ASSESSING THE
ENVIRONMENTAL, FOREST,
AND OTHER NATURAL RESOURCE
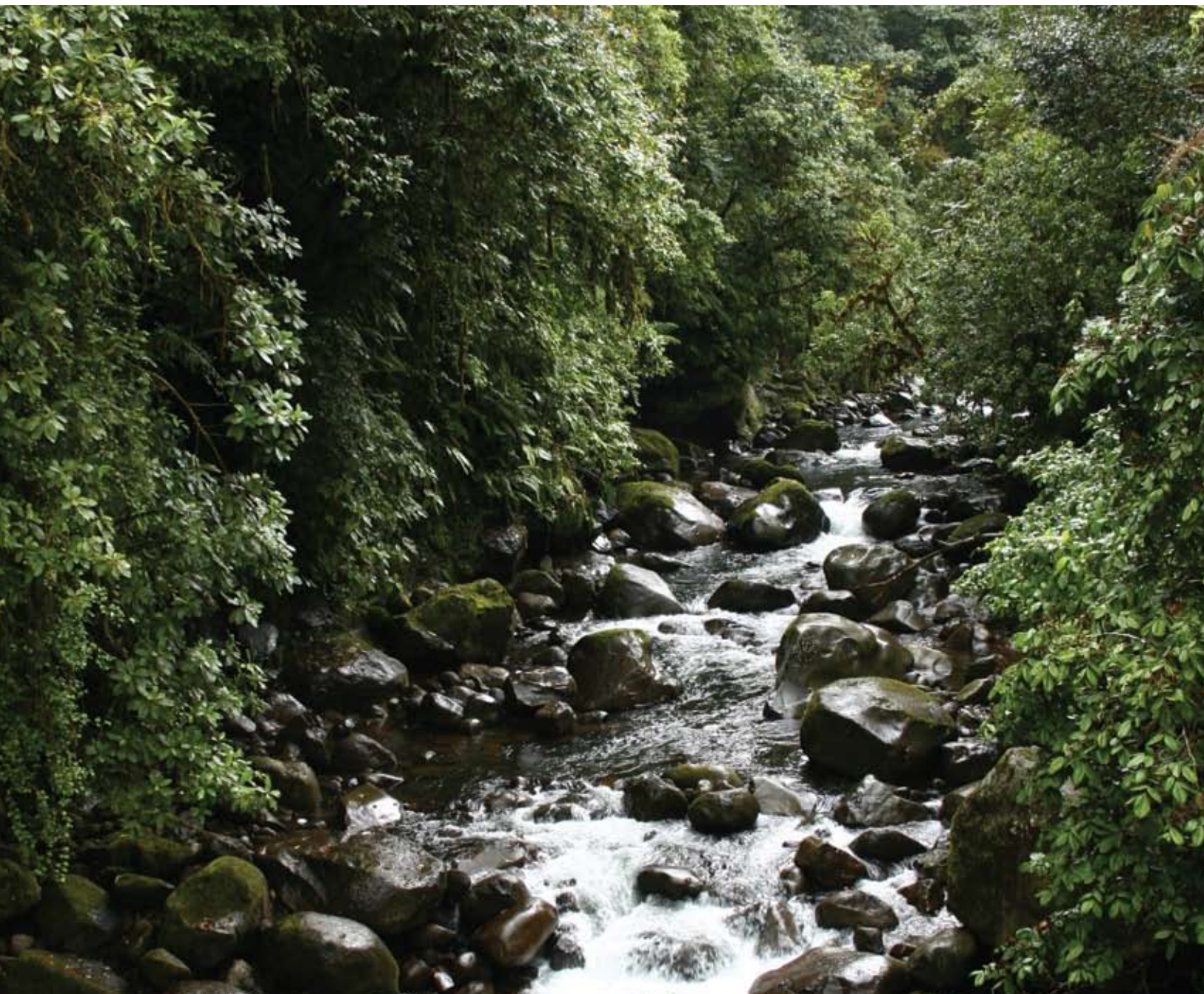## ASPECTS OF DEVELOPMENT POLICY LENDING

A WORLD BANK TOOLKIT

ASSESSING THE
ENVIRONMENTAL, FOREST, AND OTHER NATURAL RESOURCE
ASPECTS OF DEVELOPMENT POLICY LENDING

A   W O R L D   B A N K   T O O L K I T

Abbreviations

ADB	Asian Development Bank
AfDB	African Development Bank
BBN	Bayesian Belief Network
CEA	Country Environmental Analysis
CGE	Computable general equilibrium
CREED	Center of Research on the Epidemiology of Disaster
DALY	Disability adjusted life years
DFID	UK Department for International Development
DPL	Development policy lending
EER	Energy-Environment Reviews
ENS	Environmental studies
IADB	Inter-American Development Bank
NAFTA	North American Free Trade Agreement
PEER	Public Environmental Expenditure Reviews
SEA	Strategic Environment Assessment
SME	Small and medium enterprises

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1. Introduction

The Operations Policy (OP/BP8.60) on Development Policy Lending (DPL), approved by the Board in August 2004, requires that the Bank systematically analyze whether specific country policies supported by an operation are likely to have "significant effects" on the country's environment, forests, and other natural resources.[1] The implicit objective behind this requirement is to ensure that there is adequate capacity in the country to deal with adverse effects on the environment, forests, and other natural resources that the policies could trigger, even at the program design stage. Therefore, as part of all development policy operations, task managers are now required to:

- Determine the "likelihood of significant effects" on the environment, forests, and other natural resources of specific country policies supported by the DPL.

- Assess the country's environmental and natural resources management systems to determine whether there is appropriate capacity to handle potential effects, if any, and recommend actions within or outside of operations with emphasis on building required capacity.[2]

The fast-disbursing nature of DPL operations often requires that the analysis be conducted in a short time frame. There are a wide range of tools, both qualitative and quantitative, to analyze the effects of specific policies on the natural environment and natural resources. No one tool can capture all effects, both direct and indirect, of these policies; hence, an array of tools may be required for a complete analysis. There has not been any systematic attempt to organize and evaluate the different tools for a *rapid* assessment of the "likely significant effects" of specific policies envisaged in DPL operations in order to meet the due diligence requirement as laid out in the OP/BP8.60.[3] Further, there is little guidance regarding the circumstances under which the different tools can be applied. The toolkit proposed in this document will help operationalize the determination of "likely significant effects" (see Module I).

The proposed toolkit will complement the PSIA toolkit; both will feed into the design of lending activities (both DPL and PRSC) for a country and ensure that operations contribute to sustainable development without significant environmental and social effects. It will also complement other analytical tools—such as CEA and SEA—that are directed at a more comprehensive analysis.

1.1 Objective and audience

The toolkit facilitates systematic analysis of direct and indirect effects of development policy reforms on the natural environment and natural resources. It provides a framework and guidance for rapidly assessing environmental, forestry, and natural resource issues at the program concept design stage of the lending activity. The specific objectives are to:

- Organize and evaluate different tools, both qualitative and quantitative, for a rapid assessment of likely significant effects of specific economic policies envisaged in the DPL operations and other development policies on the environment, forests, and other natural resources.

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1   *Environmental effects* mean a policy-induced change in human activity that in turn leads to a change in the quantity or quality of an environmental resource (for example, loss of forest cover or habitat, or a change in the concentration of pollutants in air, soil, or water). *Significant effects* are environmental changes of sufficient magnitude, duration, and intensity as to have non-negligible effects on the natural resource base and on human welfare (OPCS 2005).

2   Borrowers' or country systems broadly refers to the capacity underlying the policy and institutional framework to identify and address environmental problems/priorities in an effective manner taking into account concerns of stakeholders (including the most vulnerable groups). It also embodies processes to adequately monitor and evaluate progress to overcome these problems. This could also include private initiatives/mechanisms for promoting sustainable development (OPCS 2005)

3   Consequent to the approval of the OP/BP8.60 on Development Policy Lending by the Bank Board in August 2004, the Environment Department prepared a good practice note on environment and natural resource aspects of DPL. The good practice note and the economic sector work on DPLs and forest outcomes prepared by the Agriculture and Rural Development Department forms the starting point for this work.

- Provide a framework (including questions to be answered, key elements, data requirements, limitations, references, and country applications) for the tools to enable the user to choose those that are appropriate for evaluating the effects of specific policy reforms on a country's key environmental, forestry, and other natural resources issues (see case example, section 5.1).
- Provide assistance in identifying a country's key environmental, forestry, and other natural resource issues (see case example, section 5.1).
- Identify circumstances under which each of the tools can be applied.
- Provide guidance for appropriate actions needed for assessing institutional capacity.

Apart from DPL task managers and environmental specialists involved in DPL operations, the toolkit should be useful to practitioners in other development organizations (multilateral and bilateral institutions) for better understanding of the implications of the policies supported through their budget support operations on environment and natural resources, including forests.

1.2 Key policies and programs addressed

DPL operations are associated with a whole array of policies such as macro policy reforms, fiscal policies, and specific sectoral policies, particularly in key sectors such as agriculture, health and education, energy, etc. In some cases, the operation may deal directly with reforms in certain environmentally sensitive sectors such as energy, transport, water and sanitation, agriculture, and forestry. In these cases, there is an obvious need for careful analysis of environmental, natural resource, and forestry impacts. In other cases, such as public sector reform and governance, there is less potential for likely significant impacts on the natural environment and natural resources. Moreover, reforms in sectors such as education and health are unlikely to have significant effects in these areas.

From an analytical standpoint, the most difficult cases are those where the effect is indirect. Trade, public expenditure management, and privatization reforms could have a significant bearing on the environment and on natural resources, but mostly through indirect channels. For example, reducing export tariffs on agriculture products may increase exports, which in

turn could increase production of agricultural products, potentially leading to encroachment into forest areas where the forests are effectively open-access. Similarly, privatization in certain sensitive sectors may need to account for environmental damages caused by past operations. Since many of these reforms involve complex changes in incentive structures (with differential impacts on various segments of the population) and also have cross-sectoral impacts, the environmental implications may not be obvious and are often difficult to predict. Nonetheless, these issues need to be confronted during program preparation or in analytic work, as the nature, even the direction of these effects will be highly sensitive to the prevailing structural characteristics and the environmental priorities of the economy.[4]

Annex A presents the pathways by which DPL policy reforms can impact on the natural environment and how such impacts can be analyzed. The policy impacts work through a number of transmission channels involving process, quantities, access to resources, and transfers of income and assets across the population. These impacts can be evaluated rapidly for their seriousness, using already developed tools and experience from past policy reforms. When a significant effect is likely, an institutional assessment is needed to see if the existing institutions in the country can cope with it. Furthermore, the impact itself will need further evaluation. This may be possible based on existing analytical work. If no such work is available, some analytical work may be needed to prepare a mitigation plan to address any major negative consequences of the DPL.

1.3 Structure of the toolkit

The toolkit organizes the different tools available for analysis of the effects of each policy, identifies environmental priorities, and then provides guidance on selection and use of the tools given the time and resource constraints. The toolkit is designed to be concise and user-friendly. It consists of three specific modules.

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4   For example, reform and modernization of the energy use and transport sectors offer potential for improving efficiency (with attendant environmental benefits), as both sectors are the major users of final commercial energy. However, it is often the case that the poor are disenfranchised from energy use because of the increase in utility prices and are driven to cheaper alternatives like fuelwood, which not only degrades forests, but also leads to indoor air pollution with serious health consequences.

The *first module* identifies relevant transmission channels through which the proposed reform would have a likely effect on the identified environmental, forest, and other natural resource priorities. The transmission channels can be broadly grouped into prices, assets, taxes, transfers, access and other country-specific factors (such as social and cultural factors). The effects of policy reform could be transmitted through one or more of these transmission channels.

The *second module* provides assistance in identifying key environmental issues in the country, regions, or sectors likely to be influenced by the DPL program. This module captures the key initial biophysical, environmental, forestry, and other natural resources issues in the DPL's relevant area of influence. The data and information are drawn from the reports and publications of national governments, the Bank's *Green Data Book*, and other relevant publications.

The *third module* presents different tools and methodologies for rapid assessment of the likely significant effects of each reform. For each tool, this module presents information on the type of questions it can answer, its complementarity with other tools, key elements, data requirements, limitations, and references to country applications. This module also provides guidance on circumstances under which each of the tools can be used.

1.4 Use of the toolkit

Figure 1 shows how the different modules integrate with one another to identify the possible impacts and assess their relevance.

Once a specific policy A is chosen, the transmission channels in Module I show what kind of impact can be expected. The description provided in the comment column of each table of Module I helps to identify the risks arising from the channel and the possible actions to manage them. An additional column identifies the relevant "indicators of state" offered in Module II.

The combination of the data from Modules I and II provides an assessment of the significance of the impact. Although elementary, this information is useful to set priorities. In fact, it is often the case that not one but several policies are suggested for implementation; therefore, an initial measure of significance allows a distinction to be made between those impacts that need to be analyzed more urgently and carefully due to their potentially severe risks and those that do not need further attention.

When the preliminary assessment of significance is complete, Module III offers a range of tools to expand the analysis. This analysis may go from a qualitative exploration of the range of possible impacts to a more sophisticated quantitative assessment of the environmental impacts.

The choice of the specific tool depends on the kind of questions that are perceived as most important by the user (both staff and stakeholders).

Summary of steps:

1. Policy A is suggested for implementation. Find the policy in the tables of Module I. A color code shows whether the policy may have positive impacts on the environment (green color), no effects (blue color), some negative effect (yellow), or serious negative effects (red)
2. The tables in Module I also identify the indicators of state that should be taken into consideration for that specific policy. Refer to Module II to find the status of the indicator for the country under study. Like Module I, the indicators provided in Module II have a color code. The indicator can reveal bad conditions (red color), medium conditions (yellow color), or good conditions (green color).
3. The combination of data from Module I and II suggest the significance of the impact (a significance matrix is provided in the case example)
4. The user can now refer to Module III for a range of additional tools to extend the analysis.

Figure 1. Steps in use of DPL toolkit
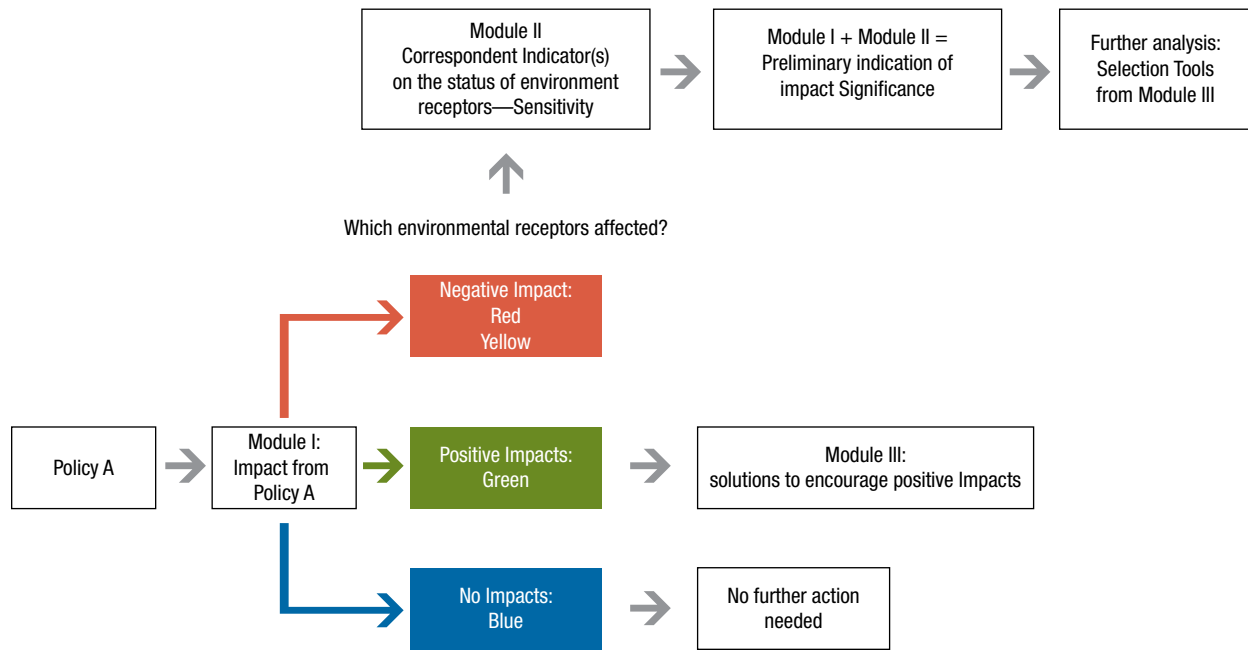
1.5 List of countries with available data

This toolkit provides data for 73 countries that have had DPL operations or where DPL operations are being planned. The full list is given below.

Albania	Armenia	Argentina	Bangladesh
Benin	Brazil	Bulgaria	Burkina Faso
Burundi	Cambodia	Cameroon	Cape Verde
Central African Republic	Chad	Chile	Colombia
Congo Democratic Republic	Cote D'Ivoire	Croatia	Dominican Republic
Ecuador	El Salvador	Georgia	Ghana
Guatemala	Guinea Bissau	Haiti	Honduras
India	Indonesia	Iraq	Kenya
Lao People's Democratic Republic	Lesotho	Liberia	Macedonia
Madagascar	Malawi	Mali	Mauritius
Mexico	Moldova	Mongolia	Montenegro
Morocco	Mozambique	Namibia	Nepal
Nicaragua	Niger	Pakistan	Panama
Paraguay	Peru	Philippines	Romania
Rwanda	Senegal	Serbia	Sierra Leone
Sudan	Tajikistan	Tanzania	Tonga
Turkey	Tunisia	Uganda	Ukraine
Vietnam	Yemen Republic	Zambia	

2 Module I—Transmission Channels

2.1 Introduction to Module I

The purpose of this module is to identify the main channels through which structural adjustment policies could affect the natural environment and to provide task team leaders preparing DPL operations with a guide to those channels that are likely to be significant.

The pathways by which macroeconomic and sectoral reforms can influence the environment are complex and depend on the existing institutional framework. With appropriate institutions to protect the environment and protect the poor, some of the possible negative consequences can be avoided, whereas in the absence of such institutional support the negative effects can be severe. Of course, the institutional structures in place are not to be judged as black or white. They can be relatively weak or strong, as assessed in the CPIA and as shown in Module II, where the environmental institutional scores for the countries of interest were provided. The degree of transmission of negative impacts will thus be a matter of judgment, depending on the strength of the national institutions. With the right institutional support, it is possible that a number of structural reforms could have benefits for the environment.

The transmission mechanisms linking macroeconomic and sectoral reforms to the environment can be seen in Figure 2, which looks at fiscal reforms at the macro level and agricultural reforms as an example of sectoral policies. The fiscal reforms could reduce resources available for environmental protection. The extent of such a reduction will depend on how well the ministries of environment and natural resources can make a case for their expenditures. The impacts of any reduction will depend on the capacity to enforce environmental laws and regulations and on the extent to which the environmental authorities can rely on other sources of finance, such as charges for environmental services and earmarked taxes on environmental pollution. The final impact will therefore depend very much on the institutional framework, but could include damages to the natural environment and increased risks to human health.

Similarly, in the examples of agricultural policies the impacts are dependent on the institutions in place and their effectiveness, as well as on what complementary policies are introduced to mitigate some of the possible negative social impacts of the policies. For example, the elimination of agricultural subsidies could result in increased rural poverty, which in turn could cause more migration to urban areas, a shift to marginal lands, and deforestation. However, if policies were in place to protect the incomes of those negatively affected, this transmission channel could become insignificant. Likewise, in the case of promotion of agricultural exports there is a risk that the process will result in increased concentration of land in the hands of a few large landowners. If this were to happen, the poor could move to marginal land, causing loss of biodiversity and soil degradation. But whether this happens depends on what policies are in place to protect small farmers. Finally, liberalization in agricultural marketing should lead to improved supplies and incomes for intermediaries. At the farm level, there should be benefits in the form of higher incomes and better land management. But there could also be increased pressure to expand production, which, if not properly regulated, could lead to forest clearance and biodiversity loss.

It is clear from this brief introduction that the transmission channels are dependent on how well environmental resources are managed and on what policies the government introduces to mitigate any negative social and environmental impacts of the reforms. The following sections identify the main reform policies and their possible and likely impacts. A color coding is used: (a) green indicates there could be positive impacts for the environment; (b) blue indicates that the environment should not be affected; (c) yellow indicates there could be negative impacts; and (d) red indicates that negative impacts are very likely. In the case of yellow- or red-colored policies and for some others, some comments are also provided on the impacts and possible mitigation measures.

The policies are divided as follows: 1 through 8 are macroeconomic reforms, and 9 through 19 are sectoral reforms.

1. Ensuring macroeconomic stability
2. Improving the investment climate
3. Improving public financial management
4. Governance reforms
5. Social protection
6. Decentralization
7. Increasing competition and entrenching property rights
8. Modernizing the rural economy
9. Agricultural sector reforms
10, Forestry sector reforms
11. Mining sector reforms
12. Fisheries sector reforms
13. Environmental management reforms
14. Education sector reforms
15. Health sector reforms
16. Infrastructure reforms
17. Energy sector reforms
18. Financial sector reforms
19. Tourism sector reforms

Figure 2. Potential transmission mechanisms from macroeconomic and sectoral policies to the environment

Macroeconomic Reform	Anticipated Response	Social/Institutional Impact	Environmental Linkages
Fiscal Reform Reduce primary spending	Reduction in resources for environmental protection	Depends on: Enforcement capacity Monitoring ability Scope for using MBIs	Effects include: Deforestation Soil contamination Increased risks to human health

Sectoral Reform Linkages	Anticipated Response	Social/Institutional	Environmental Impact
Elimination of Agricultural Subsidies	Decline in domestic production	Increased rural poverty depends on complementary support polices for the poor	Increased urban migration deforestation

Sectoral Reform Linkages	Anticipated Response	Social/Institutional	Environmental Impact
Promotion of Agricultural Exports	Increase in export agriculture	Increased land concentration with larger farms.	Depends on expansion of agricultural frontier. Biodiversity loss Soil degradation

Sectoral Reform Linkages	Anticipated Response	Social/Institutional	Environmental Impact
Liberalization of Agricultural	Rise in market entrants resulting in increased competition	Improved welfare of merchants, large & medium farmers	Depends on agriculture/land policies, soil and water management, soil degradation and biodiversity loss

Source: Adapted from Environmental Impact Assessment for Macroeconomic Reform Programs, WWF, undated.

2.2 Macroeconomic, Fiscal and Public Sector Reforms

Policies considered in this section include those designed to ensure macroeconomic stability, improve the investment climate, improve public financial management, improve governance, provide social protection, promote fiscal decentralization, increase competition and entrench property rights, and modernize the rural economy.

2.2.1 Ensuring macroeconomic stability

The broad objectives are to (a) improve fiscal performance and fiscal sustainability, (b) reduce government debt and improve debt management, and (c) expand and deepen international trade. The specific policies and their impacts are shown in **Table 1.** The following comments should be noted:

a. Positive impacts on the environment are possible with a number of policies. In such cases a proactive environmental approach can enhance these benefits. This applies to tax reform (where there can be some scope for "green" taxation), or reduction of public debt (where there may be potential for a debt for nature swap in some cases). These should be explored where possible.

b. The most risky area is with respect to trade reform. Cases where unsustainable exports of natural resources have resulted from trade liberalization have been documented. An analysis of the potential for such exports should be carried out (see Module 3 for details) and appropriate measures to prevent such exploitation should be introduced.

c. Regional trade agreements can have negative environmental consequences. Major agreements such as NAFTA have been subject to SEAs, which have identified the potentially damaging impacts of such agreements. Where the Bank is supporting regional agreements, it would be wise to have some upstream work that has identified the problem areas.

d. Where environmental budgets are at risk, it is important to make a fair valuation of the expenditures in this area. Ministries of Finance often see the expenditures on the environment as a luxury, which they are not. But the capacity of the environment ministries to make the case can be weak. They may need help to quantify environmental benefits to the economy and people's dependence on environmental goods and services.

e. Tax devolution runs the risk of competition in environmental standards (so regional authorities are lax in imposing environmental standards or levying charges so as to attract investment). This needs to be avoided, if necessary by having national minimum standards.

Table 1. Transmission channels for policies designed to ensure macroeconomic stability

Improve fiscal performance and fiscal sustainability			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Strengthen tax administration	Green	Could be beneficial if it results in better collection or green taxes	
Maintain sound expenditure composition across sectors and improve management of public expenditures	Blue		
Reduce primary spending	Yellow	Could result in cuts to environmental budgets	Environmental Health CPIA
Improve transparency of fiscal accounts and budget execution	Blue		
Reform tax policy to increase revenue base	Green	Could benefit environment if green taxes are included	
Adhere to fiscal discipline, meet targets, and ensure priority spending	Blue		
Make tax system more equitable, transparent, and stable	Blue		
Reduce tax-based expenditures	Yellow	Could result in cuts to environmental budgets	Environmental Health CPIA
Use budget management and fiscal rules to ensure budget envelope and ensure allocations to line ministries are in accord with preset ceilings	Blue		
Set a fiscal framework, identifying priority spending	Blue	Important to develop capability to show benefits of environment-related spending	
Encourage increased and more predictable revenues through improved compliance, broader tax base, and reduction in tax rates to improve investment	Blue	Broader tax base could include taxes on environmental "bads," which would benefit environment	
Create an operational fiscal policy office with capability and access to information sufficient to provide analysis of proposed tax, tariff, and financial market policies	Blue		
Strengthen fiscal devolution	Yellow	Danger of tax competition resulting in a "race to the bottom"	Environmental Health CPIA
Strengthen budget reporting and planning	Blue		
Increase equity in intergovernmental transfers	Green	Needs of regions should include funds to protect environmental resources	
Improve efficiency and impact of public spending on national, subnational, and sectoral levels	Green	Impacts should include environmental impacts	

Table 1. Transmission channels for policies designed to ensure macroeconomic stability (continued)

Improve fiscal performance and fiscal sustainability (continued)

Policy Action	Impact	Comment	Relative indicators (Module II)
Improve budget execution and financial reporting	Blue		
Improve treasury operations	Blue		

Reduction of government debt/ improve debt management

Policy Action	Impact	Comment	Relative indicators (Module II)
Simplify expenditure management and make it transparent	Blue		
Strengthen public expenditure management	Blue		
Strengthen legislative oversight on public finances	Blue		
Phase out direct and indirect subsidies to state-owned enterprises	Blue	Ensure this does not become an excuse for not meeting environmental regulations	
Implement a medium-term expenditure (MTEF) to have greater visibility of policies and place budgetary allocations in a medium-term framework	Blue		
Reallocate inefficient spending	Blue		
Reduction of public debt	Green	Debt for nature swaps could benefit environment; also some evidence that lower debt means less unsustainable natural resource exploitation	
Assessment of civil service pension liabilities and possibilities for reform	Blue		
Develop and implement a debt management strategy	Blue		
Improve debt management	Blue		
Reducing subsidies to the non-poor	Green	Often these subsidies are environmentally harmful (e.g. transport, agriculture)	
Make tax revenue administration more efficient	Blue		

Expand and deepen international trade			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Trade policy reforms; liberalization of trade regime, tariff, and nontariff regulations	Red	Risks of increased exports of natural resources in an unsustainable way if appropriate protection polices for these resources are not in place	Natural resources degradation Deforestation Air quality Terrestrial Biodiversity
Expand market access for domestic exports	Red		Natural resources degradation Air quality Deforestation Terrestrial Biodiversity
Implement complementary measures to facilitate trade and customs clearance	Blue		
Implementation of regional trade agreements	Yellow	May affect the poor, may lead to increased environmental degradation.; SEA for such policies should be carried out.	Natural resources degradation
Ensure compliance with international conventions and property rights	Blue		
Reform to promote foreign direct investment	Blue	FDI should abide by good environmental practices	

2.2.2 Improving the investment climate

The broad objectives here are to improve investment procedures, promote privatization reform and liquidation of state-owned enterprises, promote private sector development, and facilitate trade. The specific policies and their impacts are given in **Table 2**. The following comments should be noted:

a. There have been problems with the speeding up of business start-up times and licensing procedures. Where the primary investment sectors and/or operations are likely to have major environmental impacts, it is not appropriate to require these to be done hastily. This applies especially to areas such as mining and forestry. Proper procedures in these sectors will take time (as they do in industrialized countries) and the Bank should not press countries to meet shorter processing times in such cases.

b. The promotion of FDI should also not be at the expense of good environmental practices. The evidence suggests that a lot of FDI does meet national standards, and sometimes even higher standards. But this is not always the case. For example if a major job creation investment is at stake, there is an incentive for national authorities to accept lower performance standards or turn a blind eye to their not being met. The Bank should not be seen as supporting or condoning such practices.

c. Privatization can be beneficial to the environment, since it is often state industries that are the least compliant with environmental standards. However, the new, more private-sector-oriented industrial structure will need a larger and a different regulatory capacity with regard to the environment. The macro reform program should therefore be complemented with an environmental support program, as has been the case in a number of countries.

d. Policies that support international norms and conventions should be environmentally beneficial. It is important to include such conventions when designing a support program.

e. Policies to strengthen small businesses should include measures to help them be more energy efficient and better managers of their waste and environmental impacts.

f. The Bank should pursue possibilities to introduce macroeconomic reforms that link with specific reforms in a sector that could enhance the positive outcomes.

Table 2. Transmission channels for policies designed to improve the investment climate

Improve investment procedures			
Policy Action	Impact	Comment	Relative indicators (Module II)
Reduce uncertainty for investors by implementing the investment law and its supporting regulations and new operating procedures	Yellow	It is important to ensure that the supporting regulations include good environmental practice	Environmental Heath
Reduction in business start-up time by simplifying or eliminating unnecessary business licenses, procedures, and multiple registration requirements	Yellow	This should not be done at the expense of proper environmental due diligence	Environmental Heath
Facilitate doing business by streamlining registration procedures	Blue		
Establish one-stop center for business registration	Blue		
Ease entry of foreign professionals and skilled workers	Blue		
Strengthen arrangements for public-private partnerships	Yellow	The inclusion of private partners should not be an excuse for lowering environmental standards	Environmental Heath
Strengthen banking system	Blue		
Strengthen non-bank financial sector regulation and supervision to minimize chances of crisis	Blue		
Reforms to promote Foreign Direct Investment	Blue	Promoting FDI is a good policy as long as it is not done by lowering environmental standards	
Speeding up licensing of complex operations such as forest concession, power plants, pulp mills, etc.	Yellow	This can often mean that due diligence on environmental issues, which takes time, is not practiced; this has to be avoided	Environmental Heath Natural resources degradation
Improve access to international capital markets	Blue		
Establish a national investment program	Blue	The program should meet environmental standards	
Issuance of international bonds	Blue		

Privatization, reform and liquidation of state-owned enterprises

Policy Action	Impact	Comment	Relative indicators (Module II)
Sell or cancel state's minority shares in enterprises	Green	Often the state enterprises are the least compliant, but enforcement capacity may need to increase to handle the privatized industries	
Sell or liquidate companies with majority state ownership	Blue		
Sell state shares in shipyards	Yellow		Environmental health
Sell or liquidate agro-kombinants	Green		
Promote public-private partnerships in providing infrastructure facilities	Yellow	The inclusion of private partners should not be an excuse for lowering environmental standards	Environmental health
Reduce state subsidies to enterprises	Yellow	This should not result in non-payment of environmental fees	Environmental health
Contain enterprise arrears	Yellow		Environmental health
Privatization, restructuring, and bankruptcy of state enterprises	Yellow	Often the state enterprises are the least compliant, but enforcement capacity may need to be increased to ensure compliance by the privatized industries	

Reforms for private sector development

Policy Action	Impact	Comment	Relative indicators (Module II)
Reduce cost of factors like electricity, telephone, water, transportation	Yellow	It is important that the costs of these services should still cover full costs of provision, including environmental costs	Pressure on water resources Environmental health
Facilitate transit of import goods	Yellow	Ensure that international norms on hazardous goods are complied with (e.g. Basel Convention)	Environmental health
Lower administrative barriers for private investors	Yellow	This should not be done by making environmental requirements unduly lax	Environmental health
Liberalize permitting and licensing rule	Yellow		Environmental health
Improve the rule of law for the private sector	Green	It should include a fair and able implementation of laws relating to environmental infractions	
Liberalization of labor laws—less intervention by the state	Blue		
Improve and monitor business regulatory environment	Yellow	Improvement should not mean bypassing necessary environmental regulations	Environmental health Natural resources degradation
Improve functioning of land markets	Blue		
Increase private sector access to finance	Blue		

Table 2. Transmission channels for policies designed to improve the investment climate (continued)

Reforms for private sector development (continued)			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Improve functioning of labor markets through development of flexible labor and employment laws	Blue		
Create enabling environment for foreign direct investment	Yellow	Promoting FDI should not lead to lowering environmental standards	Environmental health Natural resources degradation
Enforcement of standards for goods exported, especially WTO standards for food products	Green	This should help raise environmental standards generally	
Strengthen small business	Green	Emphasis on capacity of small business to manage waste efficiently	
Promote export of handicrafts by revising laws and tax (expertise tax) schemes	Blue	Ensure that raw materials for handicrafts are sustainably exploited	

Trade facilitation			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Improve governance procedures and promotion of e-government	Blue		
Ensure compliance with international conventions and property rights	Green	Also include here possible environmental conventions (e.g. trade in endangered species)	
Simplification of customs regulations, computerization of customs procedures	Green		
Enhance team tariff through improved governance procedures, better information technology solutions, and research capability	Blue		

2.2.3. Improving public financial management

The broad objectives here are to strengthen budgeting and financial management, improve procurement, and initiate civil service reform. The specific policies and their impacts are described in **Table 3**. The following comments should be noted:

In improving control of government revenues the Bank and the Fund look to establish a consolidated set of budgetary accounts. This includes revenues from taxes that are earmarked. Sometimes the Bretton Woods institutions also ask for the taxes not to be earmarked. For the environment, however, some earmarked taxes can be justified. Where this is the

case they should be allowed to remain as such, although the consolidation can still continue.

A number of countries operate with environmental funds. Some of these have played an important role in financing environmental investments. Where the Bank engages in strengthening non-bank financial institutions it should look to ensure that these institutions are also operating under 'good practice' rules (e.g. as under the "St. Petersburg Principles" as set out by the OECD[5]).

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5   OECD (Organisation for Economic Co-operation and Development). 1995. "The St. Petersburgh Guidelines on Environmental Funds in the Transition to a Market Economy." Paris: OECD/GD(95) 108.

Table 3. Transmission channels for policies designed to improve public financial management

Strengthen budgeting and financial management			
Policy Action	Impact	Comment	Relative indicators (Module II)
Improve budgeting through future expenditure framework with a system of clear forward estimates	Blue		
Improve controls and efficiency in treasury management by consolidating revenue and expenditure accounts	Yellow	Regarding earmarked taxes, in some cases such taxes may be justified, but revenues from them should still be included in the consolidated budget	Environmental health
Increase accountability and transparency in government financial management	Blue		
Improve the stability of the financial sector by implementing good corporate governance and risk management standards, particularly in state-owned banks	Yellow	Banks should be encouraged to require good environmental standards when making loans, as is the practice in industrialized countries; they should be encouraged to adopt the environmentally relevant principles derived from the Equator Principles	Environmental health Natural resources degradation

Table 3. Transmission channels for policies designed to improve public financial management (continued)

Strengthen budgeting and financial management (continued)

Policy Action	Impact	Comment	Relative indicators (Module II)
Commercialization and transparency of commercial banks	Blue		
Strengthen non-bank financial institutions to develop a diversified financial sector	Green	Some countries have specialized environmental funds (e.g. transition economies, China); these institutions should operate under good banking practices, and the Bank should help them when it is involved in strengthening non-bank financial institutions	

Improve procurement

Policy Action	Impact	Comment	Relative indicators (Module II)
Implement transparent procurement processes and better procurement outcomes	Blue		
Enhance efficiency of procurement, e-procurement	Blue		
Legal, regulatory, and institutional framework in public procurement that complies with international standards	Blue		
Public procurement reforms to increase transparency	Blue		
Initiate civil service reform	Blue		

Pension reforms

Policy Action	Impact	Comment	Relative indicators (Module II)
Establish independent salary commission that can propose new pay designs for higher level state officials	Blue		
Civil service reform to include a framework for training, payroll verification, pay and grading policy	Blue		
Set up functional human resource management office	Blue		
Capacity of civil service to ensure skills base and address issues of retention and sustainability	Blue		
Efficient, transparent, and fair policies regarding personnel	Blue		

2.2.4. Governance reforms

The broad objectives here are to improve public administration, raise fiduciary standards, and implement judiciary and civil service reforms. The specific policies and their impacts are given in Table 4. There are no cases in this subgroup where concerns are raised about the environment. In general, policies that reduce corruption and make the judiciary and civil service more accountable and transparent should help ensure that environmental laws are respected. The component dealing with raising awareness of citizens' rights should also include a program of environmental awareness and freedom of access to information on the environment. These have been important drivers of environmental reforms in many industrialized countries and economies in transition, as well as some developing economies.

Table 4. Transmission channels for policies designed to improve governance

Improve public administration		
Policy Action	**Impact**	**Comment**
Institution building at the public administration sector to improve financial management, personnel management, and economic decision making	Blue	
Raise awareness of citizens about rights, the rule of law, and corruption	Green	It is important to raise awareness of environmental rights in the public as part of such a program
Improve performance through introduction of internal auditing, evaluation, and performance review	Blue	
Improve performance of civil service through incentives	Blue	

Better fiduciary standards and public expenditure management		
Policy Action	**Impact**	**Comment**
Transparency and accountability in treasury cash management	Blue	
Regulations to prevent money laundering activities	Blue	
Strengthen Accountant General's department	Blue	
Set up public accounts committee and records management	Blue	
Strengthen internal and external audit	Blue	
Transparency and equity in decentralized resource allocation	Yellow	Equity in resource allocation should take account of environmental obligations in different regions
Improve accountability and transparency of government financing	Blue	

Table 4. Transmission channels for policies designed to improve governance (continued)

Judiciary reforms

Policy Action	Impact	Comment
Improve transparency and efficiency of judiciary	Green	Should also help ensure environmental compliance
Improve financial situation of the judiciary sector and sustain the allocation	Blue	
Strengthen institutional capacity, promote broader civil society participation, and provide judicial services in courts that are more transparent, fair, equitable, and accessible	Green	Should help to ensure environmental compliance as well
Prepare and implement action plans to fight corruption and money laundering	Blue	
Strengthen institutional capacity of the Ministry of Justice	Blue	Should help ensure environmental compliance as well
Setting up anticorruption commissions/committees	Blue	
Regulatory and institutional mechanisms to fight corruption	Blue	Should help ensure environmental compliance as well

Civil Service reforms

Policy Action	Impact	Comment
Rationalize employment in the public sector	Blue	
Reduce deficits in the pension system and move the system toward fiscal sustainability	Blue	
Create a lean, effective, and efficient civil service free of corruption	Green	Should help ensure environmental compliance as well
Development of a human resource management system	Blue	
Promote gender equality in civil service	Blue	
Improve human resource management in the public sector	Blue	
Early retirement options, redeployment of staff, stabilization of civil service staff	Blue	

2.2.5 Social Protection

The broad objectives here are to target policies for the poor, implement pension reforms, and bring in policies to encourage growth and development of small and medium enterprises. The specific policies and their impacts are given in Table 5.

In general, measures that directly act to reduce poverty should benefit the environment. There are some cases, however, where the measures may need to be looked at carefully; for example, removal of some subsidies to the poor, where these subsidies provide an incentive not to

overexploit the natural resource base. In other cases, the programs would benefit from explicitly taking account of the relationship between the poor and their use of natural resources. For example, decentralization of poverty reduction programs should take greater account of different dependencies on the natural resources in different regions and in rural versus urban environments. In supporting small and medium enterprises (SME), attention should be paid to issues of energy efficiency and waste management. Finally where support is provided for handicrafts, it is important to ensure that the raw materials are sustainably accessed.

Table 5. Transmission channels for policies designed to target polices for the poor

Target policies for the poor			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Replace consumer subsidies with targeted programs for poor, cash transfers, etc.	Yellow	Some subsidies—such as for kerosene—can be beneficial to the environment; in removing these, account should be taken of possible environmental impacts	Environmental health Urban air quality Deforestation
Improve monitoring and analysis of information on poverty and social well-being	Green	Including use of natural resources by the poor	
Encourage participation of stakeholders in poverty reduction programs	Green		
Decentralization of poverty reduction programs	Green	Should take account of dependence of the poor on the natural resource base	
Social security and universal health insurance reform	Blue		
Improve poverty orientation of public spending	Blue		
Pension reforms	Blue		
Increase pensions, pay pensions on time, and improve pension administration	Blue		
Reform pension schemes to reduce the state expenditure	Blue		
Policies to encourage growth and development of small and medium enterprises			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Provide access to credit, technical assistance, and capacity building to these enterprises	Green	Include their capacity to manage waste efficiently	
Promote the handicrafts industry, reduce the skill tax	Blue	Ensure that raw materials for handicrafts are sustainably exploited	

2.2.6 Decentralization

The broad objectives here are to promote fiscal decentralization and to strengthen the capacity of communities to deliver public services. The specific policies and their impacts are given in Table 6.

It is frequently the experience that local authorities are less equipped and less qualified in managing environmental resources than central governments. Any program of decentralization must therefore take account of the need to build capacity at that level. This applies especially to EIA procedures, which are part of the issuance of permits for land use, including industrial plants, roads, energy sources, and mining rights. Without adequate capacity, there is a serious risk that damage will be done to the environment.

As noted earlier, it is also important to ensure that competition to attract investment does not result in a lowering of overall environmental standards.

Table 6. Transmission channels for policies designed to promote decentralization

Promote fiscal decentralization			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Improve resource allocation to the local levels, including communities, and strengthen intergovernmental fiscal relations	Yellow	It is important to take account of capacity in the regions and communities to manage complex environmental management programs, including issuance of permits for development in environmentally sensitive areas	CPIA
Strengthen capacity of communes to deliver public services			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Improve decentralization by issuing ministerial decrees for blue-book and on-granting procedures and improve the framework for sub-national government bond issuance and work-out procedures	Blue		
Provide leadership, policy, and regulatory frameworks	Blue		
Adequate and timely resources for local institutions and capacity building	Yellow	The resources and capacity needs should take account of the management of the environment as well	CPIA

2.2.7 Increasing competition and entrenching property rights

The broad objectives here are to liberalize the provision of key services, entrench property rights and secured transactions, and reform state-owned utilities. The specific policies and their impacts are shown in Table 7.

There are two key environmental issues here. First, privatization of existing services is best carried out with a prior environmental audit establishing the extent of past damage and liability for that damage. It has been shown that privatization is more effective and privatization proceeds are higher with such a prior audit than they are without it. Second, as noted earlier, as the economy moves towards private ownership of, or participation in, key industries such as transport, water and energy, the modes of environmental regulation will change, with more reliance on fiscal instruments and less on direct controls. In view of that, the Bank should support a program to strengthen and adapt the environment regulatory framework, ideally before it launches the privatization drive.

Table 7. Transmission channels for policies designed to increase competition and entrench property rights

Liberalization of key services			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Liberalization of railway services	Yellow	In bringing in the private sector it is important to carry out environmental audits and establish environmental liability for past operations, as well as to strengthen and adapt the management of the environment in the light of these changes	Environmental health
Liberalization of civil aviation services	Yellow		Environmental health
Liberalization of telecommunication services	Blue		
Entrenching property rights and secured transactions			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Strengthen creditor rights	Blue		
Strengthen civil procedures for debt recovery	Blue		
Simplify procedure for property transactions	Blue		
Reform of state-owned utilities			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Privatization of state-owned utilities	Yellow	In bringing in the private sector it is important to carry out environmental audits and establish environmental liability for past operations, as well as to strengthen and adapt the management of the environment in the light f these changes	Environmental health
Encourage private sector participation	Yellow		

2.2.8 Modernizing the rural economy

The broad objective here is to stimulate farm incomes. The specific policies and their impacts are shown in **Table 8**.

The environmental implications of these reforms should be positive. However, one should ensure that agricultural research and development programs are conscious of the environmental constraints and challenges that farmers face and that solutions are designed with a view to ensuring a sustainable agricultural sector. This should not be in conflict with the goal of increasing farm incomes; indeed, the two should be complementary.

Table 8. Transmission channels for policies designed to modernize the rural economy

Stimulate farm incomes		
Policy Action	**Impact**	**Comment**
Strengthen agricultural research and development	Green	Ensure focus is on sustainable, environment friendly agriculture
Strengthen agricultural extension services	Green	
Provision of private extension advisory services	Blue	
Provide stimulus to agricultural research	Green	

2.3 Sectoral Reforms

Sectoral reforms generally accompany investment programs in the relevant sectors. The policies supporting the investments, however, need to be mindful of possible environmental impacts. The following are the key transmission channels:

a. In agriculture there is a serious risk of deforestation and cultivation of land that is better not cultivated as a result of policies that increase the profitability of some crops. Measures need to be in place to prevent such impacts.

b. Many sectoral reforms offer a real opportunity to promote sustainable development and improve the environment. These should be taken wherever possible. Areas include building sustainability considerations into policies for sectors such as forestry, fisheries, energy, and tourism. A tool to ensure that environmental issues are taken into account at the strategic level is the Strategic Environmental Assessment. Greater use should be made of this in deciding options in the infrastructure, energy, tourism, and other environmentally sensitive sectors.

c. Promoting privatization and protecting the environment are not mutually exclusive; indeed, private sector development can help improve the environment. But it does mean a different system of regulation and the greater use of indirect methods of control, often based on market-based incentives. These should be developed in parallel with sectoral reforms.

d. Task managers are already mindful of the need to ensure that reforms do not cause hardship to the poor sectors of society. This is also important from an environmental point of view. If people are unable to access resources they were previously using in a relatively benign way, they may turn to activities that further damage the environment. Social protection programs need to be aware of these possibilities and be designed to avoid them.

2.3.1 Agriculture

The broad objectives are to (a) increase production and productivity and (b) increase competitiveness in specific commodities. The specific policies and their impacts are shown in **Table 9**.

Because of its close links to natural resources, agriculture is a particularly vulnerable sector where policy reforms with sound macroeconomic intentions can spill over into impacts on the natural environment.

It has been noted that some reforms may lead to expansion of agriculture to areas that were previously forestland or marginal land unsuitable for cultivation. Figure 3 shows some of the factors that are most likely to interact with a policy change. The extent of such agricultural expansion depends on the institutional arrangements for the protection of such lands. In other cases, reforms need to be accompanied by measures to ensure that environmental standards and requirements for good practice are respected. In the absence of such complementary policies, even the best-designed reforms can have negative environmental consequences.

Figure 3. Possible linkages between DPL policies, expansion of agriculture, and deforestation.

Table 9. Transmission channels for policies designed to increase production and competitiveness in agriculture

Increase production and productivity			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Improve access to markets (trade liberalization)	Red	Chance for extension of cultivation to marginal lands and deforestation as a result of reforms	Deforestation Air quality Terrestrial systems under threat Land degradation
Promote agronomic research	Blue		
Support for infrastructure and equipment	Yellow	Ensure environmental regulations are respected	Environmental health
Strengthen performance and productivity of the irrigation sector	Green	Scope for environmental improvements if this dimension is addressed specifically	
Increase access to micro finance	Yellow	Ensure rules and procedures for rural credit do not permit increased environmental degradation	Environmental health
Reform of land tenure laws and land acts	Yellow	Ensure it does not increase population without access to land	Deforestation Air quality Terrestrial systems under threat.
Improve rural roads	Yellow	Beneficial, but opening up of hitherto closed areas can result in deforestation	Deforestation Air quality Terrestrial systems under threat.
Product price and input price reforms	Yellow	Such reforms can increase production of some crops and increase use of inputs that are environmentally damaging; care needs to be taken to ensure this does not happen	Deforestation Air quality Terrestrial systems under threat
Maintenance and expansion of irrigation	Yellow	Beneficial if expansion does not lead to overuse, waterlogging and salinity from overexploitation of water sources	Environmental health Pressure on water resources

Increase competitiveness in specific commodities (Coffee, tea, cotton, etc.)			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Provide better incentives and institutional arrangements to farmers to increase returns	Yellow	Increased returns should not lead to adoption of environmentally damaging practices	Deforestation Air quality Terrestrial systems under threat
Improve marketing arrangements for improved seeds and fertilizers	Yellow	Should be adapted to local conditions and accompanied by training in application methods to avoid excessive runoff	Environmental health Natural resource degradation
Improved processing facilities	Yellow	Ensure environmental standards are respected	Environmental health Natural resource degradation
Reform of sector boards	Blue		
Improve trade and marketing of agro-processed products	Red	Need to ensure that this does not lead to expanded production that is environmentally damaging	Deforestation Air quality Terrestrial systems under threat
Implementation of producer price setting mechanism	Blue		
Privatization of processing facilities (e.g. cotton ginning, coffee processing)	Yellow	Ensure that private sector complies with environmental regulations	Environmental health

2.3.2 Forestry

The broad objectives are to move to the sustainable management of forest resources, improve management of production forests, and increase conservation of biodiversity. The specific policies and their impacts are shown in Table 10.

As in the case of agriculture, forest sector reforms are closely tied to the environment. In this case the prospects of positive environmental impacts are greater, since sustainability considerations are now better integrated into many forest policies at the Bank. Areas where care is needed are in the streamlining of EI (where speed is not always desirable); and in promoting forest production, where conservation of some forest areas should not be compromised. There are also potential benefits to the environment from reforms relating to better forest management, sustainable logging, and sustainable exploitation of other forest products.

Table 10. Transmission channels for policies designed to develop the forest sector

Sustainable management of forest resources			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Implementation and compliance with forestry code	Green	Code should include environmental considerations	
Encourage domestic processing of logs	Yellow	Take account of sustainability requirements	Deforestation Urban air quality
Community engagement in forestry sector	Green		
Implement forest sector monitoring	Green		
Streamline environmental and forest impact assessment	Yellow	Streamlining should not be equated with speeding up impact assessment processes that need time to be carried out	Deforestation
Transparency in allocation of forest permits	Green		
Sustainable forest management plans and timely delivery of services to the private sector	Green	Should result in more environmentally friendly management	
Effective enforcement of forest fiscal regime, such as effective collection of forest taxes	Green	If earmarked, finance can improve enforcement	
Recruitment of internationally reputed observer to monitor logging activities	Green	Should help with compliance and enforcement	
Decentralization, passing a share of forest revenues to local governments	Green		
Setting up national forest observatory with GIS capabilities to track timber flows and payment of related fees	Green	This can also assist in policing illegal logging	
Capacity building for forest institutions	Green		
	Green		
Reform forestry fund with private sector and local government participation	Green		

Management of production forests

Policy Action	Impact	Comment	Relative Indicators (Module II)
Complete forest estate zoning plan	Green	Plan should include environmental considerations Afforestation may benefit from carbon capture benefits	
Implement forest management policies and plans for production forests	Green	Benefits in the form of carbon sequestration should be taken into account	
Promote efficiency and value-added in timber product processing and reduce wastage	Yellow	Protection of protected forests should not be compromised	Deforestation
Ensure control of forest production, field applications, and enforcement and application of penalties	Green		
Establish a price for non-timber forest products	Yellow	Can improve sustainable use, but sustainability has to be managed	Natural resource degradation Deforestation
Continue the plantation development program	Green	Can be environmentally beneficial	
Encourage competitive bidding of logging permits for natural and planted timber	Yellow	Permits should not be given in environmentally sensitive areas	Natural resource degradation Deforestation
Develop a framework for effective log tracking system	Green	Should improve sustainable forestry.	
Enactment of sustainable forestry law	Green		
Improve livelihood of natural resource owners through appropriate valuation of forest resources	Yellow	Can improve sustainable use but sustainability has to be managed	Natural resource degradation Deforestation

Biodiversity Conservation

Policy Action	Impact	Comment	Relative Indicators (Module II)
Strengthen institutions for management and administration of parks, protected areas, and wildlife	Green	Ensure adequate resources for management, including through payments for ecological services, ecotourism, etc.	
Local community participation in administration of protected and sensitive areas	Green	Helps to ensure less conflict in management	
Systematic application of environmental impact assessment	Green		
Implementation of socioeconomic mitigation plans and resettlement of indigenous people	Green		
Measures to exempt nationally protected areas from logging, industrial mining, fishing, or any activity that threatens biodiversity	Green		

2.3.3 Mining

The broad objective is to develop the mining sector as a source of growth. The specific policies and their impacts are shown in Table 11.

The mining sector has major environmental impacts that need to be respected in any programs that expand the sector (Figure 4). The risks of regional authorities turning a blind eye to such concerns so as to attract private investors have to be addressed. Similar concerns apply for different reasons in the case of artisanal mines.

Figure 4. Range of possible impacts from mining operations and products
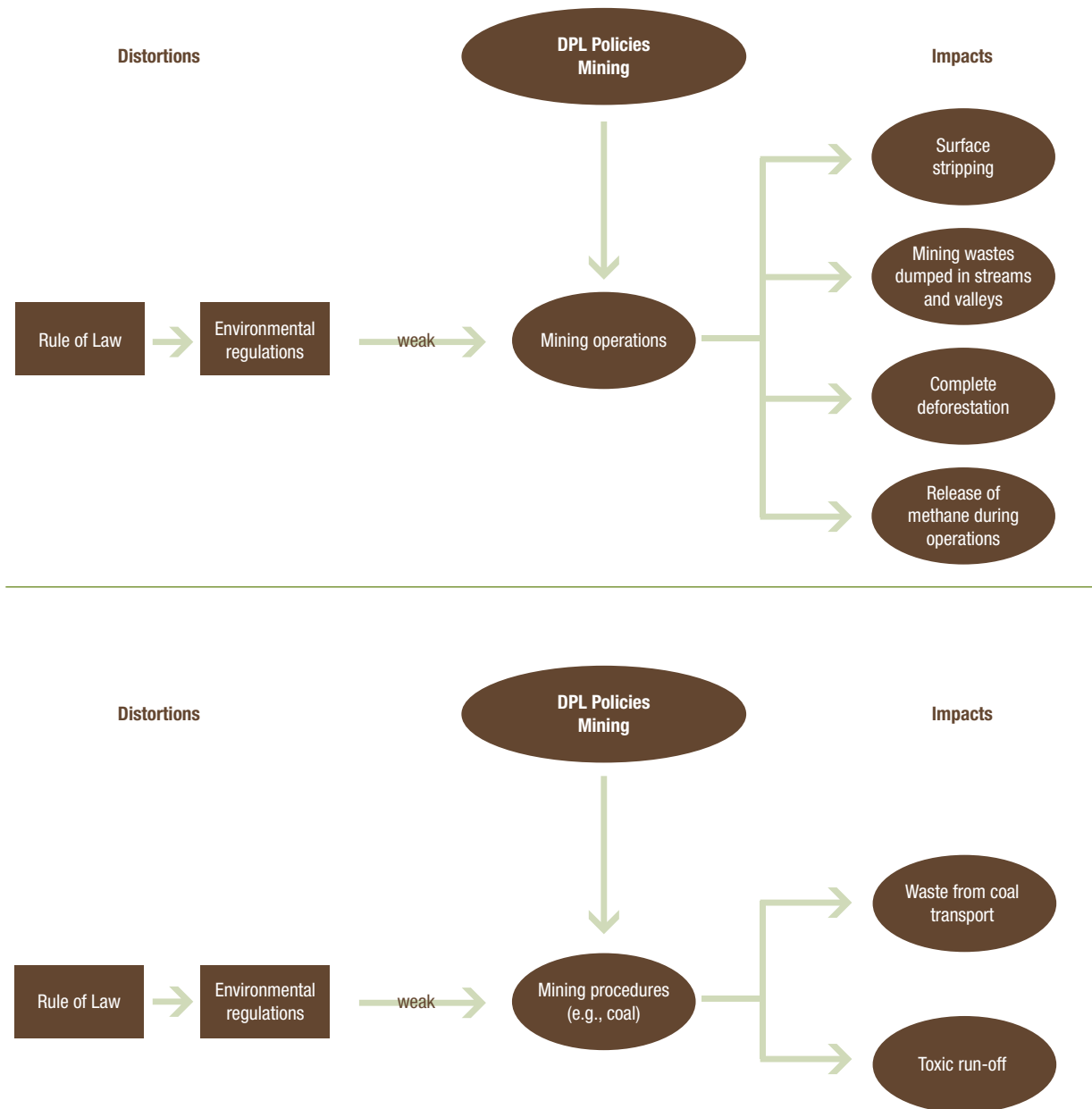
Table 11. Transmission channels for policies designed to develop the mining sector

Develop the mining sector as a source of growth			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Reform the legal, regulatory, and institutional settings in the mining sector	Yellow	Both policy actions can facilitate better environmental management, but that dimension needs to be addressed explicitly	CPIA
Improve governance and transparency	Yellow		CPIA
Improve private sector investment in the mining sector	Yellow	There has to be an adequate framework to ensure environmental regulations are respected and that the capacity to enforce the regulations are in place in a privatized setting	CPIA
Expand administration of all mining licenses through cadastral system	Blue		
Improvements in the level and quality of mining extension services	Blue		
Improve competition in the mining sector	Blue		
Update regulatory and legislative framework to bring governance and institutional standards to international levels	Green		
Design a mechanism to share mining revenues with local communities	Blue		
Capacity building in the mining sector	Green	Include capacity in the environmental sphere	
Setting up environmental management policies and guidelines for social and environmental impact assessment	Green	Ensure capacity to carry out the assessments	
Introduce better practices for improved work and living conditions in artisanal mine sites	Green	This is a potentially difficult area for environmental regulation and resources; also should ensure that the mining is not damaging to the environment	
Improve economic efficiency and transparency of the sector	Blue		
Restructuring of mining right titling system	Blue		
Strengthen environmental and forest impact assessment of mining	Green		

2.3.4 Fisheries

The broad objective is sustainable development of the fisheries sector. The specific policies and their impacts are shown in **Table 12**.

The high level of awareness of the risks of overfishing means that policies deigned to promote this sector are sensitive to this factor. The danger of promoting industrial fisheries is the impact it can have on small-scale fishers, who in turn can damage their environment as they seek alternative sources of livelihood.

Table 12. Transmission channels for policies designed to develop the fisheries sector

Develop the fishery sector			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Establishing rules of a geo-positioning system to monitor industrial fishing	Green	Can help monitor compliance	
Implement transparency in industrial fishing activities	Blue		
Comprehensive socioeconomic and environmental review of the industrial fishing sector	Yellow	This should look at the impacts on small/artisanal fishers and in turn on the environmental impacts of their activities as well as on the extent of overfishing	
Design and enforce conservation measures to protect and or restore fish populations in overexploited or fragile marine areas	Green		

2.3.5 Environmental Management

The broad objective is to improve efficiency and effectiveness of environmental management. The specific policies and their impacts are given in **Table 13**.

Reforms in this area are of course beneficial to the environment. The main risks are (a) overestimation of local capacity to handle complex management systems, and (b) promotion of decentralization in environmental management, which may create the incentives for a "race to the bottom."

Table 13. Transmission channels for policies designed to improve efficiency and effectiveness of environmental management

Improve efficiency and effectiveness of environmental management			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Ensure adequate financing for building capacity and investments for environmental management	Green		
Adoption of environmental impact mitigation plans	Green		
Pass laws and decrees on environmental regulation and monitoring	Green	These should be sensitive to local needs and capacities	
Streamline Environmental and Forest Impact Assessment	Green		
Decentralization of environmental management instruments and plans	Yellow	Can be problematic if local/regional authorities do not have capacity; can also create a "race to the bottom," with authorities vying with each other to attract investment	CPIA
Promote transparency and public participation in environmental management	Green		
Develop fiscal instruments to promote environmental management and allocate more funds to promote sustainability	Green	Management of the funds in an efficient and transparent manner is important (see section 2.3)	
Promote decentralization and role of communities in environmental management	Green	This can be problematic if local/regional authorities do not have capacity; can also create a "race to the bottom," with authorities vying with each other to attract investment	

2.3.6 Education

The broad objectives are to improve the financing and fiduciary environment for education, improve sector governance, promote equitable access to education and improve quality, and improve the quality of education. The specific policies and their impacts are shown in **Table 14**.

This sector does not have strong links to the environment. One issue, which perhaps is worth considering, is to promote environmental awareness in school curricula.

Table 14. Transmission channels for policies designed to improve financing and fiduciary environment for education and improve sector governance

Improve financing and fiduciary environment for education		
Policy Action	**Impact**	**Comment**
Fiscal framework and increased sector financing	Blue	
Facilitate transfer of resources to districts to meet the needs of education service delivery	Blue	
Increase transparency of financial management process and strengthen capacity of provincial and district capacity for monitoring flows	Blue	
Improve transparency in procurement procedures and practices	Blue	
Improve efficiency of education expenditure	Blue	

Improve sector governance		
Policy Action	**Impact**	**Comment**
Enhance monitoring of school performance by communities	Blue	
Strengthen monitoring and evaluation	Blue	
Improve teacher management	Blue	
Revitalize parent teacher associations	Blue	
Develop an education management information system	Blue	
Promote community oversight of educational programs	Blue	Include environmental awareness in such programs

Promote equitable access to education and improve quality		
Policy Action	**Impact**	**Comment**
Reduce drop-out rates, especially at lower levels	Blue	
Ensure equitable access to education at all levels	Blue	
Encourage participation of the private sector	Blue	
Promote equal access to boys and girls	Blue	
Target poor and marginalized areas with the weakest education indicators	Blue	
Reduce regional disparities	Blue	

Improve quality of education		
Policy Action	**Impact**	**Comment**
Improve teaching practices with focus on schools and student outcomes	Blue	
Reduce repetition rates and increase completion rates	Blue	
Reinforce capacity of existing academic structures and administration	Blue	
Raise awareness of parents	Blue	
Increase accountability of schools to both government and community	Blue	
Improve teacher quality via emphasis on teacher recruiting and training	Blue	
Reduce corruption and misuse of public resources	Blue	

2.3.7 Health

The broad objectives are to improve financing and the fiduciary environment, and to better target healthcare to the poor. The specific policies and their impacts are shown in **Table 15**.

In the health sector the main issue is to ensure that environment-related interventions are given a fair consideration for resources relative to interventions arising from malnutrition at one end and lifestyle choices at the other. Measures of the cost per DALY can show improvements in water supply, sanitation and reductions in some forms of air pollution to be more cost effective than some of the more conventional medical interventions.

Table 15. Transmission channels for policies designed to improve financing and fiduciary environment for health and better target healthcare for the poor

Improve financing and fiduciary environment for health			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Increase and sustain government spending to healthcare	Blue		
Increase allocative and technical efficiency of healthcare spending	Yellow	It may be that some health interventions are much more costly in terms of life years saved than some environmental interventions; an assessment of these alternatives can help in the allocation of resources between environmental health programs and others	Environmental health
Decentralization of delivery and public oversight	Blue		
Improve monitoring and evaluation	Blue		

Table 15. Transmission channels for policies designed to improve financing and fiduciary environment for health and better target healthcare for the poor (continued)

Targeting healthcare to the poor			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Increase access to affordable healthcare	Blue		
Improve quality and equity	Blue		
Decentralize health services, primary- and secondary-level services	Blue		
Planning, budgeting at the central, state, regional, district, and peripheral levels	Blue		
Strengthen partnership with private and NGO sectors	Blue		

2.3.8 Infrastructure

The broad objectives are to implement general transport sector reforms, urban sector reforms, development of ports, water sector reforms, liberalization of the telecom sector, and urban sector reforms. The specific policies and their impacts are shown in **Table 16**.

Reforms relating to infrastructure often involve policies to accompany the upgrading of systems for the delivery of services. The environmental implications of these policies are central to the decisions regarding which infrastructure is developed. Figure 5 focuses on the coastal impacts of infrastructure development. A central role should be given to SEAs that analyze the different alternatives. This would include estimates of the environmental impacts of different options. Environmental issues also arise with respect to the affordability of upgraded systems to the public and to ensure compliance with environmental regulations in any move to engage the private sector.

Figure 5. Environmental impacts of infrastructure development in coastal areas
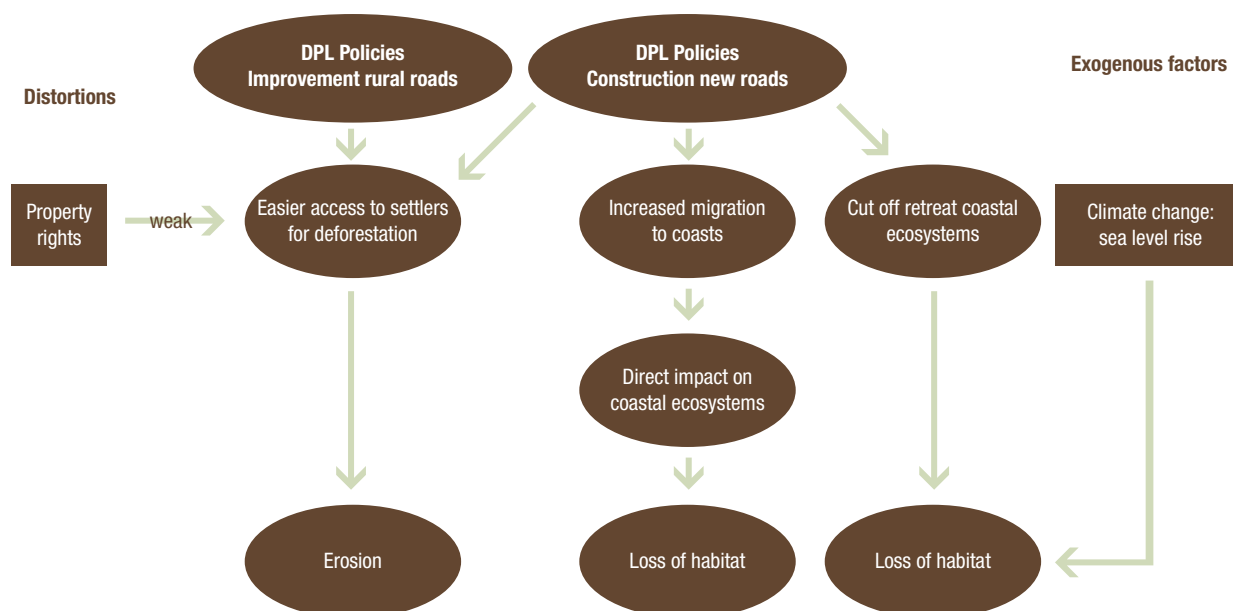
Table 16. Transmission channels for policies designed to improve infrastructure

Implement general transport sector reforms

Policy Action	Impact	Comment	Relative indicators (Module II)
Rehabilitation of rural tracks and roads in production centers	Yellow	All these have to be subject to an environmental assessment; ideally, whole programs should be assessed at the sectoral level as part of an SEA, where wider alternatives are considered (e.g. road vs. rail). Then specific projects are subject to the normal EIA procedures. Capacity to carry these out effectively has to be present.	Deforestation Terrestrial biodiversity under pressure
Development and maintenance of road network	Yellow		Deforestation Terrestrial biodiversity
Modernize and streamline trade and transport logistics practices	Yellow		Environmental health
Increase private sector participation in rail and road services	Yellow	There has to be an adequate framework to ensure environmental regulations are respected and has capacity to enforce the regulations in a privatized setting	Deforestation Terrestrial biodiversity under pressure
Sustained development of a safe, secure and efficient national highway system	Blue		
Catalyze institutional reforms in order to develop a sustainable toll highway system	Blue		
Reduce costs for port users and enhance management accountability	Blue		
Secure, safe, economical, and efficient civil aviation system	Blue		
Development of air transport	Blue	Possible area for an SEA and EA	
Increase resource generation and attract private capital	Blue	See comment on private sector participation	

Implement urban transport sector reforms

Policy Action	Impact	Comment	Relative indicators (Module II)
Lanes fully dedicated to public transport	Blue	These policies have (often positive) impacts on urban air quality; such impacts should be assessed and taken into account in the design of the policies	
Congestion pricing	Green		
Reduction of fleet and taxi services	Blue		
Rationalization of public transport supply	Blue		
Measures for financial sustainability of urban transport sector	Blue		
Promote citizen's participation in government-sponsored infrastructure projects	Blue		
Establish air pollution reduction targets	Green	Also measures to meet those targets and resources to ensure the measures can be carried out	

Table 16. Transmission channels for policies designed to improve infrastructure (continued)

Implement urban transport sector reforms (continued)			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Coordinated management of land use and land use planning for urban transport	Blue	An SEA can be particularly useful here in looking at the environmental impacts of alternative land use options	
Improve service coverage and provision for access and inclusion of people with reduced mobility/disability	Blue		

Development of ports			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Privatization of core services	Yellow	An adequate framework is needed to ensure environmental regulations are respected and there is capacity to enforce the regulations in a privatized setting, including issues regarding discharge of waste and ballast waters	Environmental health
Private sector participation in port development	Yellow		Marine systems under pressure

Water sector reforms			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Improve access to improved water sources and sanitation services	Green	The environmental health benefits here can be significant, especially with regard to drinking water; priorities in programs should be based on a careful assessment of these benefits, among others	
Increase wastewater treatment capacity	Green		
Improve water use productivity in irrigated lands	Green	There are environmental benefits to be gained here. The issues of water management cover avoidance of waterlogging and salinity; farmers need training and information in these areas.	
Foster integrated water resource management reform for sustainable water use	Green		
Improve financial sustainability of water services	Yellow	The issue here is not to raise costs so much that poor households cannot afford the services; social protection programs will need to be implemented	Pressure on water resources

Lack of access to improved sanitation |
| Improved monitoring and evaluation | Blue | | |

Policy Action	Impact	Comment	Relative indicators (Module II)
Promoting hand washing	Green	This can produce excellent results in terms of reduced diarrhea	
Measures for water pollution control	Green	Costs of treatment can be high and environmental benefits difficult to quantify; prioritization is essential	
Promote cost recovery in water utilities	Yellow	Issue here is not to raise costs so much that poor households cannot afford the services; social protection programs will need to be implemented	Pressure on water resources Lack of access to improved sanitation
Promote private sector participation in water utilities	Yellow		Pressure on water resources Lack of Access to improved sanitation
Remove subsidies in water sector	Yellow		Pressure on water resources Lack of access to improved sanitation
Development of spatial water availability data	Green	Can help in the management of water resources in an environmentally friendly way	
Develop a water rights registry and implementation of water rights market	Blue		
Enforcement of water rights and permits for establishment of more efficient water markets	Blue		

Liberalize telecom sector			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Encourage private sector participation	Blue		

Urban sector reforms			
Policy Action	**Impact**	**Comment**	**Relative indicators (Module II)**
Repeal urban land ceiling regulation	Blue		
Rationalization of stamp duty in land transactions	Blue		
Reform rent control laws to stimulate private investment in rental housing and development	Blue		
Introduction of computerized land registration process	Blue		
Reform property taxes so that it becomes a major source of revenue for urban and local bodies	Blue		
Reform of user charges by urban local bodies	Blue		

2.3.9 Energy

The broad objectives are to implement tariff structure reforms, privatization, improvements in operational efficiency and fiscal sustainability of utilities, promotion of renewable energy, increased competition in the energy market, competition in the petroleum market, and improvements in social and environmental sustainability of energy reforms. The specific policies and their impacts are shown in **Table 17**.

As with infrastructure, alternatives for energy development have to be guided in part by their environmental implications. Hence a proper assessment of alternative policies in these terms should be part of the framework for selecting options. In addition, social protection programs should recognize the possible impacts that raising energy costs for the poor can have on the environment, as households revert to environmentally damaging options to meet their energy needs (Figure 6).

Figure 6. Possible environmental impacts of energy sector policies
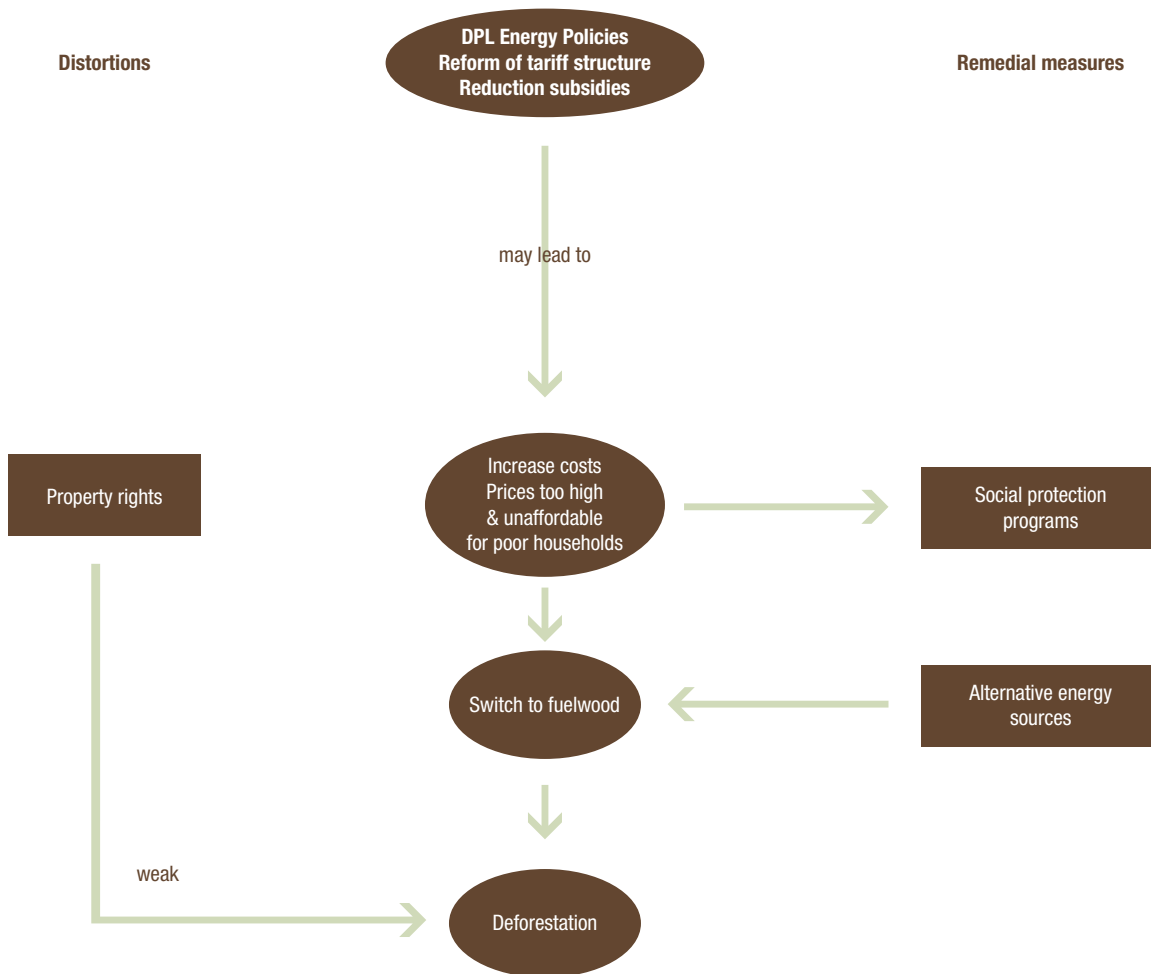
Table 17. Transmission channels for policies designed to improve energy supply and distribution

Tariff Structure Reforms

Policy Action	Impact	Comment	Relative Indicators (Module II)
Reform of tariff structure to reflect costs, cover costs of generation	Yellow	Higher costs may imply poor households cannot afford the services. They may then revert to traditional fuels with environmental and health implications. Social protection programs will need to be implemented.	Deforestation Urban air quality

Privatization

Policy Action	Impact	Comment	Relative Indicators (Module II)
Develop rules and procedures for entry of private sector	Yellow	There has to be an adequate framework to ensure that environmental regulations are respected and have capacity to enforce the regulations in a privatized setting.	
Government programs to deal with the debt of electric utilities as they are being privatized	Yellow		

Improve operational efficiency and fiscal sustainability of utilities

Policy Action	Impact	Comment	Relative Indicators (Module II)
Reduce transmission and system losses	Blue		
Increase in tariff rates to cover operating costs	Yellow	Higher costs may imply poor households cannot afford the services. They may then revert to traditional fuels with environmental and health implications. Social protection programs will need to be implemented.	
Improve operational efficiency of electric utility	Blue		
Reduce corruption in power sector	Blue		
Increasing collection rate	Blue	Higher costs may imply poor households cannot afford the services. They may then revert to traditional fuels with environmental and health implications. Social protection programs will need to be implemented.	
Remove subsidies to utilities in the power sector	Yellow		
Improve fuel quality with respect to sulfur content, lead content	Blue		

Promote use of renewable energy

Policy Action	Impact	Comment	Relative Indicators (Module II)
Reform or legal environment to promote use of renewable energy	Green		
Communication to increase public awareness	Green		
Develop institutional arrangements for operation of renewable energy projects	Green	Take advantage of carbon-related benefits	

2.3.10 Financial Sector

The broad objectives are to increase resilience and soundness of the financial system, implement reforms in the rural finance sector, and reform the insurance sector. The specific policies and their impacts are shown in **Table 18**.

Financial sector reforms of the kind outlined below do not generally have environmental consequences. It may be required, however, for privatized banks to be made aware of environmental procedures and the need for their credit policies to ensure that these regulations are respected.

Table 18. Transmission channels for policies designed to improve performance of the financial sector

Increase resilience and soundness of the financial system		
Policy Action	**Impact**	**Comment**
Restructuring and privatization of state banks	Blue	Banks should be aware of the environmental regulations governing investments and should ensure their loans are made in the light of these regulations
Reducing the stock of non-performing loans	Blue	
Reform the financial institution	Blue	
Improve internal control and audit in banks	Blue	
Modernize the payment system, legislation to prevent money laundering, and improving quality of financial information	Blue	
Strengthen fiduciary framework for public financial management and corporate financial reporting	Blue	
Increase access to finance	Blue	
Reform of the rural finance sector		
Policy Action	**Impact**	**Comment**
Establishment of a rural finance agency	Blue	Banks should be aware of the environmental regulations governing investments and should ensure its loans and grants are made in the light of these regulations
Reform of insurance sector		
Policy Action	**Impact**	**Comment**
Improving legal, regulatory, and supervisory framework for the banking sector and capital markets	Blue	

2.3.11 Tourism Sector

The broad objective is to promote tourism and tourism revenue. The specific policies and their impacts are shown in **Table 19**.

Tourism has major environmental impacts (Figure 7) and policies in this sector must be sensitive to these impacts. Several of the policies described below address these issues in a positive manner. When the Bank supports further tourism development, an SEA is desirable.

Figure 7. Environmental impacts of tourism development on coastal areas
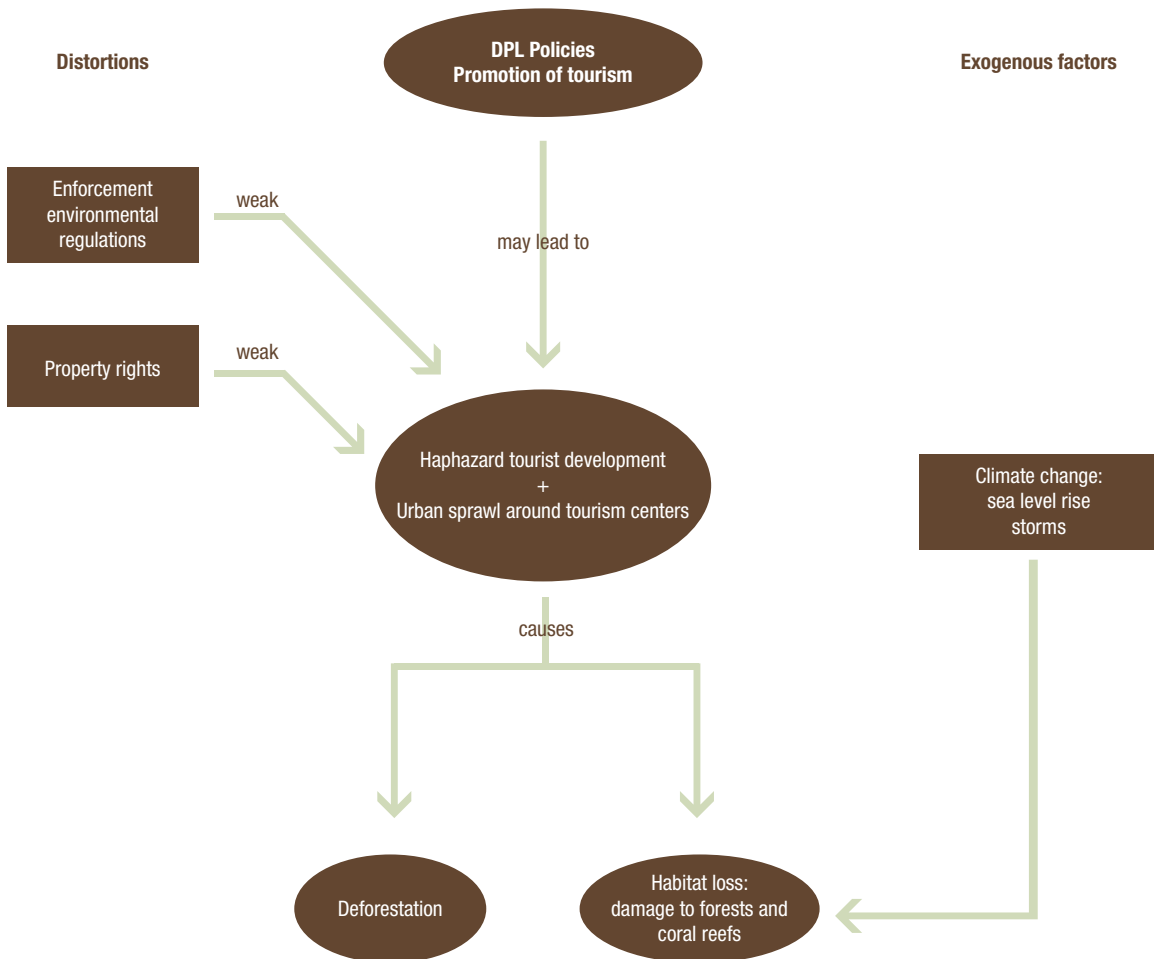
Table 19. Transmission channels for policies designed to promote tourism and tourism revenue

Promote tourism and tourism revenue			
Policy Action	**Impact**	**Comment**	**Relative Indicators (Module II)**
Increase the number of tourist destinations	Yellow	Subject to meeting key environmental conditions based on concepts such as carrying capacity; perhaps undertake an SEA	Marine systems under pressure Coastal habitat destruction (Mangrove annual % loss) Terrestrial biodiversity under pressure
Establishment and implementation of a set of benchmarks for good environmental practice in tourist facilities	Green	These are all areas where environmental issues are addressed in a positive manner. It may also be worth looking at raising revenues from a tourism tax to finance the environmental improvements and to support conservation.	
Promote sustainable tourism	Green		
Promote environmental conditions, especially in regard to wastewater and solid waste at tourist sites	Green		

3 Module II—Indicators

This module has five sections. The first section describes the current environmental and sustainability problems in the context of developing countries. The second section presents a list of indicators of potential environmental problems in the countries where the Bank is undertaking DPL operations. The third section specifically addresses the issue of environmental impacts on coastal areas by presenting a list of indicators tailored for coastal impacts.

In the fourth section, a general review of environmental analytical work completed in the countries considered is presented. The major data sources for the construction of the country environmental indicators are then presented in the fifth section.

3.1 Environmental problems and sustainability

The environmental problems of developing countries are growing

The overall environmental record in low- and middle-income countries is not improving. Despite the recognized importance of protecting the environment and conserving natural resources, many countries still continue to pollute their water and air excessively, and overexploit their water, forest, soil, fish, and mineral resources in the name of accelerating economic growth and increasing the welfare of citizens.

A number of statistics indicate the seriousness of the situation:

- A rapidly growing share—now a little over half—of the world's population lives in urban areas, contributing to more traffic, congestion, and pollution
- Half the world's wetlands have been lost in the past century
- 80 percent of grasslands are suffering from soil degradation
- 20 percent of dry lands are in the danger of becoming deserts
- Current atmospheric emissions of carbon dioxide are nearly four times the total emissions in 1950

- The tropical forest estate is shrinking at about 5 percent per decade, adding 3 billion tons of carbon dioxide to the atmosphere each year and contributing to major loss of biodiversity
- About one-third of the world is living under moderate to severe water stress, and groundwater is being depleted almost everywhere.

Environmental problems thus pose significant threats to sustainable development with severe consequences for economic development, human health, and ecosystems. Moreover, the poor and the disadvantaged bear a disproportionate cost of environmental pollution and resource degradation.

The evidence now available on the state of the global environment and its effects deserves more attention in the wider context of development. The evidence also offers a cautionary note on the difficulty of restoring environmental quality to sustainable levels. We present below the major environmental challenges/problems—including those relating to human health and welfare—that could seriously endanger development outcomes, even in the near future. Although presented individually, we should note that the problems are interconnected: for example, water quality and scarcity are related to deforestation, which in turn has implications for climate change and land degradation. These interlinkages will be important when we come to examine the implications of development policy prescriptions on the environment.

3.1.1 Water quality and scarcity issues

The principal sources of water for human use are lakes, rivers, soil moisture, and groundwater. Human activities have caused serious damage to water resources around the world. The damage to ecosystems reduces water quality and quantity, leading to a reduction in the effective water availability for human use. According to the World Commission on Water, more than half of the world's major rivers are seriously depleted and polluted. This degrades and poisons surrounding ecosystems, threatening the health and livelihood of people who depend on them. Sources of pollutants include untreated sewage,

chemical discharges, petroleum leaks and spills, dumping in old mines and pits, and agricultural chemicals that are washed off or seep into the ground from farms. Similarly, groundwater resources are vulnerable to overuse and pollution. Overuse has also resulted in depletion and salt-water intrusion in several cases in coastal areas (for example, in Chennai, India). About 2 billion people—one-third of the world's population—live in countries suffering from moderate to high water stress, where water consumption is more than 10 percent of renewable freshwater resources. Population growth, industrial development, and expansion of irrigated agriculture have resulted in significant increases in water demand in the past century.

Continued use of untreated water is one of the greatest threats to the health of poor people. Although the percentage of the population with access to improved water and sanitation has increased, about 1.1 billion people still lack access to safe water and about 2.4 billion lack access to improved sanitation. As a result, hundreds of millions of cases of water-related diseases and more than 5 million deaths occur every year. Of the 1.1 billion people using water from unimproved sources, nearly two-thirds live in Asia. (UNICEF and WHO 2003).

In coastal areas, pollution—from overcrowding, urbanization, industrial operations, tourism, and agricultural runoff—has degraded habitats and resources on land and offshore. Sewage and industrial effluents—which have increased significantly in the past few years, particularly in developing countries—are the most important sources of marine contamination.

Runoff of fertilizers and pesticides from agricultural activities has polluted surface water bodies and groundwater. Rising levels of nitrate pollution from agricultural non-point and other sources have caused eutrophication in large lakes and water bodies.

We present below a regional picture of the global state of quantity and quality of water.

Africa experiences large spatial variations in rainfall, with 95 percent of the total falling in the central and southwestern wet equatorial zone. Water stress is widespread and is on the increase in many countries, undermining food security and human and animal health. In various parts of Africa, water quality is impaired by industrial or mine effluents, sewage or

sewage return flows, runoff of nutrients and pesticides from farmlands, and salinization as a result of inappropriate spray irrigation.

Although Europe as a whole is rich in water, parts of Central and Eastern Europe and the Mediterranean countries suffer water stress and there are signs it is increasing. Water quality and pollution concerns arise from nitrate overload in agricultural lands and phosphorous from domestic and industrial wastewater running off into seas, lakes, rivers, and groundwater. In some of the Central and Eastern European countries, groundwater pollution continues to be a serious problem, although the use of nitrogen-phosphorous fertilizers has steadily been curtailed and treatment of wastewater increased. Waters of the Adriatic, the Black Sea, the Baltic, and other closed or semi-closed seas are prone to a range of pollution dangers from shipping and a variety of land-based sources.

In Latin America and the Caribbean, the spread of irrigation systems in recent decades and wasteful and inefficient state-run irrigation systems has increased pressure on available water resources. In South America, especially Argentina and Brazil, a large proportion of water is used for industry, mostly the energy, mining, and petroleum sectors. Agricultural wastes and industrial discharges are key sources of water pollution. Untreated urban sewage is a problem in and around big cities. Oil and gas industry activities pose some threat to marine and coastal ecosystems, and urban growth and tourism infrastructure have physically altered coastal areas.

Asia and the Pacific are facing problems due to pollution and inadequate supply of improved water and sanitation. In South and Southeast Asia, rivers such as the Yellow (China), Ganges (India), and Amu and Syr Darya (Central Asia) top the list of the world's most polluted rivers (World Commission on Water 1999). Most water bodies in the developing countries of the region are now heavily polluted with domestic sewage, industrial effluents, chemicals, and solid wastes. Water pollution has affected human health. The use of polluted groundwater for drinking and cooking leads to health problems such as diarrhea, hepatitis, and occasional outbreaks of typhoid and cholera. Inadequate water supply and poor sanitation cause more than 500,000 infant deaths a year, as well as a huge burden of illness and disability in the region (UNEP 1999). About 2.6 billion people—half of the

developing world—live without improved sanitation. Asia-India and China account for over half of those without improved sanitation. Though major progress was made in South Asia, only a little more than a third of its population are currently using improved sanitation. In sub-Saharan Africa as well, coverage is a mere 36 per cent (UNICEF and WHO 2003).

It is important to note that many of the problems of water stress will be exacerbated with the inevitable climate change that will take place. Expectations of more periods of drought, as well as of excessive rainfall, in virtually all regions of the world are among the predictions of the recently completed 4th Assessment of the International Panel for Climate Change.

3.1.2 Air pollution and deterioration of air quality

Air pollution is the change in characteristics of the atmosphere due to a chemical, physical, or biological agent. In addition to the direct effects of air pollution on human health, stratospheric ozone depletion as a result of air pollution has long been recognized as a threat to human health as well as earth's ecosystem. In most emerging economies, emissions from mobile sources, principally automobiles, are one of the largest sources of air pollution. In addition, stationary sources such as fossil-fuel-burning power plants, petroleum refineries, petrochemical plants, food processing plants, and other heavy industrial sources add to global emissions. According to the World Health Organization, about 4.6 million people each year die from causes directly attributable to air pollution. The direct causes of air-pollution-related deaths include aggravated asthma, bronchitis, emphysema, lung and heart diseases, and respiratory allergies.

Most air pollutants—such as particulate matter, other secondary small particles, and sulfur dioxide—are produced as a result of combustion. Secondary pollutants are formed in the atmosphere as a result of chemical reactions involving direct release pollutants. In addition to atmospheric air pollution, indoor air pollution from the burning of traditional fuels in spaces that lack proper ventilation poses serious health risks to humans. WHO (2002) estimates that 1.6 million people (mainly children under 5 and women) die each year globally due to indoor smoke from domestic use of traditional fuels. The most common of such fuels

are wood, agricultural residues, animal dung, charcoal, and (in some countries) coal.

Another dimension of fossil fuel combustion is the greenhouse effect and ocean acidification, which are largely due to elevated levels of carbon dioxide, methane, nitrous oxide, halocarbons, and halons. Elevated levels of greenhouse gases lead to global warming and climate change.

Greenhouse gas emissions—and the impacts of global warming and climate change—are of major concern to almost all regions. While industrial countries are responsible for observed increases in such gases, developing country emissions are rapidly catching up. Their contribution to future environmental damage increases as they grow. Climate change is expected to raise ocean levels, swamping the homes and lands of millions of people in low-lying countries. Developing countries lack adaptive mechanisms to cope with climate variability and sea-level change. Systems that are vulnerable also include agriculture and forestry. If projected climate changes materialize, the impacts on forests are likely to be regionally varied, affecting both distribution and composition of forests. Land degradation, floods, fires, and droughts are expected to reduce crop yields and worsen food deficits around the tropics and subtropics. Climate change is also likely to affect human health through changes in the availability of freshwater and distribution of vector-borne diseases such as malaria and dengue fever.

3.1.3 Land and soil degradation

Land degradation is the temporary or permanent lowering of the productive capacity of land. It thus covers the various forms of soil degradation, desertification, adverse human impacts on water resources, deforestation, and lowering of the productive capacity of rangelands. The term land refers to all natural resources that contribute to agricultural production, including livestock production and forestry. Activities that contribute to land degradation include soil erosion, denudation, pollution, loss of organic matter, loss of fertility and vegetation cover, invasive species, habitat conversion (whether urban or agricultural), and aquifer degradation. Land degradation in arid, semi-arid, and dry sub-humid areas resulting from adverse human impacts are often referred to as desertification.

The pace of land degradation has been increasing. In 1991 land degradation was estimated to be occurring at a rate of 5 to 6 million hectares per year. By 1996 it had affected nearly 2000 million hectares (about 15 percent) of the world's land area. A Land Degradation Assessment of Dry lands was initiated by GEF and UNEP in 2000 and is now being further developed by FAO. Land degradation can have multiple causes and impacts. Deforestation is the biggest single cause of land degradation, followed by agricultural activities, overexploitation of vegetation, and industrial activities. Climate change can also play a role, both as a cause and effect of degradation. If loss of soil organic matter resulting from degradation were curbed, more carbon could be stored in soils and plant cover rather than released into the atmosphere, a potentially significant carbon sequestration gain.

Loss of natural ground cover during conversion of marginal drylands, wilderness areas, or forests to agricultural uses is another key cause of land degradation. In productive agricultural zones, inappropriate land management policy and practice (sometimes prompted by overcrowding, food deficits, and national debt) can give rise to waterlogging, salinization, soil erosion, loss of soil fertility, and in worst cases outright desertification. Irrigated drylands and mountain soils are especially vulnerable. Other causes are acidification, toxic chemical residues, and disasters such as floods or droughts. Inequitable land tenure, the spread of urban settlements, transport networks, industrial developments, and other human infrastructure can also play a part in raising the likelihood of degradation.

The main types of soil and land degradation are water erosion, wind erosion, chemical degradation, and physical degradation. These impacts can considerably lower the productive capacity of land, as well as reduce the ability of soils to filter out pollutants and act as a buffer for soil acidity or alkalinity. Soil degradation also limits the contribution soils can make to critical life support cycles—such as the hydrological or nitrogen cycle—and to maintain natural habitats and biodiversity. In the worst cases, land degradation leads to outright desertification.

A closer look at degradation and desertification at the regional level shows that it is an ever-present risk in almost 50 percent of Africa's drylands. There have

been substantial gains in cereal production in Africa in recent decades, primarily through expansion of agricultural activities into marginal lands, natural forests, and wetlands. Such expansion carries the inevitable risk of land degradation. In many areas, loss of natural vegetation cover exposes soils to wind and water erosion and nutrient depletion. In Asia and the Pacific, land use changes driven by rapidly expanding populations and exploitation of marginal lands or forest areas results in degradation. Water erosion is most severe in the Himalayas, Central Asia, China, the South Pacific Islands, and Australia. Wind erosion seriously affects many countries, including Afghanistan, China, India, and Pakistan. In Europe, erosion—mainly water-induced—remains a problem in the black-soil regions of the Republic of Moldova, the Russian Federation, and the Ukraine.

Water and wind erosion are widespread agents of land degradation in Latin America and the Caribbean, affecting over 14 percent of the territory in South America and 26 percent in Central America. The underlying causes are urban growth and land conversion. The Clearing of forests—in Argentina and Brazil and elsewhere on a vast scale—have been largely for cattle ranching or farming cash crops for export. The forces driving land degradation and desertification in the region include tax incentives, the expansion of infrastructure such as roads and settlements, and the increased use of chemical fertilizers and the consequent nitrification of soils and waters and salinization of irrigated soil (Argentina, Brazil, Chile, Mexico, and Peru).

Desertification and land degradation are extensive across arid and semi-arid regions of West Asia. Desertification of rangelands is a pressing problem in Iraq, Jordan, Syria, and over the whole Arabian Peninsula. Wind erosion is a key agent of land degradation; overgrazing is among the factors that have hastened its effect on rangelands.

3.1.4 Forest degradation, forest conversion and loss of biodiversity

Forests play a crucial role in the lives of scores of poor people. Around 60 million people (mainly indigenous and tribal groups) are almost wholly dependent on forests, and some 350 million people live within or adjacent to dense forests, relying on them to a high

degree for subsistence and income. Another 1.2 billion people depend on open woodlands or agro-forestry farming systems, which help sustain agricultural productivity and generate income. In addition, forests also serve as economic safety nets for large sections of the population. Such safety net characteristics are triggered in periods of economic recessions, as well as through macroeconomic policy changes; for example, increasing prices of commercial fuels and electricity tariffs lead to an increase in fuelwood used for satisfying energy needs.

Deforestation is conversion of forested areas to non-forest use such as for agriculture and urban use. Other causes of deforestation are the construction of dams and roads. Forests differ in the deforestation pressures they face, the extent and depth of poverty they harbor, and the environmental consequences of their conversion (Chomitz and others 2006). To understand the environmental impacts of forest conversion, it is important to distinguish between forest types. A simple classification would be forest-agriculture mosaic lands, where natural forest management cannot compete with agriculture or plantation forests; agricultural frontier and disputed areas, where pressure for deforestation and degradation are increasing; and areas beyond the agricultural frontier, where there are a lot of forests and some pressure on timber resources (Chomitz and others 2006).

The environmental effects of deforestation can be broadly grouped into effects on climate (global as well as local effects), biodiversity, hydrology and water resources (watershed management), and soil erosion. Deforestation is one of the major causes of increasing the greenhouse effect, since it leads to more carbon being released into and less carbon being sequestered from the atmosphere. The presence of trees and plants significantly affects the hydrological cycle and watershed management in a number of ways: Tree canopies intercept precipitation, slow surface runoff, enhance infiltration, and reduce soil moisture through evapotranspiration. Their litter increases soil organic matter and thus enhances capacity to store water. On steep slopes, deforestation may result in landslides as tree roots that bind the shallow soils are lost.

According to the FAO *Forest Resource Assessment* (2005), deforestation continues at an alarmingly high rate—about 13 million hectares per year. FAO estimates the net loss in forest area in the period 2000–05 at 7.3 million hectares per year (an area about the size of Sierra Leone or Panama), down from 8.9 million hectares per year in the period 1990–2000. Africa and South America continued to have the largest net loss of forests. Oceania and North and Central America also had a net loss of forests. In Europe, forest area continued to expand, although at a slower rate. Asia, which had a net loss of forests in the 1990s, reported a net gain in the period 2000–05, primarily due to large-scale afforestation reported by China.

3.1.5 Natural disasters

Natural disasters are emerging as an increasingly important constraint on economic development and poverty reduction. Over the past few decades, a growing number of natural disasters have taken an increasingly devastating toll on human lives, livelihoods, and physical infrastructure. Scientists believe that this long-term upward trend is the result of more frequent disasters, a growing global population that continues to expand its economic assets and often lives in increasingly vulnerable areas**,** and continued environmental degradation.

In the last 10 years, economic losses from natural disasters have averaged about $40 billion a year, which is more than a sevenfold increase in real losses since the 1960s. Low-income and emerging economies, especially in Asia and South America, are particularly at risk; and within these countries, the poor stand to suffer most. Between 1990 and 1998, 94 percent of the world's major disasters were in developing countries. Twenty-four of the 49 least-developed countries face a high-level of disaster risk. Six of them have been hit by at least two major disasters in each of the last 15 years. Looking forward, the increase in surface temperatures combined with an increasing concentration of populations in urban areas, especially in "megacities," suggests that natural disasters are likely to loom even larger as a source of macroeconomic disruption and an impediment to sustained growth in the years ahead. The 2005 *World Disasters Report* estimated that global costs of natural disasters will rise fivefold over the next 50 years. (International Red Cross 2005).

3.1.6 Impacts on coastal areas

Coastal areas host a range of diverse habitats and some of the most productive ecosystems on earth in terms of goods and services. They account for about 20 percent of the total land area and host more than 50 percent of the world's population, which makes them critically important both from an environmental and a human welfare perspective. Coastal areas are increasingly threatened due to direct and indirect impacts of human activities. In particular, global warming and climate change are expected to have a significant impact on coastal areas.

The most significant effects on coastal areas are changes in water quality (pollution), quantity, and pattern (seasonal pulsing of freshwater flow to estuaries). The above three effects ultimately alter the physical and chemical conditions of estuarine-coastal waters to the detriment of local flora and fauna. Impacts of pollution include nutrients and toxic chemicals in water, as well as changes in pH, temperature, and turbidity (due to sediments), which can reduce the survival of various organisms. These effects tend to modify the biotic community, thus impairing the functionality of habitats and entire ecosystems. Erosion, which leads both to changes in water quality (sediment load) and quantity (alteration of the flow), is exacerbated by agricultural activities, upstream construction, and road building. These activities remove ground cover and at the same time alter the drainage pattern, while soil compaction increases the risk.

3.1.7 Human health/welfare and the environment

Human health depends to a large extent on the environment in which we live. The World Health Organization (WHO) estimates that poor environmental quality contributes to 25 percent of all preventable ill health in the world today (WHO, 1998). The primary environmental factors that contribute to ill health are contaminated water, poor sanitation, smoky indoor air and exposure to mosquitoes and other animal disease vectors. Insufficient and contaminated water supplies, inadequate sanitation and poor hygiene continue to be primarily responsible for global outbreaks of cholera and other diarrhoeal diseases, which claim three million lives each year (WHO 1997).

Vector-borne diseases, affecting more than 700 million people a year, are considered the most sensitive to climatic and environmental conditions. WHO has declared malaria, the best-known vector-borne disease, "public enemy number one." It affects more than 500 million people in 90 countries, causing 1.5 to 2.7 million deaths per year (WHO 1997).

In many developing regions, these traditional environmental health problems are now exacerbated by emerging problems of pollution from industry and agriculture. Chemical agents, particularly airborne ones, are considered to be major factors in causing and worsening tuberculosis, bronchitis, heart disease, cancers and asthma. Tuberculosis, the single largest cause of death in adults from infectious diseases, was responsible for three million deaths in 1996, 95 per cent of which occurred in the developing world (WHO 1997). Exposure to pesticides, fertilizers, and heavy metals poses health risks through soil, water, air, and food contamination. Global pesticide use has resulted in 3 to 5 million acute pesticide poisonings per year (WHO 1990). According to a recent report jointly published by FAO, UNEP, and WHO, children face higher risks than adults and need greater protection against these chemicals, particularly in developing countries. The above report estimates that about 1 million to 5 million cases of pesticide poisonings occur every year, resulting in several thousands of fatalities, including children. Most of the poisonings take place in rural areas of developing countries, where safeguards typically are inadequate or are lacking altogether. Although developing countries use 25 percent of the world's production of pesticides, they experience 99 percent of the deaths due to pesticide poisoning (FAO, UNEP, and WHO 2004). Epidemiological studies have suggested a link between organochlorine pesticides and cancer, including lymphoma and breast cancer (Zahm and Devesa 1995).

3.2 Indicators of Potential Environmental Problems in Countries where the World Bank is Undertaking DPL Operations

3.2.1 Purpose and background

The purpose of this section is to provide task managers with an easy-to-use table that alerts them to potential environmental problems in countries where they are undertaking DPL operations. It is adapted from work by Acharya and others (2004) at the Bank. They were concerned to see how much bank lending and assistance had been directed at countries with environmental problems, and what the correlation had been between the extent of these problems and the amount of lending and technical assistance. In this exercise, we are interested in a slightly different question: How serious are the environmental pressures in a country relative to its size, as well as relative to

other countries? Hence a number of indicators used by Acharya and others, which are based on aggregate levels of environmental pressures, are not appropriate for this exercise.

We present therefore a revised set of indicators that cover the main areas of concern for environment and natural resources when DPL operations are being designed. We do not provide an overall "environmental problems" indicator, but the information that is available provides at a glance the possible issues of environmental importance in the country.

3.2.2 Indicators chosen

Eight indicators are used as guides to environmental concerns in the countries concerned (Table 20). More precise indicators to capture the impact on fisheries are being developed (see Annex B).

Table 20. Indicators tracked for DPL countries

Indicator	Measure	Comments
Carbon efficiency	GDP per kg. of carbon	Taken from WDI, Green Data Book, 2007
Environmental health	No of Disability Adjusted Life Years (DALYs) lost per capita due to air and water pollution	Data are from Acharya and others adjusted for population
Natural resource degradation	% of total rural population living on fragile lands	Data are from Acharya and others
Terrestrial biodiversity under pressure	% of mammals and birds that are threatened	Data are from WDI, Green Data Book, 2007
Marine systems under pressure	% of fish species under threat	Basic data were collected by Acharya and others
Lack of access to improved sanitation	% of urban population without access to improved sanitation	Data are from WDI
Urban air quality	Urban population weighted annual average ePM$_{10}$ concentration	Data are from WDI
Deforestation	Annual % deforestation over the period 1990–2005	Data are from WDI, Green Data Book, 2007.
Pressure on water resources	Population in areas of excess demand and deaths/injuries from floods. Weights are equal for two components. Sum is normalized by dividing by total population.	Basic data were collected by Acharya and others
Institutional capacity to manage the natural environment	CPIA Score for policies & institutions for environmental sustainability	World Bank Data

Note: The CPIA scores are only available for IDA countries.

It must be noted that the scores and relative rankings presented in **Table 21** are not a comprehensive guide to the particular environmental issue in the country. Rather they are general indicators of possible importance of each of the issues concerned. A red listing for an indicator implies that it should be taken into account when investigating linkages between development policies and the environment. A yellow listing implies the need to look at the issue when there are other signs that the problem may be present. A

green listing does not imply we can ignore it altogether; rather, it suggests that the impact does not appear to be a priority. It may still need to be addressed if there is evidence from other upstream studies to indicate a particular transmission channel from the development policy to the environmental impact in question. The set of priorities is evident from the environmental indicators highlighted for each country in **Table 22**.

Table 21. Coding for the chosen indicators

Indicator	Coding	Comments
Carbon efficiency	Red when the country's efficiency is lower than both its income group and its regional group averages Yellow when its efficiency lies between that of its income group and its regional group Green otherwise	Carbon efficiency is much affected by level of development and region. This captures the performance of a country relative to these markers.
Environmental health Natural resource degradation Terrestrial systems under pressure Marine systems under ressure Urban air quality	Red when a country has a score more than twice the median. Yellow when the score is above the median of the group. Green otherwise.	The group is all countries in the DPL set. The use of the benchmarks reflects a judgment on the relative seriousness in the countries.
Lack of access to improved sanitation	Red when more than 25% of a country's population has no access to improved sanitation. Yellow when between 10% and 25% has no access and green when less than 10% has no access.	Based on expert opinion from WSS experts.
Deforestation	Red when there is deforestation. Green otherwise.	Based on expert opinion from forestry experts.
Pressure on water resources	Red when a country has a score more than twice the median. Yellow when the score is above the median of the group. Green otherwise.	The group is all countries in the DPL set. The use of the benchmarks reflects some judgment on the relative seriousness in the countries.
Institutional capacity to manage the natural environment	Red for CPIA scores of 3 or lower. Yellow for score of 3.5. Green for scores of 4 or higher.	Based on knowledge and judgment about the countries concerned.

Table 22. Indicators of Environmental Pressures in Selected Countries with DPL Operations

Country	GDP per unit of energy use constant 2000 PPP $ per kg of oil equivalent	DALYs Per Capita p.a.	Population on fragile lands %	Terresterial Systems Under Pressure % of mammal and bird species under threat	Marine Systems Under Threat % of fish species under threat	Lack of access to improved sanitation Urban (%)	Urban Air quality: Particulate matter concentrations Urban-Population weighted PM10 micrograms per cubic meter, 2002	Deforestation Annual % change in area under forests 1990-2005	Water Pressure Index Population in Areas of Excess Demand & Deaths/Injuries from Floods	Problem index for Environmental institutions CPIA Score in 2005 Reversed
Albania	6.4	0.02	0.24	4.3	20	1	58	0.0	3.5	3.00
Argentina	7.2	0.12	0.34	13.8	22	0	78	0.4	8.2	..
Armenia	5.2	0.19	0.26	15.5	6	4	84	1.2	12.5	2.50
Bangladesh	10.4	0.02	2.22	20.6	16	25	157	0.1	29.1	3.00
Benin	3.5	0.05	0.56	4.2	14	42	51	1.9	3.0	2.50
Bolivia	4.9	0.07	0.66	9.3	0	42	92	0.4	5.2	2.50
Brazil	6.9	0.02	3.85	19.8	12	17	35	0.5	3.4	..
Bulgaria	2.8	0.16	0.14	14.2	13	0	69	-0.6	6.8	..
Burkina Faso	..	0.06	2.15	5.1	..	55	97	0.3	6.5	2.50
Burundi	..	0.03	0.50	7.5	..	53	99	3.2	4.1	3.50
Cambodia	..	0.06	0.82	22.7	12	47	51	1.3	2.7	3.50
Cameroon	4.6	0.08	1.53	15.0	28	37	86	0.9	0.8	2.00
Cape Verde	..	0.22	0.00	14.0	11	39	..	-3.0	0.6	2.00
Central African	..	0.06	0.32	6.3	0	53	24	0.1	2.9	3.50
Chad	..	0.11	0.94	12.5	0	70	73	6.0	4.5	3.50
Chile	5.9	0.07	0.29	21.0	7	4	56	-0.4	6.0	..
Colombia	10.1	0.01	1.60	13.1	9	4	24	0.1	5.0	..
Congo, Democratic	2.1	0.09	7.56	9.4	24	57	74	0.3	1.7	3.50
Cote d'Ivoire	3.8	0.06	1.36	11.6	14	39	38	-0.1	1.7	3.00
Croatia	5.6	0.02	0.16	9.8	37	..	35	-0.1	2.3	..
Dominican Repub	7.4	0.03	0.49	21.0	VALUE	33	36	0.0	2.7	..

Country									
Ecuador	4.9	0.03	0.77	14.5	6	20	28	1.4	7.2	..
El Salvador	6.9	0.03	0.36	2.2	6	22	40	1.4	7.3	..
Georgia	4.1	0.21	0.27	14.2	18	4	46	0.0	1.8	2.50
Ghana	5.0	0.04	1.33	7.1	18	26	42	1.7	3.7	2.50
Guatemala	6.5	0.02	1.05	5.1	8	28	76	1.1	1.3	..
Guinea-Bissau	..	0.09	0.08	5.2	14	43	84	0.4	3.1	3.00
Haiti	6.4	0.06	0.70	15.3		48	47	0.6	3.5	3.50
Honduras	4.9	0.02	0.48	5.8	7	11	46	2.5	3.3	3.00
India	5.3	0.05	71.25	26.8	1	42	84	-0.4	6.3	2.50
Indonesia	4.3	0.05	14.76	29.4	3	29	114	1.6	2.9	3.50
Iraq	na	na	na	13.4	3	5	167	-0.1	na	..
Kenya	2.1	0.06	3.27	10.6	22	44	38	0.3	3.7	3.00
Lao People's De		0.02	0.70	16.9	12	39	25	0.5	1.9	2.50
Lesotho	na	0.04	0.29	7.3	50	39	94	-4.0	1.8	3.00
Liberia	na	0.04	0.25	12.8	16	51	39	1.5	0.1	na
Macedonia, fyr	..	0.02	0.09	13.2	47	..	29	0.0	4.4	..
Madagascar	..	0.06	1.07	42.7	18	51	51	0.4	1.5	2.00
Malawi	..	0.05	0.45	5.4	63	34	88	0.8	5.8	2.50
Mali	..	0.06	1.67	9.8	50	41	102	0.7	4.5	3.00
Mauritius	..	0.00	0.00	30.9	2	0	47	0.3	0.4	..
Mexico	5.6	0.05	4.81	18.8	16	10	43	0.5	8.5	..
Moldova	1.9	0.03	0.23	11.9	18	14	41	-0.2	11.4	2.50
Mongolia	..	0.05	0.10	15.0	100	25	16	0.7	10.0	3.50
Montenegro	..	..	..	..	..	..	17	..	..	..
Morocco	10.2	0.03	3.48	12.3	18	17	27	-0.1	8.6	..
Mozambique	2.5	0.06	1.02	8.6	7	49	44	0.2	4.8	3.00
Namibia	9.9	0.03	0.28	8.1	15	34	50	0.8	9.1	..
Nepal	4.0	0.02	2.10	..	0	32	43	1.6	0.8	3.00
Nicaragua	5.5	0.03	0.23	4.6	8	22	32	1.4	3.8	2.50
Niger	..	0.07	2.39	8.5	100	57	95	2.3	10.7	3.00

Table 22. Indicators of Environmental Pressures in Selected Countries with DPL Operations (continued)

Country	GDP per unit of energy use constant 2000 PPP $ per kg of oil equivalent	DALYs Per Capita p.a.	Population on fragile lands %	Terrestrial Systems Under Pressure % of mammal and bird species under threat	Marine Systems Under Threat % of fish species under threat	Lack of access to improved sanitation Urban (%)	Urban Air quality: Particulate matter concentrations Urban-Population weighted PM10 micrograms per cubic meter, 2002	Deforestation Annual % change in area under forests 1990-2005	Water Pressure Index Population in Areas of Excess Demand & Deaths/Injuries from Floods	Problem index for Environmental institutions CPIA Score in 2005 Reversed
Pakistan	4.2	0.08	13.39	13.5	15	8	165	1.6	10.7	2.50
Panama	7.6	0.03	0.18	9.3	7	11	58	0.1	0.4	4.50
Paraguay	6.4	0.04	0.22	10.4	0	6	103	0.8	3.0	..
Peru	11.3	0.05	1.67	15.7	5	28	68	0.1	6.0	..
Philippines	7.8	0.03	1.61	34.4	6	19	34	2.2	3.8	..
Romania	4.0	0.03	0.51	18.4	15	14	20	0.0	63.8	..
Rwanda	..	0.07	0.97	7.7	47	44	100	3.4	3.4	3.00
Senegal	5.2	0.08	1.15	6.6	15	30	93	0.5	6.8	2.50
Serbia	..	..	..	13.0	0	3	17	-0.4	..	2.50
Sierra Leone	..	0.11	0.70	7.7	12	47	69	0.6	0.0	3.50
Sudan	3.7	0.06	4.62	6.3	8	50	219	0.8	10.7	3.50
Tajikistan	2.1	0.03	0.85	11.8	83	29	57	0.0	9.4	3.50
Tanzania	1.3	0.06	3.05	12.6	39	46	38	1.0	5.0	2.50
Tonga	..	2.98	0.41	46.5	5	2	..	0.0	222.9	..
Tunisia	8.1	0.03	0.92	15.3	14	10	46	-4.3	6.8	..
Turkey	6.0	0.09	2.75	13.6	32	6	56	-0.3	4.1	..
Uganda	..	0.05	3.11	9.5	100	47	33	1.8	3.9	2.00
Ukraine	1.9	0.08	0.86	15.7	16	0	29	-0.2	6.6	..
Uruguay	10.5	0.13	0.01	10.9	33	5	154	-4.4	3.4	..
Vietnam	4.4	0.05	5.88	19.6	12	16	66	-2.5	2.4	2.50
Yemen, Republic	2.8	0.06	3.73	11.7	10	24	82	0.0	12.8	3.00
Zambia	1.4	0.09	0.57	5.	75	57	71	0.9	2.5	2.50

Note: A blank cell with no color indicates that no data are available for that indicator and that country.

3.3 Environmental Analytical Work

The implicit commitment underlying the Operations Policy OP/BP 8.60 is that the World Bank would systematically undertake upstream analytic work (Environmental-ESW) to ensure that environmental, forest, and natural resource considerations are adequately addressed at the program design stage. To some extent, this is also reflected in the commitments given to stakeholders (mainly NGOs) during the OP/BP 8.60 consultations, under the new forest strategy, and in response to the Extractive Industries Review.

Identifying perceived environmental, forest, and natural resource risks of policy reforms requires a better understanding of (often complex) institutional systems, policies, and capacity in client countries. Two broadly accepted and structured analytical tools in the environmental and natural resource area are the "Country Environmental Analysis" (CEA) and "Strategic Environment Assessment" (SEA). A CEA covers countrywide policies and institutions dealing with the environment, forests, and other natural resources. It focuses on the major environmental and natural resource issues in a country, reviews the policy and institutional framework, assesses institutional capacity to implement the framework, and makes recommendations for priority reforms, all at the level of the country or, in large countries, at state or provincial levels. It is a relatively new approach. Sixteen CEAs having been delivered, including recommendations on which both the Bank and the country agree. The completed CEAs, the CEA toolkit, and other related information on CEA are available at http://go.worldbank.org/J5OPF24SX1.

An SEA concentrates more on policies and institutions within specific sectors. It considers the linkages between a given sector (energy, for example) and the environment and natural resources, reviews the policy and institutional framework for dealing with environmental issues within the sector, assesses institutional capacity, and may make recommendations for reforms of policies and institutions. The World Bank's work and other supporting information on SEAs are available at http://go.worldbank.org/Y6R18VF6Z0

The Bank also undertakes Public Environmental Expenditure Reviews (PEERs), and Energy-Environment Reviews (EERs) and other Environmental Studies (ENSs). A PEER offers a way of systematically assessing the equity, efficiency, and effectiveness of public environmental spending. A PEER may be a standalone analysis, or it may be a part of a wider public expenditure review or CEA. The data and insights it yields can be valuable for the design of government budgets, policy reforms, and investment projects.[6] An EER helps to better integrate energy sector development and investment plans with the country's environmental objectives. EERs have often been supported by the joint UNDP-World Bank Energy Sector Management Assistance Program. There are a number of other sector studies that broadly integrate environmental considerations.

Apart from the World Bank, a number of other multilateral (e.g., ADB, AfDB, IADB) and bilateral (e.g., DFID) agencies undertake their own country as well as sectoral environmental assessments. We provide, in Attachment A, a stocktaking of existing environmental analytical work in countries with prospective DPL operations. This will be updated from time to time. The present list consists of 260 studies in 71 countries. It includes economy-wide studies that look at links between the economic sectors and the environment; environment-wide studies that report on the state of the environment in a range of sectors; and sectoral studies that analyze the links between the environment and the economy in a given sector. In total, there are 103 economy-wide studies, 97 environment-wide studies, and 60 sectoral studies. Table 23 provides more details by country. The table in Attachment A uses grey shading where data are not available on some aspect or another of a given study. The first entry for each country is in bold.

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6 See: http://lnweb18.worldbank.org/ESSD/envext.nsf/
41ByDocNam/EnvironmentStrategyPaperNo7Public
EnvironmentalExpenditureReviewsExperienceandEmerging
Practice2003850KBPDF

Table 23. Summary of background studies annotated in Attachment A

Country	No. of studies			
	Economy-Wide	Environment-Wide	Sectoral	Total
Albania	3	2	0	5
Armenia	0	2	0	2
Argentina	3	2	4	9
Bangladesh	4	3	4	11
Benin	2	1	0	3
Bolivia	0	3	1	4
Brazil	4	1	4	9
Bulgaria	0	0	1	1
Burkina Faso	0	1	1	2
Burundi	0	1	0	1
Cambodia	1	3	2	6
Cameroon	0	1	0	1
Central African Republic	0	1	0	1
Chad	0	0	1	1
Chile	4	1	0	5
Colombia	4	2	1	7
Congo Democratic	0	2	0	2
Cote D'Ivoire	0	1	0	1
Croatia	2	1	0	3
Dominican Republic	3	1	0	4
Ecuador	1	1	0	2
El Salvador	1	1	0	2
Georgia	0	2	0	2
Ghana	3	3	0	6
Guatemala	2	1	0	3
Guinea-Bissau	0	1	0	1
Honduras	1	0	0	1
India	2	6	7	15
Indonesia	2	2	3	7
Iraq	3	0	0	3
Kenya	3	3	2	8
Kosovo	3	1	0	4
Lao PDR	4	2	2	8
Lesotho	1	1	0	2
Liberia	1	1	1	3
Macedonia	5	1	0	6
Madagascar	2	0	0	2
Malawi	0	1	0	1

Country	No. of studies			
	Economy-Wide	Environment-Wide	Sectoral	Total
Mali	1	0	0	1
Mauritius	0	1	0	1
Mexico	1	1	0	2
Moldova	1	3	0	4
Mongolia	1	0	2	3
Montenegro	3	1	1	5
Morocco	1	1	2	4
Mozambique	2	2	1	5
Namibia	1	3	0	4
Nepal	2	0	0	2
Nicaragua	0	1	0	1
Niger	0	1	0	1
Pakistan	3	2	2	7
Panama	0	1	0	1
Peru	1	0	1	2
Philippines	2	2	2	6
Romania	2	1	2	5
Rwanda	0	1	0	1
Senegal	2	1	0	3
Serbia	3	1	1	5
Sierra Leone	1	0	2	3
Sudan	0	2	0	2
Tajikistan	1	1	0	2
Tanzania	2	2	4	8
Tonga	0	1	0	1
Tunisia	1	1	0	2
Turkey	1	0	0	1
Uganda	1	4	2	7
Ukraine	1	2	0	3
Uruguay	0	1	0	1
Vietnam	5	1	4	10
Yemen	0	2	0	2
Zambia	0	1	0	1
Total	103	97	60	260

Notes: 1. Studies specific to project preparation in the Bank are not included here.

2. Countries not covered for lack of data or time are: Afghanistan, Algeria, Angola, Belarus, Bosnia, Botswana, Cape Verde, China, Costa Rica, Egypt, Ethiopia, Eritrea, Gambia, Haiti, Iran, Jordan, Lebanon, Nigeria, Paraguay, Seychelles, South Africa, and Thailand.

3.4 Major Data Sources

Acharya, A., E. Ijjasz-Vasquez, K. Hamilton, P. Buys, S. Dasgupta, C. Meisner, K. Pandey, and D. Wheeler. 2004. *How has environment mattered: An analysis of World Bank Resource Allocation*. **Policy Research Working Paper 3269. Washington, DC: World Bank.**

This paper developed indicators of five environmental problems, an overall environmental index, and a problem index for environmental institutions. The five environmental problem indices considered are greenhouse gas emissions, health damage from air and water pollution, the threat of natural resource degradation on fragile lands, threats to biodiversity, and problems related to water resources.

The indicator for greenhouse gas emissions is the total metric tons of carbon-equivalent in 2000 from fuel combustion (CO_2), land use change (CO_2) and other sources such as methane, hydroflurocarbons, perflurocarbons, and sulfur hexafluoride.

The estimate of health damage from pollution is the total DALY (Disability Adjusted Life Year) losses from air and water pollution. The DALY estimates are from research by the World Bank in collaboration with WHO (Pandey, and others 2004; Wang and others 2003)

As regards the threat of natural resource degradation, the indicator is the total rural population living on fragile lands, constructed from a GIS overlay of demographic, topographic, climatic, and natural resource information. The rationale is based on recent research that identifies the vulnerability of people on fragile lands (land that is steeply sloped, arid, or covered by natural forest) as a major determinant of rural poverty and natural resource degradation (World Bank 2003).

The biodiversity threat indicator uses data from different sources. The World Bank's environment strategy focuses on both the threat to biodiversity from human encroachment and the value of biodiversity resources for human populations. For terrestrial biodiversity, the report used a GIS-based overlay of human population with critical areas identified by Conservation International, the World Wildlife Fund, and Birdlife International. For marine biodiversity, the report used estimates of reef ecosystems at risk by Bryant and others (1998).

Summing across all endangered reefs, the country's share of the total is used as the index of marine biodiversity threat. The biodiversity threat indicator is the composite of the terrestrial and marine indices with equal weights for both.

The water resource indicator is based on two sources of information. The first is an indicator of excess demand for water resources, using GIS to compute the total population residing in excess water-demand areas identified by Vorosmarty and others (2000). The second dataset is the database on deaths and injuries from floods maintained by the Center of Research on the Epidemiology of Disaster (CREED, Université Catholique de Louvain). The sum of deaths and injuries for all recorded floods since 1960 was first calculated and then an indicator of flood damage was computed. In computing the indicator of flood damage, deaths and injuries are weighted in the ratio 50:1. The water-resource indicator is then computed by combining the indicators of demand pressure and floods using equal weights.

The indicator for environmental policy and institutional problems is from the World Bank CPIA database, which rates environmental policies and institutions on a numerical scale from 1 to 5, with 1 as the lowest score. Wheeler and others reversed the scaling (so that 1 becomes highest) and then normalized the ratings so that countries with the greatest problems scored 100. To proxy the scale of problems confronted by environmental institutions, the mean value of five thematic indicators (global emissions, pollution, natural resource degradation, biodiversity threats, and water-related problems) is computed and normalized to the mean to the range 0–100. Then the composite problem index for environmental institutions is the product of normalized environmental index and the CPIA rating.

World Bank. 2006. *The Little Green Data Book*.

The *Little Green Data Book* was produced by the Environment Department in collaboration with the Development Economics Data Group. It provides data on agriculture, forests and biodiversity, energy, emissions and pollution, water and sanitation, environment and health, and national accounting aggregates.

http://siteresources.worldbank.org/INTEEI/935214-1146251511077/20916989/LGDB2006.pdf

World Resources Institute. *Earth Trends*.

Earth Trends is a comprehensive online database, maintained by the World Resources Institute, which focuses on the environmental, social, and economic trends that shape our world. The *Earth Trends* database provides information on coastal and marine ecosystems; water resources and freshwater ecosystems; climate and atmosphere; population, health, and human well-being; economics, business, and environment; energy and resources; biodiversity and protected areas; agriculture and food; forests, grasslands, and drylands; and environmental governance and institutions.

http://www.earthtrends.wri.org/

World Bank. Country Environmental Fact Sheets.

The Fact Sheets provide country-specific information on specific environmental indicators. These Fact Sheets have been created to present the information in a clear and user-friendly manner. The information covered in these Fact Sheets ranges from fertilizer consumption (agriculture), bird species (biodiversity), to adjusted net savings (national accounting aggregates).

http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/
ENVIRONMENT/EXTEEI/0,,contentMDK:20733046~
pagePK:148956~216618~theSitePK:408050,00.html

Environmental Sustainability Index

The Environmental Sustainability Index (ESI) is an initiative of the Yale Center for Environmental Law and Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) of Columbia University, in collaboration with the World Economic Forum and the Joint Research Centre of the European Commission.

ESI benchmarks the ability of nations to protect the environment over the next several decades. It does so by integrating 76 datasets—tracking natural resource endowments, past and present pollution levels, environmental management efforts, and the capacity of a society to improve its environmental performance—into 21 indicators of environmental sustainability. These indicators permit comparison across a range of issues that fall into the following five broad categories:
- Environmental systems
- Reducing environmental stresses

- Reducing human vulnerability to environmental stresses
- Societal and institutional capacity to respond to environmental challenges
- Global stewardship

The indicators and variables on which they are constructed build on the well-established "pressure-state-response" environmental policy model. The issues incorporated and variables used were chosen through an extensive review of the environmental literature, assessment of available data, rigorous analysis, and broad-based consultation with policy makers, scientists, and indicator experts. The higher a country's ESI score, the better positioned it is to maintain favorable environmental conditions into the future.

http://sedac.ciesin.columbia.edu/es/esi/

Food and Agriculture Organization of the United Nations (FAO). *Global Forest Resource Assessment 2005*.

FAO has been coordinating global forest resources assessments every five to ten years since 1946. *Global Forest Resource Assessment* (FRA) *2005* is the latest and the most comprehensive assessment of forests and forestry to date. With data collected from 229 countries and territories, it contains information on current status and recent trends for about 40 variables covering the extent, condition, uses, and values of forests and other wooded land. The key findings are presented under six themes: extent of forest resources, forest health, biological diversity, productive, protective, and socioeconomic functions of forest resources.

The FRA has global tables, country tables, country reports, and the background documents used in the preparation of the report. The global tables present information for 229 countries and territories grouped into six regions. The country tables provide data on all the reporting countries in a set of 15 national reporting tables. In addition, the assessment has seven thematic studies, which provide complementary information on specific topics like planted forests, mangroves, bamboo, wildland fires, forest pests, forests and water, and forest ownership and resource tenure.

http://www.fao.org/forestry/site/fra/en/

4 Module III

The available tools for analysis of impacts of macroeconomic and sectoral policies are summarized and presented in this module.

4.1 Introduction

This module provides information on the tools available for the analysis of the environmental impacts of macroeconomic and sectoral policies. The tools range from simple screening devices that help identify the key impacts, to instruments that provide more data on how serious these impacts are perceived to be, and finally to tools that can carry out an analysis of the impacts in a quantitative fashion with varying degrees of sophistication. Although the users may be familiar with most of the tools presented here— as they have been used to analyze a variety of macro and sectoral policy shifts, not necessarily environmental impacts alone—they could be modified to analyze impacts of policies on environmental and natural resources.

Table 24 summarizes the tools presented here. A task manager will probably use the screening tools to identify the environmental impacts described in Module I. Further analytical work may be needed depending on the transmission channels that are important and previous analytical work available (see Figure 2 in module I). The selection of tools will depend on the exact nature of the exercise, data availability, and on the time and resources available.

The summaries below provide a simple introduction to each tool: what it is, what it can be used for, what it tells you, which tools are complementary to it, key elements in the use of the tool, data requirements, time needed for its implementation, skills needed to use the tool, some limitations, and some references giving further information as well as examples of its use.

Table 24. Summary of available tools

Tool	Purpose	Likely applications
Checklist	Screening of major impacts	Early identification of areas where action may be needed. The two are alternatives for the same objective
Red flags		
Network diagrams	Screening tool that traces impacts through primary, secondary, and tertiary stages	Takes checklists and red flags one stage further
Action-impact matrix	Serves similar purpose to network diagrams, working with impacts across sectors rather than in terms of primary secondary stages	An alternative or complement to network diagrams
Environmental balance sheet	Weighs negative and positive effects of a macro policy in terms of likelihood, severity, irreversibility, and significance; the scores are added to give an overall evaluation	Complements action-impact matrices and network diagrams
Stakeholder analysis	Source of public perceptions of policies that are likely to impact on the.	Undertaken as part of Environmental Assessments, SEAs, and other tools
Public environmental expenditure review	Exercise that is complementary to a public expenditure review; serves to identify where public finance changes can harm or benefit the environment	In cases where major fiscal reforms are part of the DPL
Partial equilibrium models	Uses quantitative information on specific markets to estimate downstream environmental impacts	In cases where single markets are affected, especially in sectoral DPLs

Table 24. Summary of available tools (continued)

Tool	Purpose	Likely applications
Sectoral econometric models	Takes partial equilibrium models one stage further, looking at a number of related markets in a sector	As for partial equilibrium models, except a little more sophisticated
Multi-market models	Similar to sectoral models, but involving possibly more than one sector; markets are interrelated	Appropriate where clearly defined subsets of markets are affected by the DPL
Demand analysis	Assessment of how demand changes as a result of policy will feed through to environmental impacts	Useful when demand impacts are dominant
Supply response models	Assessment of how supply changes as a result of policy will feed through to environmental impacts	Useful when supply impacts are dominant
Scale-technology composition analysis	Relevant to assessment of trade impacts of a policy; breaks these down to how trade affects the overall scale of the economy, techniques of production, and the composition of industries	Trade effects of macro policies can increase environmental pressures, which are evaluated using this tool
Input-output model	Intersectoral assessment of policies across all sectors of the economy, traced through to the environment	Useful for assessment of the direct and indirect effects of changes in output structure
Social accounting matrix	Extends input-output analysis to social sectors and income transfers resulting from policies	In addition to being an input to general equilibrium models, they can be used to assess specific environmental consequences of changes in incomes and transfers
Computable general equilibrium model	Full intersectoral assessment of policies, taking account of price and income changes through the whole economy	The tool is normally developed upstream of any DPL and can be adapted to answer specific questions posed by the policy

4.2 Summary of tools available for analysis

This subsection presents a brief summary of the individual tools available for analysis of impacts of DPL policies on the environment, natural resources, and forests.

4.2.1 Checklist

What is it?
A checklist is a tool that aims to identify and analyze environmental impacts through lists of environmental resources that may be affected or lists of impacts that may occur. It lists possible questions on both positive and negative effects of a particular policy. Depending on the answers to these questions, one may develop actions that can be taken in the design of the policy to enhance positive impacts and mitigate negative effects.

What can it be used for?
This can be used to perform qualitative analysis of the impact of macroeconomic policies, sectoral policies, investment projects, and other complementary policies on the environment, natural resources, and forests.

What does it tell you?
The strength of the checklist consists in fostering thinking about all the possible significant impacts. The answers to the checklist will provide indications of possible impacts of policies, both positive and negative, on the environment, natural resources, and forests, as well as actions that can be taken in the design of the operation or within the country program to mitigate negative effects while enhancing the positive impacts of the operation. A checklist could include such items as likely policy impacts on use of nonrenewable resources; use of renewable resources; conservation of wildlife, habitats, landscapes, and protected areas; quality of soil, water, and other local

environmental resources; poverty alleviation; local or public participation in decisions about resource use and sustainability issues; access to information; and judicial redress for affected communities. A sample checklist is attached for reference.

Complementary tools
Any tool that provides quantitative estimates of policy impacts.

Key elements
The key element of this tool is a set of questions and answers about the policy reform or individual operation or the broader country program and their impacts on the environment, natural resources, and forests in the country/region.

Data/information
National environmental data, information/knowledge on linkages of proposed policies on the environment, natural resources, and forests.

Time
Could be done rapidly—in a matter of weeks.

Skills
Knowledge about the reform proposed and their possible impacts; identification of different stakeholders who may be affected by the policy.

Supporting software
Microsoft applications

Limitation
The value of the assessment is limited and will provide only descriptive impacts of policies. A commonly reported limit is in the identification of direct impacts, but not of indirect effects. It does not provide detailed quantitative measures of impacts of policies.

References and application
Iannariello and others (2002)

A Sample Checklist
Below is a set of questions about the individual operation and/or the broader country program:

1. Is there an adequate and current environmental/ natural resource ESW, such as a Country Environmental Analysis or Strategic Environmental Assessment?
2. Have the country's environmental/natural resource policies and practices been reviewed and, where appropriate, taken into account in the design of the policy-based program?
3. Specifically, are the environment and natural resources discussed as a potential risk or benefit in the loan document?
4. Have the linkages between the proposed reforms and the environment and natural resources been identified?
5. What effects of the operation are likely to be significant?
6. If there are negative linkages, have specific measures been devised to counteract the possible negative effects or an explanation provided on how mitigation is being achieved elsewhere within the country program/CAS?
7. Is there potential for enhancing positive effects?
8. How are the effects channeled? Do policy actions stimulate the substitution of inputs or consumption goods? Are the substitutes harmful to the environment and natural resources?
9. When will effects materialize? Within the life of the operation or beyond?
10. How do institutions affect outcomes? Do major environmental/natural resource policy and institutional failures exist?
11. How is environmental liability assessed and apportioned in privatization operations?
12. At the level of the country program, does the CAS include any interventions aimed at improving environmental/natural resource performance, such as technical assistance by the Bank or other donors?
13. Does the government require the public disclosure of information and data about the environment and natural resources? Is public participation part of the policy process?
14. What are the risks of unexpected outcomes? Some policy changes (devaluation, for example) change price signals throughout the economy, leading to a high probability of unexpected outcomes, while others such as education reform are less likely to have unforeseen consequences.

4.2.2 Red Flags

What are they?

Red flags look for issues in the policy reforms that raise the likelihood of significant negative effects on the environment, natural resources, and forests. For instance, they may focus on the policy, economic, and institutional distortions that contribute to negative outcomes. The transmission channels in Module I provide a set of red flags, as well as some more information on possible effects for generic cases.

What can they be used for?

This tool can be used to identify/flag the likely negative impacts of policies on the environment, natural resources, and forests. Examples of policies that raise red flags are energy price reforms, natural resource price reforms, privatization reforms, exchange rate policies, export policies, land tenure reforms, policies for agricultural growth, promotion of tourism, and promotion of fisheries. This tool will identify the resources at risk, policy and institutional failures (particularly in the resources sectors), weak regulations or absence of regulations, lack of monitoring and enforcement, etc. The information provided in Module I serves as a preliminary set of red flags, indicating where issues may arise when undertaking macroeconomic and sectoral reforms.

What do they tell you?

This tool will provide warning signals of the likelihood of significant negative impacts, both direct and indirect, of policies and interventions on the environment, natural resources, and forests. At the country program level, red flags identify adverse impacts when the country undertakes macroeconomic reforms to cope with crises.

Complementary tools

Network diagram
Checklists
Action-impact matrix

Data and information

National environmental data, information on interactions between the economy and environment and natural resources, including forests.

Skills

Knowledge of linkages between policies and the environment, natural resources, and forests.

Supporting software

Microsoft applications

Limitations

The tool will only flag the likelihood of negative impacts. It does not provide any quantitative measure of the impacts.

References: Stedman-Edwards (2005), Wolf, Yoffe, and Glordano (2003)

4.2.3. Network diagrams

What are they?

A network diagram is a tool to illustrate both direct and indirect impacts and the related consequences of development policy interventions on the environment, natural resources, and forests.

What can they be used for?

It can be used to trace the direct and indirect impacts of a given policy and the consequences of these impacts. A simple network diagram can be used to trace the chain of events arising from policy reforms and the consequent environmental and natural resource impacts. Estimates of impacts from quantitative tools could be fed into the network diagrams to present quantitative estimates of the impacts. An example of a network analysis is provided at the end of this section.

What do they tell you?

Network diagrams trace the chain of events arising from policy reforms that lead to environmental impacts. They show the causes and effects, moving through economic, social, and political spheres, thus providing a very useful tool for selecting points of intervention to mitigate environmental damage and promote environmental benefits. A causal chain diagram could also suggest ways of facilitating positive impacts, by reducing the number of links between the original action and the final impact, and maximizing the likelihood that the links will occur. Similarly, the likelihood of negative impacts may be reduced, by making the chain long and tenuous, with links that are unlikely to occur.

Complementary tools

GIS Overlays
Expert advice
Quantitative tools

Key elements

The key elements of a network are a complete mapping of all possible effects—direct and indirect—and related consequences of selected policy reforms. The network can be translated into more complicated mathematical models. Networks can be descriptive (qualitative) or quantitative depending on the level of detail of the impacts mapped in a network. In some cases it may be possible to give substantial detail and draw specific quantitative conclusions about the impacts. When such detailed information is not available, it may be possible only to predict the likely direction of change. A sample network diagram to analyze the impact of a policy to subsidize tube wells is presented below.

Time

The time required depends on the degree of complexity of the network analysis. A simple qualitative network diagram could be completed in a few weeks to about three months.

Skills

Knowledge of the transmission channels and the chain of events that could arise from a policy action and experience with environmental impact analysis.

Supporting software

Microsoft office applications

Limitation

Simple networks provide only descriptive/qualitative measures of direct and indirect impacts and related consequences. Complex quantitative networks are needed if quantitative measures of impacts are needed.

References and application: Iannariello and others (2002), Dougherty and Hall (1995)

Example of a network analysis showing the impact of a policy subsidizing tube wells and groundwater exploitation				
Primary impacts	**Secondary impacts**	**Tertiary impacts**	**Quaternary impacts**	**Mitigation**
Lowering of groundwater in the dry season	Loss of income & water from domestic hand pumps	Use of poorer quality water	Increased health risks	Ensure that new deep tube wells either hold domestic water locally or feed into the distribution system
		Income diverted to buy water	Decreased income and time	
		Travel to distant sources to collect water	Reduced quality of life	
	Loss of income & water from shallow tube wells for irrigation	Income diverted to buy water	Decreased income & time leading to possible food shortage	Deepen shallow tube wells Ensure that new Deep tube wells supply the shallow tube wells in dry season Provide compensation from deep tube well taxation
		Crop failure	Abandonment of land & migration	
			Reduced quality of life	
	Drawdown of surface water bodies	Decreased fish capture/fish mortality	Decreased protein intake	Retain stock of water bodies
			Loss of income for fisherman	
		Loss of wetland	Loss of wetland flora/ fauna migratory birds, fish spawning areas	
			Loss of wetland products	Restrict deep well development in vulnerable areas
		Reduced navigation possibilities	Increased transport costs	Increase navigation depth by dredging

Example of a network analysis showing the impact of a policy subsidizing tube wells and groundwater exploitation

Primary impacts	Secondary impacts	Tertiary impacts	Quaternary impacts	Mitigation
Agricultural intensification	Increased fertilizer use	Groundwater contamination by nitrate	Polluted drinking water by nitrates causes illness	Control fertilizer use Educate fertilizer users
		Eutrophication of surface water bodies	Increased weeds and algal bodies in surface water bodies	Remove and control weeds Educate about these effects
	Increased pesticide use	Groundwater contamination	Contamination of drinking water & health effects, more expensive alternative drinking water	Regulate pesticide use Encourage integrated pest management Subsidize non-persistent pesticides Tax undesirable pesticides Educate users of pesticides Educate people about eating contaminated fish
		Poisoning of fish, shrimp, and other living organisms	Reduction in fish catches & protein availability Pesticide residues in fish & health effects	
			Reduced income for fisherman	
			Bioaccumulation of pesticides in humans	
	Increased level of pest & disease vectors due to loss of fallow periods	Increased pesticide use	Bioaccumulation of pesticides in humans	Vaccination to prevent epidemics Encourage alternative cropping patterns Educate about disease vectors
		Increase in human and animal diseases due to vector	Loss of quality of life	
	Reduced fallow land & grassland for grazing	Fewer or poor quality livestock	Reduced protein intake & income for landless groups	Develop alternative grazing
	Reduced scrubland for fuelwood	Alternative sources sought for fuel	Income & time spent collecting fuel	Develop fuelwood supplies Promote energy-efficient cooking methods
			Destruction of trees	

Reference: Dougherty and Hall 1995

4.2.4. Action-Impact Matrix (AIM)

What is it?

An action-impact matrix is a nonquantitative systematic approach to screen the effects of policy reforms in terms of likelihood of effect. This tool will provide an integrated view of the effect of meshing economic policies on the environment, natural resources, and forest sector.

What can it be used for?

It could be used to analyze the impact of macroeconomic and sectoral policies, and investment projects and other complementary policies on the environment, natural resources, and forests. Examples of macroeconomic policies are measures to improve fiscal performance and fiscal stability; reduction of government debt and improved debt management; trade policy reforms to expand and deepen international trade; improving public financial management, etc. Examples of sectoral policies include reforms in key sectors like agriculture, forestry, mining, fisheries, education, health, infrastructure, energy, tourism, and financial sector reforms. The complementary policies include, among other things, improving the investment climate, governance reforms, social protection, decentralization, reforms to encourage private sector, privatization, etc. Examples of investment projects include hydroelectric dams, mining, afforestation, irrigation, etc.

What does it tell you?

The matrix helps to identify explicitly the key linkages between development policies and impacts on the environment, natural resources, and forests. It will first identify the transmission channels and explicitly specify the key linkages. In the next stage, it will provide qualitative indicators of possible impacts on variables of interest.

Complementary tools

The results from the use of the other tools could be fed in to an action-impact matrix; the final matrix will provide a comprehensive account of the impacts.

Key elements

Construction of AIM is a stepwise process. The first step is to develop a table of national environmental data from all available sources—national environmental action plans, environmental assessments, etc.—and organize them into a table to identify priority environmental problems. The second step is to identify the specific reforms/policies proposed and a brief review of the potential impacts of these policies. The information from the above two matrices could be combined to develop an action-impact matrix. In general, this tool will have a table of indicators and causes of selected environmental problems in the country/region, a table of current economic conditions, and the proposed reforms in the country/region. The above two tables are then used to construct the action-impact matrix, which will list the reforms and their impact on the environment, natural resources, and forests. A sample AIM is presented below.

Data/information

National environmental and economic data, information on current economic and environmental policies, proposed economic policies and their implications on the environment, natural resources, and forests.

Time

The time depends on the degree of complexity desired.

Skills

Knowledge of the macroeconomy, possible impacts of policies on environment natural resources and forests, knowledge of the transmission channels through which these could transcend.

Supporting software

Excel, Microsoft applications

Limitation

The preliminary action-impact matrix will provide only qualitative impacts of policies. It does not provide detailed quantitative measures of impacts of policies. Such quantitative measures will be available only after detailed analysis using tools that provide quantitative estimates of the impact of policies.

References and application: Munasinghe, Cruz, and Warford (1996)

A sample action-impact matrix

Policy reforms	Impact on key environmental variables					
	Urban & industrial pollution	Forest & biodiversity protection	Agric. land conversion & degradation	Energy generation & conservation	Water resources depletion & degradation	Degradation of coastal resource
Reduction in government expenditure	[-] Environmental programs like pollution abatement are often the first to be affected	[-] funds for protection of forests and biodiversity may be affected; affects enforcement	[-] funds for conservation, extension programs may be affected	[+/-] reduced subsidies will discourage waste, but may affect access of the poor	[+/-] reduction in subsidies will increase use efficiency; access to poor may be affected	[-] funds for protection of coastal resources may be affected
Improve investment climate	[+] private investment tends to introduce less polluting technology	[+] could promote plantation development, and may reduce deforestation	[+] may increase investment in land development	[+] private sector participation could improve efficiency and less pollution	[-] May result in higher prices and reduced access to improved water for the poor	
Trade liberalization	[+/-] pollution-haven effects	[-] May increase deforestation if the reform promotes trade in wood products	[+/-] through effects on output and input prices; higher output prices may foster better land management, depending on tenure status	[-] may increase demand for energy and generation needs	[-] may increase demand for water, depending on the export mix	
Privatization	[+] increase efficiency , reduce waste and pollution		[+] increase efficiency, better land management and productivity	[+] increase efficiency of generating plants, use efficiency, pricing reforms, reduction in waste and use	[+] promote more efficient use and supply of water resources	

4.2.5. Environmental Balance Sheet

What is it?

An environmental balance sheet is an analytical tool to reflect the positive and negative consequences of policy reforms on the environment, natural resources, and forests.

What can it be used for?

This can be used to carry out an analysis of the impact of macroeconomic and sectoral policies, investment projects, and other complementary policies on the environment, natural resources, and forests. It could either be qualitative or could provide quantitative measures of the impacts.

What does it tell you?

The environmental balance sheet weighs the positive and negative effects of reforms in a form that allows them to be weighed against economic benefits. The balance sheet can be simple or quite complex, encompassing quantitative measures. When quantitative estimates of positive and negative impacts are available, they could be fed into the balance sheet to get a better picture of the overall impact.

Complementary tools

Results from other qualitative tools like stakeholder analysis could be fed into the environmental balance sheet. The tools, which provide estimates of quantitative impacts, will add value to the environmental balance sheet, providing quantitative estimates.

Key elements

An environmental balance sheet could be a simple sheet or a complex one by combining several balance sheets. The environmental effects in a balance sheet are weighted by taking into account four factors in relation to the anticipated effect: probability, severity, irreversibility, and significance. While probability measures how likely it is that the effect will occur, severity measures the extent of the effect (like size of the geographical area, number of people, or the number of species affected). Irreversibility measures the degree to which the effect cannot be reversed. Significance is a measure of the local importance of an affected resource (such as economic indispensability) or its importance at the global level (such as the rarity of the species or ecosystem). An example is provided below.

Data/information

National environmental data, information on linkages of proposed policies on the environment, natural resources, and forests

Time

An environmental balance sheet could be completed in a few weeks to six months, depending on the degree of complexity and data availability.

Skills

Knowledge of impacts of policies on environment and natural resources, their probability, severity, irreversibility, and significance.

Supporting software

Microsoft applications

Limitation

The value of the assessment provided by a simple balance sheet is limited and will provide only qualitative impacts of policies. Detailed quantitative measures could only be obtained through detailed analysis using complementary tools and after combining several balance sheets.

References and application: Iannariello and others (2002), USEPA (1998)

A sample environmental balance sheet to analyze the impact of devaluation, export promotion, or subsidy reduction (1= not very, and 5 very).

Environment alaspects	Positive effects					Negative effects					
	Probability	Severity	Irreversibility	Significance	Sum	Probability	Severity	Irreversibility	Significance	Sum	Balance
Agricultural land	1	3	4	2	10	3	4	2	5	14	-4
Forest											
Air quality											
Water quality											
Biodiversity											
Greenhouse gases											
Ozone depletion											
Water use											
Energy use											
Encroachment on protected areas											

Source: Iannariello and others

4.2.6. Stakeholder analysis

What is it?

A stakeholder analysis is a systematic methodology, using both qualitative and quantitative analysis to understand stakeholders, their positions, influence with other groups, and their interests in a particular reform. A stakeholder is an entity with a declared or conceivable interest or stake in a policy of concern. Stakeholders can be of any form size and capacity. They can be individuals, organizations, or unorganized groups.

What can it be used for?

A stakeholder analysis can be used to identify people, groups, and institutions that will influence the policy reform either positively or negatively; anticipate the kind of influence, positive or negative, these groups will have on the policy reform; develop strategies to get the most effective support possible for the policy reform; and reduce any obstacles to successful implementation of the reform program. It is an integral part of an EA and SEA.

What does it tell you?

It provides an idea of the impact of the reform on political and social forces, illustrates the divergent viewpoints toward the proposed reforms and the potential power struggles among groups and individuals, and helps to identify potential strategies for negotiating with opposing stakeholders.

Complementary tools

Qualitative tools analysis
Social impact assessments

Key elements

A complete stakeholder analysis involves a series of recursive steps. The first step is to review the literature and country studies to understand the country's political economy and structure. The next step consists of collecting comprehensive data on stakeholders. Data could be collected by interviewing the stakeholders or local experts who are knowledgeable in the field or international experts. Data from the interviews are tabulated and presented as charts/matrices highlighting the attributes of stakeholder groups, including their interest (salience), influence (power), and position on the reform. An assessment of each stakeholder's power and their likely impacts on policy is then conducted through several steps. The third step is to organize the stakeholder data according to relative power/influence and salience of each stakeholder to understand their potential support or opposition to the proposed reform.

Data/information

The main sources of data and information are from interviews of the stakeholders and/or experts in the field, background information from a literature review, and study of the country's political structure.

Time

If key informant interviews are already being carried out as part of other qualitative analysis, a stakeholder analysis may be completed in a week or two. In cases where significant qualitative work has not been done, a thorough stakeholder analysis would likely involve a trip to the field, as well as collection of data and background information. This would probably take three to four weeks. A stakeholder analysis under different scenarios is more comprehensive and should grow out of the findings from other complementary analyses. A complete and comprehensive analysis may require the work of a specialist for a few months.

Skills

The specialist should have a combination of background in sociology, political science, and some knowledge of economics. Local knowledge, including contacts with local and international experts, is crucial.

Supporting software
Microsoft applications

Limitations
Stakeholder analysis uses qualitative data collected from the respondents and hence is quite subjective. The results depend on the careful selection of respondents and the interpretation of data collected from them.

References and applications: Bianchi and Kossoudji (2001), Brinkerhoff and Crosby (2002)

4.2.7 Public Environmental Expenditure Review

What is it?
A Public Environmental Expenditure Review (PEER) examines government resource allocations within and among sectors, and/or at federal and sub-national levels of government, and assesses the efficiency and effectiveness of those allocations in the context of the environmental management framework and priorities. In addition, it identifies reforms needed to improve the effectiveness, efficiency, and sustainability of public spending for environmental management.

What can it be used for?
A PEER can be used to evaluate the government's environmental management capacity as reflected in its public expenditures and could be used to evaluate how well environmental policies are being carried out as reflected in the program. The results could provide indications on how the proposed public expenditure reforms affect the environmental management capacity and implementation of environmental policies.

What does it tell you?
PEER first explores whether the environmental expenditures, both past and proposed, address the policy priorities in this sector. It then checks whether the expenditures address the policy priority in the most appropriate way. This involves asking whether there is a rationale for government intervention (market failure) in the first place and whether the instrument chosen to address it is the most efficient. The results would tell you the impact of proposed public expenditure reforms, based on past experience, on government capacity for management of the environment, forests, and natural resources and implementation of policies.

Complementary tools
Economy-wide Public Expenditure Reviews
Sectoral Public Expenditure Reviews
Agricultural sector review

Data and information
Financial statistics, government budget data, detailed environmental expenditures

Skills
Expertise in public expenditure review and environmental issues

Supporting software
Microsoft office applications

Limitations
The scope of PEER depends on the availability of data on environmental expenditures. The definition of environmental expenditures usually is difficult, as budgets of most countries typically include only expenditures of one or two agencies or ministries exclusively dealing with environmental management such as the ministry of environment. Sectoral environmental expenditures are difficult to get and are not properly accounted for in most countries.

References: Markandya, Hamilton and Sanchez-Tirana (2006), Swanson and Lundethors (2003), Pradhan (1996)

4.2.8. Partial equilibrium models

What are they?
Partial equilibrium models, using reduced form equations, analyze the effect of specific policies (such as trade policy, fiscal policy, or exchange rate policies) on variables of interest. The reduced form equations are estimated using econometric procedures and the parameter estimates are used to quantify the impacts. Examples of partial equilibrium models include supply-response models, demand-response models, and von Thunen analysis.

What can they be used for?
Partial equilibrium analysis using reduced form equations is one of the most common applications of applied econometric analysis. It can be used to predict the impact of a wide range of development policies. For example, a reduced form model could be used to analyze the effects of change in trade policy or price

and subsidy policies, particularly in the agricultural or energy sectors. A supply-response model would analyze how price changes affect supply of a commodity like timber, estimating the own and cross-price elasticities. Similarly, demand models could be used to analyze the impact of price changes on the demand for an environmentally sensitive good, demand for natural resources (including timber), and the consequent deforestation. An example of the use of cross-price elasticities is to analyze the impact of an increase in natural gas prices on the demand for coal and the possible environmental impacts of the increase.

What do they tell you?
The results provide estimates of the impacts of changes in a given policy on a particular variable of interest. The reduced form models are estimated using econometric procedures. These parameter estimates could be used to estimate quantitative measures of impacts of specific policies on variables of interest.

Complementary tools
Multimarket analysis
Sectoral models
Computable general equilibrium models

Key elements
The key elements are a system of equations specifying the underlying economic system and the environmental interactions, from which the reduced form equation is derived and estimated. The reduced form equation, which relates the policy variable and the outcomes, is estimated using applied econometrics procedures.

Data/information
The specific data requirements depend on the scope of analysis, the level of aggregation, and the type of policies considered. In order to estimate the reduced form model, data on the variables of interest and their hypothesized determinants are required.

Time
Among other things, the time depends on the policy considered, the level of sophistication of the econometric model, and data availability.

Skills
Applied econometric skills and skills in econometric modeling and environmental impact analysis

Supporting software
STATA, Eviews, Gaus, etc.

Limitations
The results depend on the quality and availability of data. When cross-country data are used, the elasticities derived from cross-country regressions may differ from the elasticity in the country itself.

References and applications: Meier, Munasinghe and Siyambalapitiya (1996), Pandey and Wheeler (2001), R. Lopez (1993)

4.2.9 Sectoral Econometric Models

What are they?
These are econometric models of individual sectors such as agriculture, forestry, wildlife and natural resources, water, energy, mining, tourism, etc. A sectoral econometric model consists of a set of completely specified structural equations, which are estimated simultaneously.

What can they be used for?
Sectoral models can be used, for instance, in the agricultural sector, to analyze the effects of a variety of policies like trade liberalization, exchange rate policies, price and subsidy policies, reforms in land tenure, reforms in rural credit, and financial markets. In the forest, wildlife, and natural resource sectors, sectoral models have been used to analyze the impact of policies such as price reforms, public sector reforms, fiscal reforms, devaluation, exchange rate reforms, etc. on deforestation, logging, loss of biodiversity, and other forest sector impacts. In sectors like energy and water, sectoral models could be used to analyze the impacts of trade reforms, price reforms, and privatization on resource use, efficiency, or pollution generation.

What do they tell you?
Sectoral analysis provides information on the outcomes of development policies on the particular sector and their potential environmental impacts. For instance, in the agricultural sector devaluation can result in a change in crop prices and increased crop specialization, which in turn may result in increased soil erosion and water pollution. Examples of other development policies with an impact on the agricultural sector and consequent environmental impacts are price liberalization; institutional reforms

like tenure reforms; donor assistance for research and extension; soil conservation; and financial market reforms. A forest sector model could tell you the impact of devaluation on roundwood prices and the consequent impacts on roundwood production and deforestation. A water sector model could predict the effect of pricing reforms on use efficiency. In the energy sector, sectoral models could be used to analyze the impact of pricing/subsidy reform on use efficiency, fuel substitution, and air pollution.

Complementary tools
Multisector analysis to analyze impacts across sectors
Computable general equilibrium model

Key elements
The key elements of an econometric model are the underlying system of equations to specify the economic interactions within the sector. The system of equations could be estimated as a system or solved to get the reduced form estimating equation of interest, which could be estimated econometrically using appropriate econometric techniques.

Data requirements
Econometric estimation requires data on the variables of interest and its hypothesized determinants. The data could be either time-series or cross-sectional time-series depending on data availability.

Time
The time required depends on the availability of data on key variables of interest and the degree of sophistication of the econometric model, which will be estimated.

Skills
Econometrics and applied economics.

Supporting software
STATA, Eviews, SPSS

Limitations
This tool does not account for cross-sectoral impacts. Although sectoral impacts may be strong, the overall impacts considering all sectors could be neutral.

References: Cropper, Griffiths and Mani(1999), Grossman and Krueger (1993), Hughes and Lovei (1999), Mackenzie (1993), Pandey and Wheeler (2001), Richardson (1996), Saunders and Cagatay (2004)

4.2.10 Multi-Market models

What are they?
Multi-market models are a class of partial equilibrium models that focus on a set of interrelated markets in which the proposed policy is likely to have its main effects. It is a simulation tool that incorporates both interactions across markets and economic, political, or technical constraints faced by policy makers. The markets most affected by the policy are included in the model. They are not full general equilibrium models, since they do not account for all sources and uses of resources in the economy.

What can they be used for?
Multi-market models could be used to analyze the impact of development policies on the environment through their impacts on production, factor use, prices, government revenues and expenditures, and foreign trade. They have been particularly popular in the agricultural sector.

What do they tell you?
The multi-market models provide *ex-ante* policy impacts, both direct and indirect impacts.

Complementary tools
Input-Output models
CGE models
Single market analysis

Key elements
The basic multi-market model has four key components: (1) specification of technology and producer behavior including resource constraints; (2) market clearing conditions, which can be represented by commodity balance constraints; (3) determinants of distribution of income; and (4) explicit representation of consumer demand behavior. In addition to the above, a multi-market model to analyze environmental impacts will have extensions to describe the relationships to the environment and natural resource sector and pollution generation. A typical multi-market model will have a set of structural equations, including commodity budget constraints; resource limitation constraints; pollution generation and equations depicting interactions between the environment and natural resources; constraints for demand behavior of consumers; equations to describe the distribution of income; factor income and product pricing constraints;

and the objective function, which drives the model to market-clearing equilibrium values.

Data/Information

Multi-market modeling is data-intensive. It requires (a) estimates of the parameters for the supply and demand functions in the markets that are affected by the policy reform; (b) determination of closure rules for the markets that are being modeled; and (c) quantitative mapping of endogenous variables to impacts on the environment, natural resources, and forests. There are two plausible approaches to gather the data. The first approach would be to estimate the producer, consumer, and factor markets to get elasticities. The second approach would use estimates (or best guesses) from other studies.

Time

A complete multi-market analysis will take at least three to six months.

Skills

Working experience with household models, input-output models, applied mathematical programming, and optimization techniques. Experience with Excel, GAMS

Supporting software

Excel, GAMS. May need STATA, SAS, or SPSS to work on the household models and related datasets

Limitations

The results are dependent on the choice of parameters in the structural equations and objective function. Any change in assumptions in the model often requires complete recalibration, which is time consuming and complicated. The behavioral parameters are subject to error and inadequacies of the data and the results could be sensitive to such effects. Multi-market models are not necessarily fully specified and are not general equilibrium models. Hence, if the proposed policy is likely to have general equilibrium impacts, multi-market models may not capture them.

References: Braverman and Hammer (1986), Lundberg and Rich (2002), Willet and Sharda (1988)

4.2.11 Demand analysis

What is it?

A demand model is another class of partial equilibrium models that analyze the consumer demand for commodities given the structure of relative prices, real incomes, and other characteristics of the economy. Demand analysis can be done for own-price effects or cross-price effects on an environmentally sensitive good and its effect on the environment, natural resources, and forests.

What can it be used for?

Demand models could be used to estimate the own-price and cross-price elasticities of demand for environmentally sensitive goods. Demand models have been extensively used in the agricultural sector. An example of its use in the agricultural sector is the analysis of the impact of pricing, tax, and subsidy reforms for agricultural inputs like fertilizer and pesticides, which will produce environmental impacts. Another example from the natural resources sector is analysis of the effect of price and/or subsidy reforms for water on consumption and sustainable use. Another example is an analysis of raising prices for natural gas on the demand for coal and the consequent environmental impacts.

What does it tell you?

Demand analysis gives you quantitative estimates of the impacts of price changes on consumer demand for an environmentally sensitive good or resource. The impacts could be either direct (own-price elasticity) or indirect (cross-price effects).

Complementary tools

CGE modeling

Key elements

There are two general approaches to demand analysis. The first approach is to specify estimable single-equation demand models and estimate them. The second approach is to use the theory of demand as a guide to the choice of functional forms and variables to be included. The key elements of the latter approach are derivation of estimable functional forms of demand equations from mathematically specified models of consumer choice, imposition of constraints on demand parameters, and derivation of estimable reduced form equations.

Data/information
Demand analysis requires data on prices, quantities, and related variables that may have direct and/or indirect effects.

Time
A complete demand analysis could take two to six months, depending on the data availability and level of complexity desired.

Skills
Expertise in applied econometric analysis and model building, applied micro and macroeconomics.

Supporting software
STATA, Eviews, SAS, Excel

Limitations
Demand models are partial equilibrium models and hence have the inherent limitations of such models. The results depend on the quality and availability of relevant data and the underlying assumptions.

References: Mier, Munasinghe and Siyambalapitiya (1996)

4.2.12 Supply-response modeling

What is it?
Supply-response models analyze how producers respond to changes in product and factor prices, technology, and access to certain constraining factors of production. Production response may arise either from the producers' behavior or from changes in technological relationships.

What can it be used for?
Supply-response models can be used to assess the impact of development policies that may result in changes in factor and product prices, changes in technology, and access to certain constraining factors of production, which in turn may produce significant impacts on the environment, natural resources, and forests. Supply-response models have been extensively used in the agricultural sector. One example of their use in the agricultural sector is analysis of production response of crops to price reforms, pricing reforms resulting in specialization in commercial crops, and the consequent environmental impacts. In the forestry sector, for example, the impact of price changes on

production/supply of timber and the consequent deforestation could be analyzed using this tool.

What does it tell you?
Supply-response models tell you the own- and cross-price elasticities of supply. It will also give the long-run and short-run elasticities, which are indicative of the rapidity of the adjustment.

Complementary tools
Demand analysis
CGE modeling

Key elements
There are two key elements in determining the production response: (1) the technological relationship that exists between inputs and outputs, and (2) the producer behavior in the choice of inputs, given the market prices and the availability of fixed factor of production. There are two approaches to estimate the production response: (1) the structural form approach, and (2) the reduced form approach. The different structural form approaches are the cost/production function models from cross-sectional data, linear programming models, profit function approach, and the use of complete structural models of the sector. The reduced form estimation of supply-response uses procedures like partial adjustment and expectations formation, estimation of complete systems of supply from profit functions, and estimation of structural models of supply and demand equilibrium.

Data/information
The data required depend on the approach and the methodology followed. The structural form approach would require, in general, data on prices, the production technology, and the prices. The data could be either cross-sectional firm-level data or time-series, or a combination of the above two could be used. The partial adjustment and expectations formation models use time-series data on prices and other variables considered.

Time
A complete supply analysis takes about three to six months, depending on the level of detail desired.

Skills
Expertise in applied microeconomic modeling, econometrics, linear programming, and optimization methods

Supporting software
GAMS, STATA, SAS, Eviews, SPSS

Limitations
These are partial equilibrium models and hence may not capture the general equilibrium effects.

References: H. Binswanger (1989) , L.Mamingi (1996)

4.2.13 Scale-technology-composition analysis

What is it?
This tool analyzes the effects of trade liberalization on environmental quality by analyzing how trade affects the overall scale of the economy, techniques of production, and the composition of industries.

What can it be used for?
This tool can be used to analyze the effects of trade liberalization and other trade policies on environmental quality and the use of natural resources and forests. Policies of trade liberalization include tariff reduction, removal of quota restrictions, and facilitating foreign direct investment.

What does it tell you?
The analysis tells you how trade liberalization affects the overall scale of the economy, techniques of production, and finally its effect on the composition of the industries, less polluting (pollution intensive) versus dirtier industries. The above three effects will provide an indication of the effects of trade liberalization on the environment, natural resources, and forests. However, the focus of the literature has been on the *composition* effects of trade reforms.

Complementary tools
Econometric models
Partial equilibrium models

Key elements
The first step in a scale-composition analysis is a study of how trade liberalization affects the overall scale—the level of production technology—of the economy. This will be followed by an analysis of the effects of trade liberalization on investment in new and improved technology. The third and the most important component is an analysis of the impact of trade policies on the composition of domestic production, composition of imports, and foreign direct investment inflows.

Data/information
The data required for this analysis is exhaustive. The main source of the data could be the central statistical agency and the concerned ministries, like the ministry of commerce. The required data include in general disaggregated data on industrial output, net value added, pollution load of the industries, data on exports and imports, disaggregated data on foreign direct investment, industrial wages, employment data, etc.

Skills
Experienced economists/econometricians with specialization in international trade and environmental economics and skill in applied econometrics.

Time
A complete analysis could take about six months to a year depending on the data availability and access to the available data.

Supporting software
Excel, Applied econometric software like STATA, SAS

Limitations
Analysis is data-intensive, in terms of both quality and quantity of data. Requires services of economists specialized in this kind of analysis.

References and applications: Mani and Jha, (2006), Gamper-Rabindran and Jha (2004), Copeland and Taylor (2003)

4.2.14 Input-Output models

What are they?
Input-output models are a class of economy-wide models made up of commodity and activity accounts that could be extended to account for the environment, forest, and natural resource interactions. In an extended environmental input-output model, the basic model is extended to account for the interactions between economic sectors and environmental sectors. The basic principle of such an environmental input-output model is that economic activities create pollution or effects on the environment, forests, and natural resources as a byproduct.

What can they be used for?

The extended environmental input-output model can be used to make simulations of impacts of general macroeconomic and fiscal policies on the economic and environmental sectors. The underlying principle is that every unit of sectoral output is associated with their impact on environment and natural resources through pollution generation, resource use, resource depletion or degradation.

What do they tell you?

The input-output multipliers tell you the direct and indirect impact of policies on each sector of the economy. The environmental extension will provide multipliers that trace impacts on the environment, forests, and natural resources.

Complementary tools

Social Accounting Matrix
CGE models

Key elements

The key element of an input-output model is the matrix of technical coefficients and the input-output multipliers. In an environmental input-output model, a row of coefficients representing physical output of each pollutant/environmental impacts and or effects on forests and natural resources per dollar of sectoral output is augmented to the matrix of technical coefficients, thus allowing the prediction of impacts.

Data/Information

The data and information required are the input-output tables and the environmental accounts that trace the pollution and environmental impacts. The central statistical organization in the country responsible for the national income accounts will have data required for compiling the input-output matrix. The data on the environmental and natural resource interactions could be collected from different related agencies.

Time

A complete input-output analysis will take at least three to six months depending on the availability of the required data and prior models to work on. It is assumed that a reasonably updated matrix is available in the first place.

Skills

Working experience with household models, input-output models, economy-environment interactions, and experience with Excel, GAMS. Experience with applied mathematical programming and optimization techniques is also desirable.

Supporting software

Excel, GAMS. May need STATA, SAS, or SPSS to work on the household models and related datasets

Limitations

Input-output models assume there is excess production capacity in all sectors and that increasing demand can always be met by higher output with no price increase. This may be unrealistic. Further, the underlying production functions in simple input-output models assume constant returns to scale and no substitution among the different inputs.

References: Doherty and Tol (2007), Huang, Anderson and Baetz (1994), Lee (1982), Leontief (1970)

4.2.15 Social Accounting Matrix

What is it?

A social accounting matrix (SAM) is a national accounting system that presents, in one unified set of accounts, a picture of the circular flow of the economy. It provides a consistent picture of the flow-of-funds as a square matrix with each row and column representing a separate account. An environmentally extended social accounting matrix (ESAM) provides an integrated, consistent dataset describing the relationships among economic activities, environment and natural resources including forests and pollution activities. A SAM is a key component of the CGE tool (see 4.2.16).

What can it be used for?

An ESAM can be used as a modeling tool to carry out simulations of impacts of specific development policies on the environment (environmental pollution, pollution abatement), natural resources, and forests. The multiplier analysis technique provides estimates of the impacts of policy shocks. The impacts could further be decomposed and traced out using several decomposition approaches, such as the additive

decomposition method,[7] multiplicative decomposition method,[8] and structural path analysis.[9]

What does it tell you?
An ESAM gives you a lot of information about the interrelations among production activities, factors of production, institutions, and the interactions among the economy, environment, and natural resources, including forests. It will capture the interactions between pollution and the environmental and natural resource effects of economic activities in an accounting system and provide quantitative estimates of these interactions.

Complementary tools
Input-output models
CGE models
Action-impact matrices

Key elements
There are six types of accounts in a SAM: (1) activity or production accounts, (2) commodity accounts representing domestic product markets, (3) factor accounts representing primarily labor and capital, (4) institutions, (5) capital accounts, and (6) the rest of the world. Activity or production accounts are used to buy raw materials and intermediate goods and hire factor services to produce commodities. Commodity accounts represent domestic product markets. Factor accounts include labor and capital accounts and receive payments from the sale of their services to activities in the form of wages and rent and income from abroad. Institutions include households, firms, and government; separate capital accounts could be identified for each. The transactions between the domestic economy and the rest of the world are recorded in the last account. In addition to the above six accounts, an environmentally extended SAM will

have separate accounts for environment- and natural-resource-related information. Environment will be treated as a production factor. It will distinguish production activities and pollution abatement activities in the activity account. A base model is first calibrated to track the overall and sectoral growth performance of the economy. It becomes the foundation for the policy simulations. This base model is then extended to simulate macroeconomic disequilibria and environmental, natural resource, and forest-sector impacts associated with alternative policy regimes.

Data/Information
Construction of a SAM is very demanding in terms of data. Without specifying the degree of disaggregation desired. it is impossible to define a general set of data needed to compile a SAM. The data sources for a conventional SAM are input-output tables, national income statistics, and household surveys with a labor module. An extension of the conventional SAM to an environmental SAM would of course need additional data on environment and natural resource sectors, which need to be collected from available sources.

Time
A complete SAM analysis will take between six months to about a year depending on the complexity, the degree of disaggregation, and availability of data.

Skills
Working experience with household models, input-output models, and accounting of economy-environmental impacts. Experience with Excel, GAMS

Supporting software
Excel, GAMS. May need STATA, SAS, or SPSS to work on the household models and related datasets.

Limitations
A major limitation of SAM is that it does not contain the notion of equilibrium prices. Prices are fixed and do not adjust endogenously. As a result, supply is either perfectly elastic and entirely demand driven, or perfectly inelastic. A second limitation is that the results are sensitive to the assumptions and the specification of the different accounts.

References: Adelman and Taylor (1990), Keuing (1993), Xie (2000)

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7   Stone, R. 1978. "The diaggregation of the household sector in the national accounts." Paper presented at the World Bank Conference on Social Accounting Methods in development planning, Cambridge, United Kingdon, April 16–21.

8   Pyatt, G., and J. Round. 1970. *Social accounting for development planning: with special reference to Sri Lanka*. Chicago: Cambridge University Press.

9   Defouny, J., and E. Thorbecke. 1984. "Structural path analysis and multiplier decomposition with a social accounting matrix framework." *The Economic Journal* 94:111–136.

4.2.16 Computable General Equilibrium Models

What are they?
Computable general equilibrium (CGE) models are completely specified, multi-sectoral/ multi-market models of an economy, consisting of a system of equations describing the economic relations among production activities, factors, and institutions. These models include the modeling of all markets (in which the decisions of the agents' are price responsive and markets clear supply and demand decisions) and macroeconomic components. They assume underlying values for parameters in the equations. Macroeconomic policy shocks are then incorporated to simulate how these shocks affect the economy, environment, natural resources, and forests.

What can they be used for?
CGE models can be used to simulate the "economy-wide" impacts of a policy or project and their interaction on the environment, natural resources, and forests. They can be used to analyze impacts of a wide range of development policies like fiscal and tax policies, subsidies, public expenditure policies, trade policies, exchange rate policies, energy policies, price policies, and sector-specific policies.

What do they tell you?
CGE models take into account all sectors of the economy and hence permit explicit analysis of both direct and indirect impacts of relevant policies on all sectors simultaneously, depending on the degree of disaggregation desired.

Complementary tools
Input-Output models
Social accounting matrix
Partial equilibrium models

Key elements
These models are improvements on traditional input-output analysis generating quantities and prices endogenously and reflecting market incentives and are dynamic. They complement partial equilibrium analysis with a broader scope of analysis and the quantification of indirect and often non-intuitive effects. Key elements of a CGE model are the models specifying the agents and their behavior, the underlying rules that bring the markets to equilibrium, the macroeconomic

characteristics of the economy, and the economy-environment interactions.

Data/information
CGE models are data-intensive and are constructed from combined national accounts data and survey data. These are first compiled into social accounting matrices (SAM), which would become the foundation of the CGE.

Time
Construction and development of CGE model is time consuming and will take six months to about a year. The time required depends on the existence of a SAM or a different CGE model built to address a different question and also the degree of disaggregation/complexity desired.

Skills
Experienced modelers with prior experience and exposure to general equilibrium/CGE models are required. Experience with economy-environment interactions is needed.

Supporting software
Excel, Eviews, Gauss, GAMS

Limitation
The results are sensitive to the assumptions made in the model, such as the "closure" rules and assumed values of key parameters. The closure rules ensure that the fiscal, trade, and savings-investment accounts balance. Whether the closure rules are fixed endogenously or exogenously can have significant impacts on the outcomes. The nature of aggregation of the production accounts will significantly affect the outcome of the model. Further, CGE models are data-intensive and the results are sensitive to the parameters used.

References and applications: Unemo (1996), Persson and Munasinghe (1996), Wing and others (2001), Goldin and Roland-Host (1994)

4.2.17 Bayesian Networks for analyzing coastal impacts

What is it?
Bayesian networks, also called Bayesian belief networks (BBNs), or causal maps, are probabilistic

graphical models based on the concepts of conditional probability and on the Bayes theorem of probability.

BBNs are technically defined as direct acyclic graphs representing a set of variables linked by causal relationships that are expressed in terms of probability. Therefore they consist of a qualitative and a quantitative layer. The former is the graphical representation of the relations between some variables (as in an influence diagram), whereas the latter informs about the strength of these relations in terms of probability.

What can they be used for?
The main application of Bayesian nets is to take decisions in the face of uncertainty (about the way a system works, the factors involved, etc).

Bayesian nets emerged from the field of artificial intelligence (AI), and their use spread to the risk assessment field. Since the early 1990s, they have been applied to the environmental sciences, in particular in water management and wildlife management studies, in the fisheries area, and lately they have been extended to climate change studies.

What do they tell you?
BBNs are decision support tools increasingly applied in the risk assessment field and in adaptive management studies. These instruments allow the combination of available data and expert judgment to measure the probability of an event given specific observations, and to help choose between different management options.

Key elements
The basic components of Bayesian networks are (a) a set of nodes (i.e. the variables, or events that populate the map); (b) edges or arcs (i.e. the connecting arrows that specify the direction of the causal relation between nodes); (c) a combination of nodes and edges, which forms the graph; (d) a probability, which

is attached to each node (either prior unconditional probability, if the nodes have no parents, or a conditional probability if the nodes have parents). These probabilities are introduced through the use of raw data, expert opinion, or information from other sources (including literature).

Data/Information
Bayesian maps are knowledge-intensive. Once the maps are correctly laid out, data is required to establish the relationship between nodes. Where there is a lack of quantitative data, expert opinion is equally valid. It has been studied that the power of the system is such that expert opinion produces very strong results.

Time
Time required depends on data gathering for the nodes of the maps. A complete analysis may take a few weeks.

Skills
Experience with the concepts of Bayesian statistics, probability. Experience with Excel.

Complementary tools
Quantitative tools
Network diagrams

Supporting software
Netica software (www.norsys.com)

Limitations
Bayesian networks are acyclic graphs, and as a result they cannot contain feedback loops (which in some cases are useful in environmental modeling). It is also fairly time-consuming to represent changes in time and space, as these would need to be modeled through separate networks.

References: Charniak E. (1991), Jensen F.V. (2001), Uusitalo L. (2006)

References

Acharya, A., E. Ijjasz-Vasquez, K. Hamilton, P. Buys, S. Dasgupta, C. Meisner, K. Pandey, and D. Wheeler. 2004. "How has environment mattered: An analysis of World Bank Resource allocation." Policy Research Working Paper No. 3269. Washington, DC: World Bank.

Adelman, I., and J. Edward Taylor. 1990. "Is structural adjustment with a human face possible? The case of Mexico." *The Journal of Development Studies* 26(3):387–407.

Asian Development Bank. 2004. "Tajikistan: Country Environmental Analysis." http://www.adb.org/Documents/Reports/CEA/taj-july-2004.pdf

Baffes, J. 2005. "The Cotton Problem." The World Bank Research Observer 20:109–144.

Barbier, E.B. 2000. "The Economic Linkages Between Rural Poverty and Land Degradation: Some Evidence from Africa." *Agricultural Ecosystems and Environment* 82:355–370.

Bianchi, R., and S. Kossoudji. 2001. "Interest groups and organizations as stakeholders." Social Development Paper 35. Washington, DC: World Bank.

Binswanger, H. 1989. "The Policy Response of Agriculture." Proceedings of the Annual Conference of Development Economics. *World Bank Economic Review* 231–258.

Braverman, A., and J.S. Hammer. 1986. "Multimarket analysis of agricultural pricing policies in Senegal." In I. Singh, L. Squire, and J. Strauss (eds.). *Agricultural Household Models: Extensions, applications and policy*. Baltimore: Johns Hopkins University Press.

Brinkerhoff, D., and B.L. Crosby. 2002. *Managing policy reforms: Concepts and tools for decision-makers in developing and transition countries*. Bloomfield, Conn.: Kumarian Press.

Bryant, D., L. Burke, J. McManus, and M. Spalding. 1998. *Reefs at Risk: A Map-Based Indicator of Threats to the World's Coral Reefs*. Washington, D.C.: World Resources Institute.

Butler, Rhett A. "Diversities of Image - Rainforest Biodiversity." 2006 *Mongabay.com / A Place Out of Time: Tropical Rainforests and the Perils They Face*. January 9, 2006. http://rainforests.mongabay.com/0305.htm.

Charniak E. 1991. "Bayesian network without tears." The American Association for Artificial Intelligence. http://www.aaai.org

Chomitz, M. Kenneth, Piet Buys, Giacomo De Luca, Timothy S. Thomas, and Sheila Wertz-Kanounnikoff. 2006. *At loggerheads? Agricultural expansion, poverty reduction, and environment in the tropical forests*. Policy Research Report. Washington, DC: World Bank

Copeland, B.R., and M.S.Taylor. 2003. *International trade and environment: Theory and practice*. Princeton, NJ: Princeton University Press.

Cropper, M., C.Griffiths, and M. Mani. 1999. "Roads, population pressure and deforestation in Thailand, 1976-1989." *Land Economics* 75(1):58–73.

Defouny, J., and E. Thorbecke. 1984. "Structural path analysis and multiplier decomposition with a social accounting matric framwework." *The Economic Journal* 94:111–136.

DFID/USAID/Future Agricultures Consortium. 2007. Evaluation of the 2006/7 Agricultural Input Supply Programme, Malawi.

Doherty, J.O., and S.J. Tol. 2007. "An environmental input-output model for Ireland." http://papers.ssrn.com/sol3/papers.cfm?abstract_id=964473#PaperDownload

Dougherty, T.C., and A.W. Hall. 1995. *Environmental Impact Assessment of Irrigation and Drainage Projects*. Food and Agriculture Organization Irrigation and Drainage Papers—53. Rome: Agriculture Department, FAO.

FAO, UNEP, and WHO. 2004. "Childhood Pesticide Poisoning: Information for Advocacy and Action." Published for the UNEP Chemicals International, Environment House, Switzerland. http://www.fao.org/newsroom/common/ecg/51018/en/maquette_childhood.pdf

FAO. 2005. *Global Forest Resource Assessment 2005*. http://www.fao.org/forestry/site/fra/en/

Gamper-Rabindran, S., and S. Jha. 2004. "Environmental Impact of India's Trade Liberalization." Available at SSRN: http://ssrn.com/abstract=574161 or DOI: 10.2139/ssrn.574161

Government of Malawi, Tobacco Industry and the Environment. 2000. "Trade and Environment Database Case Study 252." http://www.american.edu/TED/maltobac.htm

Government of Malawi, Department of Energy Affairs. 2006. "Promotion of Alternative Energy Sources Project (PAESP)."

Government of Malawi, Ministry of Energy, Mines and Environment. 2006. "Report on the Promotion of Solar-Powered Fans for Flue-cured Tobacco Curing."

Government of Malawi, Ministry of Mines, Natural Resources and Environment. 2005. "National Capacity Self-Assessment."

Government of Malawi, Ministry of Natural Resources and Environmental Affairs. 2002. "State of the Environment Report."

Gray, L.C. 1999. "Is Land Being Degraded? A Multi-scale Investigation of Landscape Change in Southwestern Burkina Faso." *Land Degradation and Development* 10(4):329–343.

Guibert, H. 2007. Evaluation des risques environnementaux liés à l'accroissement de la production et à la transformation du coton graine au Burkina Faso, CIRAD CA.

Guibert, H., and P. Prudent. 2005. Mise en place d'un programme d'évaluation des impacts environnementaux exercés par le front agricole pionnier dans l'aire protégée et la périphérie du Parc du W. City: Fonds Européen de Développement.

Goldin, I., and D. Roland-Host. 1994. "Economic policies for sustainable resource use in Morocco." Paper for the Joint Meeting on Sustainable Economic Development: Domestic and International Policy. Sponsored by the OECD Development Center and CEPR, Paris, May 24–25, 1993.

Grossman, G.M., and A.B. Krueger. 1993. "Environmental impacts of a North American Free Trade Agreement." In P. Garber, ed. *The U.S. Mexico Trade Agreement*. Cambridge, MA: MIT Press, 1989.

Huang, G.H., W.P. Anderson, and B.W. Baetz. 1994 "Environmental input-output analysis and its application to regional solid waste management planning." *Journal of Environmental Management* 42(1):63–79.

Hughes, G., and L. Lovei. 1999. "Economic reform and environmental performance in transition countries." World Bank Technical Paper 446. Washington, DC: World Bank.

Iannariello, M.P., P. Stedman-Edwards, D. Reed, and R. Blair. "Environment Impact Assessment for Macroeconomic reform programs." WWF Macroeconomics Program. Washington, DC: World Wildlife Fund.

International Federation of Red Cross and Red Crescent Societies. 2005. *World Disasters Report 2005: Focus on information in disasters*. Geneva: International Red Cross.

International Monetary Fund. 2005. "Burkina Faso: Poverty Reduction Strategy Paper." IMF Country Report No. 5/340. Washington, DC: IMF.

International Monetary Fund. 2007. "Republic of Tajikistan: article IV consultation report." IMF Country Report No. 07/144. Washington, DC: IMF.

IUCN. 2005. Les Impacts De La Culture Cotonnière Sur La Gestion Des Ressources Naturelles Du Parc W Cas de l'enclave de Kondio.

Jensen, F.V. 2001 *Bayesian Networks and Decision Graphs*. New York: Springer Verlag.

Keuing, S. 1993. "National accounts and the environment: The case for a systems approach." National Accounts Occasional Paper No. NA-053. The Hague: Netherlands Central Bureau of Statistics.

Lee, K.S. 1982. "A generalized input-output model of an economy with environmental protection." *Review of Economics and Stat*istics 64:466–473.

Leontief, W. 1970. "Environmental repercussions and economic structure: An input-output approach." *Review of Economics and statistics* 52(3):262–271.

Lopez , R. 1993. *Economic policies and land management in Ghana*. College Park, MD: University of Maryland.

Lundberg, M., and K. Rich. 2002. "Multimarket models and policy analysis: An application to Madagascar." Mimeo. Washington, DC: World Bank.

Markandya, A., K.Hamilton,and E. Sanchez-Tirana. 2006. "Getting the most for the money - how public environmental expenditure reviews can help." World Bank Environment Strategy Note No. 16. http://www.worldbank.org/environmentstrategy

Mackenzie, F. 1993. "Exploring the connections: Structural adjustment, gender and the environment." *Geoforum* 24:71–87.

Mamingi, N. 1996. "How Prices and Macroeconomic Policies Affect Agricultural Supply and the Environment." Policy Research Working Paper 1645. Washington, DC: World Bank.

Mani, M., and S. Jha. 2006. "Trade liberalization and the environment in Vietnam." Policy Research Working Paper 3879. Washington, DC: World Bank.

Meier, P., M. Munasinghe, and T. Siyambalapitiya. 1996. "Energy sector policy and the environment: A case study of Sri Lanka." In M. Munasinghe (ed.). *Environmental Impacts of Macroeconomic and Sectoral Policies*. Washington DC.: The International Society for Ecological Economics, World Bank, and UNEP.

Munasinghe, M., W. Cruz, and J. Warford. 1996. "The Environmental impact of economywide policies: Some recent evidence." In M. Munasinghe (ed). *Environmental Impact of Marcoeconomic and Sectoral Policies*. Washington, DC: International Society for Ecological Economics, World Bank, and UNEP.

Ministère de L'Environnment et Cadre De Vie. 2007. *National Capacity Self-Assessment.*

OECD (Organisation for Economic Co-operation and Development). 1995. "The St. Petersburgh Guidelines on Environmental Funds in the Transition to a Market Economy." OECD/GD(95) 108. Paris: OECD.

Pandey, K. D., K. Bolt, U. Deichmann, K. Hamilton, B. Ostro, and D. Wheeler. 2004. "The Human Cost of Air Pollution: New Estimates for Developing Countries." World Bank Development Research Group Working Paper. Washington, DC: World Bank.

Pandey, K., and D. Wheeler. 2001. "Structural adjustment and forest resources: The impact of World Bank operations." Policy Research Working Paper 2584. Washington, DC: World Bank.

Persson, A., and M. Munasinghe. 1996. "Economywide policies and deforestation: The case of Costa Rica." In M. Munasinghe (ed). *Environmental Impacts of Macroeconomic and Sectoral Policies*. Washington, DC: ISEE, World Bank, and UNEP.

Pradhan, S. 1996. "Evaluating public Spending: A Framework for Public Expenditure Reviews." World Bank Discussion Paper 323. Washington, DC: World Bank.

Pyatt, G., and J. Round. 1970. *Social accounting for development planning: with special reference to Sri Lanka*. Chicago: Cambridge University Press.

Richardson, J. 1996. *Structural adjustment and environmental linkages: A case study of Kenya*. London: Overseas Development Institute.

Saunders, C., and S. Cagatay. 2004. "Trade and the environment: Economic and environmental impacts of global dairy trade liberalization." *Journal of Environmental Assessment Policy and Management* 6(3):339–365.

Stedman-Edwards, P. 2005. "Strategic Environmental Vulnerabilities Assessment: Framework Paper." Macroeconomics for Sustainable Development. Washington, DC: World Wildlife Fund.

Stone, R. 1978. "The disaggregation of the household sector in the national accounts." Paper presented at the World Bank Conference on Social Accounting Methods in Development Planning. Cambridge, United Kingdom, April 16–21.

Swanson, AuPhil, and Leiv Lundethors. 2003. "Public Environmental Expenditure Reviews: Experience and Emerging Practice." Environment Strategy Paper No. 7. Washington, DC: The World Bank. (http://Inweb18. worldbank.org/ESSD/envext.nsf/41/ByDocName/ EnvironmentStrategyPaperNo7PublicEnvironmental ExpenditureReviewsExperienceandEmergingPractice 2003850KBPDF/$FILE/ESP&PEERs2003.pdf

Tashrifov, Yusuf. 2005. "The effects of market reform on cotton production efficiency: The case of Tajikistan." Working Paper. International and Development Economics.

United Nations Economic Commission for Europe. 2004. *Tajikistan-Environmental Performance Review*. http://www.unece.org/env/epr/studies/Tajikistan

Unemo, L. 1996. "Environmental Impact of Government Policies and External Shocks in Botswana: A CGE modeling Approach." In M. Munasinghe (ed). *Environmental Impacts of Macroeconomic and Sectoral Policies*. Washington, DC: ISEE, World Bank, and UNEP.

UNEP. 1999. *Global Environmental Outlook*. Nairobi, Kenya: Division of Environmental Information, Assessment and Early Warning, United Nations Environment Program.

UNICEF and WHO. 2003. "Meeting the MDG Drinking Water and Sanitation Target." http://www.unicef.org/ wes/mdgreport/sanitation0.php

UNEP and Tajikistan Research Library for Nature Protection. *2004 Tajikistan-State of the Environment Report*. http://enrin.grida.no/htmls/tadjik/soe2001/eng/

USEPA. 1998. *Principles of Environmental Impact Assessment*. Washington, DC: U. S. Environmental Protection Agency.

Uusitalo, L., S. Kuikka, P. Kauppila, S. Söderkultalahti, and S. Bäck. 2006. "Bayesian impact analysis of geographical environmental factors: predicting the effects of climatic change and water quality management on fish productivity." ICES CM 2006/C:04.

Vörösmarty, C. J., P. Green, J. Salisbury, and R. B. Lammers. 2000: "Global Water Resources: Vulnerability from Climate Change and Population Growth." *Science* 289: 284–288.

Wang, L., K. Bolt, and K. Hamilton. 2003. "Estimating Potential Lives Saved from Improved Environmental Infrastructure." Washington, DC: Environment Department, World Bank.

WHO. 1990. *Public Health Impacts of Pesticides Used in Agriculture*. Geneva: World Health Organization.

WHO. 1997. *World Health Report, 1997: Conquering Suffering, Enriching Humanity*. Geneva: World Health Organization.

WHO. 1998. *The World Health Report 1998: Life in the 21st Century, A Vision for All*. Geneva: World Health Organization.

WHO. 2002. "Addressing the links between indoor air pollution, household energy and human health." Based on the WHO-USAID global consultation on the health impact of indoor air pollution and household energy in developing countries (meeting report). Washington, DC: World Health Organization.

WHO. 2004. *Child Pesticide Poisoning: Information for Advocacy and Action*. Geneva: World Health Organization.

WHO. 2004. *Public health impacts of pesticides used in agriculture*. Geneva: World Health Organization.

Willett, K., and R. Sharda. 1988. "A dynamic multimarket equilibrium model for the economic analysis of pollution control policies." *Environment and Planning* 20(3): 391–405.

Wing, H, J. Aune, S. Glomsrod, and V. Iversen. 2001. "Structural Adjustment and soil degradation in Tanzania: A CGE model approach with endogenous soil productivity." *Agricultural Economics* 24(3):263–287.

Wolf, T. Aaron, S.B. Yoffe, and M. Glordano. 2003. "International Waters: Indicators for identifying basins at risk." Technical documents in Hydrology, UNESCO. http://unesdoc.unesco.org/images/0013/001333/133306e.pdf

World Bank. 2006. *The Little Green Data Book, 2006*. Washington, DC: World Bank. http://siteresources.worldbank.org/INTEEI/936214-1146251511077/20916989/LGDB2006.pdf

World Bank. 2006. *Country Environmental Fact Sheets, 2006*. http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTEEI/0,,contentMDK:20733046~pagePK:148956~piPK:216618~theSitePK:408050,00.html

World Bank. 2007. "Burkina Faso: Country Economic Memorandum Section on Agriculture, Forestry and Fisheries." Washington, DC: World Bank.

World Bank. 2001. "Tajikistan: Towards accelerated economic growth-A country economic Memorandum." Report No. 22013-TJ. PREM/Europe and Central Asia Region. Washington, DC: World Bank.

World Bank. 2004. "Tajikistan-Welfare implications of cotton farmland privatization: A poverty and social impact analysis." Europe and Central Asia Region. Washington, DC: World Bank.

World Bank. 2006. "Priorities for Sustainable growth: A strategy for agricultural sector development in Tajikistan." Washington, DC: World Bank. World Resources Institute (WRI). "Earth Trends." http://www.earthtrends.org/
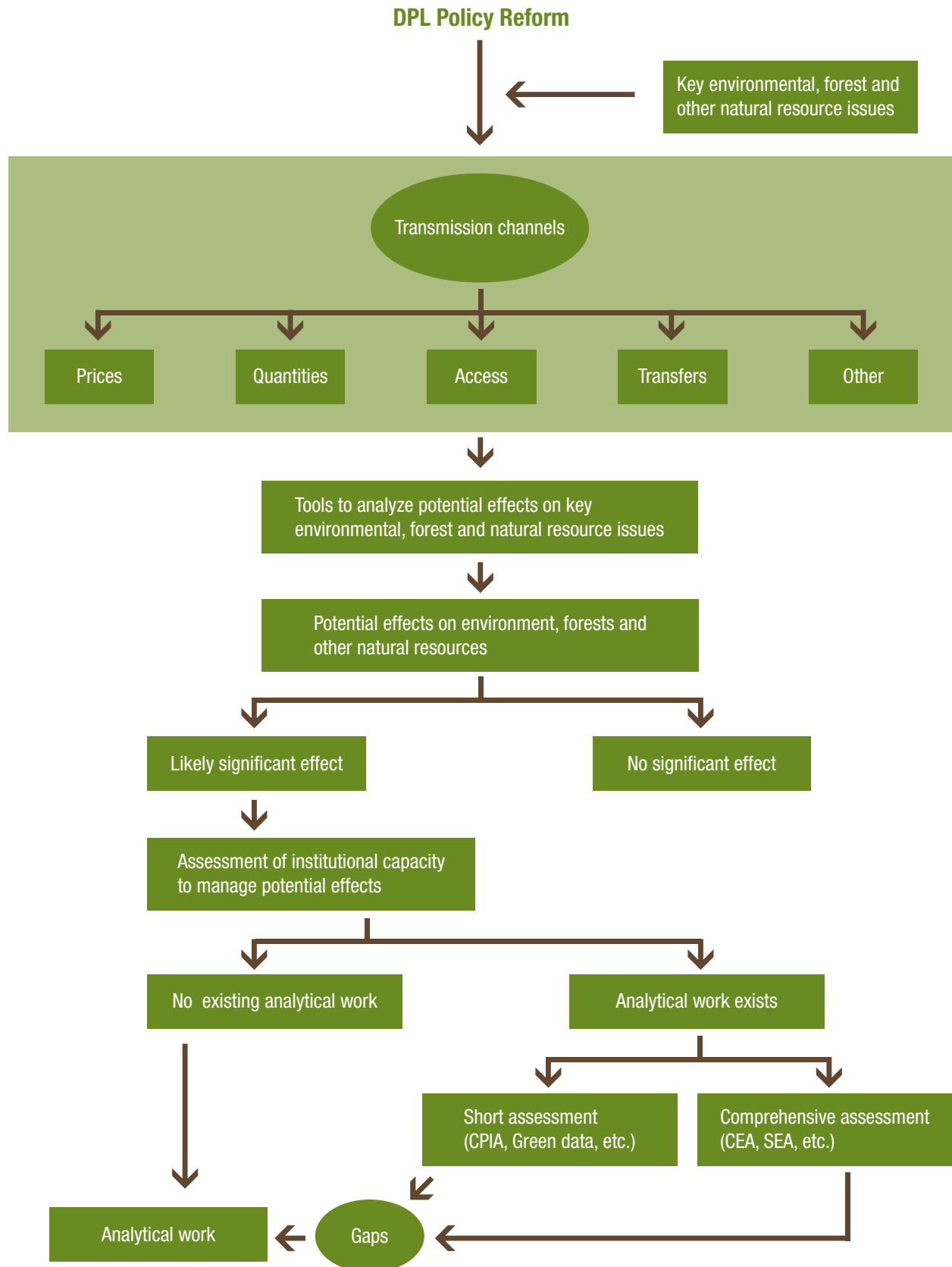
World Commission on Water. 1999. "Report of the World Commission on Water." *International Journal of Water Resources Development* 16(3): 289–320.

Xie, J. 2000. "An environmentally extended social accounting matrix: Conceptual framework and application to environmental policy analysis in China." *Environmental and Resource Economics* 16:391–406.

Zahm and Devesa. 1995. "Childhood Cancer: Overview of Incidence Trends and Environmental Carcinogens." *Environmental Health Perspectives* 103 (Supplement 6): 177–185.

Annex

DPL Policy Reform

Key environmental, forest and other natural resource issues

Transmission channels

| Prices | Quantities | Access | Transfers | Other |

Tools to analyze potential effects on key environmental, forest and natural resource issues

Potential effects on environment, forests and other natural resources

Likely significant effect

No significant effect

Assessment of institutional capacity to manage potential effects

No existing analytical work

Analytical work exists

Short assessment (CPIA, Green data, etc.)

Comprehensive assessment (CEA, SEA, etc.)

Analytical work

Gaps

DPL Toolkit Case Studies: Burkina Faso

Background and Environmental Profile

Burkina Faso is a landlocked country located in the West African Sahel. It has a population of about 13.4 million. Agriculture provides a livelihood for 80 percent of the population, but only contributes around 22 percent to GDP. Cotton exports accounted for roughly 60 percent of export revenues in 2005. The high dependence on cotton exports leaves the country's economy very vulnerable to external shocks, such as adverse developments in international cotton prices or rainfall deficits. Burkina is known to have some minor gold resources; in addition, small quantities of zinc and other metals have recently been considered to be worth extracting commercially. Per capita income was $350 in 2005, below the $450 average for low-income countries and $490 for the Sub-Saharan Africa region.

Social indicators rank largely below the average in Sub-Saharan Africa. In 2005, the literacy rate was 30 percent and life expectancy at birth was 43 years, compared to 35 percent and 46 years respectively for Sub-Saharan Africa. Burkina Faso was ranked 174th out of 177 countries in the 2006 Human Development Index (HDI) published by the United Nations Development Program (UNDP). As a result of stable and high economic growth, poverty levels have fallen in recent years from 55 percent in 1998 to 46 percent in 2003 and an estimated 42 percent in 2005. Nevertheless, the levels are high, especially in rural areas, where just over half the rural population was living below the poverty line in 2004.

Against the background of unfavorable natural conditions, the country has achieved macroeconomic stability, aided by fiscal discipline and significant inflows of external support of about 8 to 9 percent of GDP for the last 10 years. The growth rate of gross domestic product (GDP) has averaged 6 percent annually since 1995. Real per capita income has increased 20 percent since 1994.

The environmental indicators provided by the Bank and summarized in Module 2 of the toolkit show the country to be in the "red" category with respect to the proportion of the population living on fragile lands, the proportion of the population without access to improved sanitation in urban areas, and the rate of deforestation (about 100,000 ha of new land are brought into cultivation each year). The values for all these indicators are much worse than the mean for the countries in which the Bank is undertaking DPL operations.[10]

The country has a "yellow" rating for disability-adjusted life-years lost per person, the quality of the air in the main urban center of Ouagadougou, the population in areas of excess demand for water, and the number of fatalities from floods. For these indicators, Burkina Faso has values above the median for the group of 73 countries considered. Furthermore, the quality of its environmental institutions is rated intermediate, implying modest capacity at best to develop and implement environmental policy.

Importance of cotton

The high and growing dependence on cotton can be seen from the increase in area under cotton, which has gone up from 23,000 hectares in 1961 to over 500,000 in 2004. In recent years, much of this increase has occurred as a result of government policies to promote cotton (in 2000 the area planted was only 209,000 hectares.). The expansion of land area for cotton has come partly by clearing forestland, which has exacerbated the problems of erosion and availability of fuelwood. An EU GIS project in the eastern region of the country shows satellite pictures of forests being depleted, while the area under cotton is increasing. In other areas, classified forest areas are adjacent to cotton fields, which should not happen as the buffer areas next to forests are not supposed to grow cotton.

When an economy is so dependent on one crop, its economic performance is very dependent on the price of that crop, as well as on weather and other natural events. For cotton, both these factors continue to be sources of volatility. The Bank's CAS and its PRSC recognize the price volatility, but pay less attention to volatility in yields, which remain high, although there has been some improvement since 2000. Figure 1 presents the data on the volatility of cotton output measured as the 5-year standard deviation in yields.

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10   Module 1 looks at data from 73 countries where DPL operations have been carried out or are being planned.

Figure 8. Volatility of Cotton Yields in Burkina Faso, 1950–2000

Volatility 5 Yr. SD
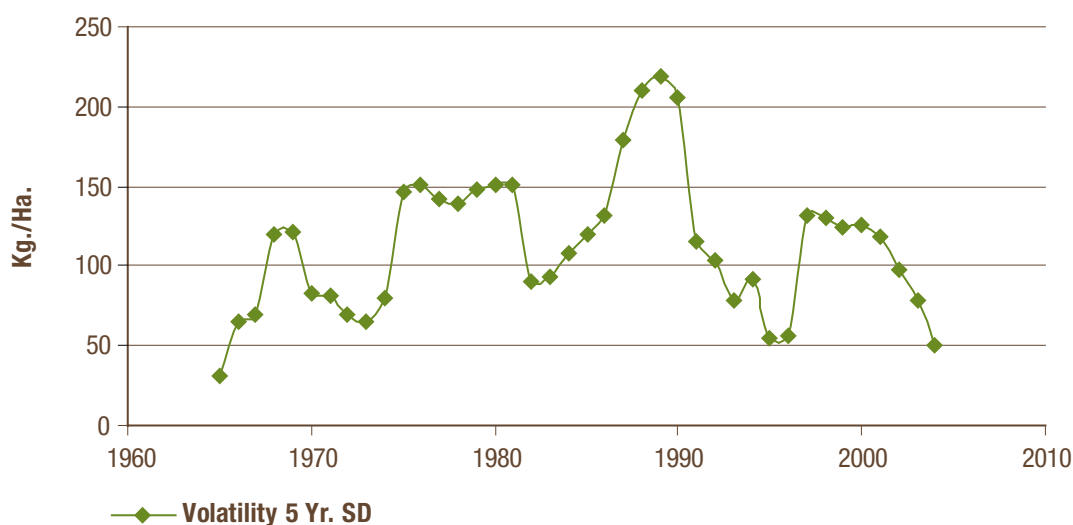
While recognizing the need for diversification, improvements in efficiency in the cotton sector remain the major objective, and this has environmental repercussions. For example, a major reform in the cotton sector has been to liberalize the cotton market. According to the Bank's draft PRSC, this has resulted in an increase in the production of cotton from 276,000 tons in 2000 to 751,000 tons in 2006. Burkina is now the largest cotton producer in Africa. The increase in cotton output has undoubtedly come in large part from putting more land under cotton, in part by clearing forestland. CONEDD, the National Office for Sustainable Development, estimates that at this rate of expansion the country will effectively be deforested in 15 to 20 years. Another important local agency (IUCN) notes a number of negative impacts from the use of inadmissible pesticides (imported from Nigeria) on cotton. Traces of these pesticides are appearing in meat.

It is clear that policies to promote cotton need to look at environmental and sustainability issues more closely. The government has a number of measures that seek to reduce the impact of cotton on forestland. These include the (a) adoption of genetically modified (GM) cotton, which is currently in a trial stage; and (b) the development of seed varieties that are more resistant to pests and to drought conditions. Projects under the donor-funded Terre Afrique program seek to contribute to these solutions through a participative approach, but so far no measurable impact has been reported.

Other environmental trends

In addition to the trends already noted, other adverse agricultural and environmental developments observed by the government in its *National Capacity Self-Assessment* are:

- Loss of soil fertility
- Stagnating yields for cereals
- Little progress in controlling the environmental impacts of fertilizers and pesticides
- Falling groundwater tables (about 2 meters from 1978 to 1999)
- Overgrazing and land degradation, especially near water sources
- Lack of continuity of projects to recover degraded land and to hold back the advance of the desert.

All these indicate that the state of the environment in Burkina Faso is poor and declining.

Main analytical work available

The annex to Module 2 provides a list of studies that have some useful material on the environmental sector in Burkina Faso.

a. The Government of Burkina Faso's (2007) *National Capacity Self-Assessment* was prepared by the Ministry of Environment with support from UNDP and GEF in 2007. It provides detailed information on the environmental issues facing the country, as well as its needs in meeting the objectives of addressing climate change biodiversity,

desertification, and sustainable development more generally. It also identifies all the agencies working in these areas in the country and estimates their capacity needs.

b. The *World Bank Country Economic Memorandum Section on Agriculture, Forestry, and Fisheries* (World Bank 2007) was prepared by the Bank as part of the CEM in 2007. It provides an up-to-date review of the issues in these sectors, as well as the economic and policy implications of likely trends in the near future.

c. *Burkina Faso: Poverty Reduction Strategy Paper* (IMF 2005) provides information on developments in the natural resource sectors in the context of the poverty reduction strategy.

d. Writing about cotton, Baffes (2005) discusses what reforms are needed in the cotton market to improve its contribution to the livelihoods of poor households. Does not cover the environmental linkages.

e. Gray (1999) found that cotton has increased farmed areas, decreased fallow periods, and contributed to pressure on land resources. Regarding the impact in terms of land degradation, at the broader scale there is evidence of deforestation and areas classified as degraded, but at the field level there is little evidence of loss of soil quality.

f. IUCN (2005) notes that the eastern part of Burkina is home to much of the biodiversity and wildlife of the country, but is currently under pressure from population growth and cotton expansion. The study looks at one area (Kondio) and the impacts of cotton on the other resources available to the villagers.

g. Guibert and Prudent (2005) report more widely on the changes in land use in the east of the country, in and around the "Parc du W." The expansion of cotton is one of the major factors that has influenced land degradation.

h. Guibert (1999) is a detailed assessment of the environmental impacts of expanding cotton in Burkina Faso.

There are no documents that specifically look at the economy-environment linkages in a systematic and comprehensive manner.

Triggers and policy actions raised in the PRSC-VII
The Bank is currently appraising the 7th Poverty Reduction Strategy Credit for Burkina Faso, which would provide annual budget support of $90 million. The program supports reforms in a number of areas. Table 1 describes the original trigger (from PRSC-VI) and the prior actions (as agreed under PRSC-VII) required from the government. There are a number of areas covered:

a. On the macroeconomic front, the triggers consist of maintaining an adequate macroeconomic framework, making reforms to the systems of VAT refunds for exports, and adopting a budget for 2007 that respects the sectoral ceilings that are in line with PRSP priorities.

b. On improving the investment climate, it seeks to reduce business start-up times.

c. On improving financial management, the trigger is to improve procurement.

d. On better governance, it asks for strengthening of capacity of audit institutions.

e. On decentralization, it seeks progress in transferring responsibilities and resources to municipalities and regions.

f. On improving infrastructure, it requires as triggers the effective implementation of the water and sanitation improvement program and progress in contracting services under the urban development project.

g. Finally, there is a sectoral trigger for agriculture, asking for reforms in the tenure laws to give greater security to farmers in targeted provinces.

Most of these triggers do not have environmental implications, but some do. The next section provides an assessment of these implications.

Environmental Risks Associated With Proposed Policies

The potential links between the reforms being supported by the PRSC and the environment are shown in Table 2. In each case, the corresponding transmission channels to the environment and the advice given on action are provided. These are taken from Module 1 of the toolkit.

a. The macroeconomic triggers are mostly neutral as far as the environment is concerned. The only exception is the determination of sectoral expenditure ceilings in line with the MTEF. The problem is that the expenditures for environmental protection and management are often not given the priority they deserve. This needs to be addressed.

b. On improving the investment climate, the toolkit flags the risk that environmental due diligence for some projects takes time. The desire to speed up the establishment of a business should not mean we cut corners in the process of EIA.

c. On decentralization, the toolkit warns that account should be taken of local capacity to implement environmental regulations. Furthermore, regulations should be designed such that there is not a "race to the bottom," with regions competing to offer investors easier terms with regard to environmental regulations.

d. The triggers on water and sanitation and on urban development are classified as "green," meaning they have direct environmental benefits. Furthermore, they offer the potential of increasing the environmental dividend from the projects by designing them with that dimension in mind. This can be achieved by bringing in environmental experts as part of the team that designs the investment programs.

e. The trigger on land tenure is classified as "yellow," meaning there could be negative impacts. These would arise if the application of the law resulted in some users who cannot establish tenure being evicted and becoming landless. Cases where such effects have resulted from land tenure programs are not uncommon.

Table 25. Assessment of PRSC-7: Original Triggers and Proposed Prior Actions

Original Trigger (from PRSC-VI)	Prior Actions (as agreed under PRSC-VII)
Maintain an adequate macroeconomic framework	Maintain an adequate macroeconomic framework
Adopt and implement the action plan drawn from the trade diagnostic study, including assessing the issue of VAT refunds for exporters within the existing regulatory framework.	Launch the preparation of the strategy derived from the trade diagnostic study and start the reimbursement of VAT arrears to exporting enterprises.
Improve the business climate by implementing the government's action plan based on the 10 macro indicators of the "Doing Business" report.	The specific indicators to be improved in the framework of PRSC-7 are as follows: (a) days to register a company; (b) employment rigidity index; (c) cost of the creation of a company (in % of national per capita income). The authorities initiated a reflection on the core 10 Doing Business indicators (starting a business; dealing with licenses; employing workers; enforcing contracts; protecting investors; getting credits; registering property; paying taxes, trading across borders closing business). This led to the preparation of a technical note that proposes a series of measures to improve the score of each indicator.
Effective implementation of the road map established by the government to reach the MDGs for water and sanitation, including adequate financing of the program budget of the General Directorate of Water and Sanitation (DGEAP) and for the expansion of the hygiene and sanitation program of the National Office of Water and Sanitation (ONEA) to four other cities.	Effective implementation of the activities of the roadmap established by the government to reach the MDGs for water and sanitation, including adequate funding for the program budget of the General Directorate of Water and Sanitation (DGEAP) and for the expansion of the urban water public utility's (ONEA) hygiene and sanitation program to four new towns.
Effective implementation of the pilot program of land tenure security in the targeted provinces; approve the land strategy in rural areas as a critical step toward the adoption of the framework law on rural land tenure.	Pursue implementation of the pilot land tenure security program in targeted provinces; and conduct further consultations to approve the strategy for land tenure security in rural areas as a critical step toward the adoption of the framework law on rural land tenure.
Adopt the draft budget for 2007 on the basis of sectoral ceilings of the 2007–09 MTEF and in line with the PRSP priorities.	Adopt the draft budget for 2007 on the basis of sectoral ceilings of the 2007–09 MTEF and in line with the PRSP priorities.

Original Trigger (from PRSC-VI)	Prior Actions (as agreed under PRSC-VII)
Implement the action plan drawn from the 2005 CPAR.	The trigger for PRSC-7 aims at allowing an improvement of procurements contracting and execution of the reforms and a control of former procurements (a) adopt a decree stating creation of a Public Procurements Regulation Agency (ARMP); (b) revise attribution, composition, and operation of the Central Tender Board (DCMP) ; (c) create services specialized in procurements contracting in the principal contracting administrations; and (d) define their attributions and operation and give more responsibilities to the contracting authorities. The realization of this measure is related to the transposition of the WAEMU directives in the national laws. A consultant has been recruited to help prepare a draft decree that will be adopted in December 2007.
Implement the functional budget classification with a marker for poverty spending to allow for tracking of such spending.	Implement the functional budget classification with a marker for poverty spending to allow for tracking of such spending.
Strengthen the capacity of audit institutions for public finance management.	Strengthen the capacity of audit institutions for public finance management.
Effective transfers of responsibilities and resources to municipalities and regions.	Effective transfers of responsibilities and resources to municipalities and regions.
City contracts are prepared with the 6 main cities.	City contracts are prepared with the 6 main cities.

Table 2. Environmental Risks and Advice on Suitable Action

Prior Actions (as agreed under PRSC-VII)	Transmission Channel to Environment (*)	Classification and Action
Maintain an adequate macroeconomic framework	Policies designed to ensure macroeconomic stability (Table 1)	
Launch the preparation of the strategy derived from the trade diagnostic study and start the reimbursement of VAT arrears to exporting enterprises.	Policies designed to ensure macroeconomic stability: (a) improve fiscal performance and fiscal sustainability by making the tax system more equitable, transparent, and stable; and (b) expand and deepen international trade. (Table 1)	Classified as blue—no action.
The specific indicators to be improved in the framework of PRSC-7 are as follows: (a) days to register a company; (b) employment rigidity index; (c) cost of the creation of a company (in % of national per capita income). The authorities initiated a reflection on the core 10 Doing Business indicators (starting a business; dealing with licenses; employing workers; enforcing contracts; protecting investors; getting credits; registering property; paying taxes, trading across borders closing business). This led to the preparation of a technical note that proposes a series of measures to improve the score of each indicator.	Policies designed to improve the investment climate: reduction in business start-up time by eliminating unnecessary business licenses, procedures, and multiple registration requirements. (Table 2)	Classified as yellow— this should not be done at the expense of environmental due diligence.
Effective implementation of the activities of the roadmap established by the government to reach the MDGs for water and sanitation, including adequate funding for the program budget of the General Directorate of Water and Sanitation (DGEAP) and for the expansion of the urban water public utility's (ONEA) hygiene and sanitation program to four new towns.	Policies designed to Improve infrastructure: water sector reforms, including greater access to improved water sources and sanitation services. (Table 16)	Classified as green— generates direct environmental benefits.

Prior Actions (as agreed under PRSC-VII)	Transmission Channel to Environment (*)	Classification and Action
Pursue implementation of the pilot land tenure security program in targeted provinces; and conduct further consultations to approve the strategy for land tenure security in rural areas as a critical step toward the adoption of the framework law on rural land tenure.	Policies designed to increase production and competitiveness in agriculture: reform of land tenure laws and acts. (Table 9)	Classified as yellow—ensure this does not increase number without access to land.
Adopt the draft budget for 2007 on the basis of sectoral ceilings of the 2007–09 MTEF and in line with the PRSP priorities.	Policies designed to ensure macroeconomic stability: improve fiscal performance and fiscal sustainability; implement a mediumterm expenditure (MTEF) to have grater visibility of policies and place budgetary allocations in a medium-term framework. (Table 1)	Classified as yellow— but it is important to include environment as a sector that needs to have a budget in line with PRSP priorities.
The trigger for PRSC-7 aims at allowing an improvement of procurements contracting and execution of the reforms and a control of former procurements (a) adopt a decree stating creation of a Public Procurements Regulation Agency (ARMP); (b) revise attribution, composition, and operation of the Central Tender Board (DCMP) ; (c) create services specialized in procurements contracting in the principal contracting administrations; and (d) define their attributions and operation and give more responsibilities to the contracting authorities. The realization of this measure is related to the transposition of the WAEMU directives in the national laws. A consultant has been recruited to help prepare a draft decree that will be adopted in December 2007.	Policies designed to improve public financial management: improve procurement. (Table 3)	Classified as blue— no action.
Implement the functional budget classification with a marker for poverty spending to allow for tracking of such spending.	Policies designed to ensure macroeconomic stability: improve fiscal performance and fiscal sustainability; strengthen budget reporting and planning	
Strengthen the capacity of audit institutions for public finance management.	Policies designed to improve governance: better fiduciary standards and public expenditure management; strengthen internal and external audit. (Table 4)	Classified as blue— no action.
Effective transfers of responsibilities and resources to municipalities and regions.	Policies designed to promote decentralization: adequate and timely resources for local institutions and capacity building. (Table 6).	Classified as yellow—the resources and capacity needs should take account of the management of the environment.
City contracts are prepared with the 6 main cities.	Policies designed to improve infrastructure: urban transport and other sector reforms. (Table 16)	Classified as green —policies can and should be designed to promote environmental benefits.

(*) The table number refers to the Table in Module 1, which describes the transmission channel.

Analysis of Policies: Preliminary Significance of Impacts

Given the screening carried out in the previous section, we can now look at the policies in more detail. We exclude the ones where the classification was green or blue according to Module 1. The ones left for further discussion are then (a) capacity for environmental management and environmental budgets (relevant to the MTEF-based budget allocations), (b) the trigger for improving the business climate, (c) transfer of responsibilities to municipalities and regions and (d) securing of land tenure. The analysis presented here is based partly on the documents and literature and partly on direct discussions with officials during a visit to Burkina Faso, as part of the PRSC VII Appraisal Mission, from February 22–27, 2007.

Capacity for environmental management and environmental budgets

The Ministry of Environment is aware of its increased responsibilities in the context of the country's wider goals of poverty reduction and there is a lot of evidence that it is doing its best to meet these responsibilities. However, it is constrained by a lack of resources. For example:

- It has not been able to monitor the measures recommended by an environment audit of the cotton sector that was carried out as part of PRSC-4.
- It is hampered in monitoring the implementation of EIAs for major projects.
- In the water sector, many projects have been undertaken without EIAs. Big reservoirs such as Ziga are an exception, but there are many smaller projects where due procedures have not been carried out due to lack of capacity.
- There were not enough resources for the ministry to carry out its supervision of investments undertaken under the PNGT2 project.
- There are four staffers in the ministry responsible for evaluating EIAs and preparing mitigation plans where necessary. The ministry has eight inspectors who are responsible for checking for compliance with environmental regulations and they are not adequately trained.

There are also signs that the capacity to carry out EIAs that has been delegated to other departments is insufficient. For example, the Ministry of Infrastructure and Transport has problems supervising the EIA process, including checking on whether mitigation measures have been implemented. Although the ministry has been given equipment by donors for undertaking these tasks (vehicles, etc.), it lacks the funds to cover the variable costs. Hence it is sometimes unable to monitor and supervise the activities. Private firms can and do help with the supervision, but budgetary support is needed.

Likewise in the Ministry of Energy and Mines, resources are inadequate. There is only one person who deals with the environment, at a time when many exploration licenses are being issued.

Environmental "cells" were supposed to be established in the Ministry of Agriculture and the Ministry of Mines and Energy, but this has not been done.

The recommendation here is that the Ministry of Environment should given greater resources and the capacity of the environmental offices in the departments should be enhanced through more training and resources. The central ministry can outsource some of the work for some of its activities (some monitoring, data collection, etc.). But notwithstanding that, it needs more resources, both in terms of personnel and equipment, if it is to fulfill its responsibilities in an economy that is being increasingly devolved. In terms of the triggers, the adoption of the next draft budget should be preceded by a careful assessment of the needs of this ministry.

Reforms to reduce the costs of doing business, simplify the EIA process, and possibly make it less effective

The PRSC seeks to reduce the cost of doing business, including the time involved in obtaining permits. However, EIAs are one area where due diligence can take time. While it makes good sense to streamline this procedure for simple projects that do not have significant environmental implications, it would be a mistake to put pressure on the EIA process for major investments with important environmental consequences. As a general point of caution, therefore, one should allow such large projects reasonable time to be reviewed. If the target time it

takes to set up a business does not fall fast enough on account of these considerations, that should not be seen as a failure.

The recommendation for this policy is to make sure that complex projects with significant potential environmental impacts are not subject to an acceleration of the processes of setting up a business. Furthermore, enough resources should be available to the Department of the Environment to evaluate EIAs carried out externally and to make the appropriate decisions on mitigation measures.

Transfer of responsibilities to regions

This policy is controversial and some government officials have expressed their concerns about it. The Ministry of Environment, for example, is worried about the environmental implications of the decentralization policy and has raised the following concerns: First, as increased responsibility for land use planning is given to the communes, there will be an incentive to be lax on environmental constraints for projects that promise employment creation. Second, the officials in the Ministry believe that capacity for environmental planning and EIA evaluation in the communes is very weak. Under the new regulations, the ministry itself will only have responsibility for land that is owned by or directly under the management of the central government (for example, closed forests). For other land use changes, the ministry can only advise the communes. There is no obligation on their part to follow this advice.

CONEDD, the Office for Sustainable Development, also believes that the transfer of capacity to the communes could be at the expense of sustainable natural resource management. Rapid exploitation of natural resources can only be prevented through helping to develop capacity at the local level. With Bank support, CONEDD is involved in some initial activities (pilots) under the Country Partnership Program (although it cannot cover all the communes).

On the other hand, the Ministry of Decentralization is more positive. It recognizes the problem of local capacity and proposes that the central ministries should not transfer responsibilities until local capacity to manage resources is adequate. In general, the capacity at the level of communes is quite weak and should be augmented through training, capacity

building, and more resources. There should be incentives for the communities to stop resource degradation. Information campaigns and education could help. But the concept of "eco-citizenship" should evolve from within.

The recommendation with regard to this policy is to monitor that this is indeed the case— that is, that transfers are only made when capacity to implement environmental policy is adequate. The government should also monitor how regions interpret environmental regulations and do not, through competition for funds, start a race to the bottom.

Land tenure

Information on the land tenure program is limited. CONEDD noted that the law on property rights is not favorable to smallholders. There are still inherent conflicts between traditional and modern rights. Under new land policy, a piece of land may belong to the government; at the local level, chiefs have considerable say in how it is used and by whom. The proposals for changes in the law, based on extensive consultations and the Bank's own review and carried out by experts in the area, indicate that the proposals amount to good practice.

The recommendation here is to monitor carefully the implementation of the program, especially in terms of its impacts on smallholders and on environmental practices.

Further Analysis Through Tools Developed in Module III

This section looks at what additional materials on economy-environment linkages are needed for Burkina Faso and what models if any should be used to carry out the studies referred to in the previous section.

There is no Country Environmental Analysis available for Burkina Faso. Given the importance of natural resources for the economy, it would be appropriate to conduct such an analysis as part of upstream work on the country. The study should cover all major sectors, as well as addressing the links between key economic sectors and natural resources. Notable among these is cotton. Another sector that should be looked at is mining.

Another upstream piece of work that may be justified is an SEA looking at the cotton and mining sectors within the context of strategies for economic development. Given the crucial importance of cotton and its links to both the environment and economic development, it is surprising that no serious analysis of the links has been carried out. As mining and mineral extraction is a relatively new economic activity in the country, a better understanding of how its expansion will impact on other sectors and on the natural resource base is warranted.

There are no specific pieces of analytical work that follow from the recommendations in Section III. Mostly what is required is monitoring of the effects of the reforms with regard to the natural resource base of the country. The one possible analytical study that could be warranted is a Public Expenditure Review, part of which should include a Public Environmental Expenditure Review that will address the needs for public expenditure to protect the environment in the light of the changing economic structure of the country. The Environment Department has a short introduction on how such reviews should be carried out and what their scope and coverage should be (Markandya and others 2006).

References

Baffes, J. 2005. The "Cotton Problem." *The World Bank Research Observer* 20:109–144.

Gray, L.C. 1999. "Is Land Being Degraded? A Multi-scale Investigation of Landscape Change in Southwestern Burkina Faso." *Land Degradation and Development* 10(4):329–343.

Guibert, H., and P. Prudent. 2005. "Mise en place d'un programme d'évaluation des impacts environnementaux exercés par le front agricole pionnier dans l'aire protégée et la périphérie du Parc du W." *Fonds Européen de Développement*.

IUCN. 2005. Les Impacts De La Culture Cotonnière Sur La Gestion Des Ressources Naturelles Du Parc W Cas de l'enclave de Kondio. Ouagadougou : IUCN.

Markandya, A., K. Hamilton, and E. Sanchez-Tirana. 2006. "Getting the most for the money—how public environmental expenditure reviews can help." World Bank Environment Strategy Note No. 16. .http://www.worldbank.org/environmentstrategy

Ministère de L'Environnment et Cadre De Vie. 2007. National Capacity Self-Assessment. Ouagadougou : Ministry of Environment.

World Bank. 2007. *World Bank Country Economic Memorandum Section on Agriculture, Forestry, and Fisheries*. Washington, DC: World Bank.

IMF (International Monetary Fund). 2005. "Burkina Faso: Poverty Reduction Strategy Paper." IMF Country Report No. 5/340. Progress Report. Washington, DC: IMF.

DPL Toolkit Case Studies: Malawi

Background and Environmental Profile

Malawi is one the poorest countries in the world, with an economy that is based on subsistence agriculture and with over 90 percent of the population living in rural areas. Average income per capita is around $160. Population is currently estimated at 12 million people and has on average been growing at the rate of 2 percent per year. With gross domestic product (GDP) growth averaging below 3 percent, this has translated into a modest 1 percent increase in per capita incomes during the period from 1996 to 2005. Malawi also has relatively high inequality in income distribution, with a Gini coefficient of 0.38. The poverty headcount was measured at 54 percent in a 2004/05 household survey and has hardly changed since the previous household survey was undertaken in 1997/98.

Social indicators are also very weak. The maternal mortality rate is currently 984 and is one of the highest in the world. AIDS has also taken its toll, reducing life expectancy from 51.1 to 36.6 years. Adult literacy for males is 75 percent, while that of females is only 54 percent. A third of the population still uses unsafe water. The country has been hit hard by drought and crop failures, which have caused famine in recent years.

The environmental indicators provided by the Bank and summarized in Module 2 of the toolkit paint a relatively poor picture of the environmental situation in the country. Its rate of deforestation, the percent of marine species under threat, and the state of sanitation in urban areas are all classified as "red."

The rate of deforestation is probably worse or getting worse than the official figure of 0.8 percent per annum (over the period 1990–2000) suggests. Studies based on WRI and FAO data estimate the annual rate of loss at 0.9 percent between 2000 and 2005 (Butler 2006). On the other hand, there is some indication that the rate of loss relative to the 1970s and 1980s has declined. The government's own *State of the Environment Report* (the latest one was published in 2002) reports loss rates of 2.8 percent over the 25-year-period 1972–97.

Other environmental indicators that could affect DPL policies include the following:

- The relatively high number of disability-adjusted life-years lost per capita due to air and water pollution (above the median for the countries considered).[11]
- Population in areas of excess demand for water and numbers of deaths/injuries from floods (above the median for the groups of countries considered).
- The quality of its environmental institutions as measured by the CPIA score, indicating modest capacity at best to develop and implement environmental policy.

The problems that beset Malawi, as well as the possible sources for future sustainable growth, are closely tied to its natural resource base. In agriculture, land area under cultivation has been expanding at about 3 percent a year, often at the expense of forest and onto lands unsuitable for cultivation; about 16 percent of agricultural land is believed to be in this category. At the same time, the mean size of land holdings has been declining (it nearly halved between 1968 and 2000 and is now only about 0.8 ha.). Soil erosion has been exacerbated and runoff to Lake Malawi has increased significantly, both largely due to deforestation. Crop yields are cyclical due to factors such as drought, but there is also a notable lack of improvement despite the increased application of fertilizers since the mid-1990s. This may be due to the high erosion rates mentioned above.

The main source of foreign exchange (around 70 percent in 2006) is tobacco, with other agricultural products (mainly coffee, tea, and sugar) accounting for most of the rest. Tobacco is strongly associated with deforestation because the curing is mostly done using fuelwood. It has been estimated that as much as 25 percent of household wood consumption is for tobacco curing. Although there are rules requiring the maintenance of wood lots to provide sustainable timber for tobacco, these are not observed. Thus there

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11   Module 1 looks at data from 71 countries where DPL operations have been carried out or are being planned.

is a strong conflict between the goals of promoting tobacco production (where the national Growth and Development Strategy aims to improve yields and profitability) and the goals of reforestation (the same strategy suggests increasing forest cover from 27.2 percent of land area in 2005 to 20 percent in 2011 and to reforest 200,000 hectares).

Fishery resources are an important contributor to rural household livelihoods and accounts for around 4 percent of GDP. There are signs, however, of declining catches due to overexploitation. Fish consumption per capita has fallen sharply from 10 to18 kg/capita/year in the 1970s to 6 to 8 kg/capita/year at the beginning of this century.

There is a stated objective of promoting tourism and increasing its share in the economy from 1.8 percent to 8 percent by 2011. While the country's natural areas could attract many more visitors, there are serious constraints in terms of transport and other infrastructure. Furthermore, tourism and mining (the other area where the government plans to increase activity substantially) are both sectors where sound and effective environmental controls should be an important part of a sustainable development strategy. At present, the capacity to provide these controls is not adequate.

Main analytical work available

The annex to Module II has a few studies that provide some information on economy-environmental linkages in Malawi:

a. National Capacity Self-Assessment. This report was prepared in 2005 by the Ministry of Mines, Natural Resources and Environment with support from UNDP and GEF. It looks at the needs of the country for preparing and implementing projects with global environmental impacts (biodiversity, climate change, desertification). This is in the nature of an inception report and is unlikely to be helpful at this stage in assessment of capacity.

b. State of the Environment Report. Prepared by the Ministry of Natural Resources and Environmental Affairs (as it then was called) in 2002, it provides a useful though dated picture of the main trends in the use of environmental resources and the areas where problems are evident. It provides only a superficial discussion of the possible causes of the trends.

c. Malawi Tobacco Industry and the Environment. Prepared by Earthlink in 1999 and available on http://www.american.edu/TED/maltobac.htm. Details links between tobacco production and deforestation.

d. Evaluation of the 2006/7 Agricultural Input Supply Programme, Malawi. Prepared by several consultants with support from DFID, it evaluates the effects of the fertilizer subsidy program that is part of the PRSC being reviewed in this case study.

e. "The Economic Linkages Between Rural Poverty and Land Degradation: Some Evidence from Africa." (Barbier 2000) This paper looks at a number of polices, including in Malawi, where erratic agricultural pricing policies in the 1980s may have distorted the incentives to smallholders to adopt less-erosive crops. Although this is not directly relevant now, it is useful to see how such polices could impact on the environment.

Task managers may wish to consult some of these, but especially C and D above.

Issues raised in the PRSC-I

The Bank is currently appraising a Poverty Reduction Strategy Credit for Malawi to provide annual budget support to the value of $20 million. The program supports reforms in the following areas:

(i)   Functioning of agricultural markets with a focus on the establishment of additional auction floors for agricultural products; having in place a better targeted and more private-sector inclusive system of providing fertilizers and seeds to farmers; improving the functioning of land markets to improve collection of land rents from leased land; and providing title deeds for land that is currently held under traditional rights.

(ii)   Improving the business environment through reforms focusing on streamlining the business licensing regime and establishing a commercial court.

(iii) Improving the coordination, funding, and coverage of social protection programs through the establishment of national social protection steering and technical committees and reaching agreement on a social protection framework.

(iv)   Economic governance with a focus on reforms that improve payroll management and external financial accountability of the GoM.

Of these, the ones that have potential links to the environment are (i) and (ii). These links are discussed further in the next section.

Environmental Risks Associated With Proposed Policies

The potential links from the reforms to the environment and vice-versa are the following:

Functioning of agricultural markets

The possible impacts here are:

1. Increases in marketing efficiency make agriculture more attractive and thereby lead to more pressure to expand onto marginal land and to clear forestland.
2. Increased application of fertilizer causes environmental problems from runoff and also increases cultivated land area.
3. Greater auctioning efficiency and improved contract farming of tobacco leads to greater demand for charcoal and thereby to further loss of forest area.
4. Unsuccessful reforms in land taxation allow leasehold land to remain idle or take away traditional rights.
5. Moves to reduce the costs of doing business put pressure to make EIA processes simpler and possibly less effective.

Increases in marketing efficiency make agriculture more attractive and thereby lead to more pressure to expand onto marginal land and to clear forestland.
In Module 1 such a policy would be classified under "Policies Designed to Increase Production and Competitiveness in Agriculture—Improve Access to Markets" (Module 2, Table 9). The policy is classified as red, meaning that there is scope for increased cultivation of marginal land and for deforestation. Care therefore needs to be taken to ensure that this does not happen.

Increased application of fertilizer causes environmental problems from runoff and also increases cultivated land area.
In Module 1 this policy also appears under "Policies Designed to Increase Production and Competitiveness in Agriculture—Improve Marketing Arrangements for

Improved Seeds and Fertilizer." The policy is classified as yellow and the advice given there is that such policies "should be adapted to local conditions and accompanied by training in application methods to avoid excessive runoff."

Greater auctioning efficiency and improved contract farming of tobacco lead to greater demand for charcoal and thereby to further loss of forest area.
In Module 1 this policy also falls under "Policies Designed to Increase Production and Competitiveness in Agriculture—Improve Access to Markets." The concern with deforestation here is obvious given the literature reviewed in Module 1.

Unsuccessful reforms in land taxation allow leasehold land to remain idle.
The relevant section in Module 1 is "Reform of land tenure laws and land acts." The policy is classified as yellow and states: "Ensure it does not increase number without access to land."

Improving the business environment

The possible impacts here are:

Moves to reduce the costs of doing business put pressure to make EIA processes simpler and possibly less effective.
This is classified in Module 1 under "Improve the Investment Climate: Reduction in business start-up time by simplifying or eliminating unnecessary business licenses, procedures and multiple registration requirements." The policy is classified as yellow and the advice is that this should not be done at the expense of proper environmental due diligence.

Improving the coordination, funding, and coverage of social protection programs

The possible impacts are classified partly under "Social Protection: Improved monitoring and analysis of information on poverty and social wellbeing;" and partly under "Improve poverty orientation of public spending" (see Table 5, Module 1). The first policy is classified as "green," and the recommendation is that any monitoring should also look at the natural resource dependence of the poor. The second policy is classified as blue, indicating no need to follow it from an environmental perspective.

Economic governance with a focus on reforms that improve payroll management and external financial accountability of the GoM

The possible impacts here are part of the "Policies to Improve Fiscal Performance and Fiscal Sustainability" (Table 2, Module 1), or part of "Policies to Improve Public Financial Management" (Table 3, Module 1), or part of "Policies Designed to Improve Governance" (Table 4, Module 1). In detail they are listed as:

- Strengthen budget support and planning (Table 1)
- Civil service reform to include a framework for training, payroll verification, pay and grading policy (Table 3)
- Strengthen internal and external audits (Table 4)
- Improve debt management (Table 1)
- Regulatory and institutional mechanisms to fight corruption (Table 4)

All these policies are classified as blue in Module 1, so no further attention need be paid to them.

Analysis of Policies: Preliminary Significance of Impacts

Given the screening carried out in the previous section, we can now look at the policies in more detail. We exclude the ones where the classification was blue according to Module 1. The ones left for further discussion are then (a) those that come under "Functioning of Agricultural Markets" and (b) those that are under "Improving the Business Environment." The analysis presented here is based partly on the documents and literature and partly on direct discussions with officials during a visit to Malawi, as part of the PRSC I Appraisal Mission, from July 29 to August 4, 2008.

Functioning of agricultural markets
Under the functioning of agricultural markets, we identified the following policies:

1. Increases in marketing efficiency make agriculture more attractive and thereby lead to more pressure to expand onto marginal land and to clear forestland.
2. Increased application of fertilizer causes environmental problems from runoff and also increased cultivated land area.
3. Greater auctioning efficiency and improved

contract farming of tobacco lead to greater demand for charcoal and thereby to further loss of forest area.
4. Unsuccessful reforms in land taxation allow leasehold land to remain idle or take away traditional rights.
5. Moves to reduce the costs of doing business put pressure to make EIA processes simpler and possibly less effective.

Increases in marketing efficiency make agriculture more attractive and thereby lead to more pressure to expand onto marginal land and to clear forestland.
The discussions that were held during the mission to Malawi and documents reviewed at that time did not lead one to conclude that this would be a serious problem. The reforms are essentially to do with improving the operations of the national marketing board for agriculture (ADMARC), which has become synonymous with financial and operational mismanagement. The measures to be taken include setting up a new warehouse and trading company. A more efficient agricultural market corporation should improve agricultural incomes and free budgetary resources for other more effective forms of agricultural support. While there is a possibility that making agriculture more attractive will result in marginal land being brought into production, there is also the fact that farmers with more sustainable livelihoods will respond to incentives that discourage such expansion. Thus the government can be more effective in preventing such expansion when farmers are not facing serious poverty. The government needs to ensure that policies to prevent further expansion of agricultural land in marginal areas are in place and are effective. If necessary, such policies should be strengthened, but this can be done at the same time as making the changes in agricultural marketing arrangements.

The recommendation for this policy therefore is to strengthen policies to prevent expansion of agriculture onto marginal land and to control deforestation but to proceed with this component as scheduled.

Increased applications of fertilizer cause environmental problems from runoff and also increase cultivated land area cultivated.
Fertilizer subsidies can improve yields and thus create better incomes. The evidence suggests that this is the case with the present program. It is fairly well targeted

to the poor (there are reports of fraud). While it may not be the most efficient way of getting higher yields, it appears to be having positive results in terms of bigger harvests and higher incomes (see the DFID-funded study just published).

There are some concerns, however, that applications are not being made in the most efficient way, or they are being made on sloping land near irrigation canals and rivers, resulting in runoff. These reports are only anecdotal and some more systematic monitoring is warranted. To the extent that such effects are occurring, they can be addressed through better information to farmers on good application practices and the team should note the importance of that. Overall levels being applied are not high and with care the environmental impacts should be manageable.

The recommendation for this policy therefore is monitor the impacts of increased fertilizer use on runoff and to provide support to farmers in these areas on good application practices.

Greater auctioning efficiency and improved contract farming of tobacco lead to greater demand for charcoal and thereby to further loss of forest.
The issue of tobacco and charcoal is of serious concern. Malawi has a high rate of deforestation and if successful these reforms will increase the pressure on the existing forest resources. While the government is aware of the problem, one cannot feel confident that it realizes how large a task it will be to reverse the current decline. The projected planting of 200,000 hectares as part of the Malawi Growth and Development Strategy (MGDS) is very ambitious; although a budget for it is estimated, the sources of funding have been not been identified. The Forestry Department only planted around 2,000 hectares last year and will need to scale up considerably to achieve the target. It is a very underfunded department at present and morale is low. Reforestation on customary land is taking place on a larger scale, but survival rates are lower there and in all cases losses from fires are high (there is very poor firefighting equipment).

All these factors indicate that the Bank needs to be actively involved in supporting measures to prevent deforestation and to undertake reforestation. One is to enforce the requirement that tobacco growers keep 10 percent of their land as a woodlot. With contract farming

and better returns, it may be easier to enforce this regulation, which is currently ignored. The Bank could help the government in implementing the regulation.

The other measure is to look at alternative sources of energy for curing. The Ministry of Energy, Mines, and Environment is looking for partners to review more efficient curing systems (the BARREM project) (Ministry of Energy, Mines, and Environment 2006). This involves the use of solar-powered fans for preparing flue-cured tobacco. Benefits include not only reduced pressure on forests, but also reductions in CO_2 emissions, which may be marketable through one or the other of the carbon funds. A preliminary assessment of the viability of the project has been carried out, from which it is clear that some kind of subsidy scheme will be needed if it is to be implemented effectively. This is something that could be looked at as a complementary activity for the promotion of tobacco. More generally, Malawi is seeking to reduce dependence on traditional fuels. The PAESP project lays out a proposed program with a budget of 430 million Kwacha ($3 million) (Department of Energy Affairs 2006). It is not clear exactly what reductions the program will achieve, but if it can be shown to be cost-effective, it would be attractive for the Bank to support a larger effort in future years, tied perhaps to substitution of traditional fuels in areas where it is active, such as tobacco.

The recommendation for this policy is to develop, for the next PRSC or subsequent ones, a clear plan to ensure either that the wood for curing tobacco is derived from a sustainable source or that curing is done using other sources of energy. This will require an evaluation of these alternatives and the preparation of a background document to assist the preparation of future PRSCs.

Unsuccessful reforms in land taxation allow leasehold land to remain idle or take away traditional rights.

The reforms in land taxation are a complex issue. At present leaseholders are not paying the tax, partly on grounds of horizontal equity and partly because they say they cannot afford to pay. There are two possibilities that have to be considered. First, and most likely, is that stronger enforcement (as proposed in PRSC-1) will not work. In that case the present situation, in which land held under leasehold is not

being farmed or is being encroached on and farmed unsustainably, will continue. The second is that the enforcement is effective, in which case the leaseholders will try and make productive use of the land, and in the process evict the encroachers. This in turn could cause an increase in rural poverty and increased pressure on the environment elsewhere.

It is difficult to assess the consequences of the policy, not least because the new tax rates that will be introduced and enforced have still to be determined. It is claimed that it will be a "more equitable tax structure," but what exactly the levels will be and how acceptable they will be is an open question.

One issue that was raised during the mission was the need for access to credit for some leaseholders if they are to bring their land into production. It may be worth looking at how this could be provided as a first step, so that the leaseholders had an income from which the tax could be paid.

The recommendation for this policy is to undertake more analytical work on the possible consequences of the changes in the tax rates on leasehold land, as well as the consequences of stricter enforcement of the new rates on land use and on individuals who have encroached on the land. Based on the results of the study, the nature of the intervention in the leasehold land market should be reformulated.

Moves to reduce the costs of doing business, putting pressure to make EIA processes simpler and possibly less effective.
The final issue is related to the component of the PRSC that seeks to reduce the cost of doing business, including the time involved in obtaining permits, etc. However, one area where due diligence can take time is EIA. While it makes good sense to streamline this procedure for simple projects that do not have significant environmental implications, it would be a mistake to put pressure on the EIA process for major investments with important environmental consequences. A case in point is the proposed Uranium Mine ("Palladin") that is currently undergoing an EIA. There are already complaints that corners have been cut in the consultation process. The Department of Environment is dealing with this and many other new projects as best it can. From what one could see, the department's management of the process is

reasonable, although the resources to look at complex issues within the department are very limited. It rightly draws on outside expertise, but that still means it needs internal resources to evaluate the advice and make key decisions. As a general point of caution, therefore, one should allow such large projects reasonable time to be reviewed and if the target time it takes to set up a business does not fall fast enough on account of these considerations, that should not be seen as a failure.

The recommendation for this policy is to make sure that complex projects with significant potential environmental impacts are not subjected to the speeding up of the processes of setting up a business. Furthermore, enough resources should be available to the Department of the Environment to evaluate EIAs carried out externally and to make the appropriate decisions on mitigation measures.

Further Analysis through Tools Developed in Module III

This section looks at what additional materials on economy-environment linkages are needed for Malawi and what models should be used to carry out the studies referred to in the previous section.

There is no Country Environmental Analysis available for Malawi. Given the importance of natural resources for the economy, it would be appropriate to conduct such an analysis as part of upstream work on the country. The study should cover all the major sectors as well as address the links between key economic sectors and natural resources. Notable among these is tobacco. Other sectors that could be looked at are maize, sugar, coffee, and tea.

Another upstream piece of work that may be justified is an SEA looking at the environmental and economic impacts of the major infrastructure projects (such as the Shire-Zambesi water way) and of major mining projects (such as the Palladin uranium mine).

The studies proposed in this review and possible tools for carrying out the studies are given in Table 1 below.

Table 26. Tools to be used for Supportive Analytical Work

Proposed Study	Method
Carry out an evaluation of the alternatives to the current unsustainable use of fuelwood for curing tobacco.	Partial equilibrium models and/or sectoral econometric models linking the market for cured tobacco with the market for renewable energies.
Analytical work on the possible consequences of the changes in the tax rates on leasehold land as well as the consequences of stricter enforcement of the new rates on land use and on individuals who have encroached on the land.	This requires a careful analysis of the agricultural sector. Possible tools are partial equilibrium models, combined with supply response models.

The tobacco energy alternatives study will have to examine the reasons why sustainable use of fuelwood is failing and what are the economics of using alternatives. Hence it has to understand the economics of tobacco production and the likely demand for fuels for curing tobacco. Previous work in this area has used the kind of models mentioned in Table 1.

The land market impacts of changes in tax rates and enforcement rates will of course focus on the role of land in agricultural production. As rates change, farm economics will determine changes in uses to which land is put. This will require careful analysis of farm-based decision-making models, which are generally partial equilibrium models but ones that have to be rich in the institutional aspects of the rural economy. One will also want to understand, for example, what will happen to those who have encroached on unused leasehold land. This will require deep knowledge of rural society, which can be embedded in the supply-response models mentioned in Module 3.

References

Barbier, E.B. 2000. "The Economic Linkages Between Rural Poverty and Land Degradation: Some Evidence from Africa." *Agricultural Ecosystems and Environment* 82:355–370.

Butler, Rhett A. 2006. "Diversities of Image - Rainforest Biodiversity." *Mongabay.com / A Place Out of Time: Tropical Rainforests and the Perils They Face*. January 9, 2006. http://rainforests.mongabay.com/0305.htm.

Department of Energy Affairs. 2006. "Promotion of Alternative Energy Sources Project (PAESP)." Lilongwe: DEA.

DFID/USAID/Future Agricultures Consortium. 2007. "Evaluation of the 2006/7 Agricultural Input Supply Programme, Malawi." Lilongwe:DFID/USAID/Future Agricultures Consortium.

Malawi Tobacco Industry and the Environment. 2000. "Trade and Environment Database Case Study 252." http://www.american.edu/TED/maltobac.htm

Ministry of Energy, Mines and Environment. 2006. "Report on the Promotion of Solar-Powered Fans for Flue-cured Tobacco Curing." Lilongwe:MEME.

Ministry of Mines, Natural Resources and Environment. 2005. *National Capacity Self-Assessment*. Lilongwe**:**MMNRE.

Ministry of Mines, Natural Resources and Environmental Affairs. 2002. *State of the Environment Report*. Lilongwe: MMNRE.

DPL Toolkit Case Studies: Tajikistan

Background and Environmental Profile

Tajikistan is a mountainous landlocked country in Central Asia with an economy that depends heavily on exports of cotton and hydroelectric power and remittances from migrants living abroad.[12] The macroeconomic performance has been impressive since the end of the civil war in 1997. The economy has been growing, and gross domestic product grew at an average rate of 8.7 percent in the last five years. The country had a population of 6.65 million in 2006, of which about 75 percent live in rural areas. It is one of the low-income countries with a per capita income of $390 in 2006.[13] The population has been growing at about 1.3 percent annually during 1997–2006, and per capita income at 5.9 percent. The country has moderate to high inequality in income distribution, with a Gini coefficient of 0.33 in 2003. Poverty in the country is still high, although declining steadily. In 1999, 59 percent of the population was living on less than $2.15 a day (at 1993 international prices); the share fell to 43 percent in 2003.[14]

Social indicators are relatively strong in Tajikistan, although the recent civil conflict has affected the pace of progress. In 2005, life expectancy at birth for females was 67 years and for males was 61, an overall average of 64 years. Literacy rates in 2000 were 100 percent for males and 99 percent for females. The net primary and secondary school enrollment ratios in 2005 were 97 and 80 percent respectively. Both infant and child mortality rates declined over the period 1995 through 2005. The infant mortality rate and child mortality rates in 2005 were 59 per 1,000 live births and 71 per 1,000 respectively. In 2005, about 59 percent of the population had access to an improved water source, which shows a marginal decline from 61 percent in 1995. Access to improved sanitation also fell marginally, from 52 percent in 1995 to 51 percent in 2004. The prevalence of HIV is

less than 0.1 percent. Recently there has been an increase in the incidence of tuberculosis in the country, increasing from 65 per 100,000 people in 1995 to 198 per 100,000 people in 2005.

The environmental indicators summarized in Module 1 of the toolkit portray a relatively poor picture of the environmental situation in the country. The problem index for environmental institutions shows the poor status of environmental governance and the need to strengthen those institutions. Access to improved sanitation in urban areas, the problem index for environmental institutions represented by the CPIA score, and the index of marine systems under threat are classified as "red," suggesting that they should be taken into account when investigating linkages between development policies contemplated and their effects on the above indicators. There has been a concern that the recent civil conflict following independence resulted in worsened public service delivery and weaker governance.[15]

GDP per unit of energy use is relatively low, in yellow, suggesting the need to look for opportunities to increase energy efficiency. Similarly, urban air quality signals a need to use caution and to look at linkages between the policies contemplated and urban air quality.

In addition to the above, other indicators that should be noted include:

- The relatively high proportion of people living in fragile lands, which is above the median for the groups of countries considered.[16]
- The population in areas of excess demand for water and numbers of deaths/injuries from floods, which is above the median for the groups of countries considered.

The government has pursued sound macroeconomic management since the end of the civil war in late

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12   There has been an increasing inflow of remittances recently.

13   Per capita gross national income using the World Bank Atlas method.

14   World Bank, WDI online

15   Tajikistan Living Standards Survey, 2003

16   Module 1 looks at data from 71 countries where DPL operations have been carried out or are being planned.

1997. To sustain economic growth, the country will need significant improvements to the private investment climate; reforms in business licensing, permits, and inspections; and transparency in privatization and market development.

The key strategic sectors for future sustainable economic growth in Tajikistan are agriculture, notably cotton, and aviation . In recent years remittances have grown exponentially due to unsatisfactory job prospects in Tajikistan and buoyant growth in Russia—the origin of about 90 percent of remittances—where monthly dollar wages have tripled since 2001. The main sources of foreign exchange are cotton, electricity, and remittances. Cotton is traditionally the most important agricultural product in the country. It accounts for about 60 percent of agricultural output, 15 percent of export earnings, and 35 percent of tax revenues. Productivity and yields in the cotton sector are low and rural poverty is highest in the cotton growing areas. Cotton yields are currently only half of their pre-independence levels and 55 percent of the yield required for reasonable profits. In order to meet the challenges in the cotton sector, the government finalized a cotton sector reform strategy in 2005. The electricity tariffs in the country are below the cost-recovery level. The government has raised electricity tariffs recently and plans to continue to do so until tariffs reach cost-recovery levels.

In addition to the reforms in the core sectors, the government is committed to implementing public sector reforms like rationalization of core public administration structures, civil service reforms, and reforms in public financial management. In order to improve public delivery of services, the government plans to implement reforms in the delivery of primary health care and education.

Main analytical work available

The attachment to the main report provides a list of studies that provide some information on economy-environmental linkages in Tajikistan:

A. *Tajikistan Environmental Performance Review.* Prepared in 2004 by United Nations Economic Commission for Europe, this report covers twelve issues of importance to Tajikistan, including the framework for environmental policy, management of pollution and natural resources, and economic and sectoral integration. The issues that received special attention during the reviews were poverty, environment, and economy; the policy, legal, and institutional framework; environmental expenditures and privatization; information, public participation, and education; management of air, water, and waste; agriculture; biodiversity; and ecotourism.

B. *Tajikistan 2002: State of the Environment.* This report, prepared by the Research Laboratory for Nature Protection (Tajikistan) in partnership with UNEP/GRID-Arendal (Norway), contains twelve environmental topics, as well as the information about the country and its socioeconomic development, a collection of maps and graphics, and references to additional information sources. Environmental indicators used in this report are based on the national environmental priorities and correspond to the international set of indicators, including those accepted by OECD, UNCSD, EIA, and UNEP.

C. *Tajikistan: Country Environmental Analysis.* This 2004 report prepared by the Asian Development Bank provides an assessment of the existing constraints, needs, and opportunities in the country, an overview of the environmental strategy, the principal environmental issues, and the environmental management regime in the country. The principal environmental issues identified are natural disasters, including drought and landslides; land degradation, including salinity in irrigated areas and soil erosion; deforestation and desertification; inadequate supplies of safe water in rural areas and deterioration of water supply; and inadequate wastewater and solid waste management infrastructure.

D. "The effects of market reform on cotton production efficiency: The case of Tajikistan." This paper (Tashrifov 2005) examines the effects of market reform on the agriculture sector of Tajikistan. It investigates the level and determinants of technical efficiency for a sample of cotton growing regions. The results show that market reforms had a significant positive impact on technical efficiency of cotton production, which, in turn has made a substantial contribution to the process of economic development.

E. "Tajikistan-Welfare implications of cotton farmland privatization: A poverty and social impact analysis." This World Bank paper published in 2004 analyzes the welfare implications of cotton

sector reform, with special reference to the privatization of farmlands in Tajikistan, which began in 1998.

F. *Tajikistan: Toward accelerated economic growth-A country economic memorandum*. Published in 2001, this World Bank Country Economic Memorandum looks at the potential to reduce poverty in Tajikistan through accelerated economic growth. It focuses on productive economic sectors, such as industry, agriculture, and the power sector. The role of the finance and banking, telecommunications, and transport sectors are also outlined because of their importance in the expansion of domestic economic activity and regional/international trade.

G. *Priorities for Sustainable growth: A strategy for agricultural sector development in Tajikistan*. Published in 2006, this World Bank study reviews recent trends and performance in the agriculture sector, identifies the factors limiting sustainability of the sector, and provides a strategic framework for sustainable agricultural growth. It provides a review of the cotton sector. The proposed sector strategies include extension of the land reform programs, cotton sector reforms, improved access to rural finance, diversification of the production base, livestock production and productivity, expansion of horticultural production and exports, reforms in rural institutions, and integration of agricultural markets.

The above documents provide a general overview of the environmental conditions in the country.

Triggers and policy actions in the Tajikistan PDPG-2

The Bank is currently pursuing the Second Programmatic Development Policy Grant for Tajikistan to provide annual budget of $10 million. The program supports reforms in a number of areas. The original trigger and the prior actions required from the government are presented in Table 1. The reforms proposed are summarized below:

a. Improve the investment climate through reforms in licensing, permitting, and inspections. Specific triggers are meant to ensure compliance with the amended law on licensing and inspections amendments.

b. In order to achieve transparency and accountability in privatization and enhancing competition, the program stipulates disclosure of information on all 2005 and 2006 asset sales by the state committee on investment and state property, and all information requested by the international firm carrying out the compliance review.

c. In order to improve public sector management, triggers include rationalization of core public sector administration structures.

d. On improving the public financial management system, triggers to improve the internal and external audit systems are proposed.

e. Regulatory reform in the aviation sector, energy sector and cotton sector include restructuring the aviation sector (Tajik State Airlines), revising electricity tariffs to cost-recovery levels, revising the cotton pricing method, and accreditation of a joint venture to provide cotton grading services

f. Reforms in public delivery of health services and the education sector.

Table 27. Assessment of PDPG-2 Original Triggers and Proposed Prior Actions

Original Trigger	Prior Actions
Improving the investment climate through reforms in licensing, permitting, and inspections	Submit to the Parliament draft amendments to existing legislation to ensure compliance with the amended law on licensing and inspections. Adopt amended regulations to ensure consistency with the amended law on licensing. Adopt government and presidential decrees to implement the new law on inspections. Submit to the Parliament draft amendments to ensure compliance with new law on inspections and issue new regulations and manuals for inspection.
Transparency and accountability in privatization and enhancing competition	Disclose information on all 2005 and 2006 asset sales by the State Committee on Investment and State Property Management in the media. Adopt an action plan to implement the communication strategy and implement short-term measures. The State Committee for Investment and Property Management submit all information requested by the international firm carrying out the compliance review. Revise implementing regulations and institutional mechanisms to implement new competition law and submit to the Parliament a new draft law acceptable to IDA on natural monopolies.
Regulatory reform in the aviation sector	Adopt a presidential decree acceptable to IDA on separation of policy making and technical regulation. Adopt a government resolution on restructuring of Tajik State Airlines that foresees by the end of 2008 separation of airlines, airports, and air traffic control.
Regulatory reforms in the cotton sector	Publish revised cotton pricing method and accredit a joint venture to provide grading services (subject to the laboratory being established with ADB financing).
Regulatory reforms in the energy sector	Complete separation of functions between electricity utility Barki Tajik and Ministry of Energy. Issue government resolution to raise electricity tariffs to full cost-recovery level in line with the agreed schedule by 2010, and adjust gas tariffs in line with increases in import prices.
Reform public sector management, including rationalization of core public sector administration structures.	Complete horizontal functional review of the central level of the executive. Establish a working group to develop the concept for the structure of the public administration and develop an action plan that includes an analysis of the current situation, development of proposals for the structure of public administration as well as reporting and accountability arrangements, public awareness, and development of a concept and measures for its realization.
Reform of the civil service	Civil service management, including adoption of a new civil service law and adoption of a government resolution and secondary legislation on merit-based recruitment and promotion.
Reform of the public financial management system	Issue a medium-term expenditure framework instructions, and issue budget instructions for the public sector in accordance with instructions for the medium-term expenditure framework. Adopt Procurement reforms—including standard bidding documents for goods, works, and services—and implementing regulations as referred to in the public procurement law.
Reform of the internal audit and control	Adopt government resolution endorsing the strategy for the development of public internal financial control.
Reform of external audit	Presidential declaration on commitment to develop an independent audit function and announcing the formation of a task force that will be responsible for setting out the options.
Reform in the public delivery of primary health care	Allocate in 2007 a greater share of wage increases in the health sector to primary health care workers as agreed with IDA. Introduce a calculation of co-payment categories and pricing for guaranteed basic benefit package acceptable to IDA.
Educational sector reform	Reform of remuneration system, pay allowances, bonuses, and promotion system of education workers so as to compensate them based on the level of responsibility and qualifications. Expand implementation of per capita financing through a government resolution to additional rayons.

While most of these triggers are benign in terms of environmental, impacts some of them may have potential/significant environmental impacts. The environmental implications associated with proposed triggers are presented below in the next section.

Environmental Risks Associated with Proposed Policies

The potential effects of the proposed reforms on environment, natural resources, and forests in Tajikistan are presented in Table 2 below. The transmission channels and the advice on possible action, taken from module 1 of the toolkit, are also provided.

a. On improving the investment climate, the toolkit alerts us to the risk that environmental due diligence for some projects takes time and the reforms to speed up licensing and permitting should not undercut the importance of the EIA or any other environmental due diligence that may be required.

b. On transparency and accountability in privatization and enhancing competition, the toolkit warns that measures to increase private sector competition and speed up privatization must ensure that the supporting regulations include good environmental practice.

c. The triggers associated with restructuring of the aviation sector, delivery of public health services, and the education sector are mostly neutral as far as the environment is concerned, and no further action is required.

d. On reform of public sector management, including rationalization of core public sector administration structures and reform of the civil service system, the triggers are mostly neutral as far as the environment is concerned.

e. On reform of the public financial management system, including internal and external audits, the triggers are also neutral. The only exception is in the determination of sectoral expenditure ceilings in line with the MTEF framework. Expenditures for environmental protection and management are not usually given the priority they deserve; this should be sufficiently addressed.

f. In the case of the triggers for cotton sector reforms, the toolkit flags the possibility of negative environmental impacts. The suggested revision of the cotton pricing system raises the possibility that the resulting increase in returns from cotton production may lead to adoption of environmentally damaging practices. Similarly, better grading practices may lead to increased opportunities for expansion of trade. Although increased trade/marketing is a desirable outcome, there is a need to ensure that this does not lead to expanded production that is environmentally damaging.

g. The trigger for energy sector reform, revision of prices, is classified as "yellow," which implies the possibility of negative impacts. Higher prices for electricity may lead poor households to revert to traditional fuels, with environmental and health implications.

Table 28. Environmental Risks and Advice on Suitable Action

Original Trigger	Transmission Channel to Environment (*)	Classification and Action
Improve the investment climate through reforms in licensing, permitting, and inspections	Policies designed to improve investment climate: eliminating unnecessary business licenses, procedures, and multiple registration requirements. (Table 6 of Toolkit)	Classified as yellow. This should not be done at the expense of environmental due diligence, environmental impact analysis
Transparency and accountability in privatization and enhancing competition. State Committee for Investment and Property Management submit all information requested by the international firm carrying out the compliance review. Revise implementing regulations and institutional mechanisms to implement new competition law and submit to the Parliament new draft law	Policies designed to improve investment procedures: Reduce uncertainty for investors by implementing the investment law and its supporting regulations and new operating procedures (Table 6 of Toolkit)	Classified as yellow. It is important to ensure that the supporting regulations include and require good environmental practice.
Regulatory reform in the aviation sector, restructuring of Tajik State Airlines, which foresees by the end of 2008 separation of airlines, airports, and air traffic control.	Policies designed to improve infrastructure: Secure, safe, economical and efficient civil aviation system (Table 20 of toolkit)	Classified as blue: no action
Implement regulatory reforms in the cotton sector, implement revised cotton pricing method, and accredit a joint venture to provide grading services	Policies designed to increase production and competitiveness in agriculture (cotton). Provide better incentives to and institutional arrangements to farmers to increase returns (Table 13 of toolkit)	Classified as yellow: Increased returns should not be from adopting environmentally damaging practices
	Policies designed to improve trade and marketing of agro-processed products (Table 13 of toolkit)	Classified as red: Need to ensure this does not lead to expanded production that is environmentally damaging.
Regulatory reforms in the energy sector- raise electricity tariffs to full cost recovery level by 2010 and adjust gas tariffs in line with increases in import prices.	Policies designed to reform tariff structure to reflect costs, cover costs of generation (Table 21 of toolkit)	Classified as yellow: Higher costs may imply poor households cannot afford the services. They may then revert to traditional fuels, with environmental and health implications. Social protection programs will need to be implemented
Reform public sector management, including rationalization of core public sector administration structures.	Policies designed to promote institution building in the public administration sector to affect financial management, personnel management, and economic decision making and improve performance through introduction of internal auditing, evaluation, and performance review (Table 8 of toolkit)	Classified as blue: No action
Reform of the civil service to include adoption of a new civil service law and adoption of a government resolution and secondary legislation on merit-based recruitment and promotion	Policies designed to create a lean, effective, and efficient civil service free of corruption and improve human resource management in the public sector (Table 8 of toolkit)	Classified as blue: No action

Original Trigger	Transmission Channel to Environment (*)	Classification and Action
Reform of the public financial management system to include medium-term expenditure framework and procurement reforms	Policies designed to improve macroeconomic stability and improve fiscal performance and fiscal sustainability: Implement a Medium-Term Expenditure (MTEF) to have greater visibility of policies and place budgetary allocations in a medium-term framework (Table 5 of toolkit)	Classified as green: But it is important to include environment as a sector that needs to have a budget line with other priorities.
Reform of the internal audit and control	Policies designed to improve public administration through introduction of internal auditing, evaluation, and performance review; strengthening internal audit (Table 8 of toolkit)	Classified as blue; No action
Reform of external audit	Policies designed to improve public administration through strengthening external audit (Table 8 of toolkit)	Classified as blue; No action
Reform in the public delivery of primary health care	Policies designed to: improve financial and fiduciary environment for health- decentralize health services, primary and secondary level services (Table 19 of toolkit)	Classified as blue; No action
Educational sector reform, reform of remuneration system	Policies designed to improve financial and fiduciary environment of education sector; facilitate transfer of resources to districts to meet the needs of education service delivery; improve efficiency of education expenditure (Table 18 of toolkit)	Classified as blue; No action

(*) Table number refers to the table in Module 2, which describes the transmission channel

Analysis of Policies: Preliminary Significance of Impacts

Based on the screening carried out in the previous section, this section looks at the policies in more detail. We exclude the ones where the classification was green according to Module 2. The remaining policies that are left (yellow and red) are:

a. Policy reforms in licensing, permitting, and inspections to improve the investment climate
b. Policies to encourage transparency and accountability in privatization and enhance competition for improving the investment climate
c. Regulatory reforms in the cotton sector, including implementation of a revised cotton pricing method and accreditation of a joint venture to provide grading services
d. Regulatory reforms in the energy sector, including raising electricity tariffs to full cost-recovery level by 2010 and adjusting gas tariffs in line with increases in import prices.

The above policies/triggers may produce likely significant impacts on environment and natural resources in the country and are discussed in detail below.

Policy reforms in licensing, permitting, and inspections to improve the investment climate

The Tajik government has identified private sector development as one of the pillars for sustained economic growth and development. The proposed reform seeks to improve the investment climate in the country through reforms in business licensing, permitting, and inspections. The specific actions proposed are amendments to the existing legislation to ensure compliance with the amended law on licensing and inspection and prepare new guidelines, manuals, and checklists for inspections. There have been problems with the speeding up of business start-up times and licensing procedures. When the primary investment sectors and/or operations are likely to have major environmental impacts, it is not appropriate to require these to be done hastily. This applies to areas such as mining and forestry. Proper procedures in

these sectors will take time (as they do in industrialized countries) and should not compromised for due diligence regarding effects on environment.

The recommendation for this policy is that in the case of complex projects with a possibility of significant environmental impacts, the analysis of potential environmental impacts should not be compromised by speeding up the licensing and permitting process. The Department of Environment may be strengthened with more resources for more effective inspections and implement compliance requirements.

Policies to encourage transparency and accountability in privatization and enhance competition for improving the investment climate
While competition increases efficiency and improves investment climate, measures to improve competition may result in the deterioration of overall environmental standards. As the government pursues privatization and encourages competition in sectors like aviation, energy, and other infrastructure operations, there could be possible impacts on the environment.

The general recommendation here is to give due consideration to the environmental impacts while implementing triggers for fostering competition though private sector participation.

Regulatory reforms in the cotton sector, including implementation of a revised cotton pricing method and accreditation of a joint venture to provide grading services
Cotton is one the key sectors in the Tajik economy. Productivity and yields in the cotton sector are low, and rural poverty is highest in the cotton growing areas. In order to meet the challenges in this sector, the government finalized a cotton sector reform strategy in 2005. The reforms in pricing and grading of cotton will provide better incentives and institutional arrangements to farmers to increase their returns. As returns to cotton production increase, farmers will tend to intensify and expand production. This might lead to adverse environmental impacts associated with production and processing. At the producer level, the main environmental impacts from cotton production, in order of importance, are use of agrochemicals (of which

pesticides are more important), water use, soil erosion and degradation, freshwater contamination, and habitat conversion and the associated loss of biodiversity. The increased use of fertilizers and pesticides will affect the quality of water and soil. The high use of pesticides may result in human health concerns for both farm workers and downstream populations.

On the processing and manufacturing side, the use of industrial chemicals, especially ones associated with dyeing textiles and finishing clothes, are of concern. These chemicals not only affect the environment, but also the workers in the processing and apparel industries.

The recommendation for this policy is to monitor the impacts of increased pesticide and fertilizers use on runoff and water quality impacts downstream. Development and use of varieties that are resistant to pests and diseases could result in overall reduction in pesticide use. Soil erosion, land degradation, habitat conversion, and effects on biodiversity need to be systematically monitored. The occupational health of farm workers also should be monitored. On the processing and manufacturing side, ensure that proper environmental safeguards are in place regarding the use and disposal of industrial chemicals and the safety of workers.

Regulatory reforms in the energy sector, including raising electricity tariffs to full cost-recovery level by 2010 and adjusting gas tariffs in line with increases in import prices
Electric energy is another key sector of the Tajik economy that provides significant foreign exchange by way of exports. The proposed reform is to revise the domestic tariff rates to cost-recovery levels.

Higher electricity tariffs may result in poor households switching to traditional fuels, including wood fuels. A switch to fuelwood in turn could lead to deforestation. Use of traditional fuels may also have health implications.

The recommendation here is to implement targeted social protection programs to provide relief to poorer household as tariff rates are increased to cost-recovery levels.

Further Analysis Through Tools Developed in Module III

This section looks at what additional materials on linkages between development policies and environment are needed for Tajikistan and what models should be used to carry out further detailed analysis of policies referred to in the previous section.

An upstream piece of work that may be justified is an SEA on the cotton sector with emphasis on the environmental and economic impacts of the revised cotton pricing and the proposed improvement in grading services. Given the crucial role of cotton in the country's economy and the environmental impacts of cotton growing, such a study is justified. Among the tools identified in the toolkit, partial equilibrium models or econometric models linking impact of pricing and market reforms, including improvements in grading on cotton production and supply (economic impacts), could be done. The economic impacts could then be mapped to the environmental and health impacts at the farm level and at the post-harvest processing operations.

Additional analytical work that may be required deals with the economic and environmental impacts of the revision of tariffs in the electric sector. The analysis should explore the economic effects of pricing reforms on generating capacity and power generation in the electricity industry and the associated environmental impacts. Similarly, pricing reforms will have impacts on poor households. The analysis should explore the possibility of those poor households reverting to traditional fuels as electricity prices go up. Switching to wood fuels and or charcoal may induce deforestation and lead to environmental/occupational health effects.[17] Selection of appropriate tools to analyze these effects will depend on the nature of the available data (and based on the input from the mission).

The impact of reforms in public financial management on the environment could be addressed through a public environmental expenditure review (PEER) that will address the needs for public expenditure allocations to protect the environment as the country adopts the MTEF framework and in the light of the changing economic structure of the country. The Environment Department has a short introduction on how such reviews should be carried out and what the scope and coverage should be (Markandya and others 2006).

References

Asian Development Bank. 2004. *Tajikistan: Country Environmental Analysis*. http://www.adb.org/Documents/Reports/CEA/taj-july-2004.pdf

IMF. 2007. *Republic of Tajikistan: article IV consultation report*. IMF Country Report No. 07/144. Staff Report. Washington, DC: International Monetary Fund.

Markandya, A., K. Hamilton, and E. Sanchez-Tirana. 2006. "Getting the most for the money- how public environmental expenditure reviews can help." World Bank Environment Strategy Note No. 16. http://www.worldbank.org/environmentstrategy

Tashrifov, Yusuf. 2005. "The effects of market Reform on cotton production efficiency: The case of Tajikistan." Working Paper. International and Development Economics. Asia Pacific School of Economics and Government, Acton: The Australian National University.

United Nations Economic Commission for Europe. 2004. *Tajikistan-Environmental Performance Review*. http://www.unece.org/env/epr/studies/Tajikistan

UNEP and Tajikistan Research Library for Nature Protection. 2004. *Tajikistan-State of the Environment Report*. http://enrin.grida.no/htmls/tadjik/soe2001/eng/

World Bank. 2001. "Tajikistan: Toward accelerated economic growth-A Country Economic Memorandum." Report No. 22013-TJ. PREM/Europe and Central Asia Region. Washington, DC: World Bank.

World Bank. 2004. "Tajikistan-Welfare implications of cotton farmland privatization: A poverty and social impact analysis." Europe and Central Asia Region. Washington, DC: World Bank.

World Bank 2006. "Priorities for Sustainable growth: A strategy for agricultural sector development in Tajikistan." Washington, DC: World Bank.

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17 In Tajikistan, there are cases of families with no access to gas and limited availability of electricity, burning wood in apartment buildings with no chimneys, which would be extremely hazardous to health. If the reforms result in less power cuts, the effects could be positive. Hence it is not clear that the reforms will have a negative environmental health impact.

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