, the Central American countries have available supplies of geothermal energy, but only two countries in the region, El Salvador and Nicaragua, have installed capacity.

The development of alternative fuels requires that governments eliminate policy-based biases against their use, provide incentives for their development, and create awareness about the potential benefits of adopting an energy strategy that includes a mix of energy sources. Currently, fossil fuel market prices are low, which makes alternative fuels less attractive. However, planning initiatives may contemplate alternative energy sources in order to reduce reliance on imported fossil fuels and allow some level of energy independence in the face of uncertain future oil prices.

Likely Impacts of Promoting the Development of Alternative Energy Supplies

GROWTH

- New investments in technology using locally available resources that promote economic development at national and regional levels.
- Savings in foreign exchange from forgone imports of petroleum products. However, imports of fertilizer may increase if people begin to use biomass for energy rather than for fertilizer; this will lead to greater expenditure of foreign exchange at least in the short term.

WELFARE

- Satisfaction of basic needs for lighting, cooking, and other services realized at a lower cost at all levels of society.
- Increased levels of national self-reliance that can weather the vagaries of international petroleum markets.
- Potential for increased employment generation in the energy sector.
- Possible loss of natural fertilizers as biomass is used to generate energy.

CONSERVATION

- Less overall environmental contamination due to a switch to cleaner technologies.
- Improved management of natural resources.

Policies Affecting the Demand for Alternative Fuel Sources

Pricing policies

In many countries fossil fuel prices are subsidized. Subsidies artificially reduce the price of fossil fuels and make alternative fuels less attractive for consumers and investors. Prices, regulations, and policy instruments often do not take into account the full cost of the use of fossil fuels, for example, their impact on the environment and human health. By not accounting for these costs, fossil fuels appear to be more attractive economically than

alternative energy sources. Specific pricing policies that bias investors against renewable resource development include: specialized tax benefits for production of coal, oil, and gas, including depletion allowances; direct subsidies for kerosene and diesel fuels; regulatory policies that permit utilities to receive a return on plants that are still under construction; disproportionate amount of publicly supported research and development devoted to conventional energy sources; and agricultural policies that discourage crop diversification to energy crops (Johansson et al. 1993).

Policies creating awareness of alternative sources

Lack of knowledge among consumers about renewable energy sources limits the adoption of alternative energy sources. In most countries demand for energy is unsatisfied. Unless the government promotes alternative energy sources through education and extension, their adoption is unlikely. Education, extension, and demonstrations of alternative energy sources would stimulate demand for the most cost-effective and technically feasible options for a given region or country. These promotional programs coupled with the availability of credit and incentive packages to promote adoption can lead to greater use of alternative sources.

Incentives to promote substitution

Because commercial banks and investors often view investment in newer technologies as risky, governments may need to guarantee credit, help provide credit through banks and other established media, and make available venture capital to promote investment. Subsidized credit needs to be considered carefully in order to avoid investment in less efficient alternatives. Making capital available for alternative energy sources in conjunction with elimination of price subsidies for fossil fuels can stimulate the move toward substitution. At the household level, consumers will require access to credit to adopt new technologies. For example, individual photovoltaic systems can meet many rural electrification needs effectively and efficiently, but the up-front costs are prohibitive. Loans can make possible this type of investment at the rural household level.

Policies Affecting the Supply of Alternative Energy Sources

Tariff policies

Tariffs on imported equipment such as solar panels, batteries, and other electrical generating or storage devices make their use less attractive compared with traditional energy sources. This is especially true if lower tariffs, or no tariffs, exist for conventional energy equipment and supplies. Alternative energy sources that rely on imported materials and equipment may only be economically competitive if tariffs are reduced or eliminated completely for these items.

Policies promoting decentralization

To satisfy future energy needs, it is likely that countries will need to invest in centralized and decentralized energy systems. Small-scale generating plants that use alternative fuels such as biomass, photovoltaics, wind, cogeneration, and biogas may be feasible in many rural and poorly served urban areas. These alternative-fuel generation plants can be designed to meet specific needs of rural communities, especially when connection to a central grid is unlikely or extremely expensive. Governments can foster decentralized generation using alternative fuel sources by making credits available to investors who wish to establish private local and regional generating capacity. Local bank credit can also be provided for investors to promote decentralized energy systems. These credits could be guaranteed by the government if banks are wary of the risk involved in investing in new technologies. Revenue for such ventures can come from various sources, such as surcharges or taxes on fossil fuel and electric consumption and international financial assistance. A small surcharge on electric rates may be warranted as a source of revenue for investment in decentralized alternative fuel plants.

Energy purchasing policies

Governments can promote development and use of alternative fuels by requiring that electric utilities purchase energy generated from alternative sources. Governments can establish regulations that allow cogenerators, wind energy farms, and other installations to sell either their total or excess capacity to a grid at a fair market price. The opportunity to sell to a decentralized source of demand as well as to the centralized grid will encourage

suppliers to use alternative sources, thereby reducing investment in conventional sources.

Policies to promote research and development

Grants to private sector and university groups can be provided to stimulate the development of promising alternative renewable technologies. Promotion of partnerships between local and international researchers can lead to promising supply alternatives. Innovation can also be promoted by allowing new technologies developed in the industrialized world to be tried in the developing countries. Such an approach would require lifting import tariffs for the specific technology. Caution is required regarding the impact of this approach on energy self-reliance goals if the adopted technology requires significant long-term importation of materials and equipment.

Energy development policies

Energy policy should be included in the intersectoral sustainable development strategy dialogue. The energy path chosen will need to be consistent with the country's overall development objectives and with its long-term energy strategy. The size of the plant to invest in and the choice of fuel source should be based on meeting the growth in demand, achieving some level of energy self-reliance, and meeting overall national development objectives, rather than on creating supply into which demand will hopefully grow.

Supply-driven energy investments are common and often lead to oversupply of energy and waste of generating capacity. To avoid these pitfalls, decision making should consider the complete range of objectives: employment creation, the environment, conservation, and the satisfaction of basic needs in conjunction with meeting growth through industrialization. This approach assumes a major role for government in energy decisions and requires cooperation from the private sector and from regional and local consumers. It also implies a willingness to adopt new technologies and new energy sources and to combine these sources to ensure adequate energy supplies.

Mini-Case

In Central America only 15 percent of rural inhabitants have electricity, and expansion of the grid to improve coverage is questionable. As a result, some countries, in particular Honduras, have begun to initiate a household solar energy project. The program is modeled on a social-technical system developed in the Dominican Republic by ENERSOL, a U.S.-based NGO, and called SO-BASEC (Solar-Based Electrification Concept). Under the program rural homes purchase a complete solar electric system ranging in maximum solar conversion capacity from 20 to 100 watts and costing between $350.00 and $1,250.00. A typical 48 watt system provides 6 kWh of electricity per month, costs between $600 and $700, and is adequate for one 8 W or 16 W fluorescent lamp, four 15 W incandescent bulbs, a 14 W black-and-white television, and a small radio/cassette player, thereby meeting many of the needs of rural families. The systems are financed through a revolving loan fund requiring a 20–25 percent downpayment and monthly payments over a three-year period. These funds are managed by NGOs and by small businesses that have sprung up to service the increasing demand. No subsidies are provided.

Information from the Dominican Republic indicates high consumer satisfaction due to household savings from not having to purchase kerosene and candles for lighting and dry cell batteries for radios, and from removal of health and fire hazards common with the use of kerosene lamps. In addition, overall monthly costs are lower with electricity, while families enjoy longer hours and improved lighting for studying and socializing. Even where the electric grid has reached families with installed solar, the households maintain the solar system as insurance against the poor quality of service and frequent brownouts of the national system. Frustrations arise among poorer members of society who cannot afford the downpayments and monthly loan payments. However, for many rural households in Central America, simple solar electric systems can help move a country toward greater energy self-reliance while avoiding greater fuel import costs and environmental degradation.

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Indicators: Alternative Fuels

Problem Indicators

- Percentage of energy derived from alternative sources.
- Rate of petroleum imports and reliance on petroleum imports to fuel economic development.
- Percentage of households with electricity.
- Community participation in energy decision making.

Policy/Process Indicators

- Use of decentralized sources of electrical generation capacity at smaller scales to meet energy needs from outside the central grid.
- Use of alternative energy sources and sale of energy, generated by alternative source, to utility companies.
- Regulations requiring that central grid systems purchase excess power from alternative generators.
- Elimination of tariffs (subsidies to fossil fuels) and other barriers to the purchase of alternative electrical generation equipment.
- Level of government and private sector supported research and experimentation to develop economically and technically feasible alternative energy schemes.
- Analysis on the economic and social trade-offs made between a commitment to conventional energy sources and the adoption of specific alternative sources that hinder adoption of the alternative technology.
- Greater awareness among the populace regarding the potential for the use of alternative fuels and increased demand for those technologies.

RESEARCH QUESTIONS

What kind of incentives will be required to stimulate private sector investment in the development of alternative fuels? Do private interests require tax breaks and subsidies or is the lack of available credit a constraint to investment? Would the private sector be more amenable to invest in alternative fuels if the government participated more in supporting research and development?

What kind of system of regulation and taxes will be most effective in eliminating oil discharges from tankers coming to refineries? What is the best way to make polluters pay for this form of contamination?

What are the gains that can be made from improving energy efficiency through the entire energy system from generation to end use?

What are the true levels of subsidy provided to fossil fuel energy in the country and how much would prices rise if pricing systems were modified to reflect marginal cost pricing?

What are the environmental consequences and opportunity costs of changing to various alternative fuels? What would be the long-term costs and benefits of making the change? What kind of energy mix would provide the greatest societal benefits?

What kind of coordination will be required between government sectors and the private sector to improve energy efficiency and promote the move toward fuel substitution? How can an integrated planning approach be achieved?

What is the level of knowledge and information available regarding alternative fuels?

Are consumers willing to switch from fuelwood to alternative sources of fuel? What would be required to make people in rural and urban areas substitute gas for fuelwood? In what areas and under what conditions should this substitution be promoted?

Energy generation is primarily the responsibility of the state. What kind of system could be developed to promote the participation of the private sector in meeting some energy needs while maintaining the authority of the state in ensuring the supply of energy?

How can a comprehensive energy strategy be incorporated into the overall government development strategy so that energy decisions are integrated into other investment and policy decisions?

What will be the impact of the elimination of all subsidies in the energy sector? For those sectors of society who are most disrupted by their elimination, what kind of program should be developed to ease the transition to nonsubsidized prices?

What approaches will be most effective in dealing with pollution resulting from the use of fossil fuels? Will taxation policies or regulations lead to achievement of improved environmental conditions? Which approaches are the most cost effective and the easiest to implement?

How much will short-term growth be affected by measures to conserve energy and to reduce pollution from the burning of fossil fuels? What would be the long-term benefits and contribution to growth of adopting these measures?

What kind of research and development program should be instituted by governments to address energy issues? How should it be financed and how should it be coordinated with other government agencies and the private sector?

Which existing cost-effective and technically feasible technologies can be implemented in developing countries to respond to their growing demand for energy and to their increasing environmental problems? What kind of financing programs would have to exist to stimulate investment in and adoption of these technologies?

What type of time frame would be economically and socially acceptable to phase in the use of only lead-free gasoline for gasoline-powered engines?

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Agriculture and Livestock

Product Price Controls

Key Points

- Price policies that depress agricultural product prices also reduce investment in conservation and decrease rural employment and income.
- The linkages from producer prices to agricultural production to the effects on natural resources is not well understood for either macroeconomic or sectoral policies.
- Production increases that result from increased prices may be due to more intensive agricultural systems, expansion of the agricultural frontier, changes in crop choice, or a combination of these. The effects on the environment and welfare are diverse.
- Increases in agricultural prices to farmers must be accompanied by complementary policies that address tenure, education, technology, and credit in order to deal successfully with environmental issues.

Governments often intervene in agricultural markets to change agricultural commodity prices, relative to one another and to prices of nonagricultural goods. Policy tools can be direct, through taxes, price controls or supports, and supply restrictions; or indirect, through exchange-rate policies or the level of protection afforded manufacturing industries (Repetto 1988, p. 5).

In general, depressing farm profitability reduces the demand for farmland, farm labor, and other inputs not supported by government subsidies. Agricultural prices tend to be lower than they otherwise would be, because farmland is a factor of production that cannot be shifted massively into other uses. Consequently, returns on investments in farmland development or conservation are also depressed. Farmers are discouraged from leveling, terracing, draining, irrigating, or otherwise improving their land. The loss of land productivity through erosion, salinization, or nutrient depletion is less costly relative to other values in the economy (Repetto 1988, p. 5).

Likely Impacts of Agricultural Price Supports

GROWTH

- Increased output of targeted crops.
- Overall impact is unknown; depends on how the mix of crops produced within the agricultural sector changes in response to relative price changes.

WELFARE

- Food prices for consumers may increase in the short run.
- Employment in the agricultural sector may increase, depending on crop choice.

CONSERVATION

- Potential increased use of pesticides depending on the resulting mix of crops in the agricultural sector.
- Increased use of marginal lands if tenure is problematic.
- Overall impact on the environment depends substantially on interaction with other policies.

At the same time, depressed farm profitability reduces the incentive to open up marginally productive land to agriculture, and also reduces the incentive to use costly inputs, such as imported agrochemicals. Hence, to a certain extent, reduced farm profitability can also lead to de facto conservation.

There is a current trend through sectoral adjustment policies to abolish price controls in order to raise agricultural prices. The argument is that raising producer prices to a level close to world prices will increase the incomes of farmers, enabling them both to secure surpluses that can be reinvested in resource conservation and to expand supply.

"But reality is likely to be far more complex and the current state of research is simply not adequate to pronounce on the nature of the linkage from producer price to agricultural supply response to natural resource effects. Some authorities argue that price increases encourage switches between crops, but have no effect on aggregate output. Others suggest that the aggregate response is also positive" (Pearce and Turner 1990, p. 354).

The natural resource and environmental dimension adds further complexity to the analysis. Positive supply response may occur through an extension of agricultural margins rather than through intensified application of technology, fertilizers, and so forth. This will be more obviously the case where there is limited access to technology or limited capacity to adopt it. But extended margins may involve clearance of hitherto forested land or movements into previously marginal arid areas. In both cases there are environmental costs in terms of increased risk of desertification, which affects medium- to long-term agricultural yields.

Even with intensive responses, an important issue is the type of crop that is encouraged. The presumption is that bush and tree crops, which have extensive root structures and provide canopy cover, are less erosive than many root crops such as cassava, maize, millet, and sorghum (Pearce and Turner 1990, p. 355). Issues of traditional versus nontraditional crops and the various issues associated with relative soil loss and relative use of pesticides as well as incentives to convert marginal lands need to be analyzed within the context of the specific country or region.

Product and input price levels affect profitability and the amounts invested among competing agricultural enterprises as well as between agriculture and other sectors. Governments try to change prices because this approach is easier than directly addressing income issues. Price distortions against agriculture are still common in many countries. In addition, it will take some time for price effects to influence production and resource use decisions and outcomes.

When agricultural policies are artificially low, slower growth or net disinvestment and increased migration of resources out of agriculture occurs. Import-substitution policies for industrial goods effectively tax agriculture because they raise the price of industrial goods relative to the price of agricultural goods as well as the price of protected farm inputs.

Price policy is often complex and price distortions are often crop specific in that some countries tax some producers and subsidize others. For example, producers of export crops have in the past been heavily taxed, and these taxes have been important and easily collected sources of revenue for governments. On the other hand, producers of food crops have been subsidized by government-administered prices that were higher than they would have otherwise been.

Objectives for agricultural pricing policies are: (1) stabilizing or reducing consumer food prices; (2) maintaining uninterrupted food supplies; (3) stabilizing or maintaining producer prices to guarantee incentives for production; (4) reaching food self-sufficiency (reducing imports); (5) providing government revenue through taxation; (6) increasing foreign-exchange earnings; and (7) promoting industrialization (Stevens and Jabara 1988, p. 392).

Government short-term policies to benefit consumers may in the long term reduce agricultural production and thereby reduce food supplies and raise consumer prices.

Government-determined prices can be fixed either above or below the free-market price. Regardless, stable and certain prices, in general, decrease the risk of using purchased inputs, and hence, farmers may be more inclined to use purchased inputs under a system of government-administered prices.

Price Ceilings

Ceiling prices are the highest prices that can be legally charged either by producers or to consumers. The level of the marketing chain at which the ceiling price is enforced, producer or consumer, is an important determinant of the potential impact on natural resource use. A ceiling on producer prices often requires other restrictions to be put in place to force producers to sell to the government. It is difficult to enforce a ceiling producer price set below the market price because black-market activities occur and shortages will result. Nonetheless, if the ceiling prices at the producer level are effectively administered, the returns to agricultural activities will be reduced and less investment in long-term resource management will be undertaken.

Ceiling prices enforced at the consumer level may or may not have the same impact as ceiling prices at the producer level, depending on whether the ceiling consumer price is effectively transmitted back to the farmer. Governments in developing countries often attempt to support producer prices and restrict consumer prices simultaneously. To achieve this objective, parastatal marketing agencies are expected to perform the necessary marketing functions at unrealistically low margins. Consequently, marketing parastatals, which tend to be less efficient than private sector alternatives, frequently generate huge fiscal deficits.

Price Floors and Support Prices

Floor or support prices provide a guaranteed minimum price to producers. Support prices set below the market equilibrium price generally involve limited purchases by the government. "The government serves as the buyer of last resort should the market prices drop to the floor level. For example, due to a lack of storage capacity or farmers' financial constraints that require selling of all of a crop at the start of a season, farm prices are often depressed at harvest. Floor prices reduce the risk of even lower prices during this period and encourage agricultural investment" (Stevens and Jabara 1988, p. 394).

In addition, as mentioned above, prices at or above the market price may be difficult to administer because of the financial drain on the treasury. The government often does not have the institutional capacity to administer these prices.

It is also important to note that large farmers tend to benefit more from support prices because, unlike small farmers, they tend to be located closer to government buying stations. Small farmers also often lack access to transportation or have such small quantities of produce that transporting it to buying stations is not worthwhile. In addition, selling to government buying agencies is occasionally restricted to registered sellers, who more often than not are large farmers.

Price Bands

There are a number of variations of the ceiling and support price system. A price band, for example, sets both a maximum and a minimum price structure. Buffer stock programs for food security might also be a part of the program.

If these programs are effectively administered, they influence not only the distribution of wealth between producers and consumers but also resource allocation in the economy. The effects can be positive from a natural resource perspective if uncertainty is reduced and prices increase on average. If, however, prices are reduced, short-term resource exploitation may be increased. The welfare effects of increasing prices to consumers can be addressed by direct transfers such as food stamps. Such a program is being tested in Honduras. Ignoring the effects of structural and sectoral adjustment policies on the urban poor has resulted in the demise

of more than one government and is a significant potential block to increasing agricultural production in many countries.

Mini-Case
Retail Price Controls in Honduras

The Honduran government fixes the maximum prices of a significant number of foods and other basic products at the wholesale and retail level. This system was established by Decree No. 502-81 in December 1981 and modified by Decree No. 460-86 in July 1986. Prices of 63 products were controlled in 1986. Food products currently controlled include sugar, edible oil, coffee, chicken, wheat flour, eggs, powdered and fluid milk, margarine, bread, pastas, butter, and salt. Other products controlled include detergents, toothpaste, pencils, fertilizer, cement, petrol derivatives, and other fuels.

Price controls are difficult to implement. The analytic capacity to account for demand and supply conditions in setting prices is scarce and errors in these determinations can have significant results.

When prices are set too low, assuming that compliance is enforced, the supply of goods brought to the market will be too small to satisfy consumer demand at that price—the reverse of the intended result. As a result, some consumers will be denied the opportunity to purchase the goods, and marketing establishments may be encouraged to participate in the parallel or black market. The supply shortages also will tend to become more serious over time, as producers of the controlled commodities shift more of their resources into producing other commodities, which are not subject to price controls.

Setting price above the equilibrium price can also be counterproductive. When insufficient competition exists among the selling firms, for example, they may be tempted to set prices at the maximum even when lower prices would cover their costs and allow reasonable returns on their investment. This again leads to a situation that price controls were intended to eliminate. If sufficient competition does exist in the market, however, prices will reach their equilibrium level—below the maximum in this case—independently of the ceiling prices. Thus, consumers, including low-income consumers, benefit more from competition than from price controls (Garcia 1988, pp. 69-70).

Many of these characteristics exist in Honduras. There are few personnel to enforce the rules although in those cases where infractions have been noted, the results have been highly publicized. Although the controls are often ineffective, the cases where they are effective can lead to, among other things, inefficient production. There are a number of important examples that affect natural resources and environmental conditions.

Consumer price controls have contributed to lower returns to agriculture, thereby affecting unemployment and underemployment in that sector, reducing production and investment, and increasing pressure on the resource base. Sugar subsidies have cost approximately 75 million Lempiras per year. Sugar production has, therefore, had incentives to use higher levels of pesticides. This has also kept more land in sugar production at the expense of other, probably more efficient, uses such as grain production. Low milk prices encourage extensive versus intensive cattle production and increasing cattle production pressure on forest and wildland areas (Johnston 1990).

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Indicators: Product Price Controls

Problem Indicators

- Productivity of agricultural lands.
- The rate of conversion of marginal and nonagricultural land to agricultural production.
- Soil erosion rates and agriculture-related environmental problems.
- Use of conservation measures and other land use improvement techniques.

Policy/Process Indicators

- Stability in agricultural prices.
- Levels of food self-sufficiency in basic food stuffs.
- Existence of integrated approaches to agricultural development that focus on land tenure issues, education, technology development, and credit to complement the management of agricultural prices.
- Policies that create price distortions against agricultural products.
- Existence of support prices below the market equilibrium price.

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INPUT SUBSIDIES AND PRICES

KEY POINTS

- Subsidies for agricultural inputs can result in the adoption of technology in the short term. But if left in place too long, subsidies can result in inefficient use and skewed production decisions.
- Credit subsidies often favor large borrowers and commercial enterprises to the detriment of smaller producers. This can result in pressure on the agricultural frontier.
- Credit policies often favor capital-intensive activities over labor-intensive activities, which creates a bias against adoption of conservation practices such as integrated pest management.
- Pesticide subsidies result in overapplication, especially by large, commercial operations.
- While fertilizer subsidies can trigger increased production, they also bias decisions against organic solutions to soil fertility problems.
- Machinery subsidies also favor large, commercial producers and bias decisions in favor of capital instead of labor, thereby contributing to rural unemployment problems.

Input subsidies are used to lower the cost of modern inputs in agricultural production. This policy is designed to address issues of lack of knowledge about improved technologies, financial constraints, risk aversion, or other economic policies that artificially raise the price of these inputs. The long-term problem of such subsidies is that they remain after the new technology has been adopted and thus encourage overuse of the inputs (Stevens and Jabara 1988, p. 401).

In addition, the production decisions made by resource users as a result of such subsidies can have significant natural resource and environmental consequences. Credit, pesticide, fertilizer, and machinery subsidies can have dramatic effects on what is produced, the external effects of that production process and the use of other lands and resources.

Likely Impacts of Reducing or Eliminating Input Subsidies

GROWTH

- Long-term increases in agricultural production from improved sector efficiency.
- Short-term reduction in the use of inputs and therefore lower production.
- Overall impact on long-term output depends on the change in the mix of crops.

WELFARE

- Long-term increase in employment in the agricultural sector.
- Shift in the distribution of income away from large producers.

CONSERVATION

- More appropriate application of chemical inputs.
- Less pressure on marginal lands.

Credit Subsidies

Credit for agricultural and livestock activities is subsidized in a number of ways: (1) purchasing specific inputs such as pesticides and chemical fertilizers; (2) growing specific crops such as cotton or coffee; (3) acquiring specific assets such as cattle or tractors; or (4) developing land by clearing forests, constructing conservation works, building on-farm irrigation structures, and so on (Repetto 1988, p. 27).

Interest-rate ceilings are imposed by regulation and loans are often subsidized, usually by allowing the lending agencies to discount their loans with the monetary authorities at favorable rates. Such policies undermine the operations of private credit institutions and potentially limit access to credit by other parts of the agricultural sector and other sectors. The lack of availability of credit can impede the adoption of conservation technology and lead to the inefficient use of inputs.

In inflationary economies, real rates of interest can be well below zero. Default rates are also often very high, because the lending

institutions are largely absolved from risk. Defaults are als frequently with the larger borrowers.

Highly advantageous interest rates imply the need for quantita tive lending limits and credit rationing. Because lending institu tions can minimize transaction costs with larger borrowers, th wealthier elements of society often capture such programs. "Th distribution of subsidized rural credit is typically even mor skewed than the distribution of land in developing countries (Repetto 1988, p. 27).

The allocation and efficiency effects of credit subsidies are les clear-cut. The uncertainty stems from credit's fungibility and th resulting difficulty lenders have in ensuring that, on the margin directed credit will actually increase the flow of resources to th activities they intend to subsidize. The longer credit subsidies ar maintained, the more likely it is that the subsidies will come t resemble general capital transfers, with little effect on th intended resource use. This is true because borrowers have a wid range of options in the long term for reshuffling their own casl resources and funds borrowed from various sources (Repetto 1988 p. 28).

However, to the extent that credit and machinery subsidies d effectively promote capital-intensive forms of agriculture witl significant economies of scale, such as ranching, they displac farm labor. Because rural populations are growing an employment problems are acute, labor displacement put marginal lands under even greater pressure. In addition, becaus the structure of credit requirements generally favors capital intensive technology, labor-intensive approaches such as integrat ed pest management will be ignored.

Pesticide Subsidies

Pesticide subsidies are provided through tax and tariff conces- sions, low-interest farm credits, incentives for local manufac- turers, and direct-marketing subsidies. Exchange-rate policie may also favor import of pesticides.

By lowering pesticide costs to farmers, these policies artificiall depress the economic threshold for pesticide use and encourag excessive application. Subsidies also artificially lower the costs o chemical use relative to other control methods: integrated pes

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management practices such as planting resistant varieties, finding and destroying infected plants, altering planting dates, and other methods. Because many of these alternative practices involve more labor time, subsidizing chemicals tends to diminish rural employment opportunities.

According to Repetto (1988, p. 18) "Virtually no research or analysis has been undertaken to find out how price subsidies affect farmers' decisions regarding pesticide use, what kind of farmers receive most of the benefits from subsidy policies, or even the extent to which subsidies are actually passed through the distribution chain and reach the farmers they are supposed to benefit." The distribution of pesticide subsidies often conforms to the distribution of landholding, which in most countries is highly skewed. "Yet most occupational poisonings affect hired farm workers, who are usually landless or very small farmers" (Repetto 1988, p. 18). In most countries pesticides are primarily used on commercial crops.

The scarcity of resources in Central America makes it impossible to effectively regulate pesticides, monitor the ecological and health effects of pesticide use, study integrated pest management strategies, or extend safe and effective methods of pesticide use to farmers.

Fertilizer Subsidies

The primary reason for fertilizer subsidies was to overcome farmers' uncertainties and perceptions of risk in adopting new packages of inputs that entailed considerably larger cash expenditures but promised higher returns.

In recent decades fertilizers have contributed more to higher yields than to expanding the areas under cultivation. But there are trade-offs to increased production from fertilizers, reduced pressure for expansion of cultivated land, and the long-term effects of fertilizer subsidies on soil productivity. A central concern is that the subsidies artificially lower the cost of maintaining and restoring soil fertility and induce substitution in favor of chemical fertilizers and against organic fertilizers. Fertilizers, like pesticides, also contribute to agricultural runoff and non–point source pollution.

Subsidies can be direct or indirect. Indirect subsidies include favored exchange rate, tariff, and foreign exchange allocations for imported fertilizers; preferential pricing of energy, feedstocks, and transport services for domestic production; and subsidized credit for fertilizer purchases.

Fertilizer subsidies have a number of important effects including: (1) distortion of the choice of crops; (2) large direct and indirect fiscal costs; (3) distributional issues associated with wealthy beneficiaries; (4) low application efficiencies; (5) less diversified and more chemical dependent cropping patterns; and (6) rural employment effects.

Subsidies for Agricultural Machinery

Agricultural machinery and equipment almost invariably receive favorable tariff and exchange-rate treatment and are afforded high priority when rationed foreign exchange is allocated. In addition, credit policies also favor mechanization.

Subsidies on agricultural machinery can result in inefficient patterns of agricultural production by inducing farmers to use equipment even when it is uneconomical to do so. Generally, this practice results in severe problems of labor displacement, reducing rural employment opportunities and exacerbating rural poverty. Equipment subsidies have not only promoted forest clearance by lowering the financial costs of land preparation, but they also have drastically changed the technology of the operation (Repetto 1988, p. 26). The subsidies almost always favor large producers and promote the relative profitability of large versus small producers.

The effects of mechanization must be analyzed within the context of trade-offs between rural employment and production contributing to national economic growth. The environmental consequences also must be considered. Subsidies should not be continued if the equipment subsidized would be used regardless of the subsidy or if the aggregate set of subsidies greatly distorts production decisions, especially where the environmental consequences of mechanization are ignored.

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Mini-Case

In Indonesia, Malaysia, and Thailand fish stocks in irrigated rice paddies, irrigation channels, and ponds have been greatly reduced by pesticide poisoning. Indonesia's experience in combating the brown planthopper in rice fields illustrates the ecological risks. Sevin was widely used, although it is known to lead to resurgences in brown planthopper populations because it wipes out insect predators. Heavier applications of Sevin have accelerated the evolution of new resistant planthopper biotypes, and have thus destroyed the resistance of two Indonesian rice varieties to the pest and eroded resistance of IR-36, a popular high-yielding variety developed at IRRI. These ecological consequences have sharply increased the risks of crop losses and raised the costs of plant protection in the affected regions.

Ecological problems are not limited to such local dilemmas. By 1980 over 400 insect pests, along with weeds, rodents, and microorganisms that cause plant diseases, had developed resistance to pesticides. The number of species exhibiting pesticide resistance is growing exponentially, and many species are resistant to a whole range of chemicals. Resistant pests have brought farmers in some regions close to bankruptcy, and as the costs of developing new safe and effective pesticides rise, the problems become more serious.

Nonetheless, in many developing nations, governments are heavily subsidizing pesticides sales to farmers. In nine developing countries in Asia, Latin America, and Africa, for example, subsidy rates range from 15 to 90 percent of full retail cost, with a median level of 44 percent. In large countries, these subsidies cost government treasuries hundreds of millions of dollars in direct outlays and forgone revenues (Repetto 1988).

Indicators: Input Subsidies and Prices

Problem Indicators

- Rates of application of pesticides per hectare for farms currently using them.
- Use of integrated pest management techniques for the range of farm sizes.
- Rate of conversion of marginal and nonagricultural land to agricultural production.
- Number of health problems arising from pesticide poisonings.
- Amount of non–point source water and soil contamination from pesticides.

Policy/Process Indicators

- Establishment of a system of short-term subsidies that will be used to attain specific objectives and phased out once objectives are achieved.
- Access to and availability of agricultural credit and credit programs and its diffusion among farmers of various sizes and needs, including smaller, poorer farmers.
- Existence of credit programs that support and promote more labor-intensive technology.
- Establishment of a system of economic incentives that promotes the use of nonchemical alternatives for fertilization and pest control.
- Input subsidies and incentives that contribute to environmental damage.
- Efforts and programs to provide for education in pesticide safety and limit negative health effects from pesticide use.

DIRECT GOVERNMENT ACTIVITIES

KEY POINTS

- It is difficult to generalize about the effects of direct government involvement in agricultural activities on the use and sustainability of natural resources. The range of potential impacts is quite diverse.
- If government agencies effectively provide farmers with greater access to inputs, particularly at subsidized prices, intensive input-dependent methods of cultivation are tacitly promoted in relation to alternative, more traditional, and perhaps lower-impact cultivation practices.
- Parastatals that attempt to control quality through minimum buying standards or price penalties for ^Gower quality tend to promote greater use of hybrid seed varieties and agrochemicals.
- Parastatals that control quantities through imposition of production quotas may indirectly inhibit matching of land use with land capability.

It is difficult to generalize about the effects of direct government involvement in agricultural activities on the use and sustainability of natural resources. The range of potential impacts is quite diverse. Moreover, the potential impacts vary greatly with existing conditions and because of interactions with other policies.

Input Marketing

Direct government involvement in the distribution of agricultural and livestock inputs is a common means for governments to encourage increased production and provide subsidies to target groups. If government involvement is effective in providing farmers with greater access to inputs, particularly at subsidized prices, intensive input-dependent methods of cultivation are tacitly promoted in relation to alternative, more traditional and perhaps lower-impact practices. Two of the more direct potential negative impacts are overuse of agrochemicals and resulting soil or water contamination.

The distribution of agrochemicals also affects efficiency of resource use by tacitly encouraging more intensive cultivation methods. Depending on land availability, the results could be quite diverse. If land is scarce, the result may be positive: decreased pressure on nonagricultural lands. If land is not scarce,

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Likely Impacts of Reducing or Eliminating Government Participation in Agricultural Marketing

GROWTH

- More efficient marketing system will increase long-term economic growth.
- Less pressure on government budget.

WELFARE

- More private-sector employment and less government employment.
- More efficient food system.
- Reduction of support to large farmers.

CONSERVATION

- Improved rural employment and more efficient food system can result in less pressure on marginal lands.

the result may be negative: lack of exploitation of idle, but suitable, lands.

The range of inputs that are distributed and the types of groups that are targeted by the government also shape land use by influencing crop choice and more fundamentally the choice between agriculture and livestock. The distribution of medicine for livestock, for example, clearly promotes the use of land for pasture over other potential uses such as agriculture or conservation, regardless of the land capability. Similarly, distribution of agrochemicals particularly suited for fruits and vegetables promotes cultivation of nontraditional export crops over production of basic grains.

In addition to efficiency of land use, the choice of inputs to be distributed can have a direct impact on the sustainability of natural resources. For instance, the impact of distributing chemical fertilizers instead of organic fertilizers is clear cut. Likewise, the choice of which pesticides to distribute can have a long-lasting effect on soil and water. It is important to note that direct government involvement also provides a means for educating producers and ranchers on the appropriate use and

application of inputs. The lack of governmental resources, however, commonly makes education a low priority.

Product Marketing

Direct government involvement in the marketing of agricultural products distorts natural-resource use by providing incentives or disincentives to increase production or by directly controlling the quantity or quality of agricultural output.

The distortion is actually derived from the objectives that underlie or prompts the government's involvement. Parastatals that are directly involved in marketing in an attempt to support minimum producer prices, if effective, will promote expanded production of the particular crop. In contrast, parastatals that are used primarily as a means to collect taxes will have the opposite effect on production. In both cases, the farmers' response to the incentive or disincentive will determine the impact on natural resource use. For instance, farmers may respond to incentives by adopting more intensive cultivation techniques or by expanding the area under production. Farmers may respond to disincentives by reducing the use of intensive inputs and investments in conservation or by shifting to other crops altogether.

Parastatals that attempt to control quality through minimum buying standards or price penalties for lower quality tend to promote greater use of hybrid seed varieties and agrochemicals. The main potential threat to natural resources is overuse of agrochemicals and the resulting soil or water contamination. Positive potential outcomes include greater care of orchards and other perennial crops, and better matching of land use with land capability.

Parastatals that control quantity through production quotas may indirectly inhibit matching land use with land capability. Quotas imply limited entry of new participants into the sector. Consequently, land owned by individuals outside the sector may be excluded regardless of its suitability. Similarly, quotas imply that producers receive a higher price than they would without the quotas. Hence, there is a disincentive for producers with quotas to shift land under production to other uses. The potential overall result is inefficient use of resources, particularly land.

Indicators: Direct Government Activities

Problem indicators

- Rate of conversion of nonagricultural land to agricultural production.
- Rates of soil and water contamination and other negative environmental impacts caused by agricultural practices.
- Improved land use practices whereby land use is in line with land capability.

Policy/Process Indicators

- Amount of government expenditures on input subsidies and increase in the use of nonchemical alternatives by farmers.
- Education programs to promote the appropriate use and application of inputs.
- A system of economic incentives that promotes the use of nonchemical alternatives for fertilization and pest control.
- Input subsidies and incentives that contribute to environmental damage.

REGULATION OF PESTICIDES

KEY POINTS

- Policies regulating the importation and use of pesticides are generally not enforced because of inadequate institutional resources.
- Poor policy enforcement has allowed contamination of soil and water, worker poisoning, and consumer endangerment.
- Pesticides are often applied in excess of recommended levels and without proper safety precautions because of user ignorance or carelessness.
- Import tariff regimes tend to favor importation of pesticides in relation to other products and to promote chemical control in place of more labor-intensive methods.
- Policies in industrialized countries that regulate pesticide residues of imported products are more effectively enforced than domestic pesticide residue policies.
- Increased production of nontraditional crops and expansion of agriculture, in general, to more marginally productive land tend to promote greater use of pesticides.
- By increasing agricultural productivity, pesticides can reduce pressures to expand agriculture into forested areas.

Direct Regulation

The most common approach to pesticide regulation is to restrict the types of pesticides that may be used in a country. The efficacy of pesticide restrictions, however, is entirely dependent on two key factors: the degree of rigor in selecting which pesticides are not acceptable and the ability of government institutions to effectively enforce the restrictions.

The selection of acceptable pesticides is usually carried out by an implementing agency, often the Ministry of Agriculture, through broad laws that generally do little more than delegate authority. Specific criteria for assessing pesticides range substantially in

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Likely Impacts of Better Implementation of Pesticide Regulations

GROWTH

- Increased cost of production will reduce agricultural production and exports in the short term.
- More efficient production will increase economic output in the long term.
- Greater certainty of pesticide safety may increase agricultural exports in the long term.

WELFARE

- Reduced exposure to toxic chemicals for rural population.
- Increased employment from integrated pest management programs.

CONSERVATION

- Reduced toxicity of soil and water.

terms of rigor and complexity. In practice, the rigor in developing countries is generally less than that in industrialized countries; pesticides that are banned or severely restricted in industrialized countries are occasionally considered acceptable in developing countries.

In general, criteria can range from clear-cut threshold levels of specific toxic compounds to more amorphous economic cost-benefit comparisons. Complexity of criteria must be balanced against the responsible institution's ability to undertake the required chemical and/or economic analyses. In practice, countries without adequate institutional capability adopt threshold levels developed by industrialized countries and require pesticide producers and importers to submit chemical analyses from independent laboratories before the pesticide can be registered as acceptable.

Enforcement of pesticide prohibitions is costly. Many pesticide problems result from lax policy enforcement because of limited institutional resources. Illegal importation is particularly difficult to monitor and is a major source of ineffective pesticide regulation. Unregistered as well as prohibited pesticides commonly find their way into countries either across unpatrolled borders or with help from border officials. Government agencies

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may confiscate nonapproved pesticides when discovered, but the probability of detection is low.

Pesticide distributors are often required to register with a monitoring agency and in some countries are subject to random inspection to ensure that all pesticides for sale are properly registered and that safe storage and handling procedures are followed. In practice, however, monitoring institutions have not had the resources to conduct such inspections.

Soil and water contamination as well as worker poisoning and consumer endangerment are thought to more often result from improper application of approved pesticides than from the use of banned pesticides. Technically, many governments have regulations that delegate authority to an institution for ensuring that application procedures are in compliance with manufacturers' specifications for human and livestock safety.

Policies that are used to ensure proper application include labeling requirements, mandated educational programs, and sanctions for improper use. Implementation, however, tends to be inadequate. Small farmers and hired hands on large farms frequently cannot read labels and have little idea of the dangers and the negative environmental effects that may result from improper application. Distributors are not likely to be of much help in providing information and extension services typically lack the resources to undertake adequate educational programs. Also, government agencies have neither the manpower nor the financial resources to monitor pesticide application and often lack the mechanisms or capability to monitor the environmental effects, such as water quality. Sanctions rarely are applied.

Indirect Regulation

The majority of pesticides used in developing countries are imported. Hence, import tariffs and other import regulations can have a significant, albeit indirect, impact on pesticide use. Tariff regimes often favor agricultural inputs in relation to other imports and effectively encourage more pesticide use than would occur under a neutral tariff regime. Similarly, tariff regimes that favor the export of crops that rely heavily on pesticides effectively encourage greater pesticide use. One tax regime in Central America went so far as to reduce further an already low import tariff for pesticides being applied to nontraditional export crops.

Cross-Border Effects

Domestic pesticide use is affected by policies in neighboring countries. Pesticides often find their way into countries despite restrictions and outright bans, and consequently, more lax pesticide policies in neighboring countries can undermine domestic policy. Similarly, price differences between countries due to variations in subsidies or import tariff structures have an impact across borders. Pesticide usage in a country will inevitably increase as a result of subsidies in neighboring countries. However, regulations in industrialized countries that limit pesticide residues in imported foods can effectively reduce and even eliminate pesticide use in agricultural exports from developing countries.

Indicators: Regulation of Pesticides

Problem Indicators

- Levels of soil and water contamination from pesticide use and runoff.
- Number of reported (and actual) cases of pesticide poisonings.
- Rates of application of pesticides per hectare for farms currently using them.
- Use of integrated pest management techniques and nonchemical pest control alternatives for farms of all sizes.

Policy/Process Indicators

- Enforcement by government institutions of pesticide regulations, with special attention given to pesticides banned in industrialized countries.
- Existence of criteria for the type of pesticides used, for adequate storage, and for labeling against health risks.
- Establishment and enforcement of strong disincentives for the illegal importation of unapproved pesticides, including fines. sanctions, and/or rewards for information, etc.
- Subsidies that lower the cost of pesticide use and result in overapplication and environmental and health problems.

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LIVESTOCK POLICIES

KEY POINTS

- Livestock producers have received many benefits from public policies that provide subsidized credit, fiscal incentives and tax breaks, advantageous land-tenure, laws and subsidized government services.
- These combined policies have provided cattle operators with significant advantages over those who use land for other purposes. The result has been destruction of large areas of forests in Central America.
- Cattle operations have been found to be unprofitable in the absence of such policies in analyses of other countries.

Many policies discussed in other sections (e.g., on agricultural and livestock policies, macroeconomic policies, and land tenure) are directed at livestock production and producers. Some of these policies may provide disincentives to livestock production, but the historical trend has been to promote and subsidize livestock production, which has resulted in a rapid expansion of pastures in Central America. This expansion has occurred almost exclusively at the expense of tropical forests, both directly and indirectly through expansion of the agricultural frontier by those unable to find jobs in an agricultural system that provides few jobs (e.g., cattle production).

Livestock production has some natural advantages over competitive land-use activities, especially forestry, because it has a shorter time frame for the return on investment and in rural areas cattle are easier to transport than timber. But cattle producers have been given additional advantages including subsidized credit, fiscal incentives, tenure policies, and provision of infrastructure for the livestock industry.

Credit Policies

Livestock production has received many forms of credit preferences. There is a natural advantage for cattle as collateral when land tenure or security are issues. In addition, credit programs have earmarked long-term loans at low or negative real interest rates for the livestock sector. Livestock producers often receive a

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Likely Impacts of Less Favorable Policy Bias for Cattle Production

GROWTH

- Shift of land from inefficient cattle operations to more efficient cattle and agricultural activities will increase output in the long term.
- Reduced cost of government-supported projects.

WELFARE

- Greater employment in the agricultural sector.
- Shift in income distribution away from the rural wealthy.

CONSERVATION

- Less pressure on forest resources.
- More appropriate land use.

disproportionately large percentage of the credit available to the agricultural sector from both public and private sources of credit.

Large livestock operators generally are members of the wealthier classes, which also control both private banks and public decisions related to nonprice allocation of credit. From the point of view of delinquencies, large cattle operations represent a large share of the debt, and the fungible loans are often used for consumption rather than for production purposes. Programs to reschedule debt similar to those discussed recently in Costa Rica favor continued support for the livestock sector.

Fiscal Incentives

Fiscal incentives provided to livestock operations have included accelerated depreciation, tax holidays, provisions for offsetting taxable income from other enterprises, and beneficial export duties relative to those on products from competitive land uses such as forestry and agricultural export crops.

Other tax incentives are more subtle. Property and land taxes, even if effectively enforced, are so low that they do not put pressure on agriculturalists to use land for the more intensive uses for which it is often suited.

Tenure Policies

Tenure and land-reform policies also provide incentives for livestock production. Land-reform laws may stipulate a certain intensity of livestock land use to define idle lands, which makes it more difficult to expropriate such land than crop lands or forestlands. Colonization and new settlement requirements stipulate that land must be cleared to be considered occupied; frequently, the only use for such land once it is cleared is for extensive cattle operations.

Provision of Public Services

Governments often provide infrastructure and livestock services to support livestock operations. In addition, livestock are grazed on public lands with little or no fees applied. The governments seldom recover directly the cost of such services even if livestock fees or head taxes exist. The charges do not account for the natural resource and environmental degradation associated with livestock.

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Mini-Case
Incentives: Livestock and Agriculture Subsidies in Costa Rica

- Land used for pasture increased from 0.8 million hectares in 1950 to 2.2 million hectares in 1984, while the total cattle population increased from 0.7 million in 1955 to 2.3 million in 1982. The expansion took place largely at the expense of forestry. While profitability of livestock production is low, the advantages over forestry are that livestock production has a shorter turnover period (yearly income) and that cattle are easier to transport than trees in areas not accessible by roads.

- Credit and credit subsidies played an important role in the expansion of livestock. The government actively encouraged the expansion. In 1970 credit for agriculture surpassed credit for ranching by 45 percent, but by 1979 credit for ranching surpassed credit for agriculture by 4 percent.

From 1956 to 1982 the percentage of credit for ranching from total state credit outlays rose 13.8 percent to 23.3 percent. Because credit tends to be given to property owners with collateral, subsidized credit has helped to cement or encourage an unequal distribution of land.

The livestock sector has a natural advantage over other agricultural activities because cattle can be used as collateral (unlike crops in the field). This can be of special importance for producers who do not own their land or do not have title to it.

If delinquencies are an indication of the size of subsidized credit given, they clearly are most prevalent in the livestock sector. The delinquency rate among large ranchers was 63.1 percent, compared with 28.3 percent for small ranchers, and total amounts outstanding on December 31, 1986, were 3.759 billion for the large livestock producers and 0.252 billion for the small ones. According to various sources, one reason for the high delinquency rate among large producers is the use of loan funds for consumption purposes.

- In 1987, a bill was passed (Ley Fodea) that dealt with various organizational and legal aspects in the agriculture sector. Part of it dealt with debt rescheduling in the agriculture sector. The intent of the original proposals were to help small and medium-size agricultural producers, but as the bill moved thorough the parliament, large producers were also included as beneficiaries as a result of a strong lobbying effort by the livestock association (Lutz and Daly 1990).

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Mini-Case
Livestock and Deforestation in Central America
in the 1980s and 1990s: Costa Rica

- Estimates of annual deforestation in the late 1970s and early 1980s range from 30,000 to 60,000 hectares. This later fell to 18,000 hectares between 1987 and 1992, and recently to only 8,500 hectares.

- Lower deforestation rates are largely a result of rapid growth in protected areas since the mid-1970s and the fact that little forest remains outside these areas. At the same time, the area in secondary forests has grown from 230,000 hectares in 1984 to 425,000 at present, largely as a result of pasture abandonment.

- Historically, conversion of forests to pastures was responsible for more than 60 percent of deforestation. Nevertheless, between 1978 and 1989 the cattle herd remained between 2,000,000 and 2,200,000 head, and since then has declined. Pasture expansion also slowed, although there was no absolute decline in pastures (through 1988).

- Within this general pattern, there are important regional differences. Although it slowed in recent years, conversion of forest to pasture continued well into the 1980s in the Huetar North and Huetar Atlantic regions. The largest stimulus to cattle expansion in these regions in the 1980s was new road construction. New roads facilitated access to forest areas and stimulated higher land prices, thus promoting land-clearing for speculative purposes.

- In contrast, in much of Costa Rica's traditional cattle areas, Guanacaste and Puntarenas, pasture lands and stocking density have been declining. This may reflect, at least in part, pasture degradation, caused by erosion, overgrazing, and soil compaction.

- Sluggish export demand, higher taxes and indebtedness, and soaring interest rates and veterinary input costs have made cattle ranching a bad investment. Beef and milk prices fell during the last fifteen years, although increasing domestic beef and milk consumption and new markets for beef exports (Mexico) and milk exports (Central American and the Caribbean) kept the sector from declining even further. Real wages have also lowered the profitability of ranching.

- Credit available for cattle decreased between 1980 and 1989, and real interest rates rose. The Agricultural Development Program (FODEA) in the mid-1980s offered debt relief to ranchers, most of which went to a few large ranchers (Kaimowitz 1994).

Indicators: Livestock Policies

Problem Indicators

- Rate of expansion of pasture lands, especially at the expense of tropical forests.
- Adoption of land use practices that are consistent and in accordance with the land's capability and that allow for more intensive and efficient production.
- Rates of deforestation directly resulting from expansion of pasture land.
- Amount of cattle per hectare that can be effectively raised due to more intensive practices.
- Amount of soil and water degradation resulting from inefficient and subsidized cattle operations.

Policy/Process Indicators

- Credit and tax policies that provide preferences to the livestock sector over other agricultural production.
- Regulations that promote land clearing as a prerequisite for ownership rights.
- Fees for cattle grazing on public lands consistent with the market rate for grazing on private lands and taking into account the costs of resource and environmental degradation.
- Credit and incentive schemes that promote livestock production only in areas suitable for pasture.
- Tax charges on the largest livestock producers to address the costs of environmental damage.
- Establishment and enforcement of regulations regarding land use and issuance of land clearing permits that take into account environmental factors.

RESEARCH QUESTIONS

To ensure that increased agricultural product prices do not adversely affect natural resource productivity and sustainability, what other policy areas need to be considered?

How does the removal of agricultural price controls affect the mix of crops produced in the agriculture sector? How does the change in product mix affect natural resource productivity and sustainability?

What changes in the mix of crops will occur as a result of the elimination of input subsidies?

How can credit policies be restructured to promote labor intensive alternatives to chemical inputs (e.g., integrated pest management programs)?

Will the banking system continue to favor large producers even if government subsidies for inputs are removed?

What program or policy alternatives are available to promote safe and correct application of intensive cultivation methods?

Does an extension system exist that can educate farmers and enable them to apply appropriate levels of inputs?

What kind of regional cooperation is necessary to deal with the cross-border consequences of pesticide policies?

What is the most cost-effective approach to ensure proper and safe pesticide use (e.g., product regulation, use regulation, education)?

What alternative collateral regimes would reduce the existing cattle bias in the banking system?

Which land reform or tax mechanisms are effective in redistributing land used for low-productivity cattle ranches to higher-productivity uses?

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Land Tenure and Colonization

Land Tenure and Markets

Key Points

- Many state-owned resource areas, such as forests and wildlands, are subject to unchecked exploitation because governments lack the ability to fully enforce control over resources.
- The insecure and uncertain tenure of land ownership for both large and small farmers promotes accelerated exploitation of resources.
- The lack of security of land ownership is caused by unclear legal titles to the land, ineffective systems for settling title disputes, and, perhaps, most important, lack of the ability to enforce rights of ownership.
- Several examples of successful models of common land ownership and resources management exist in Central America. Isolated indigenous forest populations can successfully manage resources in a sustainable way. However, common property models are very susceptible to population pressure, from inside and outside the group.
- Skewed land distribution has contributed to inefficient uses of natural resources. Large tracts of land with high agricultural potential are underutilized and are used primarily for cattle ranching, while smaller, less productive parcels of land are used for intensive agriculture.
- Skewed land distribution has also contributed to accelerated environmental degradation by forcing small untenured farmers to settle on fragile lands that are inappropriate for the intensive cultivation techniques used by these farmers.

Property Rights

There are four basic categories of land tenure: open-access, state-owned, private property, and common property. The categories are differentiated primarily by the property rights and duties associated with the land.

Likely Impacts of Improved Land Markets

GROWTH

- More efficient use of land and greater agricultural production as land becomes subject to more appropriate uses.
- More agricultural production, more exports, and increased GNP.

WELFARE

- More employment in rural areas and less population movement into urban areas.
- Increased employment in rural areas will result in lower rates of population growth when combined with family planning and fertility-regulation services.
- Food production should increase.

CONSERVATION

- Less pressure on natural resources because of greater rural employment.
- More intensive agriculture and greater use of pesticides and fertilizer.

Open-access resources

Open-access resources are not controlled by an individual, a group, or the state, and access and use are not regulated. At an extreme, resources on open-access property are subject to the rule of capture: the first individual to take control of the resource receives the benefits. This characteristic results in an "every person for himself" mentality; individuals do not consider the impact on others or on the resource in the long term. Consequently, there is a great incentive to deplete resources rapidly. Open-access land, which is often referred to as the frontier, technically no longer exists in Central America. Land has long since been designated as either private, state, or common property.

State property

State property is land that is technically owned and controlled by the state. The government has the right to deny or regulate access to or use of the property and its resources. Typically, national forests, parks, military reservations, and coastal zones are state-owned lands. Governments often assume the role of

managing the resources on these lands under the premise that open access would lead to rapid depletion of valuable national resources by such activities as grazing, fuelwood collection, and timber or fodder harvesting. Governments may also use such lands as a source of tax revenues.

In practice, however, governments often do not choose or do not have the capability to fully enforce control over the property or the natural resources such as forests or water that are on the property. For example, the inability to prevent individuals from taking fuelwood from state property is a common problem throughout Central America. As a result, state property often takes on the characteristics of open-access lands, and individuals effectively have free access to use the land and its resources as they please.

Private property

Private property is owned and controlled by an individual or corporate entity. A primary right of the private property owner is to exclude other individuals from using the property. Actual use, however, may be shaped by state regulations and perhaps most important by the owner's ability to enforce his rights. Indeed, the owner's ability to enforce the rights of exclusion and control over use of property is just as important as legal standing. An ineffective legal system or inadequate financial resources to enforce rights make the rights of exclusion and control moot. In the absence of ways to enforce rights, private property, like state property, effectively takes on the characteristics of open-access land.

In general, secure rights of ownership and the ability to enforce them provide the owner, whether individual, corporation, or group, with an incentive to protect land and carefully manage its natural resources to ensure that value and usefulness are maximized over the long term. Conversely, insecure tenants generally attempt to maximize benefits in the short term and fail to consider the negative long-term effects. Insecure ownership can promote deforestation, destructive mining of natural resources and employment of cultivation and fishing practices that rapidly or irreparably deplete soil and water quality.

There is no particular ownership structure (including private ownership), however, that guarantees long-term resource management. While the ability to alienate (or sell) land and exclude others from using the land provides a basis for long-term resource investment and management, other factors affect the

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incentive structure. When overall economic conditions favor trade versus investment and production, resource management will not be a high priority. Poor people will have no incentive to manage and conserve resources if their more immediate survival goals are unmet.

Common property

Common property is owned and controlled jointly by a group of individuals. Indigenous land owned in common by a community or tribe is a typical example in Central America. Common property differs from open-access land in two significant ways. First, as with private property, a primary right of the owners of common land is exclusion of others. Second, individual owners of common property do not have complete autonomy over use of resources; individual owners are governed by norms or rules that are jointly enforced by the group's members. Hence, effective management of resources on common land depends on the group's ability to exclude non-owners and to effectively manage its members. Throughout Central America, there are numerous indigenous forest communities that are very successful models of sustainable resource management on common property.

Common-property models, however, are susceptible to population pressures from both inside and outside the group. Increased size of the group itself can strain the sustainability of traditional management practices and make enforcement of group rules or norms difficult. Population pressures from outside the group can stretch the group's ability to exclude others. Access to markets also can strain resources in common-property systems.

In conclusion, there are no inherently superior property rights systems. Private property can result in resource mining. Common property institutions may fail as the resource becomes more valuable and exclusion more difficult. Governments seldom have the resource to manage land well. A system that draws from the strength of each form of property will be needed. The state may need to enforce private and community property and clarify boundaries and the best potential land uses.

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Common Property Regimes

Common property represents private property for the group in that all others are excluded from use and decision making and that individuals in the group have rights and duties in a common property regime. In one important sense then, common property has something very much in common with private property—exclusion of non-owners; common property is corporate group property. The property-owning groups vary in nature, size, and internal structure across a broad spectrum, but they are social units with definite membership and boundaries, with certain common interests, with at least some interaction among members, with common cultural norms, and often with their own endogenous authority systems. Tribal groups or subgroups, villages or subvillages, neighborhoods, transhumant groups, kin systems, and extended families are all examples. These groupings hold customary ownership of certain natural resources such as farm land, grazing land, and water sources.

Corporate group property regimes are not incompatible with private, individual use of one or another segment of the resources under common property. For instance, the ownership of certain farmland may be vested in a group, and the group's leaders allocate portions of the land to various individuals. As long as those individuals cultivate "their" plot, nobody else has the right to use it or to benefit from its products. But the cultivator himself does not have the right to alienate or transfer either the ownership or the use of that land to another individual; if he ceases to farm it, the land reverts to the corporate ownership and management of the group.

Contrary to such state ownership regimes, the customary common property regimes in the developing world are characterized by group/corporate ownership with management authority vested in the respective group or its leaders (Bromley and Cernea 1989).

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Mini-Case

Sustained local action is most likely to result where the resource is scarce and of critical importance to the economic well-being of a large proportion of the community, and where the transaction costs associated with collective action are less than they would be if resources were under individual control.

Government action can help create the conditions for local action by clarifying group territorial rights, adjudicating boundary disputes, and providing technical assistance to local groups.

It is difficult to interest local communities in programs to improve management of resources that are not of high value, particularly if their conservation conflicts with the use of resources that are of high value such as wildlife and forest resources in areas of expanding cultivation or grazing (Lawry 1990).

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Ownership Distribution

Management and conservation of natural resources are shaped by the distribution of land ownership in several ways. In countries where distribution of land is uneven, large farmers tend to have control over the most productive agricultural land. Consequently, small or landless farmers settle on less productive land, which tends to be more susceptible to rapid resource degradation, on forestland or other protected areas.

Uneven distribution of land also tends to be correlated with inappropriate land use. Large land parcels, which are well suited for agriculture, tend to be underutilized and are used largely for cattle ranching. This tendency is the result of a series of policies, which commonly includes subsidies for cattle ranching. In contrast, small farms are often situated on land that is not well suited to the slash-and-burn and intensive farming techniques generally used by small farmers. A particularly acute problem is erosion of hilly slopes on which small farmers often settle.

The cost of excluding non-owners from large parcels of idle land, which are generally associated with unequal land distribution, can be prohibitive. Owners are sometimes not able to fully prevent non-owners from utilizing resources. Spontaneous settlements or temporary incursions to extract resources such as fuelwood are common. Under these conditions, private land takes on the characteristics of open-access land, and neither the trespassers nor the large farmers have incentive to implement effective conservation or reforestation programs.

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Mini-Case

In Latin America, a primary force pushing the peasantry's expansion into fragile areas is inequitable land distribution. Nearly 90 percent of the farm units in Guatemala, Ecuador, and Peru are *minifundios*, often too small to provide an adequate income. At the other end of the spectrum are *latifundios*, or large holdings, which control over 80 percent of the occupied land in Chile, nearly 60 percent in Brazil, and 40 to 50 percent in Colombia, Ecuador, and Guatemala. Land reforms during the 1960s and 1970s provided some redress, benefiting approximately 10 million families. Yet, most reforms were executed amid intense political turmoil and lacked coherent policies for economically and environmentally sound resource management. As a result, peasants continue to cultivate steep hillsides, the hacienda land distributed to the peasantry is of marginal quality, and the overwhelming majority of beneficiaries have land in lowland colonization zones rather than on arable haciendas (Forster 1992).

Land Markets

Land markets provide a means of capturing the value of land. Hence, active land markets and other means to transfer rights to land (e.g., inheritance) provide incentive to legitimate owners to conserve resources because their ability to recoup the short-term cost of conservation is improved. Again, the landowner will try to maximize the long-term benefits from the land. Conversely, without land markets or an ability to transfer ownership rights through inheritance, landowners may choose instead to maximize benefits over their own lifetimes; deforestation and poor conservation of soil results.

Active land markets imply that secure individual property rights exist and are recognized. Thus, in a sense, active land markets reflect a landowner's ability to exclude others and control the resources on that land.

Active land markets also improve the willingness of lenders to accept land as collateral. The landowner's ability to obtain loans in turn raises the value of the land and thus the incentive to conserve resources. However, lending institutions in several countries do not consider the value of standing timber when assessing land.

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Taxes imposed on idle lands to promote redistribution of large underutilized areas have had a negative impact on natural resource conservation. Forestlands, by government definition, are often considered idle. Consequently, to avoid these taxes on idle land, landowners will clear forested land without regard to the value of the timber or the potential use of the cleared land. This response by landowners and the uneven application of these taxes has resulted in deforestation and has not effectively promoted land redistribution. Given other constraints in land markets, the potential for land taxes to induce the sales of underutilized arable land has been unrealized.

Land titles go hand-in-hand with active land markets. Clear titles are proof of secure tenure and are commonly desired by banks as collateral. Land markets and mortgage lending are less active in countries where land titles are unreliable or where the cost of ensuring clear title to land is prohibitive. Settling disputes over titles is typically an expensive, time-consuming process in most Central American countries. One response to the lack of enforceable tenure is the rapid depletion of natural resources, as in the case of open-access lands.

In several Central American countries, informal markets for limited rights to land claimed by squatters legitimize the existence of professional squatters and consequently provide incentive to invade de jure or de facto open-access land. This encourages individuals to invade public and private forested lands and clear the land in order to obtain rights that can in turn be sold.

Land Banks

Land banks have been used in some countries in Central America to help redistribute land to the landless or poorer rural people. Land banks can be either private or public institutions. The purpose of a land bank is to purchase and subsequently sell land while also providing credit for the new buyers. Banks may sell to either individuals or groups. Management of the process requires identification of high-quality land, clear titles, and technical assistance in the adoption and use of good agricultural practices, as well as good candidates to buy the land. Results of various land bank activities have been mixed and no completely successful formula has been identified.

Mini-Case

The Penny Foundation is a nonprofit rural development organization with a long history of community development work in Guatemala's central highlands. In 1984, it embarked on a land purchase/sale program to address the underlying structural conditions of poverty and to transfer land to landless and near-landless peasants. To date, it has purchased 28 farms with roughly 6,200 hectares and distributed them to approximately 1,300 beneficiary families. The Penny Foundation emphasizes cash crops, primarily coffee, which is produced on approximately 80 percent of the land by about 90 percent of the beneficiaries.

As a land bank, the Penny Foundation seeks farms by placing classified advertisements in newspapers and by checking word-of-mouth leads and public notices. It considers farms repossessed by banks too expensive. Before purchasing, the Penny Foundation has an agronomist and, ultimately, its board of directors, evaluate each property's overall productive potential and price; it buys less than 10 percent of all those it considers. The foundation pays the seller 50 percent of the purchase price in cash, with the balance covered by guaranteed certificates payable over five years at 9 percent interest. After parceling the land, the foundation resells it to individual peasants who make a 10 percent down payment and assume a ten-year mortgage at 12 percent interest (Forster 1992).

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Indicators: Land Tenure and Markets

Problem Indicators

- Efficiency and appropriateness of land uses.
- Change in distribution of land ownership.
- Use of marginal lands and open-access resources.
- Use of land as collateral.

Policy/Process Indicators

- Existence of effective land tax and markets.
- Government support for community resource ownership and management.
- Existence of public and private land banks.

COLONIZATION AND REFORM

KEY POINTS

- Because they promote deforestation of previously protected forestlands, government-sponsored colonization programs are in direct conflict with objectives to conserve natural resources.
- Because government-sponsored colonization programs generally do not match land use capability with the proposed use, they contribute to accelerated degradation of resources.
- The requirement that colonists must clear land of trees to register a claim encourages deforestation.
- Government reform policy that classifies forestland as idle encourages large landowners to remove standing timber to safeguard against expropriation.
- The construction of roads through forests and other protected areas to facilitate resource extraction provides squatters with access to isolated areas, particularly forests and indigenous lands.
- Deforestation of public and private lands is indirectly encouraged by policies that grant rights to squatters for improvements they make to land.

Direct Government Policies

Government programs to open up state-owned land generally conflict with objectives to conserve natural resources. Land that is chosen for colonization is frequently forested reserves or other areas that were previously designated as protected areas. Deforestation and loss of biodiversity are the most immediate results.

Just as important, land-use capability is not a strong consideration in the colonization process. As a result, colonists are often settled on land that is inappropriate for the intended use. Hence, degradation of natural resources—apart from deforestation—is accelerated. For instance, cattle ranchers have been granted land in areas with soils that are prone to compaction and thus are poor choices for pastureland. Similarly, small subsistence farmers are

Likely Impacts of Eliminating Land-Clearing Requirements

GROWTH

- Short-term loss of agricultural production, but conservation of resources for long-term use or preservation.
- Long-term growth in products from managed forests. Long-term increase in market share of managed-forest products as forests in other parts of the world disappear.
- Long-term reduction in the livestock sector unless it changes to feed-lot production.

WELFARE

- In areas that are appropriate for intensive agriculture, lower ability of rural areas to absorb population.
- In areas that are not appropriate for agriculture, higher per capita income in the long term with sustained use of forest resources.
- Decrease in the ability of rural areas to absorb population and provide a safety valve in the short term.

CONSERVATION

- Maintenance of resource in what is frequently the most appropriate long-term use.
- Greater possibilities for preservation efforts and associated benefits such as biodiversity.

often given marginal parcels that are prone to erosion and rapid loss of soil fertility.

Colonists are generally given parcels of land without consideration for the additional resources needed to ensure that the land is managed carefully. As a result, colonized land can quickly become nonproductive, at which time it is commonly abandoned.

Colonists are often required to improve the settled land to register a legal claim. More often than not, "improvement" means clearing the land for agricultural use. Deforestation and loss of biodiversity are immediate results.

A common government policy to classify forestland as idle also promotes deforestation by large landowners who clear the land in an effort to ensure that the land is not expropriated. Under this type of policy, little consideration is given to conservation and even less to reforestation.

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Indirect Government Policies

Construction of roads through forests or other protected reserves to develop mineral or timber resources often indirectly promotes colonization along the roads by providing access to previously isolated areas. This is particularly true of forestland that is owned or settled by indigenous populations. Their land is usually not cleared for agriculture, and fences or other demarcations of possession are not common. To a settler, indigenous land appears to be open-access land.

Spontaneous Settlements and Invasions

Spontaneous invasions into public or private lands often have the same immediate effects as government-sponsored colonization: deforestation and loss of biodiversity. Again, consideration is rarely given to the suitability of the land for the land use. Spontaneous invasions are indirectly promoted in Costa Rica through a law that grants the settler the right to be compensated for any "improvement" to the land, regardless of whether the land is public or private. Hence, there is incentive to quickly clear forestland even if subsequent expulsion is anticipated.

Governmental responses to invasions can also encourage future invasions. Faced with an inability to expel or resettle squatters for political reasons or lack of resources, governments choose to do nothing, which in effect condones future invasions. Some governments have effectively legitimized such invasions by subsequently providing assistance to delineate parcels and establishing mechanisms for granting title. One governmental response was to purchase private land that had been invaded and then officially redistribute it to the squatters.

Although clearly a difficult political and operational issue, spontaneous invasions should not be encouraged either openly or indirectly by acquiescence. Uncontrolled settlements can lead to inappropriate land use and resource degradation. Settlements, if necessary, should be planned with careful consideration of land use capability.

Mini-Case

The Guatemala USAID Mayarema project operates within a contradictory policy context. Jurisdictions for INTA and CONAP are not clearly delineated. Although CONAP is responsible for the MBR, it is institutionally weak and lacks power to impose legal control. A recent logging ban has increased illegal logging, which CONAP and other state entities have been unable to control. To combat the illegal activity, the government plans to reinstate industrial logging concessions. Yet CONAP's limited monitoring capacity makes that solution problematic. Industrial logging may also conflict with xate, chicle, and allspice extraction by local communities. Contradictory policy also stems from the government's view that the Petén is a breadbasket. Current market demand and government incentives for agriculture encourage forest clearing and mono-cropping of corn and beans, thereby encouraging the advance of the agricultural frontier.

There is debate within various agencies whether to establish sustainable land-use practices by improving tenure security (if so, in what form?) or by organizing communities to improve resource use. The project must stabilize forest use within a difficult context. The Petén's population is large and young (50 percent are 15 years of age or younger). The population is concentrated in southern Petén and in the buffer zone, where there is little available land remaining. The legal situation is complex. The southern Petén has some 80,000 property holders, but only 5 percent have registered titles. Many parcels have overlapping rights, most titles are not registered, and wealthy absentee landlords with titles are returning to claim property.

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Indicators: Colonization and Reform

Problem Indicators

- Rate of deforestation.
- Efficiency of land use.
- Human settlements on or near protected areas.
- Level of agricultural production.
- Level of biodiversity.

Policy/Process Indicators

- Requirements for land clearing to obtain ownership.
- Road and infrastructure construction in protected areas.
- Amount of controlled and uncontrolled colonization.

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LAND USE CAPABILITY AND PLANNING

KEY POINTS

- Land use capability systems need to be simple and easily implemented.
- Both regulatory and positive incentives can be used to implement various elements of a land use capability system.
- Many obstacles from vested interests will inhibit successful implementation.

Determining the land use capability and using the information to create policies that affect land use is one potential approach to improving resource management and efficiency of use. While often associated with zoning and other regulatory approaches to land use, land use capability systems can also be used with positive incentives.

The degree of sophistication required to set up and use a land use capability system varies from relatively easy to complicated geographic information systems (GIS). Some systems are based on biophysical use capacity, others on socioeconomic agroecological zoning.

In developing countries uncomplicated land use classification systems are preferred. However, any system will require scarce government resources to implement. In addition, there is likely to be political opposition to such systems. As with the frequently encountered problems with land titling and cadastre systems, certain individuals and groups benefit from the existing system and do not want changes.

Lutz and Daly (1990) pointed out the following potential positive aspects of land use capability and planning systems:

- The ability to delineate national parks and protected areas.
- Delineation of forest areas on private lands that are critical to other government objectives.
- Information for use in designing public projects. Land use capability would be an integral part of an environmental impact assessment.

Likely Impacts of Instituting a Land Use Capability System

GROWTH

- Short-term losses from decreased production from inappropriate uses.
- Long-term economic returns from more efficiently used land resources.

WELFARE

- Increase in long-term employment.
- Loss of wealth for those holding land in inappropriate uses.

CONSERVATION

- Less conversion of marginal land as land moves from underutilized to appropriately utilized.
- Better protection of protected areas from clear boundaries.

- Basis for granting credit.

However, such general systems are of limited use for guiding decisions at the local level because:

- Even the best information will not include locally important details such as slope and pH.
- Local knowledge is generally superior to the maps used in land use capability systems. Nevertheless, there will be cases where other goals will suggest restrictions on land use decisions, for example, to protect the habitat of wildlife species.

Land use capability and planning systems need not always be regulatory. Positive incentives include: agricultural extension and training for appropriate land uses, distribution of government lands based on appropriate land use, requiring donor agencies to use the capability system to determine the location and appropriate technologies for their projects, linking credit to type of use, and establishing tax incentives for appropriate land uses.

Mini-Case

In Costa Rica, the Tropical Science Center's land use classification system is based on climatic variation—on a typology of regional ecological zones based on variations in precipitation and temperature. Within a given climate type, there are ten variables that condition or limit productivity: depth of soil, texture, slope, pH, rockiness, risk of flooding, degree of existing erosion, micro relief, number of dry months, winds, and fogginess. The ten categories derived from an analysis of these ten variables are:

1. Very High Yield Annuals
2. High Yield Annuals
3. Moderate Yield Annuals
4. Perennial or Semi-Perennial Cultivation
5. Intensive Pasture
6. Extensive Pasture
7. Tree Culture
8. Intensive Forestry
9. Extensive Forestry
10. Preservation

(Lutz and Daly 1990).

Policy Measures for Improving Land Tenure and Land Use Conditions

1. Legal recognition of the scope of public and private ownership rights, including arrangements for sharing rights in land and arrangements for transferring rights between parties by sale, gift, inheritance, leasing, and mortgaging.

2. Provision for a system of land surveys and land title registration to define the areal scope of ownership rights, minimize conflicts over boundaries, and protect property owners and operators in the possession and retention of their rights.

3. Policies for the transfer of specified public lands to private ownership and for the private settlement of these lands.

4. Programs that encourage the public or private development or redevelopment of land resources through clearing, drainage, reclamation, terracing, and area renewal efforts.

5. Provision of public credit facilities where needed to help finance property acquisition and provide necessary operating capital.

6. Provision of educational and technical assistance to land operators to instruct them in improved management techniques and require their acceptance of managerial guidance.

7. Legal clarification of landlord-tenant arrangements with provisions for standardizing leasing terms, providing compensation for unexhausted improvements, and enhancing the rights of tenants to security and stability.

8. Encouragement of and provision of assistance in the organization of cooperatives to deal with and provide self-help in handling production, buying, and marketing problems.

9. Creation of special government programs, boards, commissions, and districts to deal with particular problems such as the need for local area planning, the provisions of parks and waste disposal facilities, the regulation of grazing areas, and the operation of irrigation and resource conservation programs.

10. Taxation of landed property, its annual rents or total values and/or the incomes derived from them to provide revenues for government operations and at times to influence and direct the uses made of lands.

11. Enactment of government regulations (e.g., zoning ordinances, building codes, provisions limiting the minimum and maximum sizes of land holdings, rent controls, and land price ceilings, and controls over eligibility to buy or own lands) to direct the use of land resources.

12. Provide for the public's exercise, when needed, of the right to take private lands with or without compensation for desired public purposes.

13. Public management and operation of specified areas of educational, forest, military, park, and other lands in the public interest.

14. Use of public grants and subsidies as inducements to get private land operators and owners and other governmental units to carry out desired land-use practices (Barlowe 1972).

Indicators: Land Use Capability and Planning

Problem Indicators

- Appropriateness of land use.
- Amount of protected areas and parks effectively managed.
- Agricultural and forest production and productivity.
- Rate of land resource use and degradation.

Policy/Process Indicators

- Level of information available nationally and locally on land use capability.
- Degree of agreement among various government and nongovernment institutions on the land use capability system.
- Strength of the land market.
- Success of agricultural credit programs in supporting appropriate land uses.

RESEARCH QUESTIONS

What are the security issues associated with different property classes? Do methods exist to provide security for land use within an economically relevant period of time, such as roll-over leases?

How active is the land market? Are there policies that inhibit its functioning, such as prohibitions on leasing and mortgaging?

Does the distribution of wealth suggest that changes in land use and markets will be difficult to implement without significant changes in the socioeconomic system? What marginal changes can be made to encourage more intensive uses of land?

Does the land tax system encourage less extensive uses of good agricultural land? How do land and property taxes contribute to government revenue and what would be the returns to more efficient tax administration?

Can land tenure changes improve land utilization if subsidies for livestock activities continue?

What kind of administrative and support system would help settlers manage forest resources as an alternative to clearing land for short-term agriculture and cattle production?

Requirements to clear land to prove occupancy should be eliminated unless land utilization warrants such actions. What are the consequences for colonization programs of eliminating such a requirement?

Governments often support or allow the building of roads, which then opens up land for spontaneous colonization. Environmental consequences either have not been considered or have been ignored for most such projects. Do governments have the political will or institutional capacity to examine these issues in advance without outside support?

Will colonization program reforms be successful in long-term resource management without reduced population growth, more rural and urban employment, or both?

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Concessions and Licenses for the Use of Public Timber

Key Points

- Timber concessions on public lands are too short and/or too insecure to provide an incentive to manage the natural forest. For a long-rotation species, it is likely that the user will not be able to recoup his investment or even be able to return for a future harvest. This situation results in resource mining.
- If the costs of extraction are much less than revenue (i.e., when there are excess profits or large economic rents), the length of the concession is not likely to be a determining factor in resource management decisions.
- Management plans with specific controls on forestry practice are often ineffective because they cannot be policed.
- The concession award process encourages non-price competition to get the best sites and is often the source of corruption.

Forest or timber concessions are agreements between governments and the private sector that allow for and attach conditions to the harvesting of timber from public lands. The primary features of a concession include its duration, conditions on amount of harvest and harvest methods prescribed or proscribed, associated fees, and the procedures for awarding, managing, and monitoring the concession. The forest type (pine versus hardwood) and condition (untouched versus degraded) are important in the analysis and determination of specific attributes of the concessions.

Duration of Timber Concessions

Short-duration timber concessions do not provide the resource user with incentives to invest either in the relatively long-term activity of restocking forest resources or in modern, efficient

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Likely Impacts of Longer Timber Concessions

GROWTH

- Short-term loss of log exports as long-term management practices, which result in a more sustained production pattern, are established.
- Increased government expenditures to properly manage the forest resource in order to ensure compliance with concession terms.

WELFARE

- Long-term employment from sustainable resource management system.
- Loss of income from short-term resource exploitation.

CONSERVATION

- Preservation of biodiversity.
- Slower conversion of forests to other land uses as a result of increased economic utilization of forests over the long term.

processing industries.

Although foresters recommend concessions of 75 years to capture more than one cutting cycle, such concessions seldom exist. The recommended cutting cycle depends on the growth rate of the particular forest resource to be harvested; however, there is little information on growth rates for the large number of species in tropical hardwood forests.

In many developing countries, concessions periods are too short or too insecure to provide an incentive for regeneration and sustained use of resources. The consequence is that the timber resource is mined (extracted once with no replanting) for short-term economic benefits and the land opened for inappropriate uses.

The length of the concession is not the only critical factor. If the concession can be revoked arbitrarily as a result of political or other changes, the length of the concession becomes less

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important because resource mining to extract the short-term economic profits overrides the benefits of long-term gain.

Although longer concessions alone may not change resource-mining behavior, longer concessions in conjunction with other policies could encourage longer-term investments .

Thus, short-term and insecure concessions result in short-term economic and employment gains, but with resulting long-term diminution of the resource base because the gains are not reinvested in long-term production. This reduces the growing stock.

The small proportion of species and volume traditionally utilized makes it difficult to justify forest management investments. Vertical integration of the industry and differentiation of forest products to use a wider range of species will complement other mechanisms to provide security of timber tenure and supply.

Conditions and Restrictions on Timber Concessions

Conditions and restrictions for granting or extending timber concessions may include requiring submission of management plans, establishing permissible annual harvests, prescribing or proscribing particular harvesting methods, and placing restrictions on the species and size that may be cut.

The information base of management plans is highly variable, as is compliance with such plans both within and across countries. Variability can result in uncontrolled resource exploitation or in sustainable use depending on the policies adopted and the effectiveness of their implementation.

The requirements for sustained resource management of humid tropical forests is not well understood, and caution is advised in terms of the level and type of forest activities permitted. There are several types of restrictions commonly applied to forest concessions—permissible annual harvests, time or diameter limits, and restrictions on cutting specific species or in specific areas.

Permissible annual harvests mandate a timber off-take for the concession area that is compatible with sustainable use. Scarce growth data, however, makes calculation of a realistic off-take

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difficult. The details of the management plan can either discourage or encourage the use of secondary, often less valuable, species. High-grading, or creaming (i.e., selective cutting of valuable species such as mahogany and cedar), will occur if management plans do not expressly address the issue.

Diameter limits that specify a minimum size for cutting can reduce long-term stand potential by selectively removing the trees with the best genetic material. Faster-growing trees eventually will be replaced by slower-growing trees.

Although selective-cutting mandates are intended to promote sustainable use and to protect specific species, such mandates often result in heavy incidental damage and in high-grading if they are not adequately monitored and enforced by professional foresters. If a stand is high-graded and not opened sufficiently, regeneration will be inadequate.

Time limits that require the concessionaire to begin cutting within a certain time period are designed to prevent hoarding and to increase short-term revenues for the government. While time limits verify that the land is being used and thereby inhibit land invasions, they may be inconsistent with sustained resource use.

Restrictions, prohibitions, and quotas on endangered or valuable species are difficult to enforce, and fines are so nominal that the potential for large returns from prohibited high-demand species outweighs the risk of getting caught.

Restrictions on harvesting marginal areas limit concessionaires' activities in areas of the concession that are considered inappropriate for sustained forest production.

A management regime that encourages high-grading reduces the long-term economic viability of the resource. The issue, however, is complex because there are few alternatives to selective-cutting systems. Clear-cutting, one alternative, may be so detrimental to soil conditions that regeneration is impossible. Selective cutting, if not followed by agricultural and cattle operations, will at least retain some of the forest cover.

The short-term winners will be those powerful enough to obtain a concession and cut the high-value species. The losers will be future generations of resource users and those, like indigenous peoples, who depend on the forest resource for their livelihood.

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Licenses

In Canada, a forest management license specifies the annual allowable cut of a geographically defined forest area and the length of time. The licensee has rights to the volume of timber equal to the annual allowable cut at prevailing forest fees. The standing timber remains the property of the government, as owner, until approval of the annual cutting plan and logging. The forest fees can be the normal forest fees applied on other tenures or forest fees established in the license agreement and adjusted by a preestablished formula.

In exchange for the security of timber supply without competition, the licensee agrees to take on forest management and forest renewal activities, either with or without compensation. This model is used in several Canadian provinces, with variable tenure terms and forest management obligations.

Forest management licenses in most provinces are for twenty-year periods, although a few may be for ten or twenty-five years. Also, in most provinces, the license is subject to a performance review and is renewable periodically, at five-year intervals (ten-year intervals in one or two provinces). This provides a regular, almost continuous incentive for performance of forest management activities. The licensee is concerned about and values the security of timber supply, and so is willing to undertake forest management and regeneration in order to preserve the security of supply. With adequate performance, tenure becomes continuing, almost perpetual. In provinces there are provisions to allow withdrawal of up to 5 or 10 percent of the area at the review, if required, for specific alternative land uses (Grut et al. 1991).

Award Process for Timber Concessions

Concessions are usually awarded noncompetitively, often to reward political victors or the military. Thus, the concessionaire selected is not necessarily the one able to pay the highest price and/or produce most efficiently. Because forests have been viewed as unlimited, concessions have been too easy to get as old ones are depleted.

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Awarding concessions noncompetitively encourages rapid resource depletion because of the potential to allow capture of the economic rent by sectors with political influence who do not pay the government and who view the resource as a short-term source of profit.

Open competition would increase revenues to the state and also would reduce the rush to get the best sites if it were conducted on a first-come, first-served basis. Concession systems should be defined so as to minimize the power of oligopolies that often dominate industrial activities. The government should establish minimum bids for concessions to help capture some of the excess profit.

Concession Size

Given the difficulty forest departments have in the technical management of concessions it may be better to grant timber concessions on small manageable areas instead of on areas that are too large and difficult for the government to manage, monitor, or police. Concession holders will also benefit from smaller concessions because they will be better able to prevent encroachment.

Small area concessions may also increase competition if an auction bidding system is adopted. This would also increase government revenue in the long term. At the least, smaller concessions will discourage excessive accumulation of better tracts of forestlands.

Indicators: Concessions for the Use of Public Timber

Problem Indicators

- Rate of conversion from forest to other land uses.
- Rate of quality change in forest cover.
- Rate of natural forest regeneration.
- Rate of reforestation.
- Soil and water quality changes resulting from changes in forest uses.

Policy/Process Indicators

- Transparency of concession award process.
- Security and duration of the timber concession.
- Timber concession requirements and the ability of the government to implement, monitor, and enforce forest management plan requirements.
- Number and size of the timber concessions.

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FOREST REVENUE SYSTEMS

This discussion of revenue systems relies heavily on John W. Gray, *Forest Revenue Systems in Developing Countries: Their Role in Income Generation and Forest Management Strategies* (Rome: Food and Agriculture Organization of the United Nations, 1983). For a more complete treatment of this subject, see this excellent reference.

KEY POINTS

- Low royalties and stumpage fees reduce government revenues and benefit concessionaires. When stumpage values are low the government does not capture much of the economic rent. Rent-seeking has resulted in over-rapid, wasteful exploitation that includes the harvesting of marginal timber stands, often in ecologically vulnerable sites such as slopes and critical watersheds.

- Low cutting fees on public land can depress stumpage prices on private land and reduce returns to long-term private investment in forestry.

- Charges based on the volume of timber removed rather than on the volume of merchantable timber in the tract result in high-grading. If sawmills buy wood on the truck, only the best logs will be harvested. It is difficult to measure trees on the stump and to control quality of inventory, and the potential for corruption is high.

- Flat charges or taxes are fixed amounts based on volume. Unless differentiated by species and location, flat charges encourage high-grading.

- Ad valorem taxes are percentages based on value. Undifferentiated, these taxes can result in greater forest destruction than differentiated taxes.

- Both flat taxes and ad valorem taxes could be differentiated by species, but differentiated rates are difficult to administer because of the large variety of species in tropical forest stands.

- Sale of timber on the stump incurs less wastage than charges based on volume on the truck because the concessionaire must purchase the entire tree. Such sales are difficult to administer, however, and require professionals to perform forest inventories, mark trees, and carry out the bidding process.

- Lower taxes on secondary species could provide incentives for utilization.

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Likely Impacts of More Public Revenue from Timber Concessions

GROWTH

- Greater ability of government to manage resources for long-term economic goals.
- More incentive for efficient management and resource utilization.
- Increased incentive for high-grading if there is a flat, undifferentiated tax structure.

WELFARE

- Efficient timber-processing plants will require fewer workers than inefficient ones.
- Forest charges will increase the value of standing timber, stimulating the industry to become more efficient in terms of vertical integration and diversification of its products. This will increase long-term employment opportunities.
- Increased ability of the public sector to provide services.

CONSERVATION

- Reduced pressure to mine the resource for short-term gain, thereby attracting more efficient firms.
- Strengthen forestry's position vis-à-vis other competing land uses.

In the short term, deforestation trends increase timber supply and keep prices from rising to reflect scarcity value. In the long term, deforestation leads to scarcity of timber and higher prices. Forest revenue systems must be able to respond to sudden timber scarcities and substantial increases in timber prices and stumpage values.

Forest concessions provide security of supply at established forest charges, security for expansion of processing plants, and bargaining power in obtaining additional timber. Charges on concessions should reflect the value of these factors to the industry, in addition to the value of the timber.

Forest charges complement management activities and contribute to increased economic efficiency. They can influence the rate of

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harvesting, the areas harvested, the species cut, and the level of utilization, and help to discourage high-grading of stands.

Stumpage charges can be set at a level that reflects the scarcity value of the forest or of specific species. Raising stumpage charges would then lead to a slower rate of harvesting. Low forest charges result in higher profits, and logging firms will expand their activities. High forest charges lead to lower profits, and firms will be less inclined to expand. When charges are high enough to reduce profits to below normal levels, logging firms will not replace equipment and will reduce logging activity.

Charges can also have an effect on what areas are harvested. Charges that do not reflect the differentials in stumpage value with respect to distance and accessibility result in overcutting of near or readily accessible areas. Charges that differentiate by distance can reduce overcutting.

Charges also can be adjusted to encourage the utilization of certain species or grades. When charges do not fully reflect differences in stumpage value between species or grades, they encourage the overcutting of more valuable timber and the undercutting of less valuable timber, counter to standard forest management objectives.

If economic rent is not completely captured by the government, windfall profits exist for the forest user. Under these conditions, there is little incentive for long-term forest resource management either by the direct user or by the government as a source of long-term revenue.

To the extent possible, charges should reflect the stumpage value of the timber cut and the value of the concession. Establishing a realistic stumpage value and the associated economic rent is not a simple task. Most countries have an ad hoc taxation system that fails to capture a significant portion of the economic rent for the government. The focus of most countries is on revenue generation, with no consideration of the effect of the tax on resource management.

The government can also collect revenue through joint ventures, full ownership or participation in concessions, harvesting, processing and marketing.

Revenue can be collected from companies and concessions as corporate income taxes or profit-based royalties and from fees levied on concessions. Examples are license fees, annual ground rentals, and fees on:

- standing timber
- timber harvested (per-tree charges)
- volume and/or area charges
- forest products (charges on processed products and minor products)
- foreign trade (export charges on processed products)
- services provided
- productive factors (such as equipment and workers)

Assessment of the cumulative effects of revenue measures in a specific country would require a detailed analysis of the conditions in that country.

Charges On Concessions

License fees on concessions

Base. A lump sum paid at the initiation of a concession or on an annual basis. The fee is usually set administratively, but it could also be set by auction of concessions or competitive bidding.

Revenue. Usually low. Potentially significant. Can reflect the value of the concession if set by competitive bidding.

Administration. Easy to administer either as an initial or annual fee. Compliance is easy; evasion, low.

Efficiency. Charges that reflect the value of concessions will discourage the accumulation of large areas. Charges should at least reflect the economic value of alternative uses of the areas.

Distribution. Primarily involves distribution of revenue between concession holders and the government.

Mini-Case

The objectives of forest pricing and concessions systems vary in importance and weight from country to country, but probably include the following:

Revenues: An important objective to finance governments and national development, to balance the budget and match revenues against expenditures.

Improved and Sustainable Forest Management: To provide incentives for efficient forest management, forest renewal, and environmental management, and to minimize damage to the residual stand and the forest.

Improved Utilization: To provide incentive for increased utilization in the forest (of species and trees), in logging (fuller utilization of trees felled), and in processing plants (increased recovery). Improved utilization can generate an increased supply of wood products, value-added, and employment from the forest, or supply the same volume of products from less forest area.

Finance Sustainable Forest Management: To finance management of forest areas for timber production, to finance the production of nonmarket, noncommercial forest outputs from managed forests, and to finance forest protection of areas not managed for production.

Development Goals:

- Industrial development and diversification through domestic processing.
- Increased foreign exchange earnings to offset import demand; to pay for imports of technology, capital, and services; or to reduce foreign debt.
- Development of low-income, underdeveloped, or remote regions.
- Employment not only in the forest industry but also in forest management and reforestation activities.
- Income generation in the country or the region.

Equity and Distribution Goals: Of benefits and costs, between government, communities, and forest users (Grut et al. 1991).

Suggestions. There is scope for greater use of license fees or other concession charges to reflect the value of concessions.

Annual ground rentals

Base. Area of the concession. Annual payment usually administratively set, but could be set by auction of concessions or competitive bidding.

Revenue. Usually low. Potentially significant. Can reflect the value of the concession if set at an appropriate level.

Administration. Easy to administer. Compliance is easy; evasion is low.

Efficiency. Low ground rentals can encourage the acquisition of large concession areas. Higher rates discourage excess accumulation and encourage better use of existing areas. Minimum ground rentals should reflect the economic values of alternative uses of the areas.

Distribution. Primarily involves the distribution of revenue between concession holders and the government.

Suggestions. Annual ground rentals can reflect the value of concessions and can be used in conjunction with charges on the timber cut where feasible. Competitive bidding for concessions can serve to set rates.

Charges Based on Standing Timber Volumes

Base. Annual allowable cut, the inventory volume of timber on the concession, or the assessed value of the concession and timber.

Revenue. If these charges match the value of concessions better than area-based ground rentals, they could theoretically be better revenue sources. In practice, however, they are unlikely to be better than ground rentals.

Administration. Difficulties and uncertainties of forest inventories, allowable cuts, or valuations make this type of charge impractical for most situations.

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Efficiency. Charges based on volumes or property values may encourage rapid liquidation of mature timber. Alternatively sufficiently high charges may encourage concession holders to relinquish excess area.

Distribution. Primarily involves the distribution of revenue between concession holders and the government.

Suggestions. Not recommended for most countries. Ground rentals are simpler.

Mini-Case

Especially in the case of stumpage fees, the revenue actually collected by governments is usually less than one fifth what it should be. One reason is that forestry department staff generally don't have the vehicles and equipment needed to go out into forests and measure the logs which the concessionaires have felled, and on the basis of those measurements to calculate the stumpage fees due. Forestry departments therefore tend to accept the volume figures given by the concessionaires. Even when forestry departments can calculate the fees due, the collection system itself may be inefficient (Grut et al. 1991).

Charges on Timber Harvested

Per-tree charges

Base. Per-tree charges are on the number of trees cut. The charge usually varies by species but not by tree diameter. The charge, which is administratively set, is often levied prior to harvesting.

Revenue. Per-tree charges cannot easily reflect variations in stumpage values of timber cut. Their advantage is that they can be collected prior to harvest.

Administration. Easy to administer. Problems and costs of scaling the volumes cut are avoided.

Efficiency. Per-tree charges encourage full utilization of each tree cut but can result in smaller trees being left, unless charges vary with diameter. Charges are often not varied sufficiently among

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species to fully reflect stumpage values, resulting in overcutting of more valuable species.

Distribution. Inequities may result; benefits accrue to those who cut larger trees or the most valuable species.

Suggestions. Per-tree charges should be used only if ease of administration is an important consideration.

Volume-based charges

Base. The measured (scaled) volume of timber cut. It includes stumpage fees, royalties, reforestation fees, silvicultural fees, and so on. Fees can vary according to species, log grade or product values, distance, location, and other factors. This is a major forest charge in many countries. It can be administratively set, value-related (ad valorem), formula-based, negotiated, or established by open-bid or sealed-bid auctions.

Revenue. Substantial if the charge is set to reflect stumpage values and adjusted to changes in costs, prices, and inflation. More sophisticated and complex charges may better reflect stumpage values and collect more revenue, but administration is more complex and costly. Charges often do not reflect the full variation in stumpage values between species; charges for higher-valued species do not approach their full value.

Administration. A single, uniform charge is simple to administer. The variation of charges for several factors complicates administration and encourages misclassification into lower-rate classes. Wood measurement is demanding of manpower and costly and may be subject to abuse and under-scaling.

Efficiency. Volume-based charges can discourage cutting of lower-valued, marginal timber. This incentive is counter-balanced, however, by the low marginal costs of logging extra timber. Charges that are uniform, or that do not fully reflect stumpage values, encourage cutting of the more valuable species, grades, or more accessible timber. Charges that reflect stumpage values accurately provide an equal incentive for cutting all timber and assist forest management.

Distribution. If charges reflect stumpage values, the value is collected by the government; if not, values are distributed to concession holders or timber buyers.

Suggestions. Volume-based charges should be an important component of a forest revenue system. Charges should be set to reflect differences in stumpage values among species, for example, and adjusted for changes in prices, costs, and inflation.

Charges based on area logged

Base. The timber in a given area rather than a unit- or volume-based charge. Lump-sum timber sales are one version in which timber is sold by auction. Payment usually precedes cutting. Administratively set or established by auction, but other methods are applicable.

Revenue. Theoretically could yield slightly greater revenue than volume charges, but in practice, with uncertainty about timber volumes or the value of the timber involved, revenues are likely to be lower than those raised by volume-based charges.

Administration. No scaling required of timber cut, resulting in a substantial savings in manpower and administrative costs. A detailed timber survey may be required to reflect timber values, or on lump-sum timber sales to reduce uncertainty of bidders.

Efficiency. As no additional forest charges are paid for cutting marginal species and trees, utilization is encouraged. The charge is suitable for clear-cutting or salvage logging. Charges should vary with stocking of stands to discourage cutting of the best trees.

Distribution. A uniform charge per hectare can be inequitable to companies cutting poorer stands.

Suggestions. Area-based charges have advantages of administrative simplicity and of fuller utilization. They could be more widely used where clear-cutting and utilization are to be encouraged, where timber surveys can be accurate, and where competitive bidding can be encouraged.

Mini-Case

In most Central African countries concessionaires face a multiplicity of forest fees. A study in one Central African country identified 53 procedures required before a log could be exported, resulting in excessive paperwork, delays, unofficial payments, and evasion. The complexity of many forest revenue systems in West and Central Africa make them unmanageable, generate inefficiencies, and open up opportunities for abuse (Grut et al. 1991).

Charges on Forest Products Production

Base. The volume or value of the processed products output rather than the timber cut. This can be a per-unit charge or an ad valorem (percentage of value) charge. It can be administratively set, ad valorem, or established by formula.

Revenue. While charges on products instead of logs may be able to reflect prices, recovery, log grade and defect, they do not reflect logging factors or distance. Charges on products can complement charges on logs, but the two must be coordinated. Charges on products that supplement charges on logs, if significant, can discourage domestic processing.

Administration. Measurement of products may be easier than scaling of logs and can also serve as a cross-check on log volumes.

Efficiency. Standing timber is treated as a free good, so recovery and utilization are less efficient. Easily accessible stands and better quality stands are overcut. However, charges on products plus supplemental charges on timber, a two-part charge, may together reflect stumpage values.

Distribution. The structure of charges can be used to influence the product mix, employment, regional impacts, and so forth. However, charges on products can encourage log exports unless matched by equivalent charges on export logs.

Suggestions. Charges on products should replace charges on logs only where there are administrative benefits because such charges can have undesirable effects on utilization or forest management. However, these charges can be useful as part of a two-part charge on timber and products, if carefully coordinated.

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Charges on Minor Forest Products

Base. Charges based on the products themselves or the firms and individuals producing them. It can be either a per-unit or a value-based charge and can be administratively set or ad valorem.

Revenue. Usually low, or even token, to avoid evasion problems, and for income-distribution reasons.

Administration. With many, scattered, small producers, administration is expensive. A simple system is needed. High charges encourage evasion.

Efficiency. Although low charges may contribute to overcutting, higher charges would not reduce overcutting, but encourage evasion. Other, noneconomic policies are better solutions to overcutting.

Distribution. Low charges can encourage production and job creation, save foreign exchange (e.g., fuelwood), and benefit the low-income rural population.

Charges on Foreign Trade

Base. The volume or value of logs or processed products. Export charges are often used in place of volume-based charges on timber cut. This type of charge is frequently used to encourage domestic processing. It can be a per-unit or an ad valorem charge and can be administratively set, value-related, or formula set.

Revenue. Export charges on logs are the major forest revenue source for many countries. Charges can be based on world market prices. Raising rates on logs brings in more revenue and encourages domestic processing—both of which benefit the country. Export charges on processed products are usually low because high charges would discourage processing.

Administration. Export charges are often easier to administer than volume-based charges on the timber cut because they are collected at export ports and are based on more readily measured volumes and values. If export charges are a significant part of

export prices, they may encourage underreporting of volumes or values. Charges can be based on posted export prices to prevent underreporting of values of shipments. Export charges may also encourage misreporting of species and grades, especially if they attempt to reflect differences in stumpage values.

Efficiency. Export charges on logs can influence forest management and utilization in many of the same ways as volume-based charges. They can be varied by species and log grade, and by distance or region as well. Because they are a significant charge, export charges on logs can generate sizable incentives for domestic processing. These incentives are greater on more valuable logs because of their higher export charges. Export charges on processed production reduce the incentive for domestic processing, but because charges on products are usually low, the effect is minimal.

Distribution. Export charges that stimulate domestic processing can generate employment and income, influence product availability and prices, and positively affect foreign exchange earnings and government revenue.

Suggestions. Export charges on logs, which can substitute for volume-based charges on timber cut, can be effective revenue sources and can also encourage domestic processing. However, export taxes alone cannot achieve both objectives. They should be coordinated with other forest charges on logs and with export charges and other charges on processed products. High export charges should be used instead of quotas or domestic-processing regulations.

Charges For Services

Fees for service provided

Base. Services such as applications, inspections, scaling, grading, port charges, and so forth.

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Mini-Case

The conversion of tropical forests to other uses in the Brazilian Amazon typically results in the destruction of more than $500 worth of salvageable commercial timber per hectare as well as the loss of biodiversity. When tropical timber is harvested for export, the revenue that governments collect from logging companies is much lower than it should be. In the Philippines, official government revenue from log harvests was only 16 percent of actual timber rents, representing a loss exceeding $850 million between 1979 and 1982 (Repetto and Gillis 1988). Substantial but unquantified loss of nonwood forest products also occurs every year as a result of deforestation. In developing countries, accelerating forest degradation threatens industrial and fuelwood production as well. The estimated economic cost of tropical forest depletion ranges from 4 to 6 percent of the gross national product (GNP) in major timber-exporting countries, sufficient to offset the economic gains of forest exploitation (Rowe et al. 1992).

Revenue. Should not be used as a major revenue source. Fee should merely cover costs.

Administration. Fees should reflect costs and be adjusted for cost changes. Charges for services should be grouped into a minimum number of classes.

Efficiency. If fees reflect the administration costs, efficient use of services will result.

Distribution. If fees cover costs, they will be equitable.

Charges On Productive Factors

Charges on workers and equipment

Base. On logging or processing equipment, number of workers, or payroll. Based on capital or labor inputs rather than outputs of logs or products. There is usually an annual fee and, in some cases, an initial fee, both set administratively.

Revenue. Usually low, but scope exists for greater use and for higher rates.

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Administration. Simple and easily administered charges. Based on readily identifiable items. Fees on logging equipment can assist in supervision of forestry activities.

Efficiency. As fixed lump-sum charges, they do not deter forest management or utilization and can encourage more efficient use of equipment. They can serve with charges on the timber cut as a two-part charge.

Distribution. Will influence the use of equipment and the substitution of labor and capital.

Charges On Companies

Corporate Income tax

Base. The net profits of corporations after the deduction of depreciation, interest payments, and other expenses. A corporation's net profits figure is taken from its audited accounts.

Revenue. Not a good substitute for forest charges. First, it applies to corporations only. Second, because the tax collects only 35–50 percent of profits, it can collect, at most, 35–50 percent of the stumpage value of the timber cut. Investment incentives and transfer prices of logs, or products sold, and of equipment purchased can reduce taxable profits.

Administration. Administratively easy if a corporate income tax system is already in place, but reliable accounting systems and government auditing of accounts are required.

Efficiency. Substitution of a corporate income tax for forest charges would put forest companies in a more advantageous position than other corporations because they would receive a free input, timber, and only part of the timber value would be collected by the income tax. Overuse of the free timber input and overexpansion of timber production would be encouraged.

Distribution. Timber companies would be better off than nontimber companies following a switch from forest charges to a corporate income tax.

Suggestions. Countries should not rely on the corporate income tax as a substitute for forest charges. Corporate income tax

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should apply equally to all corporations. Forest companies would then pay forest charges and treat them as a cost in determining taxable profits for corporate income tax.

Profit-based royalties

Base. Profits earned from the exploitation of the natural resource. Profits are defined to reflect the economic rent. The resource rent tax is a widely discussed example. Profits are defined in terms of receipts and payments (cash flow), and a normal rate of return is allowed. Profits above a normal rate of return are taxed at higher rates.

Revenue. Potentially able to capture a sizable proportion of the stumpage value. Transfer pricing problems can reduce revenue. A major problem is that revenue is not received until the investment has been recovered.

Administration. Can be relatively easy if accounting is reliable and accurate auditing is possible. The resource rent tax can supplement and complement an existing corporate income tax.

Efficiency. It is claimed that a profit-based royalty system will not deter marginal investment. It should not distort forest utilization or management.

Distribution. If effective, it is likely to collect greater revenues from the forest industry than alternative charges.

Suggestions. The resource rent tax can conveniently complement an existing corporate income tax, collecting a sizable share of stumpage values without requiring additional administration.

Government Participation in Concessions, Harvesting, and Processing

Logging operations or processing plants

Joint ventures may take the form of equity participation, profit sharing, production sharing, or options on production. A great variety of detailed arrangements is possible. The government may own and operate concessions, or may hire logging contractors. It may sell logs or operate its own processing plants.

Revenue. Joint ventures should be able to capture a portion of the stumpage value not captured by other forest charges—the portion depending on the ownership arrangements, the efficiency of the operation and the likelihood of transfer pricing problems. Full government ownership should be able to capture a greater portion of the stumpage value of the timber, either by other forest charges or as profits, provided the government can obtain world prices and can operate at costs equal to, or lower than, those of the private sector.

Administration. For joint ventures, administration can be relatively easy if the private partner undertakes planning and management; but government expertise and supervision are still required. Government ownership requires establishment of a government enterprise to operate the concession and substantial skilled manpower. Contractors can be used, but they must be supervised.

Efficiency. Advantages in pursuing forest utilization management objectives. Normal forest charges can still be levied on the operation.

Distribution. Scope to pursue income or employment objectives.

Suggestions. Can supplement forest charges but is not recommended as a substitute. A useful component of a forest revenue system because government participation provides information on the forest industry—costs, prices, and rates of return—that is helpful in setting other forest charges.

Indicators: Forest Revenue Systems

Problem Indicators

- Efficiency of usage in logging and timber processing.
- Rate of harvesting of different species.
- Rate of damage to the residual stand after logging operations.

Policy/Process Indicators

- Amount of revenue collected from logging and forest product production.
- Type of forest revenue system and its attributes related to ease of administration and the distribution of winners and losers.
- Funds available to implement, monitor, and enforce forest management requirements.

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Forest Industry and Export Policies

Key Points

- Log export bans and quotas encourage inefficient domestic processing industries as do other elements of high domestic protection. Such policies must be accompanied by forest management and regulation policies.
- Relaxation of export bans and quotas will increase the value of the resource and increase incentives for better resource management, as long as policies to inhibit resource mining exist. In the absence of such safeguards, resource mining will occur.
- Price controls on domestic timber have resulted in inappropriate uses of high-value species.
- Many export policies are established in response to the export and import policies of other countries.

Some governments often attempt to control the export of high-value timber species by imposing log export bans, species bans, and export taxes that differentiate between logs and processed wood products. Other governments have become directly involved in their forest industries. Subsidies have encouraged local processing for the purpose of increasing value-added. Governments have also set price controls to prevent high consumer prices in periods of supply shortages.

Domestic Industry/Resource Protection Policies

Log bans or quotas are established with the primary goal of increasing value-added; rarely is the goal to protect the diminishing resource. Log export bans and other policies designed to increase domestic log processing might have only short-term effects because local industries are often inefficient and governments provide logs even when demand is low in order to keep operations going. Unless these policies are supplemented with effective enforcement and forest management, they are unlikely to reduce deforestation.

Likely Impacts of Fewer Controls on Log and Wood Product Trade

GROWTH

- Increased log exports and reduced processed products in the short term, if no other controls exist on resource mining.
- Short-term increase in foreign exchange for resource owners and government treasury at expense of long-term profits.

WELFARE

- Loss of inefficient firms and associated jobs in the short term.
- In the absence of policies that ensure security of future timber sources and raise the value of standing timber, long-term loss of income from sustained forest management.

CONSERVATION

- Increased value of resource can result in long-term management if regulations are implemented and other policy reforms also take place.
- Increased value of forest resources may inhibit change to inappropriate resource uses.

These policies depress the value of the resource, thereby inducing more waste and less conservation. In some cases bans or quotas have been circumvented by over- and underinvoicing or illegal exportation. Bans on the export of particularly rare or endangered species are often ineffective because of high profits and corruption.

Log export taxes attempt to protect domestic wood processing industries and are also an element in government efforts to capture economic rent. Log-exporting countries often waive or reduce export taxes on processed wood as well as provide investment incentives and log export bans to counteract import restrictions by other countries.

Tax and tariff protection provided to wood-processing industries has been so high that it weakens competitive pressure and undermines incentives to minimize costs. This has increased pressures on forest resources. Higher export taxes on logs than on lumber and plywood are superior to bans and quotas on log exports. Export taxes furnish whatever degree of protection is

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desired, raise government revenues, and also make redundant any income tax or credit incentives for sawmills and plymills.

Local wood-processing industries have been given tax credits, import duty exemptions, and accelerated depreciation. These subsidies may reduce incentives for efficient wood utilization if they are too great or last too long. Other incentives include credit lines for forest industries and preferential interest rates.

Protection of domestic (infant) industries with the purpose of increasing the value-added from resource exploitation have generally had short-term benefits to the processing industry. These policies have then been extended too long and resulted in inefficient resource use. Industries created in such a way have also been supported by the willingness of governments to allow resource overexploitation in order to maintain employment levels or as support to a favored group. Efforts to reduce protection must address both employment and resource effects.

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Boom-and-Bust Logging

In the face of slowly rising international timber prices, the tropical timber trade will lead to boom-and-bust logging in small countries unless policies directly constrain the rate of harvest.

Does this mean that the tropical timber trade is inconsistent with sustainable development? The answer depends on how "tropical timber trade" is defined. If only the forest itself is evaluated, using the traditional forestry definition of sustainability—for example, "harvesting forests to produce an even flow of timber over time"—then a timber boom is not sustainable.

If sustainable development is defined as sustainable macroeconomic growth, then a timber boom can be an integral phase of a sustainable development process. Stumpage value that is invested efficiently can provide fuel for an economy's take-off into sustainable economic growth.

By investing timber capital in other industries or public services (e.g., infrastructure and education), a country can sustain economic growth after the forest sector goes bust.

Although "sustainable development" is usually defined at an aggregate, not a sectoral, level, it tends to be defined more broadly than as sustained growth in economic output.

Boom-and-bust logging might be considered unsustainable because it creates environmental costs or social problems that reduce human welfare, if not economic growth, either now or in the future. To the extent that stumpage values fail to reflect these nonmarket costs, timber prices are indeed "low." Whether the costs are so great that a small tropical country should refrain from boom-and-bust logging is an empirical question (Vincent 1992).

Mini-Case

Empirical evidence indicates that the value added to wood does not offset the loss in the value of wood when processing expands because of log export restrictions. In Indonesia, studies have estimated that both export earnings and economic rents (surpluses) were less during the 1980s because of log export restrictions than they would have been otherwise, despite rapid growth of the plywood industry.

In Peninsular Malaysia, one study estimated that for every $2,200-per-year sawmill job generated by log export restrictions during 1973 through 1989, the region gave up $6,100 in economic value-added (value added to wood, minus the reduction in the value of wood) and $16,600 in export earnings (because of forgone revenue from log exports). Log export restrictions stimulated expansion of processing capacity and created jobs in Indonesia and Peninsular Malaysia, but at an extraordinary cost (Vincent 1992).

Direct Government Involvement in Forest-Related Industries

Many donor activities have supported the development of local wood and timber processing activities that are often inefficient. Timber cutting permits are issued to support local plants, and many regions have been overharvested to support local timber or wood-processing plants, which often have preferred access to credit.

Direct government involvement in forest-related industries is usually characterized by corruption and inefficiency. There is currently a trend among Central American governments to divest these money-losing operations because they are supported by general government revenues. International credit has been directed at such parastatals without examination of resource issues.

Government operation of businesses has generally been inefficient and subsidized by other revenues. While the government is able through this mechanism to capture some of the economic rent and excess profits from resource exploitation, the benefits are not converted into long-term economic benefits. Short-term employment and revenue benefits are achieved at the cost of both short- and long-term resource depletion.

Price Controls

Price controls on lumber products are often enacted to prevent high consumer prices in periods of supply shortage. Such controls, however, encourage the purchase of high-value wood for inappropriate uses and discourage uses of secondary species.

Price controls, if effective, usually exist to subsidize consumers at the cost of resource owners. This reduction in the value of the resource encourages its inefficient use and long-term unsustainability.

Forest Industry Structure

It is argued that investment in long-term forest management will not be cost effective on an industry-wide scale until the industry utilizes forest resources more efficiently. Efficient use of forest resources will require vertical integration and a wider range of products. Policies can be established to further these industry requirements. Such policies include (1) more secure access to timber including purchasing forests; (2) credit subsidies; (3) fiscal incentives; and (4) joint ventures between forest owners and sawmills. It is important to avoid creating incentives that result in a transfer of resources from the public sector to a small group of individuals.

Industry returns on forest management must be sustainable in the long term. Short-term sustainable rates of return will be lower than those from unsustainable mining. Because windfall profits from forest mining can be profitably invested in a global market that is not limited by sustainability criteria, policies to prevent destruction of forest resources and to limit the opportunity for excess profits are very important for ensuring that the industry has a long-term supply of timber.

Certification and Eco-labeling

Some countries, primarily in Europe, are considering requiring certification or eco-labeling of tropical timber imports. This certification would indicate that the log had been harvested from a sustainably managed forest. At present many actors, often nongovernmental organizations, are responsible for the

certification process. No uniform standards exist, but this is a goal of the new International Tropical Timber Agreement.

Certification of tropical timber imports is intended to encourage sustainable forest management by rewarding such activities and reducing market options for timber mining. Certification has been viewed as a nontariff trade barrier by some exporting countries. It is also not applied to competitive products from temperate timber countries. Given the substitutability of the temperate and tropical hardwoods and softwoods, the certification may simply reduce the value of tropical timber through competition from temperate regions.

Mini-Case

Underinvoicing is endemic in the tropical woods export trade. Logs or finished products are ostensibly sold at one price, but the buyer in the importing country actually pays a higher price, and deposits the difference, or part of it, in the exporter's foreign bank account. Two ways to control this practice have been attempted. In Ghana there is a Forest Products Inspection Bureau, which inspects timber to be exported, and compares the declared prices with the current FOB prices. In some French-speaking African countries the posted prices are used as the basis of revenue collection.

Underinvoicing and undergrading are used by timber exporting firms both to accumulate illegal funds of foreign exchange and to export profits to a parent or related company in another country. Both practices result in underpricing of timber and therefore wasteful use, lower forest fee advantages for foreign-owned or controlled companies, and loss of revenue to the government. Underinvoicing also means that the domestic subsidiaries of these foreign-owned companies will become less profitable, at least on paper, with less profits for investment and modernization (Grut et al. 1991).

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Indicators: Forest Industry and Export Policies

Problem Indicators

- Timber harvesting rate.
- Efficiency of usage in logging and wood processing.
- Harvesting rate for valuable species of trees.
- Rate of conversion from forest to other uses.

Policy/Process Indicators

- Effective rate of protection.
- Price controls on domestic timber.
- Exports to countries that have certification programs.
- Volume of exports.

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PRIVATE AND COMMUNITY FOREST MANAGEMENT

KEY POINTS

- Attempts by government to own or control trees on private land creates uncertainty and a disincentive for long-term resource management.
- Farm and community forest management projects provide a means by which local resource management activities can replace ineffective government management.
- Nontimber forest products can provide a viable economic return over the long term but requires careful, product-specific analysis so that market potential is realistic and overharvesting does not result.

Private Forest Management and Tree Tenure

Governments have often, through direct ownership or regulation or both, established de jure control over harvesting of trees on private land. While the effectiveness of management and control has generally been insufficient, the uncertainty created by these policies reduces the incentives for forest owners to invest in long-term sustainable resource management. Particular attributes of government control of private forest include requirements for cutting licenses (with fees) and requirements for management plans.

Licenses are usually required for cutting trees, but there may be exceptions for small forests or for trees that have been planted by the owner. The licenses are usually one year in duration. They may specify requirements for specific species or for all trees. The paperwork for a license is often cumbersome, which results in ignoring the requirements and illegal cutting or overcutting. Illegal payments are often involved.

Management plans are also frequently required for cutting trees on private land. Management plans are usually little more than cutting plans and do not address sustainable forest management practices. Usually a registered or licensed forester is required to prepare the plan. The government does not generally have the

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Likely Impacts of Greater Autonomy for Private and Community Forest Management

GROWTH

- Greater long-term returns from resource management as uncertainty is reduced.
- Less government expenditure for policing and more expenditure for resource management.
- Potential future returns from preserved species found to have medicinal value.

WELFARE

- Long-term increase in employment from timber and nontimber forest management activities.
- Loss of short-term gains from conversion of forest to other land uses.
- Support for indigenous and local community resource management.

CONSERVATION

- Preservation of biodiversity.
- Retention of high-quality land and water resource characteristics.

institutional capacity to assess management plans, compliance with management plans is difficult to monitor, and overcutting is common.

Farm and Community Forest Management

Farm and community forestry refer to a broad range of tree- or forest-related activities that farmers and communities undertake to provide products for their own use and to generate local income (Gregersen 1989). There are many activities for either individual farmers or communities: community fuelwood plantations, living fences, trees for industrial inputs, fodder and other uses, agroforestry, as well as nontimber forest products such as fruit, nuts, mushrooms, herbs, honey, vines, and others.

Mini-Case

In Honduras in 1986, based on the experience gained through an FAO/COHDEFOR project (Integral Forestry Development for Social Benefits Project), the concept of Integrated Management Areas (AMIs) was introduced. This concept is founded on Article 24 of Forestry Law 103, which states that COHDEFOR shall organize the Forestry Social System, constituted by Honduran *campesinos*, associated in working groups, cooperatives, or other associative forms. Likewise, the General Forestry Regulation's Article 13 established that integrated "modules" shall be promoted, constituted by groups of *campesinos* with homogenous interests. The general objective of AMIs is:

> to carry out a sustainable forest management by achieving its utilization, protection, improvement, conservation, and increment, and contribute to the improvement of the living conditions of the *campesinos* living in forestlands, involving them in group or in associative form, in all the forestry activities, and making them participate in their benefits.

The AMIs are forest areas between 1,000 and 10,000 hectares that correspond to the jurisdictional area of one or more rural villages, depending on their common characteristics of topography, road and communications networks, and "other factors." In these AMIs, a professional forester must live, who, in conjunction with the community, and through their most representative organization, will participate in the integrated development of the area, based on the sustainable management of the forest. There are presently some 400,000 hectares of forests being managed under this concept (90 percent in coniferous and 10 percent in hardwood forests). As of 1987, some 50 AMIs were under way, involving some 2,500 direct beneficiaries (Johnston 1990).

Community forest management projects are used by governments to address open-access resource problems. These problems were often initiated by governments when they declared ownership of these resources, overturning private or community ownership and control systems. Subsequent inability to manage forest resources resulted in overharvesting because users had no incentive to manage a resource over which they had no ownership. In addition, the poorer members of the community were most dependent on these resources. In many cases, therefore, the government is trying to reestablish community control through community forest projects, even though the government does not always cede ownership. On the agricultural frontier governments

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often try rationalization of settlement resource exploitation through community forest management projects.

These projects often conflict with other government projects for industrial forest uses, officially protected areas, and indigenous peoples. Governments, often with support from donors, provide incentives for adoption of farm or community forest management. Some examples drawn from Gregersen et al. (1989) include the following:

- Cost sharing: landowners receive cash payments or subsidies in kind (e.g., free seedlings, tools, other inputs); tree planters are provided food for work; landless are provided land for growing trees. This reduces the tree grower's cost and risk; increases returns to the grower; and in the case of land given to the landless, makes it possible for them to grow trees.

- Credit: tree planters/landowners are provided credit that they normally could not obtain through the market. This can be either directly from a public agency or through private channels with government loan guarantees. Interest can be at market rate or can be subsidized but terms must accommodate the time frame associated with tree growing. This improves access to resources; reduces cash flow problems (if credit terms are appropriate); and reduces the tree grower's costs if credit is subsidized.

- Fiscal incentives such as tax exemptions, rebates, reductions, tax credits (e.g., for exported products), provision of free or subsidized crop insurance, price guarantees, contracts for production, tenure security, and forest protection services reduce uncertainty. This shifts incidence of costs, thereby reducing costs for tree growers, and increases security for tree growers because risks are shared or assumed by others. It can reduce actual costs and increase flexibility for tree growers.

- Provision of free services such as market information, extension, education, and research, and of public infrastructure such as roads increases the tree grower's knowledge and reduces uncertainty and risk as perceived by the tree grower. This can increase efficiency and net returns to the tree grower and can reduce losses.

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Nontimber Forest Products

Nontimber forest products (NTFP) are an important source of income for farmers and communities living in or near forests. NTFPs include: rubber, resin, essential oils, nuts, gum, medicinal plants, and horticultural plants. Collecting or harvesting these products is frequently incompatible with unsustainable logging activities. However, sustainable forest management of both timber and nontimber products can be a viable economic alternative to forest conversion. There are also nonpriced values to collection of NTFPs in terms of support for indigenous peoples and community activities and preservation of biodiversity that comes with the preservation of natural habitats.

There are numerous issues associated with the potential for development of nontimber forest products. These products frequently are collected from de facto open-access resources, which are subject to pressures from other potential land uses. Policies that encourage development of strong markets for NTFPs may result in overharvesting if community or government control is inadequate. Market expansion may also require greater infrastructure and institutional support than other land uses. While the economic potential for further expansion of NTFPs is great, there will need to be a better understanding of individual markets and the price effects of greater supply.

Mini-Case

The benefits of nontimber forest products (NTFPs) to rural Guatemalans are significant: a family can earn up to three times the daily wage by harvesting these products rather than clearing forest to plant corn or raise cattle. Thousands of families depend on the extractive industries for some or all of their income. To Guatemala, these renewable resources represent $4-6 million dollars each year—and this from products that, if managed properly, harm neither the plant populations nor the larger tropical forest ecosystem. In addition to these benefits, Guatemala receives additional income from nature and archaeological tourism ($185 million in 1990). Tiak National Park, located inside the Maya Biosphere Reserve in Tikal, draws 15 percent of all tourists that visit Guatemala. Although it is not certain precisely what percentage of tourism income is due to Tikal, the direct and indirect benefits of nature and archaeological tourism in the Maya Biosphere Reserve are significant. In addition, logging within areas now declared extractive reserves has generated millions each year in foreign exchange, though the benefits are more poorly distributed than with NTFPs. Nevertheless, logging may be possible in extractive reserves, though more research is necessary to learn how to log sustainably without damaging nontimber forest species and the natural forest ecosystem over the long term

One must consider the relationship between timber and nontimber forest products. A tree is concentrated capital, but it takes many years to obtain that capital. On the other hand, nontimber forest products can be collected from year to year, though their unit value is relatively small. These two activities can work together: NTFPs provide rent on the land while waiting for the trees to mature. These mature trees then provide a source of concentrated capital that NTFPs cannot easily provide, while NTFPs make it more economically attractive to leave forest as forest while the trees are maturing (Reining and Heinzman 1992).

Indicators: Private and Community Forest Management

Problem Indicators

- Degree of biodiversity.
- Rate of timber and nontimber resource extraction.
- Quality of water and land resources.

Policy/Process Indicators

- Degree of autonomy in resource management.
- Amount of uncertainty associated with resource management resulting from government activities.
- Amount of government resource in supporting resource management versus controlling or policing resources.
- Market infrastructure for nontimber forest products.

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FUELWOOD AND OTHER BIOMASS

KEY POINTS

- Fuelwood accounts for approximately 80 percent of the energy consumed in the rural household sector and 40 percent in the industrial sector in most developing countries (World Bank 1991).
- Fuelwood consumption at unsustainable levels contributes to serious environmental problems such as deforestation, soil erosion, and the deterioration of watersheds. This deterioration can lead to downstream problems including siltation of reservoirs that support hydroelectric generation and subsequent diminution of the generating capacity of these plants.
- Many urban consumers of fuelwood would generally prefer to switch to an alternative source of fuel, such as natural gas, but are constrained by the cost of purchasing stoves.
- Fuelwood supply strategies need to fit into overall economic development strategies so that efforts to increase supply are compatible with efforts to promote watershed management, address soil erosion, and improve the quality of life of people in the country.
- Consumption of fuelwood is highly inefficient both at the household and industrial levels due to the use of rudimentary technology. A variety of mechanisms, from incentives to regulations, are required to stimulate improvements in technological efficiency.

In most countries in Central America fuelwood is the primary source of energy for household consumption, with a share of approximately 80 percent of the energy consumed in most countries of the region. Fuelwood as well as other biomass, such as sugarcane bagasse, contribute around 40 percent of the energy needs to the industrial sector, primarily for the operation of brick and lime kilns, coffee processing, salt production, and sugar factories (the latter rely more on bagasse). Other smaller industries such as tortilla shops, and other food service producers also rely on fuelwood. Current technologies for the utilization of fuelwood are inefficient. This inefficiency coupled with increasing demand due to population growth contributes to environmental degradation. Fuelwood demand and extraction can contribute significantly to deforestation and watershed deterioration, especially in countries where demand for firewood exceeds the

Likely Impacts of Conservation and Improved Efficiency of Fuelwood

GROWTH

- Potentially lower per capita consumption rates of fuelwood, which should translate into lower overall costs for fuelwood purchases and lower investment of time in the fuelwood collection in rural areas.
- Greater investment in multiple use forest plantations, which will yield fuelwood as well as other forest products to meet consumer demand.

WELFARE

- Satisfaction of basic needs for cooking fuel at a lower cost.
- Improved health benefits from more efficient stoves that do not cause indoor air contamination.

CONSERVATION

- Less forest and mangrove destruction and consequently less watershed deterioration resulting from an overall decrease in the per capita consumption of fuelwood. Fewer per capita contaminant emissions into the air thereby decreasing the rate of air pollution from wood smoke, especially in urban areas.

present sustainable supplies. Rudimentary methods of charcoal production have low charcoal conversion ratios; damage soil, roots, and seedlings; and contribute gaseous and liquid pollutants to the environment.

Relevant policy issues involve decreasing the demand for fuelwood through the introduction and utilization of more efficient technologies and increasing supply of fuelwood resources to meet the increasing demand. The spatial differences of both supply and demand and the differing characteristics of urban and rural areas requires a mix of polices that will ensure the long-term availability of fuelwood supplies.

Mini-Case

Fuelwood problems cannot be generalized. Fuelwood use and scarcity reflect complex and variable interactions between local production systems and the environmental resources on which they are based. For example, the significance and origins of fuelwood problems in a semiarid area such as Nepal are distinctly different from those in a high-density/high-productivity area such as the Kenyan highlands. A further sharp distinction is evident between rural localities (where fuelwood is usually a free good gathered locally) and urban areas (where fuelwood is a commodity produced elsewhere).

Fuelwood problems have complex causes and take varied forms. In rural areas these problems reflect changes to economic and environmental relationships that affect local supply and demand. These changes can be gradual, such as erosion of local woodlands as a result of land colonization, increased herd sizes in semiarid regions, increased exports of fuelwood to meet growing urban demands, or lower quantities of residues available for use as fuel as a result of changing agricultural practices. In some cases the changes can be sudden and catastrophic such as large-scale deforestation associated with droughts, floods, or other extreme climatic events. Whether gradual or rapid, these changes lie at the heart of fuelwood problems and set clear limits on the opportunities open to confront the problems effectively (Mercer and Soussan 1992).

Policies Affecting the Demand for Fuelwood

Subsidies to promote fuel substitution

Countries can move toward greater levels of energy efficiency simply by shifting from traditional inefficiently used noncommercial fuels such as fuelwood to more efficient commercial carriers such as natural gas. Promotion of fuel substitution may require some form of subsidy to make alternative energy sources more accessible. One approach involves the provision of subsidized credit for consumers to purchase stoves. The high purchase cost of gas stoves, for example, acts as a barrier to substitution in many countries, even though the cost of gas is lower than the cost of fuelwood in many urban areas. Governments could apply subsidies to stoves that utilize the most desirable type of fuel (from the economic and environmental perspective) or to non-wood stoves in general, in which case

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consumers would adopt stoves that use the cheapest alternative source of energy. Fuel price subsidies, although popular with consumers, may prove costly to implement and too difficult to limit to specific target groups and target uses such as fuelwood substitution. Fuel subsidies may have the unintended effect of providing cheaper fuel prices to nontargeted consumers who switch to the subsidized fuel. Nontargeted consumers could consume enough of the subsidized fuel to limit availability to targeted groups and defeat the objective of fuelwood substitution.

Subsidies increase the demand for commercial fuels, which in the case of fossil fuels implies an increase in imports and foreign exchange expenditures. These costs will have to be balanced against the economic and environmental costs of deforestation and its ancillary consequences and the health costs resulting from air pollution.

Taxes

Taxes could be levied on the harvest and use of woodfuels to offset the environmental costs of deforestation. Woodfuel users would pay higher prices while woodlot owners and farmers would benefit. Unfortunately, enforcement and collection of taxes may prove costly or impossible at the household level. Application of levies and collection of fees would likely be most successful at the woodlot, public land, or industry levels. Taxes on woodburning stoves might discourage fuelwood use in urban areas, whereas in rural areas, people would construct homemade varieties. Stumpage fees on public land may be more feasible and collections can be used to improve plantations. This taxation system will not work where the markets for fuelwood are not developed and where people collect their own fuelwood.

Mini-Case

In the village of Pura (population 357 in 1977) energy is primarily provided by firewood. Kerosene and electricity supply only 3 percent of the inanimate energy used in the village while fuelwood supplies 97 percent. Only 4 percent of the fuelwood is purchased as a commodity, the rest is gathered, and 80 percent of the total fuelwood consumed in the village is used for domestic cooking needs.

The dependence on fuelwood comes at a relatively high cost. A family spends about 2-6 hours and walks 4-8 km to collect 10 kg of firewood. Children contribute 30 percent of the total labor required to collect it. The high expenditure of time and human energy to collect firewood and perform other domestic chores takes away from more productive agricultural activities, and agricultural productivity as a result is generally low. Although there is no purchase cost for gathered fuelwood, the amount of physical effort coupled with the lower energy efficiency of fuelwood makes it a relatively expensive option for rural energy. These costs will increase if population growth and land use changes further reduce the supplies of firewood located near the village (Goldemberg et al. 1988).

Taxing the installed production capacity of brick and lime kilns, charcoal manufacture, and other woodfuel-intensive processes represents another alternative. For example, governments could levy a charge on these producers based on the amount of production or the amount of wood required in the production process. This tax would raise the cost of fuelwood to the producer. More efficient processes and production facilities would ultimately pay lower taxes. These higher fuelwood costs may stimulate adoption of more efficient production techniques or move producers to switch to other fuels depending on the size of the tax. Caution is required to ensure that the tax does not encourage producers to operate inefficient clandestine kilns that would inefficiently use fuelwood. Local and regional governments may need to exercise some control over such activities. Taxes will raise the cost of production and these costs are likely to be passed on to consumers and thus have equity impacts.

Regulations

Regulations rather than taxes can be used to gain efficiencies in industrial fuelwood industries. Ordinances could be enacted to mandate conversions away from fuelwood to other energy sources or require modifications in the production processes that guarantee fuelwood efficiency in the production process.

Mini-Case

Collecting fuelwood is physically hard and time-consuming work, an arduous burden on women who typically are also responsible for collecting water, caring for children, doing agricultural work, and handling the myriad other tasks that make up the day of women in developing countries. As pressures on the local resource based develop, the distances traveled, collection times, and other demands also increase. In addition, because fuelwoods are smokier and dirtier than modern fuels, women's health may be impaired by fuelwood use. When fuel shortages lead to changes in the number or type of meals cooked, women (who, even if there is no fuelwood shortage, eat less well than men) often disproportionately suffer negative nutritional consequences. In these and other ways, fuelwood stress affects the health and environments of women more than those of men in many parts of the developing world (Mercer and Soussan 1992).

Adherence to policy could be achieved through sanctions for noncompliance. This approach is not common because such regulation requires extensive administrative capability and may cost more to administer than a tax levy on the production process or on the industry directly. As with taxes, regulation will raise the cost of production and these costs will most likely be passed on to consumers.

Incentives for technology adoption

Even if substitution is feasible through incentive schemes, woodfuel will remain a necessity for many people, especially in rural areas. Government efforts to promote the use of efficient wood stoves through extension programs and credit schemes will help lower the per capita consumption of fuelwood. Introduction of stoves can form part of larger forestry, agroforestry, watershed management, and agricultural development schemes. The increased use of biomass other than traditional fuelwood may contribute to more efficient energy use and less destructive forest practices. The production of pellets, wood chips, charcoal, and other combustible products from forest residues and sawmill wastes, and greater use of other biomass for fuels requires promotion. As part of an overall energy sector strategy policymakers can promote these technologies and, through tax and financial incentives to the private sector, increase energy self-reliance and protect forest resources. Short-term tax breaks, research and development grants, or loans from specially created environmental loan funds represent sources of financing for the development of these technologies. Some biomass may have a

greater value and be more economically efficient as fertilizer than as fuel, and incentive schemes must take this into account. There will be trade-offs between the satisfaction of energy demands and the need for fertilizer.

Policies Affecting the Supply of Fuelwood

Decentralization and private control of forestlands

The transfer of forest use rights and ownership from the state to decentralized management units such as private farmers or communities offers possible solutions to the overexploitation and poor management of forestlands, restricting to a degree the use of forestland as an unmanaged local-access resource.

Local community management may also increase the likelihood of stumpage fee collection. If local authorities have a direct financial interest in the collection of fees and the management of forestlands, they may be much more effective in controlling poaching or illegal use than a system of centralized control. Concerns include the impact on access to firewood for the poor if lands are privatized, and the ability and interests of communities to effectively control access to the forestlands and use of forest products.

Afforestation policies

A way to increase the supply of fuelwood is to increase the amount of trees available. Afforestation policies that promote the sustainable production of trees can form part of the government's sustainable development policy, which takes into account the need for forest products and the demand for fuelwood. Afforestation addresses not only energy issues but also watershed management, soil erosion, and agricultural production and can form part of an integrated development approach. Extension and credit programs can be designed to promote multipurpose afforestation efforts and even multipurpose plantations. Issues related to tree ownership and usufruct rights must be clarified before promoting these policies. Single-purpose fuelwood plantations represent another alternative, but one that has not had much success in most countries.

Energy-centered afforestation for meeting industrial demand can be a successful alternative to the importation of foreign fuel. Where land is available industries can plant the fuel required to run their industrial processes. Tax incentives for industry to adopt this type of technology and approach may be required. In such cases regulations regarding the energy efficiency of the process should be established.

Mini-Case

In El Salvador the average per capita yearly cost of fuelwood is approximately $27.00, while propane gas costs around $9.25. For a family of six, a household in El Salvador would have to pay an average $162.00 per year for fuelwood, while slightly less than $56.00 per year for propane gas, making fuelwood almost three times more expensive. Unfortunately propane stoves are too expensive for many consumers. Given the up-front capital costs involved in purchasing stoves, it is easier for consumers to purchase fuelwood. Credit programs allowing people to finance the purchase of stoves could result in lower monthly costs for most families and a decrease in the use of fuelwood (Current and Juarez 1992).

Bans on wood collection and use

Prohibitions against the use of trees limits the overall availability of wood for fuel, but only up to a point. Bans are difficult to enforce, even in designated protected areas. The cost of administration and control of such policies is high and the results generally disappointing.

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Mini-Case

Used by 97 percent of households in Chad, woodfuels (principally fuelwood and charcoal) are the country's main energy source. They are growing increasingly scarce, however, in Chad's largest city N'Djamena (pop. 500,000) because of disorganized fuel harvesting and slash-and-burn agriculture in the city's environs.

A woodfuel management program may soon put the city on the road toward a more sustainable energy supply, however. The strategy is based on transforming the random cutting of forests around the city into a village-based system for marketing, taxing, and managing woodfuels.

The reform would be accompanied by measures to increase efficiency of fuel distribution and use within the city and by pricing and taxation reforms.

Demand for woodfuels in Chad, some 2.4 million tons in 1990, is expected to reach 4 million tons by 2010, with the majority of the increase coming from the urban sector. The projections are of particular concern around N'Djamena, where woodfuel reserves are depleted and the environment threatened by desertification. The problem is exacerbated by the fact that most urban households cannot afford to purchase modern energy products such as electricity, kerosene, and liquefied petroleum gas.

Although Chad developed a new Forestry Code in 1989, implementation and enforcement were lacking, and the few antidesertification projects were targeted at improving city and village environments rather than at systematically promoting efficient woodfuel use and popularizing efficient energy appliances and practices. Drought and war, as well as insufficient funding, have impeded progress in ameliorating energy and environmental problems.

An efficient an environmentally sustainable energy strategy for households emphasizes village-level control and sale of woodfuels as a key to transferring responsibility for developing and exploiting forest resources from the state to the local populations. This would allow rural villages to manage woodfuel resources in their local catchment areas, with technical assistance in sustainable woodfuel harvesting practices.

On the urban side, the project would design and implement an effective distribution system for woodfuel and would strengthen the local capacity to promote production of improved woodfuel stoves by the private sector and substitution by kerosene and liquefied petroleum gas. These targeted activities would be accompanied by price and fiscal adjustments to support sound energy use overall, such as lower taxes on modern fuels and heavy taxes on wood cut from nonmanaged areas (ESMAP Connection 1994).

Indicators: Fuelwood and Other Biomass

Problem Indicators

- Efficiency in the burning of fuelwood in household stoves and in industry.
- Number of households relying on fuelwood to meet energy needs, especially in the urban sector.
- Acreage in multipurpose forest stands.
- Indoor air contamination from traditional fuelwood burning methods.
- Amount of time women and children spend gathering fuelwood, thereby contributing to lower costs for fuelwood use.

Policy/Process Indicators

- Existence of incentives to promote the planting of forests to meet the multiple needs of development and energy.
- The passage of regulations or the implementation of taxes to promote greater efficiency in both home and industrial use of fuelwood.
- Credits and/or subsidies provided to segments of the population to permit the purchase of stoves of less expensive and cleaner fuels such as natural gas to induce consumers, especially in urban areas, to substitute natural gas for fuelwood.

REFORESTATION POLICIES

KEY POINTS

- Fiscal incentives for reforestation have been successful in the short term but often to the benefit of wealthier groups.
- Reforestation projects that account for the needs of local resource users or communities are more successful than large government projects on public lands.
- Plantations are better targets than natural forest activities for reforestation activities.

Reforestation efforts have taken two broad approaches. The first has focused on fiscal incentives and has included a wide range of measures including tax deductions and exemptions, subsidized inputs, and deposit fees. The second approach of reforestation efforts has been large government projects on public land, often supported by donor governments. Less frequently, projects have been focused on communities or smallholders. The success of these efforts has been mixed from an economic, welfare, and natural resource management point of view.

Reforestation can mean either restoration of degraded stands to approximate their natural states, enrichment planting of primary species, or, more broadly, establishment of plantations. The incentive approaches described below have been used to address each of these types of reforestation. Efforts have met with little success, although plantations have succeeded in relieving some of the pressure for wood products from natural forests.

Fiscal Incentives and Policies

Fiscal incentives include exemptions from various taxes, income tax deductions, property tax deductions, and special fee reductions. The effectiveness of any incentive depends on how well the tax is collected in the first place and who actually pays the tax.

Tax incentives often accrue to the wealthy, and lands reforested are not always those that are the most suitable for reforestation.

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Likely Impacts of More Fiscal Incentives for Reforestation

GROWTH

- Short-term loss of government revenue.
- Increased plantation production, usually by wealthier elements of society.

WELFARE

- Can be transferred from government to those reforesting.
- Long-term employment opportunities can increase.

CONSERVATION

- Reforestation provides a number of side benefits in terms of watershed and soil retention traits.

Beneficiaries are often larger corporations.

Import duty exemptions on reforestation equipment must be carefully monitored for abuses because equipment has multiple uses and such subsidies also often accrue to the wealthy. Replanting subsidies often subsidize the conversion of natural forests to inferior monospecies plantations with the associated loss of both the value of tropical hardwoods and biological diversity.

Deposit fees for reforestation or damages are collected in order to guarantee that reforestation will actually occur. The deposit must be high enough to produce the desired behavior. The deposit is refunded on evidence of an adequate replanting program. If the deposit is not returned, it then becomes another tax. Deposits should be placed in secure escrow accounts to ensure their proper use. In some countries, the deposit is collected from concessionaires on public lands but is not completely applied to reforestation if not refunded.

To affect behavior, fiscal incentives must be realistically related to the actual cost of reforestation. If the incentives are lower than actual costs, behavior will not change; if the fiscal incentives are greater than actual costs, inappropriate reforestation may occur. The long-term effectiveness of reforestation activities, however, will depend on the attitudes of the local resource users or owners.

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Success can be judged by the survival ratio of reforested areas given a sustainable resource management system.

Reestablishment of a natural resource system is more expensive than preservation. There can be significant short-term costs associated with reforestation incentives. The benefits often accrue to the wealthy, who can manage such resources for long-term benefits if the macroeconomic environment or tenure situation supports such behavior. If underlying factors do not support long-term management, reforestation efforts will fail.

Mini-Case

Although plantations have usually been developed on land owned by the state or forest industries in developing countries, smaller private landholders have been regionally important, and are likely to become more so in the future as pressures for land increase. There is a wealth of information describing the characteristics, behavior, and requirements of these forest growers in both industrial and nonindustrial societies (e.g., Arnold 1983; Blatner and Greene 1989; FAO 1985a; McGaughey and Gregersen 1988). The successful involvement of such landholders in tree growing depends largely on security of tenure over the land, or at least over the trees on it, and on assured access to markets at the time of harvesting. Many schemes by which industrial wood users enter into agreements with private landholders for the supply of wood have been successful. Schemes that involve the purchaser in establishment and management of the plantations usually have more efficient and environmentally satisfactory operations. Depending on the scale of private firms' or individuals' holdings, taxation arrangements that do not discriminate against forestry, or the availability of credit on appropriate terms for tree growing, also are likely to be important (Kanowski and Savill 1992).

Public Reforestation Projects

Large public reforestation policies are often donor supported and are often inefficient. Large, government-administered projects often fail to account for agroforestry options or nontimber products from forests. Generally, government ownership of forestlands has been extended to direct government involvement in activities for which the government has no special capacity.

There seem to be diseconomies of scale and institutional weaknesses with government activities that have not been recognized and administratively addressed. Smaller individual and community-focused activities have generally been more successful because they have addressed the short-term needs of individuals and communities.

The measure of success of reforestation efforts is the number of trees that survive within a long-term resource management system. If incentives are not established for sustained management of the resource, reforestation efforts will not succeed.

Government reforestation efforts are a drain on public resources that often results in neither significant short-term nor long-term benefits to the environment. Successful projects have usually been structured to meet resource user needs. Plantations have been more successful but have also often involved extensive private sector participation.

Indicators: Reforestation Policies

Problem Indicators

- Trees harvested from plantations.
- Reforestation on land suitable for forest management.
- Degree of water and soil retention in watersheds.
- Ratio of natural forests to mono-species plantations.
- Degree of biological diversity.
- Tree survival rate for reforested areas.

Policy/Process Indicators

- Distribution of beneficiaries among the wealthy, middle-income, and low-income groups.
- Type of projects: large public projects, plantations, individual and community fuelwood or agroforestry efforts, and so on.
- Government revenues and costs from reforestation.
- Import duty or tax exemptions.

RESEARCH QUESTIONS

Does the tax system absorb the economic rent for the public sector or does the existence and availability of such rents provide resource users with incentives to mine the resource regardless of the length of the concession?

What incentives would encourage industry to acquire ownership of forests?

What are the elements of a successful forest management system?

How would the establishment of a different concession award system interact with other public forest revenue-generating systems and the total amount of economic rent captured by the public and private sectors?

How does the present forest revenue system affect resource use decisions?

Does an adequate information base exist to establish a finely differentiated tax system? Because this is generally not the case, what administratively easier revenue systems are useful for a specific country?

There are trade-offs between economic efficiency and administrative costs and ease. Does the current system address these trade-offs?

Inefficient wood-processing industries have been documented in many situations where protection levels are high. What is the level of protection for these industries?

What complementary policies will be needed to limit resource mining if protection levels are reduced?

Does the macroeconomic environment preclude long-term investment behavior by timber firms?

Where parastatals still exist in timber production, marketing, and processing, what are the employment and resource use trade-offs?

Do other policies need to be changed in order to encourage private enterprise? What policies must be enacted to enforce resource management controls that encourage long-term management?

What is the overall structure of the timber and wood products industry? What is the direct and indirect role of the government in this structure?

What is the effect of a particular domestic price control on supply and use of various wood species?

Do fiscal incentives, if they exist, subsidize short-term behavior without considering long-term prospects for resource management?

Will ex ante deposits be more effective than ex post penalties in affecting compliance with management plans associated with natural or induced reforestation projects?

What has been the long-term success of public reforestation projects? How have these projects been financed? What is the level of donor involvement? What has been the cost?

Have projects been designed to address resource user and community issues? What have been the problems and the reforestation survival ratio?

Have plantations been a focus of either public or private reforestation projects? Have these plantations been focused on the domestic market, the international market, or both?

What has been the industrial structure of these activities and the role of government in encouraging plantations?

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Indigenous Peoples

Indigenous Land Rights

Key Points

- Most remaining forested wildlands areas in Central America are occupied by indigenous groups (National Geographic Society 1992). These areas have remained in forest cover because they have been inaccessible to outside development interests. The groups inhabiting them have evolved usufruct strategies that have not exceeded the forest's regeneration capacity; these groups' lack of access to large-scale extraction technologies has also served to protect the land.

- Ensuring long-term sustainable use of these forest resources and preserving their biodiversity will require policies that promote convergence of the interests of indigenous peoples, conservationists, and political forces.

- Security of tenure is the basis of cultural identity and self-determination for indigenous people, who may view conservation measures as means to that end. Their alliance with conservation organizations does not guarantee a long-term convergence of interests unless conservation projects are supportive of local economic and social development objectives.

- Indigenous models of land use and management in tropical rain forests maximize the number of crops produced in order to minimize the risk of crop failure. It is not clear if these management strategies can be sustained outside their cultural settings and/or be adopted by settler or non-native groups.

- The World Bank's experience in Latin America indicates that sustainable management and conservation require recognizing, demarcating, and protecting indigenous land claims, and incorporating indigenous knowledge and interests into planning and development.

- The indigenous peoples occupying these areas offer an extremely cost-effective alternative for managing large tracts of forests in an integrated fashion through communal ownership.

- Indian groups have not been participants in the decision-making and planning processes that affect the use of their lands and resources. Giving these groups control over their traditional lands can be a powerful force for sustained management of the remaining forested wildlands areas.

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Likely Impacts of Protecting Indigenous Land Rights

GROWTH

- The impact on short-term economic growth is likely to be small.
- Over the long term, successful management of the forests for a sustainable yield can be achieved with participation by indigenous groups and would have a measurable, positive impact on economic growth. The yield will depend on particular products identified by forest dwellers and potential spin-offs from industrial application.

WELFARE

- The impact on welfare indicators is mixed. Members of indigenous groups would benefit from having control over traditional lands and the opportunity (or requirement) to manage them on a sustainable yield basis. The potential for higher income, communal ownership and management of assets, and greater political security would accrue to indigenous peoples.
- People who are now using traditional lands for agriculture and livestock activities and government-sponsored and spontaneous colonization would lose the benefit of exploiting frontier lands.
- General welfare is enhanced to the extent that the maintenance of large tracts of forested lands contributes to the provision of environmental services on a regional basis and preserves options value for future generations.

CONSERVATION

- Delegating management of large forested areas to indigenous groups frees scarce government resources for managing state-owned lands, including protected areas.
- The implementation of policies that merge conservation goals and the rights of indigenous peoples over humid tropical forests would further environmental and natural resource goals.

All of Central America's remaining forested wildlands areas, including established protected areas, are being rapidly destroyed by invading colonists, overcutting of fuel wood, uncontrolled harvesting of timber products, and industrial development. This problem exists because of the difficulty in establishing enforceable and exclusive property rights over an open-access resource.

Attempts to establish private property rights have focused on individual ownership of small tracts of land. Because indigenous lands are held communally, they are not legally recognized—a situation that has allowed landless colonists to invade communally managed forested lands and claim title. The result has been the gradual destruction of both forested wildlands and the cultural integrity of the indigenous inhabitants.

Security of tenure is the basis of cultural identity and self-determination for indigenous people, who may or may not view conservation measures as means to that end. Consequently, their alliances with conservation organizations do not guarantee a long-term convergence of interests unless conservation projects support local economic and social development objectives.

Attempts to improve security of tenure over traditional lands for indigenous groups have focused around four policy themes:

- Management of parks, Indian parks, extractive reserves, and protected areas
- Application of international human rights agreements
- Changing values and moral persuasion; and development of national legislation.

While the state usually retains control of indigenous lands and recognizes community ownership of property, it promotes small private holdings and colonization laws under the pretext of increasing productivity and modernization. There is no law that addresses indigenous land titling and no coherent legislation and policies to rescue lands of indigenous groups.

With the exception of the new constitutions of Nicaragua and Guatemala, national constitutions in Central America do not recognize indigenous populations. In almost all cases, a law or decree obligates the state to provide services and take special measures to improve the social and economic conditions of indigenous populations. Although some national legislation speaks of "respect for uses and customs of the indigenous peoples," this sentiment is not formally codified and generally is ignored in the application of the law.

Values, Assumptions, and Policy Guidelines

Constitutional law and legislation on land tenure, water rights, civil status, and educational policies have been shaped by the values and assumptions summarized below: (Stavenhagen 1991, p. 35; United Nations 1991).

Old values. Indigenous cultures are inferior to the national culture; they are traditional, archaic, simple, parochial and primitive. The national culture represents progress, development,

modernity, civilization, technological and social complexity, and prosperity.

Old assumptions. Indigenous groups stand in the way of national development, growth, and prosperity. The "indigenous problem" is the result of socioeconomic isolation. Lack of economic integration and physical isolation explain their backward technology, illiteracy, ignorance, lack of skills, and parochial and traditionalist world view.

Old policy guidelines. These values and assumptions logically have led to policies that stimulate economic, social, and cultural change and integrate indigenous populations into modern social and economic development, ensuring the erosion of their culture, the gradual shrinking of traditional territories, and the disappearance of identifiable indigenous groups.

New values. The concern for ensuring long-term economic sustainability requires making public choice trade-offs between growth today and growth tomorrow. This focus leads to valuing the preservation of future options, valuing resilience over efficiency, and increasing the valuation of benefits and costs that are not reflected in the market, such as environmental services.

New assumptions. Diversity of all kinds is a source of adaptive strength and resilience. Healthy participatory democratic processes are the only known way to foster transparency, oversight, and the kind of informed bargaining and negotiation between competing interests that can address public choice trade-offs. Protecting human rights and upholding democratic processes are inseparable.

New policy guidelines. More and better information will lead to better policies. The potential winners and losers of resource allocation decisions should be empowered to participate in the policy formulation and planning processes. Resource management should be decentralized and the users should be involved in implementation.

The old set of values in Central America that underlie the policy choices for dealing with indigenous people are the same as those found in North and South America. In its worst form, the old set of values leads to extinction; in its most benign form, it leads to assimilation into the dominant culture and loss of native cultures.

Recognition of the rights of indigenous peoples has strong international support. (See the section on International Conventions and Support.) That support, however, is rarely transformed

into programs that protect the rights of native populations within national boundaries.

The new set of values described above proposes an alternative to assimilation or extinction and establishes a programmatic link with the conservation and natural resource management goals of nation states. It is based on the proposition that indigenous peoples have developed management technologies to harvest a wide variety of products from the tropical humid forest in a manner consistent with sustainable use of the forest.

The preservation and sound management of humid lowland forests can be enhanced by directly incorporating the goals of indigenous peoples into national goals for conservation and management of natural resources. This can be done by recognizing and protecting indigenous land claims; using the knowledge of indigenous populations on a variety of products that could be harvested and marketed; using the time-tested technologies for extraction of some products as the foundation for research and development; and maintaining the low people-to-land ratio that is common to forest dwellers.

Indicators: Indigenous Land Rights

Problem Indicators

- Protection for forested wildlands to preserve both biological diversity and cultural integrity.
- Access to land and resource ownership and usufruct rights by indigenous groups.
- Involvement and participation of indigenous peoples in protected area planning and management.
- Rate of non-indigenous incursions onto indigenous lands.
- Conflict between indigenous groups and non-indigenous colonizers over land.

Policy/Process Indicators

- Laws established that recognize the legal rights of indigenous peoples to communally held land.
- Secure land tenure rights established for indigenous peoples.
- Establishment of laws and policies that protect the rights of indigenous peoples as citizens.
- Commitment to research to determine whether indigenous land use management strategies can be effectively adopted by non-indigenous groups.
- Incentives provided for resources users to adopt indigenous land use management strategies that are determined to be effective and transferable.
- Incorporation of indigenous knowledge and practice into the management, planning and development of protected areas and ecologically sensitive regions.

RESOURCE MANAGEMENT

KEY POINTS

- Any protectionist policy requires controlling technology and the relationships between communities within the protected area and the outside world.
- Customary owners are generally very practical about comparing the potential returns from various management schemes.
- As protected areas become exposed to development pressures, it is increasingly difficult to exclude nontraditional technologies and limit people's life choices.

Various management strategies have emerged for fostering the merger of conservation goals with those of indigenous populations (Clay 1990; Poole 1988). In the absence of adequate laws and enforcement capabilities, management strategies that structure use incentives and specify behavior are important policy tools for achieving convergence of interest between indigenous groups and conservation goals.

The terms of management strategies must ultimately address how gains and losses are distributed; who decides on levels of use or rates of extraction and by what process; who makes choices about alternative uses and assesses the opportunity costs of forgone benefits; and how compensation is provided.

As protected areas become exposed to development pressures, it is increasingly difficult to exclude nontraditional technologies and limit people's life choices. Indigenous peoples cannot be denied health care, and increased populations require enlarged hunting areas and/or new food sources leading to more extensive and/or intensive agriculture. Customary owners are generally very practical about comparing the potential returns from various management schemes.

Likely Impacts of Creating Biosphere Reserves with Indigenous People's Participation

GROWTH

- Sustainable long-term use of buffer zones with short-term economic losses.
- Increased cost of government management and enforcement.

WELFARE

- Involvement and empowerment of indigenous people.
- Preservation of indigenous knowledge of flora and fauna.

CONSERVATION

- Sustainable long-term resource use.
- Preservation of biodiversity in ecosystem.

Exclusion from Parks and Protected Areas

Indigenous peoples have been excluded from protected areas either because hunting and gathering are prohibited or because the reserve is for nonnative sports hunters only. Exclusion of indigenous peoples is more common in former British colonies. This practice has resulted in a variety of perverse outcomes: continued invasion of park boundaries, social breakdown, population explosion of previously hunted animals and diversion of the benefits of resource use to outside groups.

Experience indicates that these outcomes can be largely avoided when indigenous groups are involved in the planning and management of protected areas.

National Parks and Indian Parks

The objective in designating land as a national park or Indian park is to protect and preserve its present state with no human modification. While indigenous populations are accommodated as

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"part of the natural order," they are denied the right to change and develop such lands. Examples are Xingu National Park, Brazil; Aripuana Indian Park, Brazil; Yanomami Park, Brazil; Lauca National Park, Chile; and Manu National Park, Peru.

Conditional Occupancy and Use

Conservation agencies may impose restrictions on the technologies used and the manner of resource use. Insistence on "traditional" or "subsistence" technologies essentially excludes indigenous land use when it evolves beyond arbitrarily defined limits of the approved form, or as social and economic pressures cause migration from the park area.

Extractive reserves and extractive forests are a form of conditional occupancy. To be viable, these must allow extractive activities to evolve to generate new forms of economic activity (Allegretti 1990).

Priority Use

Resources shared with nonaboriginal users can be allocated on a priority basis, with highest priority given to subsistence uses.

The conditions imposed on methods of resource utilization are often more diligently imposed on indigenous residents than on outside users; indigenous people have often been asked to curtail traditional practices to preserve a resource, while outside groups have been allowed access to the same resource.

The World Conservation Strategy suggests that allocation among native users be left to the indigenous community and that the surplus be shared between native groups and other users for commercial or recreational purposes.

Lease-Back Provisions

Title to parks and protected areas can be given to indigenous communities and then leased back to conservation agencies.

Indigenous participation in managing and protecting aboriginal lands requires a flexible approach that conflicts with state government's predisposition to centralize power. This conflict may be partially solved by a strong NGO role.

Mini-Case

Kakadu and Coburg National Parks, in Australia, were first passed to aboriginal ownership and then leased back as park land. The management agreements specify the role aboriginal populations have in policy formulation, planning, training, and employment.

Compensation for Conservation

Indigenous inhabitants can be compensated for the forgone benefits and/or direct losses they sustain as a result of the area's protected status.

Mini-Case

Amboseli National Park in Kenya devised a formula for an annual fee to compensate the Masais for lost grazing opportunities when park animals entered Masai lands. Revenues from campsites and lodges were redirected to local communities.

Biosphere Reserves

The concept of biosphere reserves evolved in Latin America in response to two conditions: (1) most surviving wildlands are occupied by indigenous peoples; and (2) national parks and other conservation areas are exposed to colonization and industrial development. The biosphere reserve is a complex of conservation units that includes protected core areas surrounded by buffer zones in which varying intensities of resource exploitation are permitted. These permitted resource uses provide lower but sustainable revenues for the benefit of local communities rather than for outside interests. Examples are the Proyecto de Estudio del Manejo de Areas Silvestres de Kuna Yala or Udirbi Park; Darien National Park, in Panama; Rio Platano, in Honduras; La

Amistad, in Costa Rica and Panama; and Maya Biosphera, in Guatemala.

The concept attempts to diffuse change in the surrounding regions through dissemination of information, experimentation, demonstration, persuasion, and education. The success of maintaining special conservation areas is dependent on the cooperation of local communities and the extent to which they receive the benefits flowing from conservation.

The two recognized key ingredients are conservation initiatives by indigenous groups and active involvement of conservation NGOs. Indigenous groups, however, are not generally empowered to undertake autonomous conservation measures.

A third ingredient for success must be innovative institutional arrangements for risk-sharing and for investing and distributing the revenue from resources that do not lend themselves to short-term, regular, and discrete yields. Analogies might be indigenous natural resource mutual funds or the revenues that Saudi citizens receive from their oil resources

Management and Research

Indigenous groups have historically "managed" their resources through a variety of mechanisms. The new management problem arises because outside interests are competing for these resources in ways that the market recognizes as more profitable, at least in the short term.

Management mechanisms must incorporate new ways to establish market value, allocate and delimit use rights, and choose among competing uses. Indigenous groups can contribute to this process through research and direct administration of the natural resources on which they depend. Experience indicates that their involvement leads to improved and more readily accepted and enforced management.

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Mini-Case

The Alaska Eskimo Whaling Commission, Eskimo Walrus Commission, and the Caribou Management Boards monitor wild populations, conduct scientific research aimed at ensuring the continued existence of species within traditional use, develop management plans, and generate local community compliance with sound conservation practices.

Mini-Case

The Makivik Research Center in Quebec develops indigenous scientific research capacity; initiates and conducts wildlife research and management projects that respond to Inuit needs; collects, analyzes, and disseminates scientific and technical information to the Inuit; and provides training and education in wildlife research management.

Mini-Case

Wildlife Management Areas in Papua, New Guinea, remain under customary ownership, and landowners select a management committee to control hunting. There is no tenure transfer, and flexible management leads to regulations that are responsive to local needs.

Forest Parks and Refuges Catering to Ecotourism

Indigenous groups can convert their traditional lands into parks and protected areas.

Mini-Case

The Kuna Proyecto de Estudio del Manejo de Areas Silvestres de Kuna Yala (PEMASKY) is a conservation area initiated and managed by the Kuna. The boundary is patrolled by park guards and marked by a four-meter-wide cleared trail, concrete markers, and notices of penalties for hunting and clearing land. The management concept is being expanded to include an agroforestry component.

Recreational Development

In general, indigenous communities have not been receptive to large-scale tourism projects and have not benefited from them. They have, however, been receptive to small-scale, high-paying developments such as ecological tourism, activity tourism, and sports hunting and fishing. Indigenous groups that have wanted to benefit from ecotourism have received little support from tour companies.

Protection of Boundaries

All indigenous lands, whether legally established as indigenous reserves or protected areas, have been invaded by colonialists. A clearly marked boundary, patrols for surveillance, and legitimate procedures for warning and evicting colon are required to thwart such invasions. The problematic legal status of many indigenous areas and weak enforcement mechanisms of the nations' legal systems make evictions through standardized legal procedures difficult or impossible. As a result, some communities have assumed protection responsibilities through informal methods.

Mini-case

The Awa Ethnic Forest Reserve in Ecuador uses an innovative method of showing conspicuous conventional land use. The Awa cleared a 12- to 15-meter strip around the reserve's perimeter and planted it with fruit and hardwood trees, established nurseries at potential entry points, and developed a strategy to colonize a planned entry road.

Economic Development Projects

Development projects in the buffer zones surrounding biosphere reserves provide sustainable alternatives to monoculture, logging, and colonization. They may include adding value locally through secondary processing, agroforestry, realizing economic value of wildlife conservation and environmental rehabilitation. Based on

his experience in Latin America, Smith (1987, cited in Poole 1989) says that development projects should meet four criteria:

- The indigenous community controls conceptualization, planning, and implementation.
- The indigenous community exercises control over its territory and the resources within its territorial limits.
- The program promotes self-sufficiency and economic independence for the community.
- The development processes strengthen social and cultural community bonds.

Indicators: Resource Management

Problem Indicators

- Security and rights of access to natural resources for traditional users in and around protected areas.
- Levels of unauthorized poaching and encroachment in protected areas.
- Exploitation of resources on indigenous lands by outside population groups.
- Participation of indigenous groups in decision making regarding resource use in and around indigenous lands.
- The number of sustainably oriented economic development project undertaken with indigenous groups in and around protected areas.
- Use of appropriate technology that promotes efficient and sustainable use of resources and ensures income but does not lead to environmental degradation.

Policy/Process Indicators

- Existence of incentives and management structures to promote conservation while protecting indigenous access to resources .
- Existence of a system giving priority use of natural resources to subsistence users, especially in areas of conflict over scarce resources.
- Policies in place recognizing the rights of indigenous groups to use and manage specific resources.
- Efforts underway to demarcate indigenous lands and control encroachment.
- Incentives established for tour operators to work with indigenous groups but under regulations guaranteeing indigenous control over the tourism process.
- Greater participation of indigenous peoples in research studying the use and value of forest resources.

INTERNATIONAL LEGAL INSTRUMENTS

KEY POINTS

- Sustainable use of the remaining forested areas in Central America will depend on the way in which the rights, protections, and responsibilities of the indigenous groups occupying them are specified.
- International human rights agreements primarily protect individuals. Individual versus group ownership, however, is a key policy issue because of the important role that secure land tenure plays in the sustainable use of forest resources.

International human-rights agreements provide the initial legal basis for addressing the incursion of outside development interests. International human-rights law mobilizes, and offers a common framework for, national legislation (Indian Law Resource Center 1984, pp. 50-58; Davis 1988).

UN Charter

All member countries have a legal obligation to promote and encourage the rights and protections identified in the UN charter. Article 55 states that, ". . . based on respect for the principle of equal rights and self-determination of peoples, the United Nations shall promote . . . universal respect for, and observance of, human rights and fundamental freedoms for all without distinction as to race, sex, language, or religion."

The **Universal Declaration of Human Rights,** Article 17 states that, "Everyone has the right to own property alone as well as in association with others," and "No one shall be arbitrarily deprived of his property." Article 27 states that, "Everyone has the right freely to participate in the cultural life of the community. . . ."

The **International Covenant on Civil and Political Rights** is binding on Costa Rica, El Salvador, Nicaragua, and Panama. The International Covenant on Economic, Social and Cultural Rights is binding on all of the above plus Honduras. Article 1 of both covenants states:

Likely Impacts of Adherence to International Legal Instruments Supporting Indigenous People's Rights

GROWTH

- Short-term losses from lack of resource mining by colonists.
- Long-term sustainable economic growth from nontimber forest products, among others.

WELFARE

- Preservation of living cultural heritage.
- Loss of opportunities for colonization.
- Indigenous people's welfare will depend on technology allowed.

CONSERVATION

- Preservation of biodiversity.
- Sustainable resource use.

"All peoples have the right of self-determination. By virtue of that right they freely determine their political status and freely pursue their economic, social and cultural development.

"All peoples may for their own ends, freely dispose of their natural wealth and resources . . . . In no case may a people be deprived of its own means of subsistence.

"The States Parties to the present Covenant, including those having responsibility for the administration of Non-Self-Governing and Trust Territories, shall promote the realization of the right of self-determination. . . ."

Prevention and Punishment of the Crime of Genocide

In the Convention on Prevention and Punishment of the Crime of Genocide, the definition of genocide is limited to extreme violations. The concept of "ethnocide" has not been adopted as a formal legal term in any major human-rights instrument, but it

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has been used to describe cases in which a group, as a people, is being destroyed by policies or practices imposed by a national government, even though members of the group are not being killed.

Implementation

The right to self-determination has not been established for Indian peoples under international law. The international community has not decided whether Indian nations, tribes, and communities are "peoples" or a "minority group."

Domestic remedies must be exhausted before a human-rights complaint can be brought to an international organization, and access to Indian groups is further restricted by limitations on standing. The International Court of Justice in The Hague will not accept Indian complaints about human-rights violations. Only members of the United Nations can be parties, and countries must consent before the Court is permitted to hear a case brought against them.

United Nations 1235 Procedure (established in 1967 under Economic and Social Council Resolution 1235) permits an international nongovernmental organization to make complaints about situations that "appear to reveal a consistent pattern of gross and reliably attested violations of human-rights and fundamental freedoms." This forum may be used only by NGOs granted consultative status with the United Nations Economic and Social Council.

United Nations 1503 Procedure authorizes the UN Sub-Commission on Prevention of Discrimination and Protection of Minorities to investigate complaints. Complaints must be about massive violations of human-rights. All proceedings, including the final decision, are kept secret from the public and the plaintiff.

The **United Nations Educational, Scientific and Cultural Organization** (UNESCO) accepts complaints brought by individuals or groups related to the fields of education, science, culture, and information. This encompasses the "right of minorities to enjoy their own culture . . . and the right of peoples to self-determination, including the right to pursue cultural development." The goal is to negotiate a settlement through closed meetings; however, the procedure is not as secret as the UN 1503 procedure.

The **Optional Protocol to the International Covenant on Civil and Political Rights** enables the Human Rights Commit-

tee to receive and consider communication from individuals claiming to be victims of violations of the rights specified in the Covenant. This avenue is available to countries that have ratified the "Optional Protocol" (Costa Rica, Nicaragua, Panama). Of importance to Indian groups is the "right of ethnic minorities to enjoy their own culture in community with other members of their group." The Human Rights Committee generally does not consider complaints unless they have been filed under one of the other international complaint procedures; however, the procedure is more open to the public than the 1503 procedure.

Organization of American States Charter

The **OAS Charter** requires that all member countries "respect the fundamental rights of the individual without distinction as to race, nationality, creed or sex." The OAS has two human—rights instruments, both of which have been ratified by Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. (Belize is not a member of the OAS.) Neither instrument specifically mentions the rights of indigenous populations, but both establish clear international language stating that government policy must not discriminate for reasons of race, color, sex, language, religion, political or other opinion, national or social origin, economic status, birth, or any other social conditions.

The **American Declaration of the Rights and Duties of Man** adopted by the Ninth International Conference of American States, Bogotá, Colombia, identifies rights similar to those in the United States. The preamble states, "Inasmuch as spiritual development is the supreme end of human existence and the highest expression thereof . . . [and] . . . since culture is the highest social and historical expression of that spiritual development, it is the duty of man to preserve, practice and foster culture by every means possible." Article XIII states, "Every person has the right to take part in the cultural life of the community."

The **American Convention on Human Rights** (also called the "Pact of San Jose," 1978) was signed at the Inter-American Specialized Conference on Human Rights, San Jose, Costa Rica, November 1969 and put in force July 1978. It is a formal inter-American treaty that strengthens and elaborates on the human-rights laws of the American Declaration requiring OAS countries to "achieve progressively" the economic, social and cultural rights which it declares. The Preamble recognizes "that the essential rights of man are not derived from one's being a national of a certain state, but are based upon attributes of the

human personality and that they therefore justify international protection."

Implementation

Complaints are referred to the Inter-American Commission on Human Rights (IACHR) and to the Inter-American Court on Human Rights. The IACHR is the most convenient forum for Indians. Its reports are submitted to the OAS General Assembly and covered in the international press. The commission acts as a mediator, not as a court; however, if a friendly settlement cannot be reached, the commission may make its report public.

The OAS Inter-American Court on Human Rights was established in 1980. The IACHR may present cases involving countries that are parties to the Convention in the Inter-American Court in San Jose, Costa Rica. Indian peoples, however, may not directly present their own complaints.

To date the IACHR has not made a formal pronouncement on the land rights of indigenous populations, although Article 21 of the American Convention on Human Rights is broad enough to include the collective property rights of indigenous groups.

On November 18, 1989, the General Assembly of the OAS charged the IACHR to prepare a new juridical instrument on the rights of indigenous peoples of the Americas to be ready in 1992. The OAS development and approval of new international legal standards would parallel the work of the UN Working Group on Indigenous Populations. To date there has been only token involvement of Indians in the process, and a draft document is not available.

Other Sources of Policy

Explicit and implicit policies emerge from the activities of other organizations and interests.

International Labor Organization Convention 107, also called the Convention Concerning the Protection and Integration of Indigenous and Other Tribal and Semi-Tribal Populations in Independent Countries, is the only international convention that specifically addresses Indian rights. Complaint procedures may not be used by individuals. ILO member countries are Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

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The emphasis is on "integration" or assimilation. Article 11 states "the right of ownership, collective or individual, of members of the populations concerned over the lands which these populations traditionally occupy shall be recognized." Article 12 states "indigenous populations should not be removed from their habitual territories without their free consent, except under exceptional circumstances." Article 13 calls for "governments to recognize the traditional procedures of indigenous populations for the transmission of rights of ownership and use of lands, as well as to prevent persons who are not members of native groups from taking advantage of the native groups' customs or ignorance of the national legal system in order to secure ownership or use of their lands."

ILO Convention 169 revises 107 with the intention of removing assimilative language. Article 1 adopts the term "peoples." Articles 6 and 7 establish the principle of consultation and participation in legislative or administrative measures, plans, and programs for national and regional development that may affect indigenous groups directly. Articles 8-12 specify the relationship between indigenous and national legal systems. Articles 13-19 deal with land ownership, recognizing collective land rights, protecting the rights of ownership and possession, the right to natural resources, and rights in connection with removal and relocation of people.

Indigenous participants to the revision process have claimed that the document fails to recognize their world view. Two main concerns are the use of "consult" in place of "consent" and the qualification of "peoples" to not imply the rights attached to the term under international law.

The World Bank has established directives providing policy guidance to "ensure that indigenous people benefit from development projects, and avoid or mitigate potentially adverse effects on indigenous people caused by Bank-assisted activities." The Bank's Indigenous Peoples Development Plan lays out the prerequisites and steps required for a planning and development process based on the "informed participation of the indigenous people themselves."

Indicators: International Legal Instruments

Problem Indicators

- Incursion onto indigenous lands by outside populations.
- Human rights violations against indigenous peoples.
- Economic assistance targeted to support the economic development needs of indigenous peoples.

Policy/Process Indicators

- Creation of policies recognizing the rights of indigenous groups to natural resources and land in areas of traditional use or settlement.
- Existence of legislation consistent with international treaties respecting the human rights of indigenous groups.
- Established policies recognizing the rights of indigenous people to equal protection under the law.
- Established mechanisms in place to review and hear indigenous claims or denouncements against incursions or land conflicts.

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Changing Values and Moral Persuasion

Key Points

- Beliefs and values about "progress," "cultural diversity," and what constitutes "human-rights" drive policy and the legislation implementing it.
- New values that stress preservation of future options, resilience over efficiency, and the protection of cultural diversity are leading to policy guidelines to protect indigenous rights to traditional lands and resources and to promote the participation of indigenous peoples in the use and development of those areas.

New statements of policy on the rights of indigenous peoples are gradually finding their way into national legislation and into the policy objectives of donor institutions such as the World Bank (United Nations 1991).

UN Working Group on Indigenous Populations

The Working Group on Indigenous Populations was established in 1982 under the UN Commission on Human Rights and its Sub-Commission on Prevention of Discrimination and Protection of Minorities. Its purpose is to "review developments pertaining to the promotion and protection of the human-rights and fundamental freedoms of indigenous populations and to give special attention to the evolution of standards concerning the rights of indigenous populations." Although the Working Group is not a judicial body and has no legal power to provide remedies, it is presently the most important international organization to which Indians are bringing general human-rights complaints.

The Working Group states in the 1991 Draft Universal Declaration on the Rights of Indigenous Peoples:

"Considering that all peoples contribute to the diversity and richness of civilizations and cultures, which constitute the common heritage of humankind [and] . . . believing that indigenous peoples have the right freely to determine their relationships with the States in which they live in a spirit of co-existence with other citizens. . . .

Likely Impacts of Changing Values Related to Indigenous Peoples and Resource Use

GROWTH

- Short-term economic losses as incursions into indigenous lands decrease.
- Long-term preservation of a priced and unpriced economic value.

WELFARE

- Greater cultural diversity.
- Greater appreciation of interdependence between short-term and long-term gains to communities.

CONSERVATION

- Preservation of biological diversity.
- Long-term sustainable resource management.

"Indigenous peoples have the right to self-determination in accordance with international law. By virtue of this right, they freely determine their relationship with the States in which they live . . . . Indigenous peoples have the collective and individual right to be protected from cultural genocide . . . the right to maintain their distinctive and profound relationship with their lands, territories and resources, which include the total environment of the land, waters, air and sea, which they have traditionally occupied or otherwise used . . . the right to own, control and use the lands and territories they have traditionally occupied or otherwise used. . . the right to the full recognition of their own laws and customs, land tenure systems and institutions for the management of resources . . . the right to effective State measures to prevent any interference with or encroachment upon these rights. . . ."

The Working Group also enumerated for the first time the specific rights that are guaranteed by the right to self-determination:

"The right to participate fully at the State level, through representatives chosen by themselves, in decision-making about and implementation of all national and international matters which may affect their rights, life and destiny. . . . The States have the duty to guarantee the full exercise of these rights, [and] . . . the individual and collective right to access to and prompt decision by

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mutually acceptable and fair procedures for resolving conflicts or disputes. . . ."

International Conference of NGOs, Indigenous Peoples, and the Land

This 1981 conference established the relationship between land ownership and self-determination, including the right over natural resources contained in the soil and beneath the soil, and affirmed: "Indigenous peoples . . . have the right to live freely in their own territories . . . the tight relationship that indigenous peoples maintain with the land must be understood and recognized as the fundamental basis of their cultures, spiritual life, integrity as peoples, and their economic survival."

Inter-American Indian Congress

The Fifth Inter-American Indian Congress, Quito, Ecuador, 1964, stated, "In all development programs, the rights of aboriginal populations to the possession and free utilization of the lands that they occupy shall be respected. . . . The recognition of the right of forest-dwelling populations to land should be carried out through the concession and maintenance of reservations or inalienable land grants; and . . . the governments should create, maintain and amplify reserves or national forest parks occupied by forest-dwelling Indians."

The Eighth Inter-American Indian Congress, Merida, Yucatán, Mexico, 1980, stated, "The design and execution of national development plans should embody policies, systems and procedures that will guarantee the ownership and use of the land and of the natural resources that for centuries have belonged to the Indian peoples as one of the basic ways to guarantee their physical, economic and sociocultural survival, as well as their access to national development within respect for the peoples' right to self-determination."

The Tenth Inter-American Indian Congress dealt with territorial rights of Indian populations and their consequences for human rights.

Indicators: Changing Values and Moral Persuasion

Problem Indicators

- Incursion onto indigenous lands by outside populations.
- Human rights violations against indigenous peoples.
- Representation of indigenous groups in international, national and regional congresses.
- Recognition of indigenous rights within the general population.
- Respect for cultural diversity.

Policy/Process Indicators

- Policies in place to provide greater opportunities to indigenous people in education and in the workplace.
- Established mechanisms in place to review and hear indigenous claims or denouncements against incursions or land conflicts.

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interface these two kinds of law between the national system and the *comarca*, or autonomous homeland?

Involving indigenous groups (or local residents) in the management of conservation units (including appropriate development projects) will require new institutional mechanisms for: (1) linking state and local authorities; (2) developing new levels and types of enforcement authority; (3) resolving and mediating conflict; (4) collecting and dispersing revenue for local management needs; (5) sharing among community members the returns on longer-term investments; and (6) compensating community interests for the forgone benefits of conserving resources or using them at a slower rate. What models from other areas (e.g., policy, management, investment, insurance, etc.) can be adapted or modified? What lessons have been learned from current projects?

Indigenous economies utilize local resources for subsistence, barter, and limited outside revenue. How can the use value represented in this economy be included in formal planning activities?

What is the impact of the various donor policies on the ability of indigenous groups in forested areas to control their resources and make self-determined decisions about their resources? How do those policies interact with the constellation of national laws and policies in terms of these issues?

RESEARCH QUESTIONS

Income generated by exploiting natural resources in conservation areas and buffer zones should be reinvested in developing sustainable production techniques and distributed equitably to community members. What mechanisms are currently available for channeling benefits to local communities? What new institutional mechanisms might accomplish this? How could they be implemented? (For example, the revenues from forest concessions might be invested in an international mutual fund that functioned as a community endowment fund. Interest would be used as a revolving fund, credit union, etc.)

What percentage should local people receive to compensate them for forgone uses so that the marginal benefits equal the marginal costs?

How can fee structures be established to serve various management objectives? What are the behavioral implications for various objectives, for example, supplementing regular government appropriation, or making the unit self-sufficient? What other policies need to be in place so that perverse incentives are not created?

How should fee structures take into account different groups? What are some mechanisms for establishing communal ownership of traditional lands?

What national laws affect indigenous people directly and indirectly in their resource use patterns? What changes would be required to guarantee tenure rights both individually and collectively?

To date there is no treatment of customary law with respect to: (1) indigenous management systems over a range of resource types and economic contexts; (2) the impact of indigenous management systems on natural resource management practices; and (3) the "fit" of indigenous management systems with external policies, for example, forest management, parks, preserves, and so on. What are the most important customary laws that guide behavior with respect to forest resources in the major groups under consideration?

The notion of *derecho consuetudinario*, or customary law, is more like English common law than the Roman law that gave rise to Latin American legal procedures. What structural and institutional conditions would have to exist to accommodate, link and

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Protected Areas and Wildlife

Types and Legal Basis of Protected and Reserved Areas

Key Points

- Although the legislated protected area systems in Central America are extensive, there is often no government presence in the field and most areas are being rapidly degraded through human encroachment.
- Population pressure and poverty are the main threats to protected areas. Policies to establish, manage, and protect conservation areas must anticipate and take into account demographic trends.
- Effective protection requires changing, limiting, or preventing certain activities.
- If enforcement capabilities are absent, then changes in behavior require an integrated package of incentives that alter individual decisions about the gains and losses associated with various uses.
- Successful management policies must provide benefits for both the protected area and nearby residents.
- Incentives, especially those aimed at stimulating production, may have unanticipated outcomes.
- Fiscal incentives generally result in overexploitation of biological resources rather than conservation of biological resources.
- Protected and reserved areas must be supported by appropriate national policies and be part of an integrated package that includes rural development, education, protected-area management, training, institutional development, and legislative reform.

Likely Impacts of Maintaining and/or Expanding Protected Areas

GROWTH

- Long-term growth in GDP from an increase in tourism and its associated industries, and multiplier effect from development of infrastructure to support the tourist industry.
- Protected marine areas contribute to GDP from the productivity of fisheries.

WELFARE

- Long-term growth in local employment from tourism and park management activities.
- Conditional management schemes promote long-term access to some park resources.
- Extractive reserves create higher incomes for local people.
- In the short term, the local population will be deprived of the benefits of hunting and gathering to the extent that these uses are prohibited. To the extent that protected areas provide a renewed source of game moving out into buffer-zone areas, long-term welfare will increase.

CONSERVATION

- Protects biodiversity, representative ecosystems, and future development options.

Types of Protected Areas

In Central America there are 162 protected areas covering 5.4 million hectares (10.3% of the total of Central America). The total area declared covers 8.7 million hectares, or 16.3% of the territory of the 71 forest reserves, including Indian reservations. Most of the declared areas are "paper parks"; that is, they are inadequately managed, have no clear physical limits, legal property titles, or records, and there is no permanent institutional presence in the field.

The major threats to protected areas include inappropriate development to promote tourism; concessions to transnationals for petroleum exploration and extraction; illegal deforestation; spontaneous land colonization; illegal taking of fish and shrimp; expansion of the livestock and banana industries; forest fires; urban growth; isolation of most conservation areas; limited interest and political support; and contradictory policies among

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government sectors, inadequate authority, and low priority given to conservation.

Although establishing a protected area changes its de jure tenure status, de facto tenure may not change, essentially creating an open-access resource. Other parts of the government may also continue to ignore the de jure change of ownership. For example, ministries with responsibility for forestry, agrarian reform, and rural development may continue to allow timber concessions and colonization within and around a new protected area. Policy reform therefore must focus on both the national and community levels.

At the community level, management activities can increase the supply and/or reduce the demand for resources that exist within the protected area. Demand can be reduced by increasing penalties and improving enforcement and by creating alternative sources of income for that derived from the protected areas resources. Supply can be increased by developing alternative supplies in the areas surrounding the protected area, such as woodlots, and captive breeding programs for wildlife. Community control of the regulation of protected areas, enhanced by outside monitoring and administrative support, has the advantage of reducing the need for outside enforcement.

There are a number of distinct types of protected and managed areas that reflect the degree of human intervention and management objectives.

Scientific Reserves and Wilderness Areas. A scientific reserve is an area (including where appropriate a coastal or marine element) that possesses outstanding or representative ecosystem features and/or flora and fauna of scientific importance that is available primarily for scientific research and/or environmental monitoring. A wilderness area is a large unmodified area (land or water) that retains its natural character and influence without permanent improvements or significant habitation and that is protected and managed to preserve its natural conditions. The area may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

National Parks and Equivalent Reserves. A national park is a relatively large, natural area (including where appropriate a coastal or marine element) designated (a) to protect the ecological integrity of one or more ecosystems for this and future generations, (b) to eliminate exploitation or intensive occupation of the area, and (c) to provide a foundation for spiritual, scientific,

educational, and environmentally compatible recreational opportunities. Equivalent reserves are natural areas of similar character designed for the same reasons, variously called state parks, provincial parks, marine parks, or tribal council parks.

Natural Monuments. A natural monument is a significant natural or natural/cultural feature that is of outstanding or unique value because of its inherent rarity or representative qualities.

Habitat and Wildlife Management Areas. These are areas subject to human intervention devoted to the study of the requirements of specific species for breeding, feeding, and survival. Specific functions include maintenance of sustainable populations and protection of rare and threatened species.

Protected Land and Sea Scapes. These are areas where harmonious interaction of people and nature has produced a scenically attractive area with unique or unusual patterns of human settlement and/or traditional practices associated with nonintensive types of agriculture, grazing, forestry, or fishing.

Resource Reserves. Resource reserves protect natural resources for future uses until management objectives can be established. Examples include Kenya's Kora and South Turkana National Reserves and Brazil's forest reserves.

Natural Biotic Areas and Anthropological Reserves. These areas are designed to allow traditional societies to continue their way of life undisturbed by modern technology, usually with the caveat that they continue living in harmony with the environment. Examples are Brazil's Xingu Indigenous Park and Botswana's Central Kalahari Game Reserve.

Transnational Parks. Ecosystems do not follow national borders, and in the last five years interest has grown in establishing protected border areas. Examples are Trifinio and Biosfera de la Fraternidad Reserve (Guatemala, Honduras, and El Salvador); La Amistad Reserve (Costa Rica and Panama); and SIAPAZ, Protected Areas for Peace (Nicaragua and Costa Rica). Other cooperative efforts are: Rio Coco/Bos Awas/Rio Platano/ Tawahka Project (Honduras and Nicaragua); Chiquibul/Mayan Mountains Project (Guatemala and Belize); and Calcakmul, Mirador/Rio Azul, and Rio Bravo/Lamanai, an initiative for establishing a protected area system of Gran Peten-SIAPAZ (Mexico, Guatemala, and Belize).

Mini-Case

Continued population growth and economic expansion in Central America, attended by poverty and social inequity, have two-thirds of the region. In the department of the Petén, Guatemala, agricultural frontier expansion and logging have resulted in the conversion of 200 to 400 square kilometers per year for the last 10 to 15 years. Population increased from 64,500 in 1973 to 250,000-300,000 in 1989. Under the current pattern of extensive agriculture and cattle raising, widespread forest conversion will continue, threatening the region's social stability and ecological and economic productivity.

In response to this threat, the Maya Biosphere Reserve (MBR), encompassing nearly 1.5 million hectares, was established in the northern Petén in 1990. The Consejo Nacional de Areas Protegidas (CONAP) was established to administer this and other reserves in the country. Although the legal framework is in place for the management of the reserve, there are many challenges facing the institutions and communities responsible for the MBR and its natural and cultural resources.

The MBR includes zones for both the strict preservation of forests, wetlands, and other natural ecosystems, as well as the sustained management of extensive forested areas (6,000 to 8,000 square kilometers). The reserve, which occupies the northern 40 percent of the Petén, is located within a larger bioregion that includes southwestern Campeche and southeastern Quintana Roo in Mexico, as well as northwestern Belize (Reining and Heinzman 1992).

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Mini-Case

In Guatemala, there are six types of protected areas, each with unique requirements.

Type I: National Parks and Biological Reserves

- Completely excludes human interference, prohibits the destruction of any specimen of flora and fauna, bans mineral exploration or exploitation.
- Disallows the use of conservation easements.

Type II: Biotopos Protegidos, National Monuments, Cultural Monuments, Historical Parks

- Allows only minimum human impact.

Type III: Multiple Use Areas, Manatiales, Forestry Reserves, Wildlife Refuges

- Managed with the objective of maintaining the productivity of the area and its resources, and contributing to development.
- Use requires adequate program plan. Without such plans, the only allowed uses are those traditionally pursued by native populations and those that fulfill basic needs.
- Given adequate plans, can contain zones appropriate for the production of sustainable products.

Type IV: Natural Recreation Areas, Regional Parks, Scenic Routes

- Protection of resources is emphasized for educational and recreational purposes.
- Can be regulated for intensive use, and alteration of the area is permissible. The environmental impact, however, should be minimized.

Type V: Private Natural Reserves

- Owner maintains property rights but voluntary submits the land and its resource to conservation practices.

Type VI: Biosphere Reserves

- Permits the harmonious coexistence of conservation and sustainable use practices.
- Divided into distinct use areas (nuclear zones, modifiable use zones, and multiple or sustainable use zones).
- Provide opportunities for investigation, environmental education, tourism, and controlled recreation.

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Problem Resolution for Protected Areas

There are five general approaches for addressing conflicts or problems that arise with protected areas and other environmental issues. These include: judicial, administrative, legislative, arbitration, and popular action and denouncements.

Judicial involvement in protected areas generally arises from the civil and criminal codes of the country. The effectiveness of the judicial role will depend on the integrity of the judicial system. If there is a high level of corruption and/or excessive judicial procedures, control will not be effective. In many developing countries the role of judicial systems with environmental issues such as protected areas is relatively new. Some efforts at sensitizing judges and prosecutors to environmental issues have been undertaken in some countries. In other cases, special environmental courts have been established, although their jurisdiction is often unclear because there is no established legal framework for environmental problems. There is more experience with the land tenure issues that arise with protected areas.

Mini-Case

In 1992, in La Compania Electroquimica Pesada S.A. (ELPESA) lodged a "Recurso de Amparo" (a habeous corpus re. activity rights) against the Ministry of Economics and Development, the Ministry of Health, the Minister of the Institute of Natural Resources and the Environment (IRENA), and all members of the National Commission for the Environment and Territorial Order (CONAMOR). The company based its actions on the fact that CONAMOR had ordered the closing of its productive operations (at its industrial plant), violating constitutional norms.

On September 3, 1992, the Supreme Court declared the "recurso de Amparo" without grounds and in its opinions was very clear in placing the health of the workers at ELPESA and the health of the general population above economic values and objectives. In addition, the Court noted that in such cases the inertia of the country's authorities had no place and that the state should act promptly and energetically to avoid worse acts of wrongdoing.

Administrative regulations and standard operating procedures and their associated fines and penalties are generally the first point in the process of problem identification and dispute resolution. Institutional weaknesses limit the ability of resource

management agencies to effectively implement the regulations. In addition, the fines and penalties are usually fixed in either the law or regulations and do not over time present disincentives to actions whose rewards are much greater than the fines.

Legislative actions, other than writing laws, is investigative in nature. If a particular problem is identified, a legislative committee can investigate and bring attention to the issue. This can also result in drafting legislation or suggesting administrative reforms.

In some countries arbitration, mediation, and conciliation are formal options to address problems related to protected areas. However, these options have had little use thus far in Central America. As more participatory resource management approaches are taken with protected areas, these approaches may become more widely used.

Popular denouncements and demands (*accion* and *denuncia popular*) allow individuals and groups to bring to the attention of administrative or judicial authorities (special environmental *procuradors*) illegal environmental actions by private or public agencies. These require an investigation as well as public notice of the results of the investigation. Results of this process include censure and injunctive relief from the offending actions.

Mini-Case

The El Salvador Peace Accords provide for a "Procuradoria Adjunta del Medio Ambiente" within the Procurator for the Defense of Human Rights. The Adjunct Environmental Procurador receives public *denuncias* related to environmental affairs (in verbal, written, or other form of communication). It then investigates the case and solicits the authority or person presumed responsible, who provides the Procurador with information about the situation and how it is being addressed. Within eight days of the *denuncia*, the Procurador sets forth a resolution and prepares a statement of its conclusions and recommendations. These are communicated to the appropriate administrative entity who, if they fail to take action within a reasonable time or adequately explain why they have not taken action, are subject to public censure by the Procurador.

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Mini-Case

In Guatemala, Article 30 of the Environmental Protection and Improvement Law does provide for the *denuncia popular* regarding any action or omission that causes the contamination, deterioration, or loss of natural resources or quality of life. In addition, Article 37 allows anyone affected by environmental degradation to request an investigation of such matters. This is called a *denuncia administrativa*. NGOs such as Defensores de la Naturaleza, Amigos del Bosque, Aprodema, ARCAS, and others, often use such *denuncias* on behalf of environmental concerns.

Land Use Policy and Issues

Establishment of protected and reserved areas often legally requires management plans and much less frequently needs to be based on land use planning. Where land use planning is required, as in Costa Rica where the land use classification system is simple and easy to implement, institutional resources are still a limiting factor in actual adoption of the system. Requirements for management plans face similar institutional constraints.

Legal requirements for plans often must confront conflicting institutional mandates, which ultimately determine the success or failure of protected areas management. In many countries in Central America, national agrarian reform agencies have established settlements in areas declared protected or reserved for other uses. Similarly forest and agricultural activities may be given licenses or concessions that require management plans for which oversight is lacking. In addition, mineral and energy mining and exploration activities (often directed by a government agency) occur in some protected areas even though that is prohibited by the protected areas law. The capability to clearly delineate and manage protected areas is insufficient.

Protected areas have frequently been established on private property. In many cases the government can expropriate private property but is required to compensate the landowner. Because resources are scarce and procedures cumbersome or untested, expropriation for protected areas is rare. Because the land ownership and tenure system is unclear, the issue is left unaddressed. If private land lies within an established protected

area, its use may be limited, depending upon the type of protected area established.

Private nature reserves and conservation easements are relatively new forms of protected areas activities in Central America (primarily in Guatemala, Costa Rica, and Belize). In some cases the government may own the land and let private individuals or groups manage the area. In other cases, the owner has "full" property rights as long as the land is dedicated to conservation purposes. Tax incentives support some of these arrangements. More frequently, no formal arrangement exists for private nature reserves.

Mini-Case

In Costa Rica, according to the Institute for Agrarian Development (Instituto de Desarrollo Agrario, IDA), IDA coordinates with MIRENEM (Ministry of Natural Resources, Energy and Minerals) before establishing *campesino* settlements or other projects that involve the disposition of lands. IDA also claims that the proposed general environmental law would further enhance this coordination. Currently, both the Forestry Law and the Law of Multiple Land Titling outline procedures for coordination between IDA and the Department of Forestry. While IDA is allowed to title lands in areas where 20 percent or more of the land is without title, this is conditional on the lands being assessed by the Department of Forestry, which determines whether or not they are better suited to being forestry reserves. If so, they pass from IDA's jurisdiction to the Department of Forestry's (as part of the State Forest Patrimony). Only lands declared appropriate for agricultural use can be used for human settlement.

Despite this juridicial basis for coordination, IDA colonization programs have occurred in protected areas without Forestry Department approval. According to MIRENEM, tenancy issues remain a source of ongoing conflict in all the protected areas. For example, in the Tortuguero Protected Zone, the Neotropical Foundation bought land inside the zone in order to later donate it to the state. But a group of persons claiming to be the true owners of the land are contesting this purchase. In the Golfo Dulce Forestry Reserve, tenancy problems are being encountered in the BOSCOSA project. MIRENEM is attempting to prevent such matters in the future by emphasizing greater community involvement.

Indicators: Types and Legal Basis of Protected and Reserved Areas

Problem Indicators

- Total area of protected areas.
- Level of biodiversity.
- Rate of resource use and degradation.
- Existence of unique natural areas.
- Rate of human incursion into protected areas.
- Threats to biological diversity from human intervention.

Policy/Process Indicators

- Number of protected area personnel to patrol parks and exert control over areas.
- Existence of programs that promote community involvement in protected area management.
- Phasing in of agreements with local communities regarding park access and resource use rights in national parks consistent with sustainable management goals for the resource.
- Elimintion of incentives that promote exploitation of protected area resources.
- Increased participation and involvement of NGOs as partners with the government to manage protected aras.
- Creation of modified institutional structures that eliminate contradictory policies promoting both conservation and exploitation of the same resources and that establish coordinated efforts between resource agencies.
- Policies in place that direct the revenue collected by parks and reserves be allocated to the various protected areas and not to the national treasury for general budgetary purposes.

RESOURCE MANAGEMENT AND THE LOCAL COMMUNITY

KEY POINTS

- Management strategies provide incentives and disincentives to resource use by local communities. These inducements are intended to change the benefit-cost calculations of resource users.
- Economic incentives that reflect the management requirements of ecosystems are required to support institutional and legislative mechanisms.
- Management schemes should maximize direct economic benefits to communities surrounding protected areas.

The discussion and mini-cases presented in this section are drawn from Jeffrey A. McNeely, Economics and Biological Diversity, International Union for Conservation of Nature and Natural Resources, 1988.

Incentives and disincentives target different user groups to achieve specific objectives that reduce the need for residents to degrade protected areas. Such incentives include improving the productive capacity of communities adjacent to protected areas, reducing agricultural pressure on marginal lands, compensating villagers for income lost because of new use restrictions, developing other income-generating activities, and increasing employment opportunities for local residents.

Three general categories of incentives and disincentives can be used to promote conservation at the community level: direct cash incentives (rewards, fees, compensation for losses, grants, loans); in-kind incentives (food, livestock, access to resources); and fiscal incentives.

Community Participation

There are a range of possible policies related to the role of local communities in the design, planning, and management of protected areas. Often, however, no policy exists that mandates

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Likely Impacts of Increased Community Involvement in Management of Protected Areas

GROWTH

- Increased long-term growth arising from nondepleting resource activities.
- Decreased short- and long-term economic growth from consumptive use of resources.

WELFARE

- Decrease in short-term availability of open-access resources to poorer elements of the community.
- Improved income from participation in protected areas management.

CONSERVATION

- Less incursion by local communities for consumptive use of resources.
- Increased biodiversity.
- Improved protection of wildlife.

community participation, which effectively ignores the people most likely to be directly affected by the establishment of protected and reserved areas. When policies do address the involvement of local communities, those policies usually address management issues rather than involvement in the design and planning stages.

Implementation of community participation requirements is uneven. Effectiveness of community participation depends on the leadership and cohesiveness of the community and on the resources that the implementing institution has to facilitate such a process. Furthermore, throughout most of Central America (with a few exceptions) there is no active involvement of indigenous groups in design, planning, or management of protected areas although they may legally have such rights. Donor-supported projects and NGOs have actively involved local communities and, in some cases, indigenous groups in both design and management activities.

Direct Cash Incentives and Disincentives

Cash incentives must be clearly linked to changes in behavior. For example, entry or user fees can be returned to local communities as an incentive for complying with the management objectives of a protected area. The allocation of a portion of the revenues from the protected area to community development projects can also be tied to community management schemes. Care must be taken not to create perverse incentives that exceed the area's carrying capacity.

Cash rewards for outstanding service and/or reporting illegal harvesting are usually more effective incentives for controlling the activities of outsiders. Cash compensation can be given to local inhabitants for damage done by wild animals that are protected in the reserve and for not using resources that were previously available.

Subsidies can be used to stimulate a variety of activities; for example, reforestation, development of butterfly ranches, crocodile farms, or wildlife management projects that reduce pressure on species in protected areas. Farmers can receive income support for retiring land in environmentally sensitive areas or in protected areas.

Credit at favorable terms can enable individuals and communities to invest in the productivity of their own lands through improved production technologies, better access to markets, improved packaging and collective negotiation for better market prices. Short-term loans to villagers can be provided by revolving funds, which can be managed by a community organization.

Wages can be paid to residents of buffer zones for a variety of conservation activities: reforestation, soil conservation, farming of traditional crop varieties, construction of trails and firebreaks, and so on. Experience indicates that this technique works best on communal lands or in protected areas, and with a community cooperative that is responsible for project design and payments.

Fines, to be effective, must be greater than the expected value of the resource being poached (i.e., the market value times the probability of being caught and convicted). Fines can be returned to communities whose local leaders are assigned policing responsibility.

Mini-Case

Amboseli National Park in Kenya provides the Masai pastoralists with incentives to help protect the park's resources:

- A water diversion system that pipes water from the park to artificial swamps outside the park for the Masai's cattle.
- A grazing compensation fee to cover livestock losses due to wildlife migrating from the park onto Masai lands.
- The Masai control hunting and cropping on their land and receive subsidies to accommodate tourist campsites and lodges.
- The park headquarters includes a community center, school, and medical facilities.

Results: Net monetary gain to the park from use of Masai lands is about $500,000/year, and the Masai receive an income that is 85 percent greater than they would obtain from livestock alone.

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Mini-Case

Economic incentives for Ban Sap Tai, a village at the edge of Khao Yai National Park, Thailand.

The following incentives were established to halt poaching and encroachment into the park:

- A trekking program using villagers as guides and porters.
- Establishment of an Environmental Protection Society (EPS) that functioned as a community-based credit cooperative, education center, and collective business enterprise. The EPS established a revolving fund and a cooperative store.
- Training for villagers in management and administration of cooperatives and the revolving fund.
- Community woodlots.
- Food-for-work program for community development projects.
- Technical training in improved cultivation techniques, conservation of forests, soil, and wildlife, and basic business skills.
- Training of village health volunteers to provide health and family planning services.
- A cooperative program between EPS and Khao Yai Park to reforest parklands previously under illegal cultivation and demarcate the park boundary.

Results: Encroachment on parklands has been halted, existing farms inside the park removed, and poaching greatly reduced. The program has been expanded to adjacent villages.

In-Kind Incentives and Disincentives

Incentives include goods and services that are provided to individuals, communities, and institutions in order to change their resource use behavior. Food for work is most effective with specific, well-defined projects and has been used where communities performed development or conservation work in exchange for food. Improved breeds of livestock can be used as an

incentive to increase productivity, thereby reducing pressure on marginal lands.

Experience has demonstrated that equitable access to resources in protected areas is a powerful incentive for the surrounding communities to conserve resources. Examples include access to building materials, thatch grass, meat, and extractive products, and the direct profits from uses of the protected area.

Extractive reserves or extractive forests remain in the public domain but are occupied by groups that use the area's resources under a land-use concession subject to preestablished management conditions. The state gives exclusive use to practitioners of traditional extractive activities, usually for a minimum of 30 years. Theoretically, this form of management would allow the state to control or mediate the impact of outside development interests and help prevent subdivision of the land into small private units that encourage colonization (Anderson 1990).

Disincentives can include jail sentences, confiscation of land, or elimination of use rights. Disincentives require institutional capabilities to apply them.

Mini-Case

Zimbabwe's Matobo National Park gives thatch-collecting licenses to women nominated by village elders. Licenses are contingent on local people abiding by park regulations. The women harvest the thatch according to a pre-determined annual quota and give the park one bundle for every ten cut. The park's share is used for roofing park facilities. Annual quotas provide the community with an income ranging from $20,000 to $60,000.

Results: Poaching, wild fires, and cattle trespassing have been reduced along with costs for pasture management.

Fiscal Incentives and Disincentives

Fiscal incentives direct funds toward conservation activities in and around protected areas, and can include taxes and tax exemptions, tariffs, price supports, insurance, guarantees, preferential access to credit, and debt swaps. Foreign govern-

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ments and international lending agencies can provide fiscal incentives to develop economic polices that promote investment and employment in sustainable use activities around conservation areas.

Tax deductions, exemptions, and credits may be offered to individuals or corporations and applied to taxes (on land, income, sales, inheritance, or capital) in return for conservation-related behavior in or around conservation areas. The effectiveness of such incentives presupposes that the government has the ability to levy and collect taxes. Tax incentives tend to be more useful for large land owners and commercial operations than for small farmers that operate outside of the tax system.

Import taxes and duties can be waived for equipment that is required for activities that support conservation. Increased depreciation of investments can be offered to encourage investment in appropriate tourism and eco-development such as butterfly ranches, wild game ranches, and multi-use sustained management private forestry.

Services can be provided to communities in buffer zones or conservation areas as compensation for not using resources that were previously available. Examples are accelerated development aid, education, improved health care, and rural electrification. These indirect incentives function best as part of larger rural development efforts. National plans and development strategies can give these areas priority attention from national and international development agencies.

Social incentives can be structured to change behavior. Experience indicates that the strong community institutions, enhanced land tenure, training, education, and employment associated with maintaining the conservation areas are powerful incentives for local populations to protect and support the management objectives of conservation units.

Disincentives, which have not been used extensively in Central America, include refundable damage deposits attached to forest concessions in parks and buffer zones, taxes as disincentives to environmentally destructive land development, or pollution taxes on industries locating in environmentally sensitive areas in and around buffer zones.

Indicators: Resource Management and the Local Community

Problem Indicators

- Rate and type of resource use.
- Degree of biological diversity.
- Amount and type of extracted resources.
- Human intervention and encroachment into protected areas.
- Local involvement in management of protected areas and local support for protected areas by local communities.
- Amount of income communities derive from the protected area, either as revenue from tourism or as transfers to compensate for loss of resource use.

Policy/Process Indicators

- Increase in both government-sponsored and private-sponsored buffer zone activities to promote sustainable economic development.
- Policies established to increase the percentage of user fees that are reinvested directly into the protected area to cover management and logistical needs.
- Existence of incentives linked to park protection that also respond to the economic and social needs of local people.
- Creation of monetary sanctions and fines whose value is greater than what people would receive from the sale of resources taken from a protected area.
- Establishment of education programs that teach the importance of protecting biological diversity and therefore protected areas.
- Policies in place that direct revenue collected by parks and reserves to be allocated to the various protected areas and not to the national treasury for general budgetary purposes.

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FINANCING

KEY POINTS

- Financing mechanisms most commonly used are government budgets and foreign donations by international development agencies and conservation organizations. Other sources such as food sale franchises, souvenirs, and crafts are not common. Income from entrance fees and individual donations is small.
- Trusts and private administration of funds from debt swaps and international donations are becoming more common sources of funding.
- The amounts available per protected area have been decreasing due to an increase in the number of protected areas, inflation and devaluation of national currencies, and structural adjustment conditionalities.

The discussion and mini-cases presented in this section are drawn from Jeffrey A. McNeely, Economics and Biological Diversity, International Union for Conservation of Nature and Natural Resources, 1988.

Money can be allocated as a regular national budget or as a special budget. Bilateral agreements or cooperative efforts with international agencies can include elements with support incentives for sustainable development of buffer zones and park management.

Protected areas should earn a fair return on the money they bring into the economy. This can be generated by bed taxes for tourist hotels, departure taxes at airports, and franchises for operating nonextractive concessions (e.g., hotels, tours, and restaurants). These funds can be used to develop incentives for conservation and management of protected areas. They must, however, be monitored and revokable if agreed-upon conditions are not met.

Entrance fees, which are a measure of willingness to pay, should be used to manage the protected area and to provide economic incentive packages for surrounding villages. They must be tied to management objectives and their impact must be regularly monitored because they may function as a perverse incentive to maximize revenue, resulting in overuse of park resources. A two-tier fee system, with higher charges for international visitors

Likely Impacts of Improved Financing of Protected Areas

GROWTH

- Short-term increase in government budgets for protected areas.
- Long-term returns from nonconsumptive uses such as nature tourism.
- Limited financial effect on taxed sectors such as tourism and extractive concessions.

WELFARE

- Movement of funds from national budget to local and community resource management.
- Loss of income and employment for consumptive users of natural resources.

CONSERVATION

- Improvement in protection of wildlife and resource use.
- Improved level of biodiversity.
- Improved off-site or downstream resource use from watershed and forest protection.

and lower fees for residents, is an equitable way to increase revenue.

Janzen suggests that protected areas diversify their endowment portfolios to include ownership of adjacent agricultural lands. The areas would benefit from agricultural profits to support management of the area and would be able to control the kinds of agriculture carried out on neighboring lands.

Irrigation projects or hydroelectric installations dependent on water from a protected area can implement water charges to improve the efficiency and equity of water use and to generate funds for managing and protecting the watershed. As an indication of the value for watershed protection, Hufschmidt and Srivardhana (1986) showed that annual expenditures of $1.5 million would be justified in terms of benefits to the Nam Pong Reservoir in northeast Thailand.

Special taxes on timber extraction, wildlife, and wildlife products, and concession rights can be used to set up special funds for appropriate development activities in and around protected areas.

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Large development projects supported by external funds can pay an "environmental maintenance tax" by allocating funds for identifying, establishing, and managing protected areas, and by creating a self-sufficient endowment fund for continued management. Variations on this theme include (1) mandatory investment of a percentage of the total project costs in reforestation and conservation activities and (2) conditionalities attached to extractive concession agreements that require the concession holder to provide resources, activities, and support for various incentive programs aimed at maintaining the long-term productivity of the area.

Voluntary private sector support activities that rely on the same protected area or natural resource can also be sources of funds for sustainable management and protection efforts.

Mini-Case

The Côte d'Ivoire created an environment fund from taxes imposed on oil tankers docking in the country. The fund is used to purchase equipment for monitoring ecosystems, preventing pollution, and improving environmental management.

Mini-Case

Florida's Recovery and Management Act establishes a Hazardous Waste Management Trust Fund financed by a 4-percent excise tax on disposal until the fund reaches $30 million, and a 2-percent excise tax thereafter.

Mini-Case

The International Trust for Nature Conservation, established by the Tiger Mountain Group in Nepal, invests excess profits from nature tourism into local conservation activities to protect wildlife and its habitat. One such activity is a conservation education program for the villages surrounding Royal Chitwan National Park.

Mini-Case

When large tracts of land are held in both government and private hands, they can be traded to benefit both private sector interests and protected areas.

In March 1988, U.S. legislation authorized the federal government to give title for 11,000 hectares of public lands in Nevada to Aerojet-General Corporation. In exchange, the government received 2,000 hectares of wetlands in Florida owned by Aerojet, which will be sold to the South Florida Water Management District for $2.4 million. The U.S. government will use the proceeds of the sale to purchase additional lands in two national wildlife refuges in Florida.

International NGOs

International NGOs, usually based in the United States, such as Conservation International (CI), The Nature Conservancy (TNC), World Wildlife Fund (WWF), and World Conservation International (WCI), have large protected-area programs. They can often provide seed funding to initiate appropriate incentive projects.

The Nature Conservancy is creating Conservation Trust Funds throughout Latin America. These funds will receive capital through large-scale debt-for-nature swaps to be used to guarantee secure funding for local conservation efforts.

Mini-Case

The Nature Conservancy's Parks in Peril Program is a public/private partnership to safeguard "paper parks" of the western hemisphere by building a basic conservation infrastructure, integrating conservation areas into the economic and cultural needs of surrounding communities, and creating long-term funding mechanisms to sustain local management.

Foundations, Trust Funds, and Endowment Funds

Foundations, trust funds, and endowment funds are legally established organizations set up as corporations or limitedliability

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charities to receive donations from private and public enterprises that support efforts to manage and conserve protected areas. Foundations or trusts provide grants for specific activities and subsidies for ongoing costs and loans. Foundations are governed by boards and audited accounts are publicly available.

Mini-Case

The Indonesian Wildlife Fund was established by the Ministry of Forestry to receive voluntary contributions from the timber trade. An independent board of directors allocates the funds to local conservation projects.

Mini-Case

The Zambian Conservation Revolving Fund was established by the National Parks and Wildlife Service to receive income from the harvest of hippos and auctions among safari hunting companies. Local chiefs receive 40 percent of the proceeds from auctions, and 60 percent goes to wildlife management. Poaching has decreased dramatically and manpower in the protected area has increased.

Public Law 480 Funds

Local currency counterpart funds derived from Public Law 480 enable certain nations to pay in local currency for food imports from the United States, with the local currency to be spent in the importing nation.

Mini-Case

In 1987, Conservation International purchased Bolivian debt worth $650,000 from Citibank of New York for $100,000. CI canceled the debt in return for an endowment fund in local currency worth $250,000 to cover the operating costs of managing the Beni Biosphere Reserve. USAID contributed Public Law 480 local currency funds worth $150,000. The government of Bolivia agreed to provide maximum legal protection and to demarcate a buffer zone around the reserve.

Mini-Case

In 1987, the Natural Resources Conservation fund was created by the Costa Rican government to allow the National Parks Foundation to exchange $54 million in debt for 75 percent of the debt's face-value amount in local currency government bonds that would mature in six years paying 25 percent interest. Proceeds were used for park management, land purchase, deforestation control, and environmental research. In 1989 the program was expanded to convert up to $15 million per year for three years by offering twenty-year bonds.

Foreign Aid

Many aid agencies have begun to invest in protected areas in Central America. Examples are USAID, ACDI, ASDI, DANIDA, NORAD, GTZ, the German Reconstruction Bank, the Inter-American Development Bank, the World Bank, and the European Community.

In 1989, Central America received $16 million from foundations, NGOs, and the U.S. government to study or protect biodiversity.

Joint Government-NGO Financing

International NGOs have channeled USAID funds and funds from private foundations into protected areas. Examples are the (1) RENARM Project implemented by Cultural Survival and two consortia (PACA composed of CARE and TNC and Paseo Pantera composed of WCI and CCC); (2) Mayarema Project in Peten,

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Guatemala; (3) LUPE in Honduras; (4) Marena in Panama; and (5) Boscosa and Foresta in Costa Rica.

Mini-Case

In 1990, the U.S. Congress enacted the first direct appropriation for a debt-for-nature swap in Panama, using up to $15 million in USAID funds. The swap converted up to $100 million in Panamanian commercial debt for a Conservation Trust Fund to protect the Panama Canal watershed and several million acres of tropical forest.

Debt-For-Nature Swaps

In 1987, Conservation International carried out the first debt-for-nature swap in Bolivia. There have been twelve additional swaps in which NGOs have used private and public funds to purchase a country's commercial debt on the secondary market at prices ranging from 11 percent to 33 percent of face value. The debt is exchanged with the debtor country for local currency in the amount of the face value of the debt, which is then invested in conservation, either directly or in bonds.

Benefits of debt-for-nature swaps include:

- Governments reduce their external debt and consequently the amount of foreign currency owed on principal and interest.
- Banks reduce their exposure to risky debt, recover a portion of a debt that may otherwise be uncollectable and receive a tax benefit. Banks can also donate their debts and receive tax benefits.
- The NGO obtains a favorable rate of exchange in local currency, which is invested in bonds or in project activities.

Constraints on debt-for-nature swaps include:

- Much of the debt is not commercial debt and is therefore not traded in secondary markets.
- Effective NGO intermediaries are a critical element. In many cases, the lack of credible NGOs has slowed the process.

- There is a need to protect against inflation and local currency devaluation.

- Governments have been more interested in debt-for-equity swaps in the industrial sector or other private investment.

Governments must print local currency bonds, which increase the money supply and have an inflationary effect. TNC commissioned a study to assess the impact of this effect in Costa Rica. The study concluded that the inflationary impact would be less than 0.5 percent if Costa Rica were to spend $50 million in local currency generated by swaps in one year. The problem becomes smaller as the term of the bonds increases (Chew 1991).

Bilateral Debt-For-Nature Swaps

The Enterprise for the Americas Initiative calls for the United States to reduce and restructure loans for Latin American and Caribbean countries with serious debt-servicing problems. The United States will negotiate reductions in principle and accept interest payments in local currency to be placed in a trust to support environmental programs when countries: (1) Adopt strong economic reform programs in conjunction with the IMF and World Bank; (2) pursue comprehensive investment reforms with the Inter-American Development Bank or other multilateral institutions; and (3) complete commercial bank debt reduction as appropriate.

Indicators: Financing

Problem Indicators

- Rate of resource use and/or degradation.
- Level of biodiversity.
- Wildlife numbers.
- Level of protection provided to parks.
- Level of encroachment in protected areas.

Policy/Process Indicators

- Increased international financial support for protected areas from NGOs and bilateral and multilateral agencies.
- Increase in the operating budgets and control staff of protected areas.
- Existence of policies that permit protected areas to earn a fair return on the money brought into the economy by tourism.
- Policies in place that direct revenue collected by parks and reserves to be allocated to the various protected areas and not to the national treasury for general budgetary purposes.
- Institution of fiscal policies that transfer income from resource exploitation to resource conservation, such as resource use taxes that go toward financing protected area management.

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INTERNATIONAL CONVENTIONS AND SUPPORT

KEY POINTS

- Successful long-term management of protected areas requires international cooperation because ecosystems extend beyond national borders.
- International treaties provide binding, legal obligations that become the basis for national implementing legislation. These treaties establish the same obligations for all parties and provide an institutional setting for cooperation.
- International treaties are most successful when they provide for regular information exchange, a coordinating secretariat that interacts with governmental and nongovernmental organizations, and an effective reporting and review system.

Following are three examples of international conventions that support preservation and protection of natural areas.

Convention on Wetlands of International Importance Especially as Waterfowl Habitat held in Ramsar in 1971. Under this convention, parties agree to use wisely the wetland resources under their jurisdiction, to designate for conservation at least one wetland of international importance, and to establish and protect wetland reserves regardless of their international importance. A Wetland Conservation Fund with an annual budget of about $660,000 is available to help nations meet their obligations. By 1990, 61 countries had designated 421 sites covering more than 30 million hectares. The secretariat is provided by IUCN.

Convention Concerning the Protection of the World Cultural and Natural Heritage held in Paris 1972. The World Heritage Convention (in force since 1975) recognizes the obligation of governments to protect unique natural and cultural areas and the obligation of the international community to help pay for conservation efforts. Each party to the convention must contribute to a fund to support these sites and related research. Contributions are set at 1 percent of each party's contribution to the annual budget of UNESCO. The secretariat is also provided by UNESCO.

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Likely Impacts of Attendance at International Conventions

GROWTH

- Short-term decrease in income from resource mining activities.
- Increased long-term returns from nonconsumptive uses of protected areas.

WELFARE

- Loss of employment from cross-border resource uses.
- Improved long-term resource availability.

CONSERVATION

- Increased preservation of migratory wildlife species such as turtles.
- Preservation of areas supporting greater levels of biodiversity.

FAO International Undertaking on Plant Genetic Resources held in Rome in 1983. This is a voluntary agreement among nations to support the principle that plant genetic resources are the common heritage of humankind. A Commission on Plant Genetic Resources has established an International Fund for the Conservation and Utilization of Plant Genetic Resources based on voluntary contributions. The secretariat for the commission is housed at FAO.

Mini-Case

At the urging of the World Heritage Convention, the federal government of Australia offered Queensland a package of subsidies worth $71.6 million as compensation for income that will be lost through cessation of extractive uses. This package includes subsidies for public works, reforestation, World Heritage Area management, private and community initiatives, adjustment assistance, and business compensation for those affected by the discontinuation of logging inside the World Heritage Areas.

Indicators: International Conventions and Support

Problem Indicators

- Human intervention from cross-border incursions into protected areas located along international borders.
- Levels of biodiversity and ecosystem protection resulting from international support.

Policy/Process Indicators

- Participation in international treaties and conventions for the conservation of biological diversity.
- Establishment of coordinated efforts and cooperative agreements with international agencies and through international agreements to conserve protected areas.

NATURE TOURISM

KEY POINTS

- Nature tourism plays an important role in some Central American economies, but potential revenue sources are not fully mined.
- Earmarked taxes can ideally be used to support a specific park or park system, but it is very likely that other sources of support will also be needed.

Nature tourism, which "involves traveling to relatively undisturbed or uncontaminated natural areas with the specific object of studying, admiring and enjoying the scenery and its wild plants and animals, as well as any existing cultural areas" (Lindberg 1991, p. 23), is a significant source of revenues in Costa Rica and Belize, and has potential throughout Central America.

Nature tourism not only provides funds but also promotes conservation and preservation of natural resources. These socioeconomic benefits act as incentives for governments to (1) establish and maintain conservation areas; (2) stimulate investment in sustainable utilization of natural areas; and (3) establish policies and incentives that promote nature tourism.

When considering a program to promote nature tourism, however, governments must realize (1) that nature tourism must be controlled so that the carrying capacity of the resource is not exceeded and (2) that nature tourism cannot provide all the funding necessary for conservation activities (i.e., other sources of funds will be necessary).

Fragile natural areas can be damaged if nature tourism is not controlled; and nature tourism may also have unintended negative effects on other sectors. For example, tourists in Costa Rica use large amounts of electricity, and the profits generated from tourists must be balanced against the costs of producing additional energy, including the long-term environmental costs of construction and operation of hydroelectric facilities.

Nature tourism can provide funding for development programs near parks and increase the demand for local goods and services. Several specific revenue issues should be considered. First, the entrance or user fee structure should be multi-tiered—higher for

Likely Impacts of Greater Nature Tourism

GROWTH

- Short-term decrease in income from consumptive resource uses.
- Long-term income increases from nonconsumptive resource uses.
- Greater diversification away from resource-exporting economies, hence greater resilience in the economy.

WELFARE

- Loss of income and employment from resource activities susch as forestry, mining, and agriculture.
- Increase in employment and income from tourist-based activities.

CONSERVATION

- Greater levels of wildlife and biodiversity.
- Long-term resource preservation.
- Less off-site effects from consumptive resource uses.

foreign tourists and lower for nationals. Such systems have been successfully instituted in Costa Rica, Guatemala, and several other countries. Second, current fees are generally low, and can probably be increased significantly to capture more revenue, without causing any reduction in the number of visitors. In fact, visitors may willingly pay more if they understand that part of the fee will be used for conservation of the site. However, earmarking funds for specific sites may result in a lack of sufficient funds for some parks and excess funds for others if an equitable distribution system is not established. Despite the revenues generated from user fees, parks often need additional funds from the national treasury.

Fees also should be adjusted for inflation and changes in demand. In Costa Rica, fiscal stamp fees, which help to finance the park system, can only be increased by the legislature; and have not been increased in eleven years. While entrance fees have been changed by executive order, the increases have not kept pace with inflation (Lindberg 1991, p. 23).

Mini-Case

"In Costa Rica, proprietary funds from entrance fees (including fiscal taxes) complement the general government allotment. The Costa Rican case shows the importance of earmarking. Although the government is aware of the value of conservation, park budgets declined in real terms during an economic downturn. Proprietary funds also declined in real value, but the Costa Rican conservation community was able to mount enough support for the funds to resist government pressure to eradicate them altogether under an austerity program mandated by the International Monetary Fund. The funds were less susceptible to elimination because they were independent of the central government treasury" (Lindberg 1991, p. 6).

Indicators: Nature Tourism

Problem Indicators

- Level of resource use and degradation.
- Level of biodiversity and numbers of wildlife.
- Level of amenities for nearby residents.
- Income to protected areas from tourism that is distributed to the park system for its operation.
- Income to communities from both protected area revenues and from economic activities related to tourism.
- Unauthorized exploitation of resources in protected areas.
- Number of tourists visiting protected areas.

Policy/Process Indicators

- Policies established to ensure that money derived from tourist revenue flows to local communities.
- Existence of revenue-sharing ventures to ensure that tourism profits do not accrue only to large-scale national and international tourism operators, but also to local organizations and communities.
- Policies enacted to control tourist numbers so that they are commensurate with a specific tourist carrying capacity.
- Establishment of a distribution system so that visitor fees from tourist travel to popular protected areas are shared with the entire park system to better protect biological diversity.
- Establishment of a tourism fee structure that captures tourists' willingness to pay for the experience and thereby raises needed income. Rates can vary according to popularity of the protected area.

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WILDLIFE PROTECTION AND TRADE

KEY POINTS

- Both international treaties like CITES and national legislation protecting wildlife have been difficult to implement because of the high prices that wildlife command and rural poverty.
- Large shipments of wildlife have been limited as a result of treaties and legislation.
- Porous borders in Central America have allowed continuation of wildlife trade.

International trade in wildlife has contributed significantly to the extinction of wildlife species of flora and fauna. There is great demand for some of these species, and the prices paid in developed countries are so high that existing international and national wildlife protection laws are difficult to enforce.

Capture and trade in wildlife is one way for poor people to earn a living. Nevertheless, international treaties and supporting or complementary national legislation may have reduced the scale of such operations, although capture of banned or restricted species occurs frequently.

International Conventions

The principal international treaty governing trade in wildlife is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In force since 1975 and currently ratified by 111 nations, CITES lists endangered species for which international commercial trade is prohibited or is regulated via permit systems.

Designated authorities in each country review and grant permits, and records of permits granted must be transmitted annually to the Convention Secretariat for review, although many parties do not comply. The convention establishes three levels of restriction on wildlife trade:

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Likely Impacts of Enactment and Enforcement of Wildlife Protection Laws

GROWTH

- Short-term loss of trade-related income.
- Long-term potential for nature tourism.

WELFARE

- Loss of source of income for rural poor; potential for employment in tourism-related activities.

CONSERVATION

- Preservation of wildlife and biodiversity.

1. Trade is prohibited for plants and animals whose world populations are clearly in danger of disappearing in the short term (CITES Appendix 1).

2. Trade is restricted for plants and animals whose populations are excessively threatened, even though they are in not in immediate danger of extinction (CITES Appendix 2).

3. Trade is restricted for plants and animals whose local populations are threatened (CITES Appendix 3).

The last two categories require the exporting country to certify the export to the importing country.

Information about endangered species is often scarce. Many species have yet to be identified even though enough information exists to identify some species for inclusion in CITES Appendix 3.

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Export Controls and Cross-Border Issues

Because trade in wildlife results from a combination of factors associated with high demand and high prices and with extreme poverty in rural areas of developing countries, enforcement of regulations is difficult and illegal trade is common.

Other international treaties also affect wildlife trade. The Convention on the Conservation of Migratory Species of Wild Animals held in Bonn in 1979, in force since 1983, obligates parties to protect endangered migratory species and establish international agreements to protect species that are not yet endangered. It prohibits trade of listed endangered species and encourages member states to conserve and restore habitat areas for migratory species. However, the 36 current signatories do not include several countries of major importance for migratory birds.

Some countries in Central America have laws, regulations, or executive orders that limit or prohibit trade in wildlife and/or endangered species. Because of the institutional weaknesses of the agencies given responsibility for enforcement of the law, most of these laws are widely ignored.

In some cases, those who have been caught in such trade have been dealt with harshly as an example to others involved in illegal wildlife trade. Some evidence exists that large shipments of protected wildlife have been curtailed by customs officers. However, wildlife trade flows easily across the porous borders between Central American countries. In some cases, wildlife is captured in one country and transported to another where exportation is either allowed or easier. Another problem is that prohibited flora are difficult to identify and customs officials lack the expertise needed to perform their enforcement responsibilities. Also, when the trade is lucrative enough, corruption can occur at borders.

In addition, migratory species such as green turtles face pressures in some parts of their habitat and not in others. Some problems arise from hunting, others from habitat destruction.

Hunting Laws

Some countries have enacted hunting controls or bans and charge fees for sport hunting. These laws are largely ignored and the fees typically are not collected because the departments assigned to enforce the regulations are too weak to apply the laws.

Mini-Case

Costa Rica. The new Wildlife Conservation Law, which regulates the hunting, capture, transport, and trade of wildlife, is administered by the Director/Department of Wildlife (Direccion de Vida Silvestre) and provides for important sanctions. Nonetheless, illicit wildlife trafficking is a problem in Costa Rica. One response has been the creation of ecological district attorneys/prosecutors whose job is to both curb and prevent ecological crimes. A second response has been coordination among the Department of Wildlife, the Defensoria de los Habitantes, and national and international NGOs. Airport operations have also helped to prevent trafficking and identify traffickers.

Honduras. Matters of wildlife protection are handled by COHDEFOR through its department "Vida Silvestre y Fauna." However, this department still lacks approved regulations. While Honduras has signed and ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), wildlife trafficking still exists and the government has typically done little to stem such activities, especially when the traffickers are politically connected to the government's *en turno*. Although prohibitions have been established they generally go unheeded due to political compromises, inadequate resources, or lack of controls. Even such positive initiatives as Executive Agreement 001-90, which places a temporary ban on hunting, capture, or commerce in all species of wildlife, its products and subproducts until comprehensive wildlife studies are conducted, lacks the institutional resources to succeed.

Guatemala. At the domestic level, hunting and fishing laws exist, but their application is infrequent and inconsistent. The Protected Areas Law establishes wildlife as part of the natural patrimony and declares the restoration, protection, conservation, and management of wildlife to be in the national interest. Nevertheless, effective control in these matters has been deficient due to CONAP's lack of resources. In the face of limited economic and human resources for enforcement and the continued presence of economic incentives, wildlife tracking continues.

Indicators: Wildlife Protection and Trade

Problem Indicators

- Numbers of wildlife and level of biodiversity.
- The rate of capture and trade in wildlife.
- Rates of recuperation of threatened species.
- Rate of habitat destruction caused by human encroachment.

Policy/Process Indicators

- Ratification and enforcement of CITES and other treaties protecting wildlife.
- Efforts under way to strengthen agencies responsible for the enforcement of wildlife, including application of significant monetary sanctions.
- Existence of training programs for customs and border officials to recognize endangered flora and fauna.
- Establishment of incentives destined to clamp down on illegal trade in wildlife, including systems of rewards for officials and informants and serious fines for transgressors.
- Signing and implementation of regional international treaties or agreements to address trade in and exploitation of migratory species.

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RESEARCH QUESTIONS

What is the level of fees and taxes associated with nature tourism? What is the relative relationship of supply and demand for this type of tourist activity?

Are earmarked taxes in place? What is the level of support for a specific park or park system?

What different management capabilities are required by the five categories of management objectives? What are the trade-offs associated with the possible combinations of public and private distribution of management responsibilities in these cases?

What are the impediments (political, economic, legal) to establishing, funding, and managing cross-border parks? What incentives can international lending and development agencies create to make international cooperation beneficial to the parties?

Income generated from exploiting the natural resources in conservation areas and buffer zones should be reinvested in developing sustainable production techniques that are distributed equitably to community members. What new institutional mechanisms might be able to do this? How could they be implemented? For example, the revenues from forest concessions might be invested in an international mutual fund that functioned as a community endowment fund Interest would be used as revolving fund, credit union, and so on.

What mechanisms are available for channeling benefits to local communities?

What should be the percentage received by local people to compensate them for forgone uses so that the marginal benefits equal marginal costs?

How can fee structures be structured to serve various management objectives? What are the behavioral implications for various objectives, for example, supplementing regular government appropriation, or making the area self-sufficient? What other policies need to be in place so that perverse incentives are not created?

How should fees be structured to address the diverse concerns of different groups?

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Water and Watershed Management

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Water and Watershed Management

Water Control, Use, and Pricing

Key Points

- Water user fees do not represent the value of the resource to the user, which results in inefficient water use. Additionally, fees are seldom collected.
- Subsidized water prices lead to overconsumption and to waste.
- Water is often treated as an open-access resource and as such is not sustainably managed.
- Water use rights can be established to determine who has rights to use certain amounts of water and for what purposes. Permits for use can be issued so that water use is consistent with development policy objectives.
- Water is generally considered the property of, or is controlled by, the state; however, government institutions responsible for management of water resources are typically weak and often have conflicting and overlapping mandates.
- Countries may need to adopt a policy that reflects the principle that the polluter pays in order to ensure that adequate quantities of clean water are available. Water charges may need to reflect the cost of treatment or remediation.
- Water use planning will require coordination among various bureaucratic institutions and water user groups to ensure successful water resource management.

Management of surface and groundwater sources is important to ensure the quality and quantity of water available for domestic, industrial, and agricultural uses. In Central America water resources are generally considered the property of the State, which theoretically controls water use and allocation. However, because water is often viewed as an open-access resource, control of its use by government institutions is often difficult. The open-access nature of water is especially true for groundwater, where

Likely Impacts of Improved Management of Water Resources

GROWTH

- Lower growth at first as prices for water rise and users adjust use patterns and invest in treatment of existing water supplies, followed by higher growth as water is applied to its most valuable uses.
- Savings will occur as less investment is required to develop new supplies or to pump from greater depths due to aquifer depletion.

WELFARE

- Access to clean water supplies and improved health.
- Water allocated to its highest value use ensures elimination of wasteful practices.
- Some problems for certain sectors to pay higher water prices, which in the short term may diminish per capita consumption rates.

CONSERVATION

- Less depletion of aquifers, thereby conserving groundwater supplies.
- Improvement and maintenance of water quality.

few controls exist on pumping. Most Central American governments have established priorities for water use. Domestic use has the highest priority, followed by agricultural and industrial uses. However, the ability of states to manage water resources to meet these conflicting demands is low.

Water management generally takes one of two forms: (1) local control by individuals and communities evolves to determine water use or (2) various government institutions are assigned mandates, which often conflict. Indeed, competing, conflicting, and overlapping authority among government institutions is a common source of watershed management problems throughout the region. In part, this problem arises because the government is unable to manage the responsibility it has assumed in the context of extensive interdependencies among the water uses and water users.

The demand for water supplies to meet domestic, agricultural, industrial, and energy needs will increase with population growth and overall economic development. Growth in demand is occurring precisely at the time that watershed deterioration and groundwater depletion are reducing water supplies. At the same

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time water is becoming scarcer, relationships among users are becoming more complex. As the demand increases conflicts are inevitable, especially under present water use regimes. Because water is artificially cheap, there is no incentive to conserve it or to use it for the most highly valued use. Domestic, industrial, and agricultural users consume water indiscriminately and do not concern themselves with wastage.

Policies Affecting Water Use

Water pricing

People demand access to water for human consumption, agricultural and industrial production, electric generation, recreation, and for other uses. Thus, water has a value that can be expressed in terms of price. Unfortunately, water is often considered a free good or at least many believe that it should be available to everyone at the lowest possible cost. Where prices are too low, water is wasted or is used as a reservoir for dumping pollutants. Adequate pricing mechanisms are needed to ensure the sustainable use of water resources and avoid continued pollution of water sources. Several pricing structures can be applied to water use.

Flat rate charges. A flat rate charge is usually assessed in an effort to recover at least operation and maintenance costs, and sometimes capital costs. Charges are based on units such as household, area irrigated, property values, types of fixtures, number of residents, and so forth. The benefits of flat charges are ease of administration and fee collection. Flat fees generally do not include any incentives to conserve or ration use and may be inappropriate in situations where water is scarce.

Volumetric charges. Installation of meters allows water charges to be based on the volume of water used. Prices can be set low enough for smaller volumes to meet equity concerns, but high enough for large volumes to provide an incentive against overuse and wastage. Metering, along with a rate structure that captures the true cost of providing water to consumers, provides incentives for conservation and delays the need to develop new water sources until a future date. Volume charges should also be levied against entities that deliver water because these charges will act as an incentive to repair leaks and water diversions and avoid

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wastage. A disadvantage of volumetric charges is that meters are expensive to install.

Marginal cost pricing. Marginal cost pricing establishes a price for water equal to the incremental cost of supplying an additional unit. This rate is related to quantity and rises as greater quantities are supplied. Long-run marginal cost pricing provides the most efficient allocation of water, especially when opportunity costs are included. Under this scenario water prices reflect the incremental cost of supplying an additional unit of water and the value of that unit in alternative uses.

Average cost pricing. Cost recovery is attained by charging a rate for each unit equal to the average cost of providing all units. The system is simple to manage and equitable. Average cost pricing results in cost recovery, but does not capture opportunity cost.

Ability to pay. Tariff rates are determined based on income or wealth. Equity considerations are more important than cost recovery under this scenario, although efforts are made to recover costs. This approach is very common for rural water systems and for some irrigation works.

The above pricing mechanisms represent a range of policy tools used primarily for surface water. Some or all may be in effect in a country at one time, depending on the system and the historical management. As water becomes scarcer, water charges may need to move toward long-run marginal cost pricing in an effort to avoid overuse and wastage of a country's water resources.

Taxes and incentives

"Polluter pays" principle. An additional charge or surcharge can be levied on water users who pollute the water by using it. The surcharge should cover some or all of the costs of treatment and remediation and should be high enough to provide an incentive for polluters to recycle contaminated waters or treat them before discharge. Funds collected can be used to support regulatory activities and clean up polluted waterways.

Pump charges. Taxes or charges on individuals who extract from groundwater aquifers can promote lower pumping rates and less water extraction. Charges should be based on the quantity of water extracted from the aquifers and adjusted upward until demand is equal to an extraction rate that does not reduce the total amount in the aquifer. These charges can be very successful

in lowering water use although their administration may be difficult for some countries.

Subsidies. Water subsidies promote overuse and waste of a scarce resource and encourage use for potentially less valuable alternatives. Elimination of subsidies will lead to more efficient allocation of water, especially as adequate pricing mechanisms replace the subsidies. Eliminating subsidies will be unpopular with those who receive them. Higher water prices may initially lead to higher food production costs under irrigated regimens.

Property and use rights

Water allocation. Three important factors in water management are determination of who has the right to use water, how much, and at what cost. Allocation can be based on previously established use rights or by administrative decision, where a public utility or water authority authorizes water distribution and use through a system of permits. Allocation of groundwater is more complicated and will most likely require monitoring by water authorities or by user groups associations in charge of issuing permits. The assumption is that secure entitlements will promote long-term investments to obtain and use water supplies.

Tradable property rights. A creative water management approach allows the various economic sectors to trade established water use rights. This process allows water to be reallocated from low value to high value uses and also leads to a more decentralized approach to water use decision making. Tradable entitlements, however, require the formation of water user associations that can coordinate with regional governmental water authorities.

Quantity-based pumping controls. Pumping permits that establish the size and spacing of pumps can help reduce rates of groundwater extraction. Pumping quotas that fix the annual extraction rate for a user can also be effective, but require metering and control, as well as acceptance by farmers. Setting limits on the quantity of water pumped may reduce water use. A more effective approach may be to set limits based on overall water management goals, or to set annual pumping rates and allow rights to be transferred and traded through a market mechanism. These tradable pumping permits would improve allocative efficiency.

Resource administration

Water use and control is often dictated by fragmented bureaucracies that must respond to demands from diverse economic sectors dependent upon water supplies. This fragmentation leads to conflict and waste. Because water uses and water users are interdependent, policy formulation must be based on the participation of the various sectors involved. Water use associations, industrial users, and others can participate to improve the water use planning process.

Policies Affecting Water Quality

Municipal, industrial, and agricultural contamination of both surface and groundwater supplies restricts the amount of clean water available, increasing the potential for conflict and raising the cost of providing clean water. Contamination of water sources is a serious problem in Central America because regulation is inadequate and because water pollution results from many processes that are not included in the cost of water production or in the costs of municipal garbage collection or sewage disposal. Sedimentation from erosion caused by land use practices in upper watersheds adds to the contamination problem and affects reservoir storage. As contamination increases, the availability of clean water decreases, and treatment for specific uses will add to the costs of obtaining adequate water supplies. Requiring the polluter to pay the costs of treatment and remediation can help limit pollution from point sources as well as provide funds to pay for the necessary remediation. Other policies may be required to deal with non-point source pollution.

Voluntary approaches

Voluntary approaches rely on education, moral persuasion, and technical assistance as a way to influence the behavior of polluters. Although easy to implement in terms of political and economic feasibility, voluntary approaches may not be effective by themselves. Polluters may have little incentive to change behavior because they benefit in the short term from polluting practices and see little to gain from efforts to conserve water quality.

Regulations

Policies can be adopted that call for specific actions or prohibitions. They may establish design standards for

infrastructure or management plans (such as for watersheds) to minimize water pollution or may prohibit practices that contribute to non-point pollution. Governments may also limit the rate of discharge of certain pollutants into water bodies, but this requires sophisticated monitoring capabilities. Regulation will require a competent administrative and enforcement structure and may not be appropriate if such a structure does not exist.

Incentives

Incentives represent an alternative to regulation. Taxes can be charged on inputs that are known to pollute, such as fertilizers and pesticides, and the revenue used to monitor discharge or invest in remediation. A disadvantage would be the effect of higher agricultural input prices on producers prices and incomes. An alternative approach would be to provide subsidies to farmers who adopt desirable practices on their land to limit the amount of pollution going into water bodies.

Government provision

Another approach allows the government to purchase land use rights or water rights in a particularly critical region. In this case, water management is provided by the state or transferred to a competent nongovernmental organization for a specified amount of time.

Mini-Case

Chile is the only country to legally establish tradable property rights under its water allocation system. Under the law, Chile requires the establishment of water user associations at the local level and a national water authority that resolves conflicts over use. Conflicts that cannot be resolved by this process pass to the judiciary for resolution. After initial allocation of water rights, all water transfers must be approved by the local water user associations and the national water authority. This process establishes property rights and a market for water resources and promotes efficient allocation of this precious resource.

Indicators: Control, Use, and Pricing

Problem Indicators

- Levels of pollution in water bodies and along coastal areas.
- Wastage within water distribution systems.
- Groundwater and surface water quality.
- Groundwater levels.

Policy/Process Indicators

- Modification or elimination of subsidies for water use in general and especially in the agricultural sector.
- Establishment of pricing systems that reflect the cost of supplying water to the user, and contemplate including opportunity costs.
- Introduction of water allocation systems to ensure that water is used for its most valuable use, and that well-established guidelines are followed to determine who, how much, and for what purpose water is used.
- Establishment of an integrated management process for water resources management, including participation of local communities.
- Establishment and enforcement of water quality standards, including the institution of regulations for water treatment.

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WATERSHED MANAGEMENT

KEY POINTS

- Watershed policy is a collection of policies from many sectors that have consequence for resource use in a geographically delineated unit that encompasses biophysical, socioeconomic, and political interactions.
- Improved management of watersheds will require (1) the participation of watershed inhabitants in the identification and implementation of programs and policies that address the needs of both upstream and downstream inhabitants, and (2) collaboration among diverse resource management and policy institutions that have little experience in coordinating their activities and setting common goals and objectives.
- National-level policies that affect the prices of agricultural inputs and the price of commodities can have major impacts on the management of watersheds.

A watershed is a topographically delineated area that is drained by a stream system. It is a hydrological or biophysical unit or system as well as a socioeconomic-political unit that can serve as the basis for the planning and management of natural resources. Within a watershed's boundaries, interactions between water and other resources affect people living in both the upstream and downstream areas of the watershed. These interactions tend to coincide with the watershed boundaries and typically do not reflect political and administrative divisions. This situation makes sectoral approaches to management inadequate.

Treating the watershed as a unit of analysis and as the object of development encourages planners to consider the total set of biophysical and socioeconomic interactions and to treat the management of multiple resources in an integrated manner. Agricultural, soil conservation and forest programs and policies within the watershed should be analyzed in terms of their overall impacts within the watershed and beyond (i.e., downstream and coastal effects). Watershed management practices should be based on the physical and socioeconomic characteristics of each watershed and form integral parts of forestry, agricultural, hydroelectric, irrigation, and rural development projects.

Likely Impacts of Improved Watershed Management

GROWTH

- Increased agricultural production on watersheds due to improvements in overall land use and production techniques.
- Greater availability of water that can be used for irrigated farming in lowland areas leading to higher production of irrigated crops.
- Greater investment in upland watersheds and technical assistance to farmers converting from subsistence farming to market production.

WELFARE

- Reduced upstream and downstream devastation from heavy rains and flooding.
- Longer life of hydroelectric projects and lower energy costs.
- Greater participation of watershed inhabitants in the development process.

CONSERVATION

- Protection of wildlife and fish habitat.
- Improved aquifer maintenance and spring flow.

Policies Applied at the Watershed Level

Successful watershed management policies must focus on upstream inhabitants and their behavior because their actions will determine the quantity and quality of water arriving downstream from the watershed. A major conflict within a watershed exists between the small farmers' need for short-term soil and forest exploitation and society's concern for long-term soil productivity and water management.

Financial Incentives

A variety of market-based incentives exist to compensate watershed occupants for long-term management and conservation.

Credits and subsidies. Loans at below market rates can be provided to farmers in upland watersheds to encourage them to adopt techniques that limit watershed destruction, follow soil conservation guidelines, and adopt specific technologies to ensure sustainable management of the watershed. Credits can be provided to fund technological change, soil conservation works, as well as production of desired crops. Part of the credit package should include training in agricultural techniques that help meet watershed conservation objectives. Cash transfers to farmers who plant desirable tree species in critical watershed areas, or who adopt agroforestry techniques can also encourage others to adopt similar changes.

Taxation. In the downstream areas of watersheds, taxation on property, water use, or on agricultural inputs is a policy tool to (1) raise revenue to provide incentives for improved upstream land management and (2) bring direct user costs more in line with the true costs of using these inputs. A system of economic incentives reduces the burden of command and control alternatives and does not distort investment behavior elsewhere in the economy.

Regulation

Regulations are based on watershed management objectives and may include prohibitions on cutting trees in and around watershed areas or on inappropriate land types. Prohibitions must include legal and/or monetary sanctions severe enough to be effective to persuade people to change behavior. Regulations tend to be more costly to implement than taxes and subsidies and are often ignored when farmers believe they are unfair.

Land tenure

Achievement of upstream management objectives may require establishing well-defined property or use rights. Private or communal property and usufruct rights for land and resources in the watershed are needed so that individuals and communities have a stake in promoting the long-term use of the resource. Land use arrangements must be legalized to protect the rights of all resource users.

Institutional Policies

The success of any policy aimed at achieving an integrated watershed management approach requires establishing collaborative institutional relationships among the implementing agencies and various users of the watershed.

Integrated management and development plans

Coordination and collaboration among the various governmental institutions responsible for managing of resources in the watershed is essential. This collaboration includes joint planning, objective setting, and budgeting for activities within specific watersheds and should involve local, regional, and national-level institutions. Moreover, the institutions must have the capacity to plan, establish goals, and technically and financially manage the proposed integrated watershed management schemes. Institutions involved in agricultural production, forestry, water resources, irrigation, hydroelectricity, economic development, and soil conservation are likely collaborators.

Public participation

Inhabitants of watersheds must participate in setting overall management goals and identifying the correct mix of incentives and taxes that will yield desired results. This includes bringing together upstream and downstream inhabitants for planning purposes. Watershed inhabitants need to understand and agree with the long-term management objectives, and NGO involvement can facilitate public participation.

Privatization

Various services such as water delivery, treatment, pipe repair, and meter reading can be carried out by private sector entities that contract with municipal authorities. The government's role would be to monitor the performance of the companies to ensure water quality and consumer satisfaction. Privatization may increase overall water delivery efficiency in urban areas.

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Mini-Case

The Upper Pampanga River Project is the Philippines' first large-scale, multipurpose water resources development project and centers around the Pantabangan dam and reservoir. The dam, completed in 1977, impounds approximately 3 billion (thousand million) cubic meters of water. The project cost more than 900 million pesos (approximately $12 million), and upon completion was expected to irrigate 100,000 hectares of land in both wet and dry seasons, generate 232 million kilowatts of electricity annually, and reduce flood damage to crops, livestock, and infrastructure (David 1987).

Unfortunately, the project has not reached these targets. The population has increased, in part because of rapid in-migration associated with construction activities. Most of the population is now dependent on agriculture for their livelihood, and much of the land development has occurred in an unsustainable manner that has caused soil erosion and reservoir siltation. As Cruz (1988) stated, "soil erosion does not necessarily impose current costs on the private land user as long as the topsoil layers are not completely depleted. Since the upland farmer has no right to the land and therefore no stake in ensuring its long-term productivity, the potential gain by reducing the loss of soil nutrients cannot be captured by the farmers. It is therefore not surprising that upland farmers exploit the land until its productivity declines and then move on to a new plot."

As a result of these and other problems the present sedimentation rate for the Pantabangan reservoir is four times the original estimate of 20 tons per hectare per year (David 1987). Even with the enlargement of dead storage area, the estimated service life of the reservoir has decreased from the original 100 years to 61 years. The magnitude of benefits from the stored water has also decreased.

Cruz (1988) estimated the on-site and off-site costs of soil erosion in the Pantabangan area. The main on-site effects are related to loss of organic matter and nutrients; the main off-site effects are reservoir sedimentation and loss of hydropower, irrigation water, and flood protection.

In attempting to counteract these effects, the government launched a watershed rehabilitation and management project aimed at the individual resource user. Progress has been slow and the challenge is large. In an analysis of the Pantabangan watershed, the National Irrigation Administration highlighted some of the major problems: pervasive rural poverty; rapid land conversion and accelerated soil erosion; inadequate government regulatory and management capability; ineffective land use planning; poor delivery of agricultural support services in the uplands; and critical gaps in available technology, knowledge, and manpower for proper resource conservation.

In addition, analysis of the Pantabangan problems indicates that a large amount of sediment is already in transport within the system and may not reach the reservoir for some time. Even if all on-farm erosion ended tomorrow, sedimentation of the reservoir would continue for many years.

The need to analyze the reasons for resource degradation and to design appropriate management policies is critical. The answers, however, are not easy because a primary target of any management plan, the individual farmer, is very poor and very hard to reach. Therefore, even though the causes and costs of mismanagement are known, it requires careful planning, financial resources, and political will to help solve the problem (Dixon 1989).

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Indicators: Watershed Management

Problem Indicators

- Soil loss due to erosion of slopes, siltation of rivers and water bodies (especially reservoirs behind hydroelectric dams).
- Agricultural productivity on watershed lands.
- Amount of tree cover on watersheds through afforestation, agroforestry, and improved silvicultural management.
- Seasonal availability of water in springs and rivers within the watershed.
- Water quality flowing from watersheds into coastal waterways.

Policy/Process Indicators

- Coordination and participation among residents of the watershed in decision making on watershed issues.
- Systems established at the national and regional levels to promote greater coordination among governmental institutions.
- Clear definition of property and or use rights related to resource use in the watershed among the various parties.
- Well-established agreements regarding land use management.
- Existence of economic incentives (e.g., taxes, subsidies, credit, income) that brings private costs and benefits more in line with the average true costs and benefits based on watershed productivity considered as a unit.
- Elimination or modification of policies that are biased against small farmers and development of policies that promote sustainable use of natural resources by small farmers living in watersheds.

IRRIGATION PROVISION AND PRICING POLICIES

KEY POINTS

- Irrigation has resulted in increased agricultural production and changes in the choice of agricultural crops; however, the real costs of irrigation are rising.
- Irrigation can also result in waterlogging, salinization, sedimentation, and associated negative effects from fertilizers on soils and water.
- Public sector projects and policies often subsidize irrigation users. This results in wasteful use and high demand because users do not bear the costs in proportion to the value of the water.
- Water charges would increase efficiency and allow the government to recover a greater portion of the costs of the system.
- Water use charges reflect an agreement between the government institution charged with establishing the fees and the farmers or users associations. To be effective, rate charges must be supported by technical assistance to promote better water use practices and farmers must participate in the operation, management, and monitoring of water use.
- Decentralization and local management and control of water use and fee collection represents an efficient water management alternative.

Irrigation has provided dependable water supplies, which have allowed farmers to intensify production by shifting crops and adopting high-yield varieties that respond to fertilizer. This has increased the marginal returns to water and both private and public returns to irrigation system investments. However, large and small irrigation activities can produce waterlogging, salinization, and sedimentation that in the long term reduce agricultural productivity both on- and off-site. Irrigation projects that draw from groundwater present other problems associated with resource drawdown exceeding recharge rate and infiltration by fertilizers and pesticides.

Likely Impacts of Improved Pricing of Irrigation Water

GROWTH

- More efficient production of commodities and greater overall production with increased availability for other uses.
- Increased government revenues.

WELFARE

- Greater availability to other water users.
- Increased employment from a more efficient and expanded irrigation sector.

CONSERVATION

- Less pressure on marginal lands.
- Fewer examples of environmental problems from irrigation because water use is more efficient.

Public sector irrigation is heavily subsidized and has become an enormous fiscal drain in many countries. In most countries, revenues from public water systems do not cover their operating and maintenance costs, and fall far short of returning the capital invested. Revenues are also small relative to the value of the irrigation water on the farm. The value of the water to farmers can greatly exceed its cost, which results in excess demand and nonprice rationing systems. Farmers usually want additional irrigation supplies because they pay little of the additional costs. Because most revenue systems do not impose charges based on the volume of water used, the marginal costs to farmers are close to zero (Repetto 1988, p. 10). Low charges for marginal water use also contribute to the cultivation of relatively low-value or water-intensive crops in irrigated areas as well as slow adoption of water-conservation technologies and practices.

Water charges based on the volume used will provide farmers an incentive for more efficient use. This will reduce excessive seepage into aquifers, reduce the risks of waterlogging, and reduce the demand for additional large-scale and costly irrigation system expansions. Irrigation agencies, however, are not structured to support good management through market-based incentives.

Mini-Case

At 1988 prices, US$250 billion had already been invested in irrigation in developing countries, and US$100 billion more may be spent this century to create more capacity. The benefits in expanded farm output have been substantial, but there are serious economic and environmental problems, especially with large public irrigation systems. Costs have been much higher and agricultural benefits lower than projected when investments were made. Operation and maintenance of completed systems are often deficient, and negative environmental impacts have been extensive. In India and Pakistan alone, more than 20 million hectares have been lost through waterlogging, and at least 30 million are seriously affected by salinization (Repetto 1988).

Capital budgets are typically allocated from the national treasury, and project revenues are returned to the treasury. Financial management of irrigation investments is inadequate.

Where funds for operation and maintenance depend on fees charged to irrigators, and are low relative to operation and management costs or capital requirements, an interactive process of declining performance and declining collection of charges results. Where funds are allocated from central revenues and do not depend on farmers' contributions, irrigation agencies are less accountable to users for good performance. Poor operating and maintenance standards not only reduce agricultural benefits but also can increase water losses and damage to soils and aquifers (Repetto 1988, p. 13).

There are also many off-site interdependencies between irrigation and downstream users as well as the interaction between surface and groundwater use. Policy discussions have focused on the possibility of taxes and subsidies to account for the off-site effects of irrigation activities. However, given poor administration of irrigation systems, these approaches, whether for watershed management or coastal zone management, have little chance for near-term implementation.

Indicators: Irrigation Provision and Pricing Policies

Problem Indicators

- Efficiency in the use and application of irrigation water.
- Salinization, sedimentation, and waterlogging on irrigated lands.
- The rate of irrigation pumping and thus of mining underground aquifers.
- The per hectare demand for water.
- Percentage of irrigation water used in the production of high-value crops.

Policy/Process Indicators

- Changes established in water pricing to reflect the actual value of the water used in irrigation.
- Marginal cost of water for irrigation.
- Existence of irrigation associations that coordinate with government agencies to establish and collect fees in accordance with pricing policies that reflect the marginal cost.
- Levels of community involvement and management in irrigation management and decision making.
- Establishment of charges for irrigation water use that reflect the costs of mitigating pollution or other adverse environmental effects from irrigation.

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RESEARCH QUESTIONS

What is the water ownership and control system? Is it effectively managed?

How stable are the revenues and what form do they take?

Do water user fees reflect the marginal value of the water to the users?

What government and private institutions are involved with water use and management? Do their mandates conflict? Are any watershed management coordinating institutions in place? Are they effective?

What is the level of public and private involvement in irrigation?

Are irrigation systems charging for irrigation water? If so, does the charge reflect the value of the resource to the user?

Do the existing institutions have the ability to implement improved charges? What are the costs and benefits associated with implementation of higher irrigation fees?

Have water distribution fees been considered or implemented? What is the financial status of the government institution in charge of irrigation projects?

What kind of property and/or usufruct rights work best to ensure the desired resource management objectives of a given area or watershed?

Under what circumstances is it better for central authorities than local administrative units to manage water use and collect water fees?

What types of incentives that motivate farmers (especially in upland watersheds) to adopt sustainable practices that will contribute to better holistic management within the watershed? What will downstream users require to ensure their contribution to programs that improve management upstream?

What are the best land use remedies for watershed deterioration taking into account the social and economic desires of the local populations, and long-term resource management objectives?

What kinds of administrative structures are best suited to bring together the various governmental institutions involved in watershed resources for the purposes of joint programming and budgeting to ensure that watersheds are treated as a functional planning unit? How can existing systems be modified to allow more flexible planning and budgeting? What kind of institutional training and capacity building will be required to permit institutions to coordinate their activities in a holistic approach to watershed management?

What will be the short- and long-term social and economic impacts of adjusting water prices to reflect water's true cost, including opportunity costs?

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Coastal Zone Management

Policies Affecting the Quality of Coastal Resources

Key Points

- Subsidies for pesticides and fertilizers result in their overuse and runoff into coastal areas, harming coastal aquatic life.
- Subsidies for cattle can result in greater erosion and runoff into coastal zones and negatively affect quality of the coastal zone environment.
- Subsidies for mariculture can have significant localized effects on coastal estuaries.
- Taxes and user fees can be used to control coastal water discharge and quality.
- Regulations, if they are enforceable, can control both onshore and offshore contamination.
- Communal management of coastal fisheries can be a low-cost and efficient way to maintain sustainable levels of fish populations.
- Integrated coastal zone management is an approach that attempts to deal with the physical and institutional interdependencies of the resources.

Subsidies

Subsidies at various levels can contribute to coastal resource degradation. In most countries water quality is degraded due to pesticide and sediment contamination. Pesticides subsidies represent a serious problem because they often reduce the cost of pesticides to the point where they are overused; subsequent runoff carries the pesticides from watersheds into coastal zones. Pesticide overuse can also result from intensified production of vegetables and other agricultural products to take advantage of export promotion policies. Pesticides in coastal waters may also

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Likely Impacts of Mariculture Development

GROWTH

- Increased production, foreign exchange, and government revenue in the short term.
- Long-term decline if the resource base is irreversibly harmed.

WELFARE

- Increased employment in mariculture but possible loss of employment in artisanal fishing and other mangrove-dependent activities.
- Large short-term rewards for the politically powerful.

CONSERVATION

- Loss of biodiversity.
- Possible overharvesting of shrimp larvae.

affect the human population because estuarine filter feeders, such as locally consumed shellfish, are particularly prone to accumulations of toxins.

Subsidies to the cattle industry also can affect coastal resources by leading to changes in land use patterns, deforestation, and land compacting, which in turn leads to greater erosion rates and sedimentation. Cattle subsidies also tend to force non-cattle agriculturists onto steeper lands, where cultivation results in increased erosion and an increased amount of sediment entering coastal water systems.

Export subsidies to the mariculture industry can promote rapid growth and expansion of the industry. Localized concentrations of mariculture industry can increase the organic load of nutrients in coastal waters and increase biological oxygen demand (BOD). A high BOD in turn negatively affects the survival and growth of estuarine organisms in the most severely affected areas. Existing mariculture subsidies may be difficult to eliminate because businesses have become dependent on them; however, subsidies without adequate control of siting and overall investment level will result in the degradation of coastal resources.

Subsidized prices for water (or for fuel to operate pumps) may result in overpumping of nearshore aquifers and intrusion of salt water into coastal zone aquifers. These issues become increasingly important as population increases in coastal areas and the demand for water increases. Water fees that do not take into account the cost of pollution will discourage actions to treat water and lead to the dumping greater quantities of untreated waste into coastal zones. Removing subsidies and adopting a policy that forces the polluter to pay can represent an important step in stemming the pollution of coastal areas.

Investment Incentives

Tax incentives and subsidies can have an important impact on the use of coastal resources. Subsidized credit and export credits typically have been used to promote mariculture, especially the shrimp industry. Intensive shrimp culture leads to changes in coastal resource use and to the destruction of mangrove areas. Of particular concern is the overexploitation of shrimp larvae upon which the shrimp industry depends for breeding stock. Overpromotion of shrimp without adequate controls can lead to the demise of the industry as well as unsustainable use of the coastal resources.

The promotion of tourism along the coast can lead to increased wealth and the generation of foreign exchange. Tax reductions or holidays, elimination of import duties, and infrastructural development are policies used to encourage both local and foreign investment in tourism. However, these incentives, without adequate planning and control to deal with appropriate land use issues, public access to beaches, and potential contamination problems from garbage and wastewater can lead to destruction of coastal resources. Increased tourism can also put pressures on coral reefs because collecting may occur. Any incentive program for tourism must be accompanied by appropriate, accepted, implementable regulations to minimize the likelihood of the destruction of coastal zone resources.

Pressure on mangroves can be relaxed through incentives for small-scale industry to reduce its use of mangrove forests as sources of fuel, and increasing alternative fuelwood supplies. Incentives could include taxes and fees assessed on production processes that result in destruction of mangrove forests, and credits to purchase improved, environmentally sound technologies.

An integrated approach to managing coastal resources would include such programs under coastal zone management plans.

Fiscal Instruments

Taxes on effluent discharge can be levied against hotels, industries, and municipal plants that discharge raw waste into coastal zones in order to provide an incentive to treat waste or to meet waste discharge guidelines. Taxes or use fees can also be collected for garbage collection and disposal. Care must be exercised to ensure that the fees are not so high that they encourage illicit dumping of wastes as people attempt to avoid payment. (Disposal of toxic wastes such as hospital wastes deserves special attention.) Such fees are generally opposed by hotel and vacation home owners, but given the poor state of water quality monitoring, taxes and fees may be the only effective tools for controlling the deterioration of water quality.

Regulations

Regulations can be used to limit the amount of contamination in coastal waters and along the shorefront. However, to be effective, compliance must be monitored and regulations are best supported by well-implemented fiscal incentives and sanctions. Market-based methods are generally more efficient than regulatory instruments but difficult to calibrate. Even roughly structured fiscal incentives can provide revenue for supporting the administrative structure required to develop and implement regulations. In many cases regulations are already in place, but enforcement is weak, due to inadequate institutional and financial resources or lack of political will.

The enforcement of regulations that require treatment of effluent from homes and factories will improve the quality of water discharged into coastal areas. Countries need to begin by requiring and providing treatment facilities and rehabilitating existing treatment facilities. The major roadblock to improved treatment is construction costs; it is easier to dump untreated waste than to invest in treatment plants.

Voluntary Approaches

The control of non-point source pollution that threatens the quality of coastal resources may require measures that citizens can adopt voluntarily. Voluntary approaches result from policies aimed at education, moral persuasion, and technical assistance as a way to influence the behavior of polluters. Although easy to implement in terms of political and economic costs, voluntary approaches may not be effective as stand-alone measures because polluters individually benefit in the short term from polluting practices and often see little gain from efforts to preserve water quality. Educational programs will most likely yield benefits in the long term and will need to be combined with regulatory and fiscal approaches.

Integrated Coastal Zone Management Plans

Integrated coastal zone management represents a commitment to sustainable coastal resource development through the integration of various sectors and levels of government. Many developing countries have embraced the concept of integrated coastal zone management in an effort to address the deterioration of resources, but implementation of specific policy reforms or actions has not always followed. Countries in the Americas with coastal zone management plans include: Argentina, Belize, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Honduras, and Venezuela.

Special Area Management Programs are small-scale versions of national integrated coastal zone management plans. These plans are regional in scale and encompass a coastal ecosystem such as a watershed related to a coastal estuary. Pilot management programs and projects are generally undertaken to manage the resources in the special area. Successful special area management programs have been implemented in Ecuador.

Mini-Case

In the Gulf of Fonseca region of Honduras local coastal inhabitants, who are generally poor, believe that the wealthy, with assistance from the state, have been able to appropriate common coastal resources for personal gain. This gain has been at the expense of the rural poor who have traditionally used the areas where shrimp farms are located for hunting, fishing, shellfish collecting, and wood gathering. Due to concessions granted by the state the lands have effectively become private property under control of both national and transnational enterprises. The companies, in an effort to assert ownership rights, minimize alleged theft, and limit access, have erected fences and hired armed guards to patrol the concession areas. Conflict between the concessionaires and local inhabitants has developed. The greatest problems identified by the local inhabitants are:

- Lack of access and use of large areas of coastal zone due to shrimp farm production. In addition, land speculation has become a problem and concessionaires try to fence off greater areas, which might be appropriate for shrimp farms or possibly pasture land.

- Local inhabitants lack access to estuaries that are supposedly still open because access is blocked by owners of adjacent shrimp farms who fear theft.

- Fences block normal travel routes, thus forcing people to walk long detours to reach boat landings and places that are still accessible for open exploitation.

- Road and shrimp farm construction have altered water flow regimes, especially affecting the seasonal lagoons rich in fish species that local people exploited.

- People fear that mariculture activities have affected recruitment of shrimp and other species to the detriment of the local subsistence economy.

- Concessions granted without the participation of the local communities and disregarding customary access and use rights to coastal zone resources have led to conflict between local populations and concessionaires. Lack of access to resources for many people in the Gulf region limits their ability to sustain themselves from their previous livelihoods and may increase poverty and pressure on nonpropertied resources.

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Indicators: Quality of Coastal Resources

Problem Indicators

- Deforestation rate of mangrove areas along the coast.
- Quality of water flowing into coastal waters from watersheds.
- Effluent quality from communities and from hotels flowing into coastal water bodies.
- Levels of coastal zone biodiversity and ecosystem integrity.

Policy/Process Indicators

- Coordination among natural resource institutions and agencies with respect to maintaining coastal ecosystems.
- Programs to manage fisheries and coastal resources, including greater community involvement in management planning.
- Subsidy programs for fisheries and for mariculture.
- Property and usufruct rights for coastal resources that establish well-defined and recognized rights and an equitable access to resources.
- Production levels for fish and shrimp.
- Education programs and increased dissemination of information to communities and tourists regarding coastal zone resource conservation.
- Regulation of coastal zone resource exploitation.

POLICIES AFFECTING THE USE OF COASTAL RESOURCES

KEY POINTS

- Zoning, licensing, concessions, and other resource use controls are used by governments to affect resource user behavior, but they are often ignored.
- Government ownership of coastal areas is seldom effective in protecting the resource base.
- Private ownership fails to account for important environmental values of coastal resources.
- Successful coastal resource management requires consideration of the coastal ecosystem on a broader scale to include coastal waters, mangroves, coral reefs, the shorefront, and the adjoining watersheds that affect the quality of coastal resources.
- Management of coastal resources requires that communities participate and that the proposed management alternatives respond to the broader socioeconomic development needs of the population.
- Community ownership or use rights can be an efficient method for dealing with the open-access resource issues that are frequently encountered in coastal areas.

Ownership

Coastal zone management, like watershed management, is primarily focused on resource and institutional interdependencies. Many kinds of resource issues arise because of the variety of uses that are attached to the resource and associated with the location.

Likely Impacts of Increased Community Ownership of Coastal Resources

GROWTH

- Short-term reduction in harvests as open-access resources become controlled.
- Long-term, sustainable use of resource as long as the community is able to control resource access.
- Reduced government cost to police resources.

WELFARE

- Availability of the resources for future generations.
- Exclusion of some groups and individuals from resource extraction.

CONSERVATION

- Sustainable resource use if communities are self-disciplined and able to control access.
- Improved coastal ecology.
- Preservation of biodiversity.

The policy issues involved include: (1) the private and public benefits of preservation of coastal areas, especially mangroves, regardless of the de jure ownership system; (2) the effectiveness of public ownership controls where that system exists; (3) controls on private ownership and development; and (4) the often complex and confusing and uncoordinated set of institutions responsible for coastal zone resource management.

Resource uses can include biological resources and wildlife habitat, mangrove tree use for charcoal and salt drying, and mariculture. Conflicts between users are common. Problems also exist when the coastal areas absorb pollutants from upstream urban, agricultural, and mining activities. Mangroves are also destroyed to make room for urban and tourist developments.

Government de jure ownership of coastal resources is common throughout Central America. Belize, however, does have much of

its coastal resources in private ownership. Public ownership generally is ineffective in controlling deleterious uses of mangroves because ownership by the state creates an open-access resource where the incentives are to use the resource before others. Legislation prohibiting or controlling use of coastal zone resources has been ineffective because the institutions charged with implementation are generally weak.

Where private ownership regimes hold, the value of the resources in terms of wildlife habitat and environmental maintenance will not necessarily influence decisions about their use. Even where governments attempt to regulate or control private uses, the ability of institutions is weak and the potential short-term gains from alternate uses are too great to effectively control behavior.

The physical biological, and socioeconomic interdependencies of coastal resources are reflected in all countries in the region by a large set of public and private actors with different interests and charges. In the public sector, many institutions have confusing, conflicting, and/or time-consuming regulations, which hampers effective government action. Consequently, another problem is that coastal zone management projects are frequently focused on establishing institutional coordination among diverse groups and institutions.

Regulations

Several types of regulation can be used to ensure the best use of coastal resources, and many of these will be found in any integrated coastal zone management plan. Regulations, however, are effective only when an adequate administrative capacity exists to ensure their implementation.

Zoning

Certain types of development can be restricted to particular areas of the coastal zone to ensure that development occurs in preestablished zones and that wetlands and other biologically important zones are protected. This approach is consistent with approaches undertaken in the special areas management programs for coastal zones in Ecuador.

Licensing

In areas where the state is the owner of coastal zone resources, licensing can help remove the open access characteristic of coastal resources and establish property rights over some resources and also provide a way to monitor specific resource uses in the coastal zone. When properly conceived, licenses provide use rights for a long enough time to encourage long-term investments. The fees for permits or licenses must reflect the environmental costs of the coastal development. Licenses can be allocated through a lottery or other equitable means to avoid local resentment from the entry of large concerns or foreign enterprises to the detriment of local interests. Licensing and permitting requires political will to promote equity and sustainable management goals.

Concessions

When the state is the owner of coastal land, concessions for land use, especially for mariculture and tourism, can be used to (1) coordinate competing uses, (2) allow the state to capture resource rent, and (3) act as a vehicle for implementing environmental protection regulations. In general, concessions should (1) be competitively awarded, with fees capturing the value of the location in the case of tourism and/or the production conditions in the case of mariculture, (2) require management plans, (3) be revokable upon failure to comply with management plans, and (4) be transferable so that concessionaires can capture the value of long-term investments.

Controls on resource use

Governments can attempt to limit the amount of fish caught, control the taking of wood from mangroves, and limit the construction of beach homes. In many countries regulations already exist, but are not enforced. The cost of implementing regulations often is high and relegated to low priority by governmental agencies.

Community ownership or use rights

Governments can, in coordination with community groups and NGOs, establish community-based resource management schemes whereby the responsibility for managing coastal resources can be turned over to community groups. Criteria for management and use could be established through agreements between the

government and the communities and address issues related to sustainability. The open access nature of coastal and marine resources as well as the state's inability to manage resources contribute to the growing popularity of community management among development planners. Success in this arena will greatly depend on the government's ability to pass decision-making power to communities and treat them as equal partners in management.

Mini-Case

In El Salvador the environmental NGO, Amigos del Arbol (AMAR), set out to protect sea turtle eggs from human predation by addressing the economic needs of the Barra de Santiago community on the Pacific Coast. Many people in the community obtained some income from collecting and selling sea turtle eggs on the open market, thereby putting in danger the survival of sea turtles in order to meet short-term economic needs. Through financing received from various sources AMAR became the primary purchaser of turtle eggs from members of the community. In exchange for eggs the collectors received vouchers from AMAR that could be exchanged for goods at a store run by AMAR and from a local retailer. The retailing arrangement allowed people access to certain goods whose purchase previously required travel outside the community.

In addition to selling eggs to AMAR, the collectors participated in the turtle protection program by establishing nests for the collected eggs and in the festivities of releasing the baby turtles to the sea when ready. AMAR also created a center for environmental education where collectors, community members, and children received education classes on the importance of protecting the coastal environment, especially the mangrove swamps and estuaries upon which the local economy depends. The population now has a greater understanding of the importance of managing the coastal ecosystem and is participating in attempts to control the degradation that results from both local and external demands for the region's resources. Efforts will soon be underway to address the degradation of the watersheds adjoining the Barra de Santiago in an effort to stem the flow of contaminants into the coastal zone.

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Management

Improved management of coastal resources will require major changes in orientation of ministries and agencies involved in natural resources and development planning. These groups and agencies tend not to coordinate efforts even though they deal with issues affecting interdependent resources. This bureaucratic fragmentation occurs at the cost of effective resource management.

Administrative integration

The diverse nature of the coastal ecosystem, especially given the ties to inland activities and ecosystems, requires integrated development planning. Fragmented bureaucracies and centralized policy formulation must be replaced by the participation of agencies and organizations that are involved in the implementation of policies and projects that affect use of coastal resources. Decisions on coastal zone management need to be included in forestry, agricultural, watershed management, and land use plans. Formation of a multisectoral Coastal Resources Commission, tied to the local Environmental Councils, offers a promising management strategy.

Community participation

Effective management of the coastal zone has been achieved in several cases when local inhabitants participate in the management of coastal resources. Given the open-access characteristics of coastal resources, policy implementation may prove more successful if local inhabitants have a stake in the process and in the implementation of regulations. With local participation, policies are more likely to respond to the needs of people who most closely depend on the use of coastal resources for their livelihood.

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Indicators: Use of Coastal Resources

Problem Indicators

- Land use patterns including preservation of mangrove areas.
- Flora and fauna species populations and diversity.
- Harvest rates for commercial and artisanal fisheries.

Policy/Process Indicators

- Community involvement in land use decisions.
- Enforcement and effectiveness of government land use controls.
- Education programs on ecological and environmental conditions in coastal areas.
- Degree of transparency and participation in decision processes involving the use of coastal areas.

POLICIES AFFECTING THE MANAGEMENT OF FISHERIES

KEY POINTS

- Fisheries are an example of an open-access resource. Some definition of property rights and institution of controls limiting catches and fishing activities will be required to ensure that the resource is not overexploited to the point of species extinction, especially as human populations and demand for fisheries resources grow.
- Government declarations of ownership and establishment of regulations and controls seldom yield beneficial results, primarily due to the weak institutional capacity, lack of resources, poorly trained human resources, and a lack of a serious mandate to carry out regulations.
- Management of fisheries resources may benefit from involvement of communities dependent on these resources in their management and in the enforcement of regulations and controls.
- Many fisheries issues cross national boundaries, which complicates solutions to the problem of overexploitation.
- A combination of user charges and property rights to a fixed quota have been suggested as efficient strategies.
- Without the ability to exclude unauthorized users, management is problematic.

Subsidies

Governments often provide various types of subsidies and credits to support the fishing industry. These subsidies cause an increase in the number of people employed in the fishing industry and an increase in investments in new technology. Both scenarios result in the harvesting of greater numbers of fish and damage to the marine ecosystem resulting from technology employed. In addition, subsidies to support the fishing industry are counterproductive in countries that are beginning to feel the economic and social pressure from decreasing catch sizes. Elimination of subsidies could make certain types of fisheries exploitation unprofitable and ease the pressure on stocks, but will reduce employment and may cause migration from coastal to urban areas.

Likely Impact of Improved Fisheries Management

GROWTH

- Short-term depletion of catches and production with long-term sustainable production.
- Increased cost of government regulatory activities.

WELFARE

- Loss of employment in the short term.
- Long-term certainty of employment.
- Increased food supplies in the long term.

CONSERVATION

- Maintenance of habitat and diverse fish populations.
- Sustainable use of the resource and ecosystem.

Subsidies are particularly damaging to an open-access resource because they artificially lower the cost of extraction and improve profit margins, in a context where there is no incentive to manage or conserve the resource and exclusion is impossible. Elimination of direct and indirect subsidies that contribute to the increasing number of fishermen and to the use of technologies that deplete fisheries is essential for sustainable management of fisheries.

Regulations

Various regulatory measures have been attempted, but most have not been effective. Biological management measures such a mesh size regulations, closed areas, and total catch quotas have proved difficult to implement and have resulted in an increase in the number of users. Unfortunately the cost of monitoring such a system may prove untenable for many countries.

In general, quota systems protect the inefficient, ignore the differences in fishing skills among participants, and result in higher average costs. The inefficient effort of new investment

under a quota system represents lost opportunities for the nation from investment in other sectors.

Controls on equipment and fishing methods may be easier to monitor and enforce, however, to be successful it must be coupled with a mechanism to limit the numbers of fishermen.

Indirect regulations such as zoning may prove effective. Specific fisheries zones could be established and fishing would be allowed in those areas only. Once again, monitoring is required. Education and awareness programs may need to accompany any program focusing on zoning to gain adherence to the program.

Taxes

Taxes on certain fishing equipment, boats, and so forth may serve as a barrier to entry into fisheries. The goal of fiscal incentives would be to limit the number of fishermen as well as the size of the catch in order to preserve stock sizes. Such taxes are not common in most countries; there appears to be a preference for regulation, despite the difficulty of enforcement.

Taxes increase the average cost and prevent new entry but do not draw resources from the rest of the nation to achieve a production quota (Johnston et al. 1988, p. 165) Taxes are also a transfer from the fishing industry that may or may not be used to improve management.

Use Rights

Community use or ownership rights may provide an alternative to open access. Community-based management schemes could provide community groups with fishing rights, that is certain fisheries or areas could be delimited as artisanal fishing grounds. Decisions on management of the resource would be made at the community level or would lead to the formation of cooperatives that would make appropriate fisheries' decisions. The system is self-policing and costs little to implement. Community use rights may only be effective in very localized settings and not effective over an extensive geographic area or when fish stocks are migratory.

Individual Transferable Quotas offer another mechanism for dealing with the open-access question. Individual fishing boats

could receive quotas for specific fish species and gain a type of property right. These rights could be bought and sold in the marketplace with no increase in the amount of fish that can be taken. Although useful for establishing rights the cost of monitoring and compliance is very high and may be beyond the capabilities of many countries.

Collective management of marine resources has been successful in many cases. Under these systems, property use rights for marine resources can be assigned in a number of different ways. It is important to distinguish between the rights of access and extraction at an operational level and the collective rights of management, exclusion and transfer (sale or lease) of the resource. The authority to develop access and extraction rights (e.g., harvesting rules) at the operational level and to change them is what makes community or collective property rights a powerful tool for managing an otherwise open-access resource. Voluntary or self-organized management arrangements can produce rules for managing a marine resource that are precisely tailored to the conditions of a specific site. The knowledge base for these rules comes from a community of fisherman who learn from their accumulated experience and the arrangements can be enforced because they are self-imposed and therefore viewed as legitimate (Schlager and Ostrom 1992).

Right to access and withdrawal

An authorized user has rights to use and extract marine resources but cannot devise their own harvesting rules or exclude others, however, they may trade or sell their rights. The rights of authorized users are defined by those who hold the collective rights to manage the resource and exclude unauthorized users.

Mini-Case

In 1973 the Alaska legislature adopted a limited entry system that divides Alaska salmon and herring fisheries into discrete fisheries. A commission determines the number of permits available for each fishery, and adjusts harvesting rates by increasing the number of permits or buying back existing permits. Permits are transferrable but cannot be used as collateral. Fishers do not participate in making operational-level management rules (Schlager and Ostrom 1992).

Right to management, exclusion, and sale or lease

The right to manage marine resources, exclude unauthorized users, and sell or lease these rights is a collective-choice right to decide how, when, and where harvesting may take place; decide who may have access to a resource; and sell or lease their collective-choice rights.

Mini-Cases

1) Net fishermen of Jambudwip, India, exercise management rights but do not have authority to decide who may enter the fishing grounds. They have developed a set of rules for selecting, using and abandoning a fishing site. At the beginning of the season each crew selects a spot to set their net that is neither in front of, or behind another's net. When the crew removes their net, no other crew may harvest in the same spot without permission.

2) The Turkish government leases lagoons to cooperatives. To harvest in the lagoon, a fisherman must belong to the co-op which requires living in an appropriate village for a minimum of six months and having no wage employment income. In Newfoundland only local fishermen are permitted to participate in a lottery to gain access to a trap site and to sit on the local committees that operate the lottery. These local committees legally define the boundaries of fishing areas over which each community has jurisdiction. In both cases the members can make management decisions and exclude unauthorized users however they cannot sell or lease their rights of management and exclusion.

3) Members of the Vigia Chico lobster cooperative in Ascension Bay, Quintana Roo State, Mexico, hold a complete set of rights over a specific area, which they may sell or lease to other members of the coop (Schlager and Ostrom 1992).

The rights of access, withdrawal, management, exclusion and transfer can be de jure rights that are enforced by government, or then can be de facto rights that originate among resource users who cooperate to define and enforce rights among the group. A combination of de jure and de facto property rights often exist simultaneously. These may conflict, overlap and/or compete, and a new technology can seriously disrupt their delicate balance (Schlager and Ostrom 1992).

Mini-Case

The fisherman of the Valenca estuary in Brazil held de jure rights of access and withdrawal from early 1900. Over the years, fishermen developed de facto harvesting arrangements, divided the estuary among different technologies and allocated fishing spots by lottery. Later, in an attempt to "modernize" fisheries, the government made nylon nets available to anyone who qualified for a bank loan. The Valenca fishermen could not purchase nets because they did not qualify. Wealthy individuals who qualified for loans, purchased nets and hired inexperienced fisherman. These new fishermen with nylon nets invaded the estuary. De facto property rights were rapidly destroyed, and the fishery overharvested and abandoned. (Schlager and Ostrom 1992)

When de facto management regimes are established by local fishermen, the costs or regulation are born by the beneficiaries. Most studies indicate that the right to exclude unauthorized users is crucial for long-term sustainable management and for investing in institutional arrangements to manage the area.

Public Participation

Successful fisheries management may result from reaching agreements directly with all fishermen involved and establishing mechanisms that can be implemented and monitored by local populations with support from governmental agencies. Where restrictions on fisheries limit economic possibilities, especially for artisanal fishermen, the need for alternative livelihoods must be addressed. A decision that favored artisanal fisherman would most likely meet with opposition from larger commercial fisherman. Public participation to discuss arrangements and to deal with conflict over fishing rights and areas may help ease the tension.

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Indicators: Fishery Regulations

Problem Indicators

- Size and age distribution of certain fisheries stocks
- Populations of fish stocks that are currently overfished.
- Degree of overall biodiversity.

Policy/Process Indicators

- Coordination between artisanal and commercial fisheries that enhances satisfaction of their diverse needs.
- Regulations and controls on fisheries allocations and on equipment and techniques to limit overfishing of stocks.
- Sustainable fishing and fish processing techniques.
- Subsidy programs for fisheries aimed at the conservation of stocks and long-term sustainability of fisheries operations.
- Education programs and increased dissemination of information to communities and fisherman regarding fisheries stock management.
- Community involvement and participation in the development of fisheries controls and regulations in coordination with government agencies.

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RESEARCH QUESTIONS

What institutional structures control use of natural resources in coastal areas?

Are significant fiscal and export incentives in place to encourage activities which, while increasing foreign exchange, negatively affect the environment?

What minimum basic regulatory policies are needed to control the open-access nature of some coastal resources and/or help ensure that private transactions take into account environmental values?

International fisheries are especially complicated to manage when national regulation is weak. What minimum regulations are needed to manage the resource for sustained use?

What kind of institutional arrangements and modifications in existing planning and implementation mechanisms will be required to reach the levels of coordination necessary to undertake an integrated approach to coastal management?

What kind of incentives are required to address the economic needs of the population dependent on coastal resources and to ensure the adoption of sustainable coastal resource management practices?

Given the open access nature of fisheries resources, what combination of regulation, incentives and use rights can be successfully applied to preserve fisheries stocks? How will governments attend to the short-term loss of employment in the sector as these adjustments are made?

What is the relationship between post-larval numbers and mangroves and other coastal habitats?

How are natural stocks of shrimp affected by post-larval harvesting and collection of females?

What impact does water pollution have on plant and animal populations in the wild?

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