Environmental Assessment Sourcebook 1999

CHAPTER 2

GLOBAL AND CROSS-SECTORAL ISSUES IN ENVIRONMENTAL REVIEW

This chapter presents information and guidance on a number of pervasive natural resource issues. By discussing them in a single chapter, the Sourcebook avoids the multiple presentations that would otherwise result, since these issues are encountered in a wide variety of Bank-supported projects.

Whether the topic is one of global significance, such as atmospheric pollution or biological diversity, or concerns a particular category of ecosystem, such as wetlands, the format is generally the same. Each section introduces the issue, presents any Bank policies or procedures that have been established, discusses the relationship of the issue to Bank lending, and provides guidance for TMs who must deal with the issue in environmental assessments.

Atmospheric Pollution

1. Atmospheric pollution refers to a variety of physical and chemical alterations of the atmosphere, including natural alterations such as volcanic emissions of particulate matter, and anthropogenic (manmade) alterations such as climate warming (the "greenhouse effect"), ozone depletion, acid rain, and the release of airborne toxic pollutants. This section will discuss two phenomena of global significance, climate warming and ozone depletion, together referred to as global change. It will also consider acid rain, which can have significant transboundary impacts.

2. The greenhouse effect is a natural component of the earth's climate by which certain atmospheric gases (known as greenhouse gases) absorb some of the radiant heat which the earth emits after receiving solar energy. This phenomenon is essential to life on earth as we know it, since without it the earth would be approximately 30 degrees centigrade cooler. However, certain anthropogenic activities have the potential to amplify the greenhouse effect by emitting greenhouse gases (primarily carbon dioxide, methane, nitrous oxide, chlorofluorocarbons and halons, and tropospheric ozone) to the atmosphere and causing their concentrations to increase. The result is an increase in mean global temperatures, i.e., climate warming.

3. Ozone (O_3) is a gas that occurs at low concentrations throughout the earth's atmosphere, although most resides in the upper atmosphere, or stratosphere (from about 10 to 50 kilometers above the earth's surface), where it acts as a protective shield, preventing harmful ultraviolet radiation from reaching the earth's surface. Ozone is constantly formed and destroyed in the stratosphere, forming a balance between O_3, O_2, and O. However, reactive chlorine and bromine species, originating primarily from the use of chlorofluorocarbons (CFCs) and halons, promote the destruction of ozone and upset this balance. It is the chemical stability of CFCs and halons, and consequently their extremely long atmospheric lifetimes of up to a century and longer, that allows them to reach the stratosphere. Once in the stratosphere, ultraviolet radiation causes the release of chlorine and bromine atoms, which act as catalysts in the destruction of ozone. Through this process, CFCs and halons contribute to general ozone depletion, as well as to localized seasonal ozone holes over Antarctica and perhaps also in the Arctic.

4. The anthropogenic activities that contribute to climate warming and ozone depletion are an integral part of human life and economic development. Anthropogenic increases in concentrations of carbondioxide (CO_2), which are responsible for about half of the climate forcing that occurred during the 1980s, result primarily from the combustion of fossil fuels (coal, oil, and natural gas) and tropical deforestation. Cement production produces a minor amount of CO_2. Anthropogenic methane (CH_4) emissions, responsible for about 15 percent of the climate forcing in the 1980s, result from agricultural activities (anaerobic decomposition of organic material in flooded rice fields and in the guts of domestic animals, burning of lands for pasture and

crop management, and burning of agricultural wastes such as rice straw), fossil fuel production (coalbed methane release during mining, and venting and leakage of natural gas during production and transmission), and anaerobic decomposition in landfills. Anthropogenic nitrous oxide (N2O) emissions, responsible for about 5 percent of the climate forcing in the 1980s, result primarily from agricultural activities (use of nitrogen fertilizers, land clearing, and biomass burning). A small, uncertain portion of the N2O emissions arise from fossil fuel combustion. Tropospheric ozone, responsible for a small and highly uncertain portion of the climate forcing of the 1980s, is not emitted directly by human activity. However, its concentration is strongly governed by trace gas emissions resulting from industrial activity and transportation.

5. CFCs and halons are manmade chemicals, responsible for about 17 percent of the present climate forcing, and believed to the main cause of the ozone depletion observed to date. CFCs are used as aerosol propellants, refrigerants, electronics solvents, and in foam blowing and chemical production; halons are used for fire extinguishers. Two other long-lived, manmade chemicals, carbon tetrachloride, which is used in chemical production, as a solvent, and as a grain fumigant, and methyl chloroform, used in industrial degreasing, cold cleaning, and as a solvent, are additional important greenhouse gases as well as ozone depleters. Table 2.1 presents anthropogenic emissions of the major greenhouse gases, by activity, and the effect of those emissions on climate forcing over the last decade.

6. Anthropogenic emissions of greenhouse gases over the last century have already committed the earth to a warming of 1-2 degrees centigrade. An effective doubling of CO2 (an increase in the atmospheric concentrations of all the greenhouse gases that in total is equivalent to a doubling of the pre-industrial concentration of CO2), expected to occur around the middle of the next century, is predicted to result in warming of 1.5-4.5 degrees centigrade. For comparison, between the last glacial maximum (about 18,000 years ago) and today, average global temperature has risen about 5 degrees centigrade. Even over the last 700,000 years, the maximum global temperature swing was no greater than 5 degrees centigrade.

7. It is not only the magnitude of the potential warming that is alarming, it is also the rate of expected climate change. Natural ecosystems that could possibly migrate or adapt in a less rapidly changing world, may not be able to adjust quickly enough to survive. Potential impacts include loss of forests, wetlands, and other ecosystems, and the decline and possible extinction of many species. Managed systems may be more resilient, although impacts are still likely to be large, particularly in countries that are least equipped to adapt. Changes in temperature and precipitation will affect agricultural and water management practices. Sea level rise will cause coastal flooding and salt water intrusion into bays and coastal aquifers to increase, and will destroy valuable wetlands. The frequency of extreme weather events (e.g., heatwaves, hurricanes) is likely to increase, affecting human health and property, and natural and managed ecosystems. Higher temperatures may exacerbate air pollution, especially smog.

8. The Antarctic ozone "hole" was first recognized in the late 1970s, and its connection to the use of CFCs and halons was established about a decade later. Significant declines in ozone in the Southern Hemisphere mid-latitudes and more modest declines in the northern mid-latitudes observed in the 1980s, as well as the decrease in the global contration of ozone of a few percent between 1969 and 1986, are also believed to be due primarily to the use of CFCs and halons.

9. Continued stratospheric ozone depletion and the resultant increase in penetration of biologically-damaging ultraviolet radiation to the earth's surface will have harmful effects on human health and the environment. Solar ultraviolet radiation induces skin cancer, cataracts, suppression of the human immune response system, and indirectly (through immunosuppression) the development of some cutaneous infections, such as herpes. Natural and managed ecosystems are likely to be affected through three mechanisms: (a) general damage to biological functions in plants resulting in stunted growth and lowered competitive capacity, (b) specific damage to DNA with similar effects, and (c) specific damage to germ cells resulting in increased mutation rates. Agricultural yields are likely to decrease and be of poorer quality, although plant breeding and genetic engineering may produce ultraviolet resistant crops. Nonmanaged ecosystems, however, may not fare so well; less resistant species will be more vulnerable and ecological

balance may thus be threatened. Ozone depletion is also likely to cause accelerated degradation of plastics and paints used outdoors, and to exacerbate urban smog.

10. Because the gases responsible for climate warming and ozone depletion have very long lifetimes once they are introduced into the atmosphere, delays in reducing emissions produce a relatively longer commitment to global change, as amplified in Table 2.1. Although the magnitude of the effects are uncertain, they are potentially severe and possibly irreversible. Taking prompt action seems wise, in light of the risks associated with delay, as well as the fact that many commonly proposed actions make economic, social, and environmental sense on their own.

. more efficient use of fossil fuel energy and development of aalternative, renewable energy sources;
. reducing the rate of deforestation and increasing reforestation (e.g., carbon sink forests);
. collection and use (as an energy source) of coalbed methane and methane generated from anaerobic systems (landfills, animal wastes, etc.);
. more efficient agricultural practices (more efficient fertilizer use, sustainable rather than shifting agriculture); and
. development and use of less damaging replacements for CFCs and halons.

11. Acid rain results from the presence of abnormally high atmospheric concentrations of substances that form acids in reaction with water -principally sulfur dioxide (SO2) and, to a lesser extent, nitrogen oxides (NOx). These oxides are formed in nature (in volcanic gases and sea spray, for instance), but in highly industrialized or urbanized areas, man-made sources emit quantities which exceed natural amounts. Coaland oil-fired generating plants are the largest sources of SO2, followed by use of high-sulfur coal and oil in industry and home heating. Energy generation and internal combustion engines are the largest sources of NOx. Data show that precipitation in wide areas of both Europe and North America is abnormally acidic.

12. Available evidence does not permit a complete assessment of the extent of damage caused by acid rain worldwide. However, poorlybuffered lakes and streams are susceptible to the changes in pH acid rain can cause, and food chains have been shown to be affected in North America and northern Europe. Certain tree species are also sensitive to acid rain, and forests have been affected on both of those continents. Stone buildings and monuments, among them many properties of historic and cultural importance, deteriorate faster where precipitation is acidic. In the cases of Canada, Germany, Yugoslavia and the Scandinavian countries, major sources of the SO2 that forms the acid rain are located in other countries.

Bank Policies, Procedures, and Guidelines

13. Although there is no separate Bank policy on climate warming and ozone depletion, guidance on global environmental issues is provided in the Bank publications, and work on the Global Environmental Facility is accelerating. Operational Directive 4.01, Annex A: "Environmental Assessment," states that the Bank "keeps fully abreast of findings [of investigations of global environmental issues], primarily through its Principal Advisor, Science and Technology, and draws upon prevailing views in developing its own environmental, economic, and sectoral policies, with a view to minimizing possible adverse impacts on global systems such as the atmosphere and oceans. While EAs should collect or refer to the relevant data, the Bank does not normally expect global environmental issues to require separate analysis in project-specific EAs. Such issues should, however, be addressed where relevant and feasible in policy and sector work" [see para 11].

14. A 1989 policy paper from the Energy Sector Management Assistance Program (ESMAP) emphasized the challenges to the energy sector by the potentially disastrous effects of climate warming. The paper stresses the need for developing countries to increase sustainable energy use and improve the efficiency of production and distribution.

15. A World Bank Discussion Paper on climate warming outlines the present state of the science of climate warming, and reviews its implications for economic development (Anderson and Waltz, 1990). Policy on

energy-efficiency is stressed as making sense environmentally and economically as well. Also, international collaboration is recognized as essential for effective response to climate warming (see para 20).

16. The Bank, through such actions as sponsorship of the Consultative Group on International Agricultural Research (CGIAR), participates in programs to improve our understanding of the science of climate change. CGIAR supports the International Rice Research Institute, which is involved in research to quantify and reduce methane emissions from rice paddies.

17. The Bank's Environmental Guidelines recommend limits on SO2 and NOx from industrial and energy sector projects. Adherence to them or to comparable limits through selection of low-sulfur fuels and installation of pollution control equipment, important in the management of regional air quality, contributes to control of acid rain as well. The Bank has also supported numerous urban projects involving conversion of heating systems from coal to gas. Sarajevo, Yugolsavia is an example. Such investments, made primarily to alleviate unhealthy air quality, act to reduce acid rain formation.

Relationship to Bank Investments

18. Numerous development activities, such as the following, may influence climate change and ozone depletion:

. energy projects involving increased production, transportation, and consumption of fossil fuels;
. forestry projects involving clear-felling or intensive logging, construction of access roads and establishment of forest products industries which induce development and further forest clearing;
. agriculture projects involving conversion of forests to pasture or crops, cultivation of paddy rice, livestock management, use of nitrogen fertilizers, burning of savanna and other lands for pasture management, burning of agricultural wastes; and
. industrial development projects involving the use of CFCs, halons, and related manmade chemicals; and construction of landfills.

19. Activities that may decelerate the threat of global change are:

. energy projects involving increased fossil energy efficiency and conservation, the development of alternative energy sources (e.g., biomass, solar, wind, hydroelectric, and cogeneration), collection and use of coalbed methane as an energy source, improved natural gas transmission systems to reduce leakage;
. industrial development projects involving the use of substitutes for CFCs, halons, and related manmade chemicals; collection of methane from landfills and other waste streams and use as an energy source;
. forestry projects involving sustainable fuelwood use and agroforestry development, forest conservation and reforestation/ afforestation;
. agriculture projects involving the development of sustainable systems, restoration of degraded lands and accumulation of soil carbon, and improved efficiency of livestock management and fertilizer use; and
. development of effective environmental regulations and agencies.

20. Energy-related investments mentioned in paragraphs 11 and 12 have implications for acid rain as well. In addition, the following projects or components can have positive impacts on the problem:

. requirements for SO2-removal equipment in industry and energy projects;
. conversion to low-sulfur energy sources in urban and industrial areas; and
. transportation sector policies which emphasize alternatives to automobiles.

21. The Bank finances projects in all of these sectors. It can therefore influence potential greenhouse warming, ozone depletion and acid precipitation through the selection and management of projects that minimize emissions of gases that contribute to these problems, and through recommendations regarding sectoral and national development strategies of borrowing countries. Of particular importance are those

projects that increase efficient energy generation and energy use, and that reduce reliance on CFCs and halons and fossil fuels.

22. The Bank already supports programs designed to improve energy efficiency and conservation. Examples include the FY88 and FY89 projects in Argentina, Bangladesh, India, Malawi, Morocco, Somalia, and Zimbabwe, all of which specifically addressed improvements in utility efficiency.

23. The Bank has undertaken a series of bilateral discussions to assess interest in the establishment of a Global Environment Facility, a mechanism through which additional funds for global environmental problems would be mobilized and managed. Such funds would be used to assist developing countries reduce use of substances that are ozone depleting (e.g., make technology transfer to reduce CFC-dependency; adopt cleaner fuels and technologies in the energy sector; retrofit or design plants in the power and industry sectors to reduce greenhouse gas emissions; and improve forest management and conservation to increase the absorption of atmospheric CO2).

24. Actions that can reduce the risk associated with global change, include:

. scaling down and/or delaying long-lived projects in favor of shorter-lived ones until future regional climatic change can be more accurately predicted;
. carefully evaluating coastal development projects in light of expected future relative sea level rise (a function of the global rise due to climate warming plus local land motion due to groundwater withdrawal, tectonic forces, etc.);
. conservation of an adequate gene pool to ensure the ability to develop agricultural species able to withstand climate extremes and increased ultraviolet radiation.

Guidance for Environmental Assessments

25. Ideally, contributions to climate warming and/or ozone depletion will be among the major issues identified during the screening of proposed projects. During initial environmental reconnaissance, the significance of the contributions should be determined and any additional concerns identified. Although the absolute magnitude of the contribution to global change, e.g., extent of climate warming attributable to the project over its expected life, will often be difficult to estimate, the relative magnitude of the contribution should be assessed. A draft Congressional Report by the U.S. Environmental Protection Agency (EPA) contains extensive information on greenhouse gas emission coefficients that can be used in this process, e.g., grams of CO2 per giga-joule of delivered energy for a combined cycle gas turbine versus a simple cycle gas turbine (USEPA 1990). Also, studies are available that quantify the relative effects on ozone depletion of CFCs, halons, and their potential replacements (Fisher 1990).

26. Options to reduce a project's contribution to global change without adversely affecting the cost or success of the project should be evaluated. For example, expansion of domestic coal mining operations is likely to result in methane emissions. Collection of the coalbed methane and use as an energy source would not only reduce the contribution to climate warming, but might also be economic. Similarly, the development and use of alternatives to CFCs and halons should be encouraged when appropriate. Several U.S. EPA reports contain detailed discussions of technical options to reduce greenhouse gas emissions (Gibbs and Lewis 1990).

27. When evaluating various alternative projects, not only should potential total gas emissions be considered, but also the particular gases that are released since not all the gases are equally efficient in terms of their greenhouse and ozone depletion capacity. For example, even though natural gas emits approximately 30 percent less CO2 per unit of energy produced than oil (and over 40 percent less than coal), the production and distribution of natural gas often results in the release of CH4, which radiatively is a much more effective greenhouse gas than CO2 (over 20 times more effective, kilogram for kilogram, over a 100-year period). Therefore, when considering switching from oil to natural gas in order to reduce CO2 emissions, the increased potential for CH4 emissions must also be considered (Shine 1990).

28. Implications of climate warming and ozone depletion for a proposed project should also be assessed. For example, projected sea level rise and increased coastal flooding should be considered when evaluating the design of a coastal drainage and wastewater system.

The Report of Working Group 1 of the IPCC (1990) provides estimates of future sea level rise.

29. The effect of existing government policies and institutions on activities that contribute to global change should be examined, and those that provide disincentives to reducing emissions of trace gases identified. For example, certain economic policies (e.g., tax concessions, subsidies) may promote deforestation or inefficient use of energy. Construction of roads and industrial logging development may provide access to previously inaccessible forests and indirectly contribute to loss of forest lands. Technologies that use chemicals that are likely to be phased out over the next decade (i.e., certain CFCs) should not be endorsed (USEPA 1990).

30. Innovative methods to fund reductions in emissions of greenhouse gases and ozone depleters and/or compensate local affected groups for costs they may incur, include:

. levy of a carbon (or greenhouse warming potential) tax on the basis of a country's emission of greenhouse gases, measured in terms of the impact of the emitted gases on global warming;
. establishment of a clearinghouse fund through which countries can substitute action at home for a more efficient, i.e., economic, action in another country;
. private investment, especially in renewable energy, energy conservation, and sustainable forest management; and
. an environmental levy from all countries based on GNP.

These and other funding mechanisms are discussed in more detail in the World Bank Discussion Paper, Funding for the Global Environment, May 1990.

31. In project-specific, regional and sectoral EAs in urban, transportation, energy and industry sectors, implications for acid rain formation should be considered. Where acidification of precipitation is found to be a probable effect of the project, the assessment should proceed to identify the geographical area which could be affected (which may greatly exceed the limits of the study area for other environmental impacts) and to characterize the resources within it in terms of susceptibility to damage from acid rain. The presence of poorly-buffered (low alkalinity) lakes and streams, cultural properties constructed of acid-soluble rock (limestone, marble and serpentine, for example) or sensitive tree species (e.g., northern red spruce) should raise concerns about possible ecological or cultural property damage which should be encompassed in the assessment of impacts and development of mitigating measures.

International Treaties and Agreements on the Environment and Natural Resources

1. Public international law governs the conduct among states and other international "persons", namely international public organizations. The World Bank, an organization created and governed by international law, undertakes its operations in compliance with applicable public international law principles. These are commonly reflected through such legal instruments as treaties, conventions, or other legally binding multilateral, regional, or bilateral agreements.

2. Environmental and conservation matters fall within the ambit of public international law in a number of instances. First, many resource and environmental questions can only be properly addressed if dressed if a number of states adopt common rules for the solution of the problems posed, the most frequently cited examples being those affecting the entire global community (e.g., high seas, atmosphere). The principle applies equally within a narrower geographic scope (e.g., regional seas or rivers). Similarly, the proper management of shared resources (such as fish stocks) can only be achieved by action on the regional or sub-regional level. Second, actions taking place within one state may produce effects which impinge upon

resources or environmental quality in one or mo re other states or beyond the limits of national jurisdiction. These results may be direct and apparent, as in the case of air pollutants affecting a state downwind of their sources; or, they may illustrate more complex consequences of the action complained of, as when a lower riparian state suffers from flooding or siltation caused by deforestation in a state upstream. In general, the scope of the appropriate legal response is determined by the nature of the issue to be addressed.

Scope of International Environmental Law

3. More than 300 multilateral treaties and formal agreements relevant to environmental protection have been adopted since 1869 and many of these carry substantive obligations for the states which are parties to the treaty. In addition, a much larger number of bilateral agreements have been concluded, ranging from understandings between states about the exchange of information and research cooperation, to substantive questions like those on boundary water management. Where a country has assumed international or bilateral environmental law obligations, they must be taken into account in project design to prevent violations and, if possible, to promote compliance. Accordingly, EA will identify whether there are international environmental law obligations of the borrower that may affect or be affected by the project.

4. The subject matter of international environmental law instruments includes

(a) issues that traditionally have been considered global, and

(b) issues that traditionally were considered domestic matters but whose ecosystem linkages or resource use considerations made international cooperation necessary. Historically, marine pollution on the high seas received the most attention. Recent years have brought increased focus to other global issues, such as:

. protection of the ozone layer (Vienna Convention for the Protection of the Ozone Layer, 1985);
. trade in endangered wildlife (Convention on International Trade in Wild Flora and Fauna, 1975, commonly known as CITES);
regulation of the seas (The United Nations Convention of the Law of the Sea, 1982 -not yet in force); and
. trade in toxic substances (Convention on the Control of Transfrontier Movement of Hazardous Substances, 1989, commonly known as the Basel Convention -not yet in force).

A global law of the atmosphere also is being developed.

5. In the category of issues which traditionally were considered domestic, most of the international law activity has related to convention of natural resources. In particular, the Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 1971, (commonly known as the Ramsar Convention) provides international mechanisms for declaration of national wetlands of international significance which, once declared, carry state obligations to protect. The Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972, provides an international mechanism for recognizing important national heritage sites, of either outstanding cultural or natural value, with similar state obligations. A number of treaties or bilateral agreements also exist dealing with regional resource management issues, such as regional fisheries use, protection of wildlife habitat or river basin management. The African Convention on the Conservation of Nature and Natural Resources, 1968, the Convention of Nature Protection and Wildlife Preservation in the Western Hemisphere, 1940, and the ASEAN Agreement on the Conservation of Nature and Natural Resources, 1984, incorporate principles for the protection of wildlife and parks and the sustainable use of harvested natural resources. Recent initiatives for a global umbrella convention in biodiversity conservation (both habitat and species) have produced a draft text, but formal deliberations by states have not yet begun.

Analyzing Obligations Under International Law

6. When identifying international environmental law obligations of a particular borrower, it is important to look beyond the text of formal treaties to a number of subsidiary devices which may be used to avoid delays

in bringing multilateral treaties into force. One of the most common forms of subsidiary agreements is the "protocol" which is authorized by the treaty in question and generally contains far more detailed provisions on some aspects of the subject matter of the treaty than the text of the treaty itself. Familiar examples include protocols under the Regional Seas Agreements relating to oilpollution control, control of land-based sources of pollution, and specially protected areas. Similarly, there is the Montreal Protocol on Substances that Deplete the Ozone Layer, 1987, under the Vienna Convention for the Protection of the Ozone Layer. It is important to be aware of which protocols borrower states may be party to, for such agreements have the potential to develop almost as if they were sub-conventions devoted to precise questions with very specific implications as to resulting state obligations.

7. Another subsidiary device used under international law to speed implementation and regular updating of treaties is to put references to technical matters in an appendix or annex, with the treaty specifying that annex amendments are possible by less rigorous or formal means than for the body of the treaty itself. Common examples of this approach include the list of protected species in appendices to CITES, various annexes to conventions dealing with marine pollution from different harmful substances, and the new Basel Convention on toxic trade (not yet in force). As part of the analysis of a country's treaty obligations, it is important to understand the specific content of such technical annexes and the borrower's legal standing with them (e.g., has the borrower ratified, renounced, made reservations, etc.).

Implementation

8. International or bilateral treaties by themselves have little direct impact on environmental quality or natural resource conservation. They operate primarily through domestic policies, statutes, and programs. A number of situations may arise under national law when a treaty is ratified by a state and triggers an obligation for implementation. First, the treaty in question may be entirely consonant with domestic law and practice, and thus be implemented exactly as domestic law. Second, while consonant in all material respects with domestic law, the treaty may require the government to monitor or report on environmental conditions or natural resource degradation to an international body or another country; thus, the treaty may assign government authorities a role in implementation which they did not have earlier (e.g., CITES reporting, toxic dumping reporting, CFC reporting). Third, the treaty may require a material change in the law.

9. A further implementation consideration resides in which domestic agencies have implementation responsibility. While commonly it is the role of the Ministry of Foreign Affairs (or equivalent) to negotiate treaties abroad on behalf of the country, once a multilateral treaty or agreement has been ratified, some technical entity typically will be responsible for implementation. Frequently, local capacity to deal with the technical complexities and reporting and enforcement requirements may lag far behind what is anticipated during the treaty negotiation process. Therefore, an analysis of existing institutional capacity to implement treaty obligations also may provide important information on whether compliance is feasible in practice and what strengthening measures might be warranted to ensure compliance.

Legal Information and Analysis

10. There are several publications on international treaties and agreements in force. These are updated periodically (see References). TMs can obtain the most recent information for a particular country by consulting the country counsel in the Legal Department of the Bank. Identification of the actual national environmental obligations under public international law generally requires the assistance of legal experts in the country concerned. Typically, the Ministry of Justice and/or Ministry of Foreign Affairs (or equivalent) maintain a list of international and bilateral agreements to which the state is a party. With this list, it is possible to identify obligations which may have a relationship to proposed development projects. The Legal Department is available to assist through the country counsels and environmental counsels in identifying and working with local lawyers and reviewing details of particular treaty obligations and their implications for proposed projects.

International Waterways

1. Projects involving international waterways and subject to the World Bank Operational Directive (OD) 7.50 "Projects on International Waterways" are those corresponding to the following descriptions:

(a) Types of international waterways:

(i) river, canal, lake or any similar body of water which forms a boundary between, or any river or body of surface water which flows through two or more states, whether members of the Bank or not;

(ii) any tributary or any other body of surface water which is a part or component of any waterway described in (i) above; and

(iii) bays, gulfs, straits, or channels -bounded by two or more states or, if within one state, recognized as necessary channels of communication between the open sea and other states -and any river flowing into such waters.

(b) Types of projects:

(i) hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial, or

similar projects which involve the use or pollution of international waterways as described above; and

(ii) detailed design and engineering studies of projects under (b)(i) above, including those to be carried out by the Bank as executing agency.

2. Waterways have always been important to countries, for trade and defense and as a commodity to be used, and likely will become more so as awareness of the interconnectedness of global resources (as reflected in such terms as "global commons") and as concern for global pollution and potential global threats (such as depletion of the ozone layer and global warming or forcing) grow.

Bank Policy

3. The Bank recognized the significance of international waterways to its members and incorporated into OD 7.50 explicit guidelines for projects involving them. This operational directive will be summarized and quoted from here, but should there be a difference of emphasis, the directive should be followed. The guidelines emphasize the necessity of identifying early in project planning the possibility of international waterways being involved and of notifying Bank officers and the other parties involved (e.g., the other riparians).

Notification of Bank Officers

4. The process of reporting begins with the Initial Executive Project Summary (IEPS). Throughout the project, the Senior Vice President, Operations (OPNSV), should be kept informed by the director of the Country Department (CD), through the Regional Vice President (RVP) and in consultation with the Legal Department. Before an appraisal is undertaken, the transmittal memorandum for the Final Executive Project Summary (FEPS) should be prepared in collaboration with the Legal Department and should convey all relevant information on the international aspects of the project. The transmittal memo should be adressed to the RVP and copied to the OPNSV and the Vice President and General Counsel.

5. The Staff Appraisal Report (SAR) and the Memorandum and Recommendation of President (MOP) should deal with the international aspects of the project, and should state that Bank staff have considered these aspects and are satisfied that:

(a) the issues involved are covered by appropriate agreement or arrangement between the beneficiary state and other riparians; or

(b) the other riparians have given a positive response to the beneficiary state or to the Bank, in the form of consent, no objection, support to the project, or confirmation that the project will not be harmful to their interests; or

(c) in all other cases, in the assessment of Bank staff, the project would not cause appreciable harm to the other riparians, or would not be harmed in like manner by the use of the waters by other riparians.

Notification of Other Riparians

6. As early as possible during the identification stage of the project cycle, the Bank should advise the state proposing the project on an international waterway (the beneficiary state) that, if it has not already done so, it should formally notify the other riparians of the proposed project. If the beneficiary state does not wish to give notification, the Bank normally will do so. If the beneficiary state objects to the Bank's giving notice, the Bank will discontinue further processing of the project. The executive directors should be informed of these developments and of any further steps taken.

7. OD 7.50 (para 8) describes cases where notification of riparians will not normally be required.

(a) Projects involving additions or alterations to any ongoing schemes that in the judgment of the Bank meet the following criteria:

(i) they will not adversely change the quality or quantity water flows to downstream riparians; and

(ii) they will not be adversely affected by the use of water that upstream riparians might make.

However, if there is any agreement or arrangement between the riparians, Bank staff should secure compliance with such agreements.

(b) Water resource surveys and feasibility studies on or involving international waterways. However, beneficiary states should be required to include in the terms of reference for such surveys and studies, an examination of any potential riparian issues.

8. Explicit procedure is provided (OD 7.50, paras 10-14) for complex situations where there are conflicting objectives between riparians.

Integration into Environmental Assessment Process

9. The environmental impacts of projects always should be evaluated as early as possible in planning, but it is crucial when international waterways are concerned. When the other riparians are notified of a project that may involve their waterways, enough data should be provided to enable them to determine its potential effects. If Project Details are not available at the time of notification, they should be made available as soon as possible after the notification. Bank staff should evaluate the information and ensure that it is adequate for the purpose of making an informed determination.

10. If it is proposed to go ahead with project appraisal prior to the availability of project details, the CD director should notify the OPNSV (according to specified procedure in OD 7.50, para 4), clarifying the international aspects, and request approval to so proceed with appraisal.

11. The Bank's Legal Department will explore the various international agreements, country legislation and regulations and so forth, that will affect a project involving international waterways. (See section on "International Treaties and Agreements on the Environment and Natural Resources" for further discussion.) The TM will normally need only to be advised of the sensitivity of such projects, to foresee as quickly as possible their involvement, and to bring the matter to the attention of the appropriate Bank officers.

International Waterways as a Global Concern

12. There is growing awareness about the global environment and growing concern about the far-reaching effects of a country's practices -practices that at one time seemed to be the proper concern only of the state in which they occurred. For example, one nation's industries or agriculture have become the proper concern of another when they pollute its lakes and rivers. If the trend toward global awareness continues, it can be expected that Bank projects increasingly will be defined as involving international waterways and thus be regulated both by Bank policy and international law.

Footnotes

1/ Definitions and project descriptions are the same as those used in OD 7.50 "Projects on International Waterways."

CROSS-SECTORAL ISSUES

Biological Diversity

1. Biological diversity, or biodiversity, refers to the variety of the world's biological resources -its living organisms. It is a function not simply of the number of ecosystems and distinct plant and animal species in existence at any given time, but also of genetic differences within individual species. This great diversity of the world's plant and animal species has intrinsic value, simply for existing. Further, biological diversity is more than a concept; it is a precious natural resource -a resource essential to human existence and commerce.

2. All principal food crops of today were derived from wild species, and the existence of genetic variability in the form of wild relatives of domestic crops is the source for continued improvement in yield and resistance to disease or stressful changes in environmental conditions.

Many industries depend on plants and animals for tannin, resins, dyes, oils and other raw materials. A large number of modern drugs originate from wild species of fungi, bacteria, higher plants and animals. Many crops are pollinated by naturally occurring events. Wild species help prevent pest outbreaks. With only a small fraction of existing species inventoried (perhaps as few as five percent), the diversity of biological resources promises numerous discoveries of useful products as yet unidentified.

3. No less important are the intangible, cultural values of biodiversity. Wild plant and animal species are sources of recreation and aesthetic pleasure to many people. They are deeply embedded in folklore and our shared heritage; they inspire works of art and expressions in languages and figure prominently in religions.

4. Biological diversity is also the characteristic of wild species and natural ecosystems that allows them to withstand external stress. Genetic variability within a species is the basis for its developing resistance to a disease or a change in climate which would otherwise cause its extinction. Species diversity affords stability to ecosystems; while a particular pollutant may destroy or drive away some of the species at one level in a food chain, others which are more resistant may remain to reproduce in greater numbers and sustain the organisms which depend on them.

5. Conservation of biological diversity is therefore a form of natural resource management which has as its primary goal maintaining the long-term potential of world biological resources to meet the needs and aspirations of future generations -a fundamental principle of sustainable development. Natural resource management practices which seek only to maximize short-term productivity, and even some practices which maximize long-term productivity of specific resources, often have the opposite effect. Thus we are witnessing the loss of biological diversity at an alarming rate, due largely to the demands of growing populations on biological resources and habitats -and the losses are irreversible. Some scientists believe 15 to 20 percent of the estimated 10 to 30 million species of plants and animals extant in 1980 may become extinct by the year 2000 if present trends continue. They estimate that extinctions are occurring 1,000 to 10,000 times more rapidly today than during the millions of years before human intervention become a significant force. These statistics illustrate the urgent need for sound management of natural resources (and especially for conservation of biological diversity) in the work of development agencies worldwide.

Bank Policy, Procedures, and Guidelines

6. The Bank has two policies directly relevant to biological diversity: (a) preservation of endangered species and critical habitats, and (b) conservation and management of wildlands. The Bank's biodiversity working

group addresses other aspects of the issue also and is promoting ways for the Bank to increase its role in this field.

7. Operational Manual Statement 2.36 "Environmental Aspects of Bank Work," issued in May 1984, states in paragraph 9(b) that the Bank "will not finance projects that cause severe or irreversible environmental degradation, including species extinctions without mitigatory measures acceptable to the Bank." In para 9(g), it states that the Bank "will not finance projects which would significantly modify natural areas designated by international conventions as World Heritage sites or Biosphere Reserves, by national legislation as national parks, wildlife refuges, or other protected areas."

8. Operational Policy Note 11.02 "Wildlands: Their Protection and Management in Economic Development," issued in June 1986, is based heavily on the principle of conserving biological diversity. Because most of the world's plant and animal species depend on wildlands for their existence, the destruction of wildlands is accelerating the extinction of species. The Bank has derived its primary wildlands strategy from this relationship: conserve biological diversity by preserving sufficient amounts of representative wildlands and protecting or managing them to sustain their viability as plant and animal habitat.

Relationship to Bank Investments

9. Examples of development activities which may have the most significant negative consequences for biological diversity are:

. agriculture and livestock projects involving land clearing, wetlands elimination, inundation for irrigation storage reservoirs, displacement of wildlife by fences or domestic livestock, heavy use of pesticides, introduction of cash crop monoculture into settings previously dependent on a large suite of local crops for subsistence agriculture;

. fisheries projects involving conversion of important natural breeding or nursery sites for aquaculture or mariculture, overfishing, introduction of exotic species in natural aquatic ecosystems;

. forestry projects involving construction of access roads, intensive logging, establishment of forest products industries which induce other development near the project site;

. transportation projects involving construction of highways, bridges, roads, railways, or canals, all of which may facilitate access to and spontaneous settlements in natural areas;

. channelization of rivers;

. dredge and fill activities in coastal or inland wetlands;

. hydropower projects involving large water diversion, inundation or other major transformation of aquatic or terrestrial natural areas, leading to habitat reduction or modification with resultant forced movement of fauna into new areas and likely violation of carrying capacity there;

. irrigation and other water supply projects that may remove water, drain wetland habitats or eliminate essential watering sources;

. industrial projects involving air, water, or soil pollution;

. large-scale loss of habitats due to mining and mineral exploration; and

. conversion of biological resources for industrial fuels or feedstocks.

10. The Bank finances projects in all of these categories. It can therefore influence the management and protection of biological resources and promote conservation of biological diversity through selection of projects, participation in the project preparation and environmental review process, project appraisal, implementation and recommendations regarding the sectoral and national development strategies of borrowing countries.

11. Between 1975 and 1988, the Bank has assisted in the finance or execution of more than 40 projects with components for conservation of biological diversity, primarily in the course of implementing its wildlands protection policy. Most of these projects have involved the establishment and/or strengthening of institutions responsible for wildlands management areas. More recently in Madagascar, the first country where the Bank assisted in developing an Environmental Action Plan, a major investment program entitled Environmental I Project includes watershed management and protection of biological resources in the Malagasy patrimony in association with the development of tourism.

12. The Bank participates in programs to improve the international gene bank network; it has been direct donor to the Consultative Group on International Agricultural Research (CGIAR) and an indirect supporter of the International Board for Plant Genetic Resources. CGIAR has enabled agricultural research centers in a number of regions to become storage centers for wild (and locally important) species and varieties of economically important food crops.

Guidance for Environmental Assessments

Determination of Impacts

13. Ideally, any implications for biological diversity will be among the major issues identified during the screening of proposed projects. During environmental reconnaissance conducted as part of an early preparation mission, the significance of the issues can be determined and any additional concerns identified. The resulting information is useful both for integrating biological diversity into project planning and design and for establishing the scope of an environmental assessment or other environmental study which may be conducted in conjunction with project preparation. A simple checklist to assist in early identification of biological diversity issues is provided here.

(a) Identify the specific types of ecosystem the proposed project will affect (e.g., tropical forest, salt marsh, wet savanna, etc.). Are any of them wildlands of special concern or designated natural sites of national or international importance?

(b) What are important biological features of the ecosystems (e.g., habitat for endangered species, or only breeding and nesting area for a particular species)?

(c) Determine the general nature of the project's impact on ecosystems (e.g., deforestation, flooding, draining, changing hydrologic regime, facilitating human access, vehicle traffic and noise).

(d) Assess the significance of likely negative impacts relative to:

. total area of ecosystem type in region and/or country (e.g., project will destroy approximately 10 percent of nation's remaining lowland swamp forest); and

. cumulative effects and trends for ecosystem type (e.g., tidal wetlands area is being lost in the country at an annual rate of three percent a year; this project and two other harbor facilities projects planned for the coastal zone will involve a total of 6 percent of the remaining area).

14. When a project has implications for biological diversity but the issue is relatively uncomplicated and the nature of the project permits, the design may be modified to eliminate the concern (e.g., change in highway alignment to avoid a wildlife refuge). Otherwise, the issue should be incorporated explicitly into the scope of

an environmental assessment or other study where it will receive more detailed analysis and will be considered when measures to mitigate adverse impacts are developed. In most cases, a qualified specialist will be essential.

15. The sample terms of reference for environmental assessments presented in the Sourcebook and the survey techniques just described should yield most of the information needed to assess project impacts on biological resources. In making a rapid assessment of habitats and species composition of plant and animal communities, the following are important information sources:

. publications on natural areas of special concern or international importance; . national compilations of flora and fauna; . stock assessments and timber, fish or other biological surveys providing census data and trends in species and populations; . national or regional programs monitoring the status of or trends in biological resources; and . local and regional research institutions and NGOs.

16. The contribution of particular ecosystems to the region and country probably exceeds simple conservation of biological diversity. OPN 11.02 discusses free environmental services that wildlands provide. Sometimes these contributions to national, regional and local economies can be measured in monetary or other terms, and can be included in any consideration of the costs and benefits of a project modification or mitigating measure to conserve specific biological resources. When not measurable, they should be described quantitatively.

Determination of Institutional Resources to Mitigate Impacts

17. In conjunction with preparing an inventory of biological resources, examine existing government policies and laws and the institutions available for their management.

. Review legislation and policies in sectors that may affect biological diversity, the extent to which conservation of biological diversity is integrated into rural development programs, and conflicts or cooperation between agencies responsible for natural resources exploitation and/or conservation - agriculture, fisheries, forestry, mineral resources, energy, water resources, recreational lands.

. Determine whether sectors such as commerce, transport or the military will have major impacts on biological resources and, if so, whether their policies are consistent with conserving biological diversity or, at least, do not unnecessarily deplete the resources in question.

. Identify policies that provide disincentives to conservation of the biological resources important to sustaining diversity, including tax concessions, credits, subsidies, grants, or indirect incentives such as construction of roads or other infrastructure in forest reserves.

. Evaluate the effectiveness of procedures and organizations for implementation of policies, laws and regulations.

Mitigating Measures

18. The technical aspects of mitigation plans for projects which may have adverse impacts on biological diversity include actions such as:

. establishing wildlands management areas or other protected habitats in the project's area of influence; . establishing equivalent conservation units elsewhere in the region to offset unavoidable loss of habitat in the project area; . designing buffer zones, wildlife corridors, and other features to maximize the benefits of the wildlife management areas or minimize impacts of the project on wildlife; . restoring damaged habitats; . creating new habitat, such as wetlands, artificial reefs, bird nesting sites; and . maintaining rare or endangered species in special facilities, such zoos, botanical gardens, seed storage.

19. Institutional aspects of mitigation plans may include:

. strengthening existing agencies with management responsibility for parks and preserves, other wildlands management areas, and biological resources in general;
. establishing new institutions, procedures and regulations;
. promoting regional perspectives in development planning to avoid loss of biological diversity through cumulative or intersectoral impacts;
. strengthening land use planning and control institutions and instruments;
. supporting scientific research pertinent to biological diversity;
. environmental education; . incentives for conservation; and
. compensation and/or concessions to groups negatively affected by conservation measures.

OPN 11.02 on wildlands provides more information and references on these topics.

20. Community involvement is critical to conserving biological diversity, especially in cases where the approach involves imposing restrictions on the use of lands enjoyed by the public or considered the domain of indigenous peoples. It is especially important to pursue dialogue with affected groups on the following topics:

. the importance of biological diversity;
. benefits to be gained from conservation of diversity;
. local costs and benefits of the project;
. realistic management options; and
. local customs, traditions, and cultural values.

21. Project components for conserving biological diversity are usually a small percentage of total project costs. However, they do not often produce revenue directly, and their operating costs may fall on agencies, which are not participating in the main components of the project. It will be difficult to obtain enthusiastic cooperation from the local parks and recreation department, for example, if it finds itself burdened by the additional expense of managing a reserve established as part of a hydroelectric power project, from which it derives no income. Implementing agencies must receive the necessary resources.

22. There are a number of methods to finance conservation of biological diversity and/or compensate local affected groups for costs they may incur in participating:

. charging entry fees to natural areas where visitors are permitted;
. taxing tourism revenues in localities where natural areas are tourist attractions;
. returning a portion of the profits from exploiting biological resources to the local community; . implementing water use charges for the water produced by a protected area;
. including a modest charge in electricity rates where power source is a reservoir protected by the conservation unit;
. "renting" the inundated area in perpetuity to the hydroelectric power producer; . establishing linkages with other development projects;
. building conditionality into extractive concession agreements;
. seeking support from international organizations; and
. establishing local "ownership" by implementing conservation through local special-purpose corporations or conservation NGOs.

23. Sectoral and intersectoral opportunities to support biological diversity initiatives do not normally arise of their own accord. In many instances they must be pursued out of the project context, for example:

. incorporation of biological diversity concerns into economic and sector planning documents;
. assistance with government planning for the management of biological resources;

. inclusion of biological diversity management issues in policy dialogues between governments and international agencies;
. cooperation with national and international NGOs; and
. incorporation of biological diversity into the curricula of development training institutions such as EDI.

(See Table 2.2 for examples of how these initiatives can be carried out.)

24. Supervision is a key aspect of conservation of biological diversity in Bank projects. It is important to monitor the implementation of biodiversity components and to evaluate the quality of the work. In addition, longer-term monitoring, perhaps beyond the end of the actual project implementation, may be the only way to determine the extent to which the project components are being sustained and are actually contributing to conserving biological diversity. That information should be fed back into country strategy and project planning to improve biodiversity components in future work.

Wildlands

1. Wildlands are natural land and water areas that have been modified by human activities only slightly or not at all. Any relatively undisturbed natural ecosystem may be a wildland; forests, grasslands, inland bodies of water, inland and coastal wetlands, and marine areas such as coral reefs are all examples.

2. Wildlands merit special attention in environmental assessments. They are valuable because (a) they constitute habitats for indigenous plant and animal species (and thus contribute to maintaining biological diversity); (b) they perform important environmental services for society at little or no direct cost; and (c) they are in some cases essential to the livelihood of indigenous peoples. (For further discussion, see the sections on "Social Issues in Ecologically Sensitive Areas" and "Indigenous Peoples.") Wildlands are vulnerable to the pressures of population growth, landlessness, and economic development and have been rapidly disappearing in many countries, developing and developed alike.

3. Wildlands of special concern are those recognized as exceptionally important in preserving biological diversity or performing environmental services. Some of these have been officially designated by national governments, sometimes in collaboration with international agencies such as the United Nations (e.g., World Heritage Natural Sites). Others are as yet unprotected but recognized nationally or internationally as biologically unique, ecologically fragile, or of special importance for local people or environmental services.

Bank Policy, Procedures, and Guidelines

4. The Bank's Operational Policy Note No. 11.02 "Wildlands: Their Protection and Management in Economic Development" expresses its general policy:

(a) The Bank normally declines to finance projects involving conversion of wildlands of special concern, even if this conversion occurred prior to the Bank's being invited to participate in the project.

(b) When wildlands other than those of special concern may become involved, the Bank prefers to site projects on lands already converted sometime in the past, rather than in anticipation of a Bank project.

(c) Where development of wildlands is justified, then less valuable wildlands should be converted rather than more valuable ones.

(d) When significant conversion (100 km2 or a significant proportion of the remaining wildland area of a specific ecosystem, if smaller) of wildlands is justified, the loss should be compensated by inclusion of wildland management components in the project concerned, rather than in some future project. This component should directly support protection of an ecologically similar area.

5. This policy pertains to any project in which the Bank is involved, whether or not the Bank is financing a component that affects wildlands.

6. Bank policy further states that, where the success of a project depends on environmental services provided by certain wildlands, a project component should be included which will conserve the wildlands. Where the wildlands do not directly serve the project, the project may be improved through wildland management to provide socioeconomic benefits in the general area. Projects with wildlands management as their sole objective are to be encouraged.

Relationship to Bank Investments

7. Wildlands are potentially linked to virtually every sector of Bank lending operations, either as resources which may be damaged or eliminated as a direct or indirect impact of a project, or as resources on which the success of the project in part depends.

. Agriculture and livestock projects may result in the displacement of wildlife and the elimination of wildlands.

. Aquaculture projects sometimes lead to loss of natural breeding and nursery grounds and disturbance of ecosystems by introduction of exotic species; many natural fisheries, however, are dependent on headwater and wetland nursery areas and may be adversely affected if these are not protected.

. Forestry projects may include logging of wildland areas and can facilitate uncontrolled access to them via logging roads.

. A variety of transportation projects, including roads, railways, canals, river dredging, and port development, also make wildland areas more accessible, induce development, and may directly eliminate wildlands.

. Shipping channel maintenance becomes more costly when a watershed has a high rate of soil erosion, which may be caused by the elimination of natural vegetation.

. Dams may inundate wildland areas but may also benefit from them for control of siltation, protection of reservoir water quality and maintenance of a balanced hydrologic cycle.

. Industrial development can affect wildlands adversely (through thermal pollution from cooling water discharges, for example, or chemical pollution of aquatic and terrestrial wildlands via water or air).

8. Environmental impacts on wildlands are often intersectoral. For instance, wetlands and headwaters are vulnerable to industrial or municipal wastewater discharges, agricultural runoff, siltation from forestry operations, or dredging and filling for transportation projects or shoreline development. If these wildland areas are not protected, fishery productivity and revenue can be diminished. Where the wildlands in question are tourist attractions, loss or damage can reduce tourism revenues as well.

9. There are also linkages to regional or global environmental conditions. Wildlands can be breeding, resting or wintering sites for fish or bird species which migrate long distances to other ecosystems. Large tracts of forest can have a moderating effect on regional climate, and destruction of them may also contribute to global warming.

10. Experience from more than 40 Bank-supported projects that included an explicit wildlands management component, has demonstrated that failure to include wildland management provisions early in the project cycle can reduce project benefits. While it may increase project complexity somewhat, it has rarely caused significant delays. The main exceptions are cases where not incorporating wildland management early caused costly delays later. The Bank therefore concluded that wildland management should routinely be

incorporated into certain types of projects, and that this should be done as early as possible in the project cycle to minimize costs and facilitate implementation.

Guidance for Environmental Assessments

11. The environmental assessment process provides a framework within which the costs and benefits of converting wildlands to more intensive uses can be compared with those of conserving them. It also serves as a vehicle for discovering project alternatives or components which have neutral or positive impacts on wildlands and for identifying and implementing measures to mitigate or offset negative impacts when they are otherwise unavoidable.

12. The process of describing the environment of a proposed project in an environmental assessment includes locating and characterizing all wildlands which exist in the study area. The following information should be obtained for each wildland:

. site name (if an official name has been given);
. type of ecosystems;
. geographical extent (best shown by map) and size;
. important physical, biological and socio-cultural characteristics (e.g., recharge area for significant aquifer, habitat for endangered species, presence of tribal people, religious significance, etc.);
. international, national or other designation, if any;
. current site condition (e.g., undisturbed, degraded);
. type of protection or management, if any, using IUCN wildlands management area (WMA) categories (see Annex I of OPN 11.02) or relating local nomenclature to those categories;
. agency responsible for management; and
. source of above information.

13. Information on internationally recognized wildlands -such as Unesco World Heritage natural sites, wetlands of international importance, endangered species habitats and national parks and protected areas - areas can be obtained from the publications and computerized data base of the International Union for Conservation of Nature (IUCN).

Within individual countries, agencies responsible for wildland management can provide locations and descriptions of nationally significant wildlands. National nongovernmental organizations can be good information sources, as can conservation-oriented international NGOs like World Wildlife Fund and The Nature Conservancy. "Wildlands: Their Protection and Management in Economic Development" contains directories of governmental and nongovernmental organizations concerned with wildlands and an extensive bibliography of pertinent publications.

14. There may be wildlands in a project study area which will not be discovered from the sources just described; they may be small in size, unstudied, lacking international recognition, or without any national status as a wildland management area (WMA), yet may still be valuable to the region or important to the success of the project. National or local NGOs, scientific research organizations, and local governments may have information on these sites. Aerial photography and field reconnaissance should be employed when the setting is such that there is reason to believe wildlands exist of which even these sources are not cognizant.

15. The processes of analyzing project alternatives and predicting environmental impacts of the proposed project include consideration of potential effects on wildlands, and the environmental assessment report should present the results explicitly. Measuring impacts is a task for specialists in the types of ecosystems involved. It includes but is not limited to the following concepts:

. area lost, in absolute terms and as a proportion of the total area of the ecosystem type in the region or country; . area altered, in the same terms, and the nature of the alteration; . extent of change in resources critical to the wildland, e.g., water quality, freshwater flow, tidal flushing, ambient air quality, nutrient cycles;

. extent and duration of external disturbances (e.g., noise, smoke, dust and fumes during construction or operation; vehicle or ship traffic; visitors to previously undisturbed site; interference with animal migration or daily movement); . extent of habitat loss or modification and the likely effects on numbers and diversity of plant and animal species; . changes in plant and animal productivity, including economic value when possible (e.g., annual fishery revenue); . losses in environmental service levels (e.g., waste assimilation, erosion control, and groundwater recharge); replacement costs of the lost services); . numbers of indigenous peoples affected and the nature of the impact; . change in numbers of visitors, and associated revenues, if the wildland is an important tourist site; . changes in other social benefits and services (e.g., recreation, aesthetic enjoyment, conservation education, medical research); . indirect impacts of loss of wildland (e.g., increased pressures on remaining wildland areas, need for more frequent channel dredging); and . indirect impacts of improved access to wildlands, such as increased tourist revenues, recreational benefits, poaching, disturbance of wildlife, illegal conversion to other land uses, and illegal harvesting.

16. Measures to avoid or mitigate negative impacts should be recommended and incorporated into the EA's Management Plan to Mitigate Negative Impacts. Where there are unavoidable negative impacts, such as conversions of significant amounts of wildland areas to other land uses, the environmental assessment should include not only mitigation measures but also recommendations for the wildlands management component of the project which OPN 11.02 requires to compensate for the loss.

17. Management systems vary depending on biological conservation needs, environmental services requiring protection, regional economic opportunities, subsistence needs of local people, and adjacent land use patterns. Often mitigation measures and management techniques, of which examples are listed below, will overlap or coincide. In every situation, the capacity of existing institutions to implement technical or regulatory solutions must be evaluated, and the Management Plan to Mitigate Negative Environmental Impacts and/or the wildland management component should incorporate appropriate recommendations for institution building or strengthening, training and education. Measures to be considered are:

. alternative project siting or routing to avoid wildlands; . establishment of WMA's to provide for protection or some form of controlled use of wildlands (see Annex I of OPN 11.02 for categories of WMA) either in project area or elsewhere (as compensation for converted wildlands); . including wildland-sensitive features in project design, such as fish ladders, wildlife passages or crossings, noise barriers; . establishing buffer zones around wildlands; . rehabilitating or creating ecosystems to offset wildland conversions or add to existing stock; . supporting research programs relevant to wildlands management and preservation of biological diversity; . strengthening wildland management institutions, both government and nongovernment, with staff, equipment, training, and support of enforcement activities; and . establishing environmental and conservation education programs at local schools.

18. "Wildlands: Their Protection and Management in Economic Development" contains a great deal of practical information pertinent to project development and environmental assessment. The appendices listed below are particularly useful:

Appendix C: Identifying Wildlands of Special Concern in the Project Design Appendix D: The Appropriate Siting, Size and Shape of WMAs Appendix E: Categories of WMAs Appendix F: The Management of WMAs Appendix G: Selected International Agreements Related to Wildland Management

Wetlands

1. The United Nations convention on Wetlands of International Importance (Ramsar Convention) defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters." Among the most important wetlands are: tidal and fresh water marshes, bogs, fens, herbaceous and wooded freshwater and peat swamps, mangroves, coastal lagoons, floodplains, deltas and estuaries.

2. Wetlands are wildlands of particular importance both economically and environmentally. The most important roles which wetlands perform are:

. Production of services. Wetlands can contribute to local rainfall and can be an efficient, low cost water purification system (herbaceous swamps), a recreation area (hunting, fishing, boating), a buffer against floods, and protection from coastal erosion by storms (mangroves).

. Preservation of biological diversity. For many species of shrimp, fish, and waterfowl, tidal and fresh water marshes, coastal lagoons and estuaries are of vital importance as breeding grounds as well as staging areas in their migration routes. All types of wetlands may harbor unique plants and animals.

. Production of goods. Wetlands are among the most productive ecosystems in the world. Estuaries and tidal wetlands, in particular mangroves, are important nursery areas for most species of fish and shrimp which are later caught offshore. Shallow water areas are, in general, rich fishing grounds. Floodplains are important grazing areas for cattle and wildlife and vital spawning grounds for many fish species. Swamp forest may yield valuable timber.

Note that certain of the roles of wetlands are institutionally significant. For example, fishes do not recognize national boundaries or may migrate long distances. Consequently, destruction or degradation of wetlands in one country may have direct impacts on the biological resources of others. (See "International Waterways" section.)

3. Despite their importance, wetlands everywhere are under threat. These threats come from conversion to intensive agriculture and/or aquaculture, industrial development, artificial hydrological changes or degradation through over-exploitation.

Relationship to Bank Investments

4. The issue of wetland conservation is relevant to a large variety of Bank projects, such as:

. projects which affect the hydrology of a wetland, such as construction of a road or high dam, flood control, lowering of the aquifer drainage, and irrigation and other water supply systems;

. direct conversion of wetlands for agriculture, port facilities, navigation projects, and aquaculture (in particular mangroves for shrimp culture);

. projects which indirectly influence wetlands through disturbance of the ecological conditions, such as those causing pollutants to flow into the wetlands, those posing the threat of introduction of exotic species (aquaculture), those introducing physical disturbance by people, and those contributing to acid rain or to rise in sea level; and

. watershed management on other projects conducted for environmental purposes.

Bank Experience

5. The Bank has significant experience with wildlands conservation and management issues through financing of various projects on wetlands. Wetland management issues played major role in projects such as:

. the Nakdong Barrage and Land Reclamation Project in Korea, where the Bank financed a management study, changes in the design of the project and set loan agreement conditions to safeguard a wetland of international importance that was threatened by the project;

. the Southern Conveyor Project in Cyprus, where plans have been made to restore Akrotiri Lake, an important wetland;

. those within the context of the Environmental Program for the Mediterranean where management of the most important wetlands in that region has been foreseen;

. the Lower Guayas Flood Control Project in Ecuador which includes an Environmental Impact Assessment and a conservation component for wetlands; and

. conservation projects in Brazil's Pantanal, the world's largest freshwater swamp, through the North West Development Program and the National Environmental Project.

Bank Policy, Procedures, and Guidelines

6. The most important Bank policy document is the Operation Directive 4.00 Annex D "Wildlands: Their Protection and Management," which lists wetlands as wildlands of particular importance.

7. Bank procedures, in turn, are supported by such international policy as the Ramsar Convention which encourages member countries to designate significant wetlands within their borders for a worldwide list of areas valued for their biological and other scientific features. (There are currently over 395 designated wetlands sites in 46 countries.) Wetlands listings are available through the regional environmental divisions. However, it is critical to remember that virtually all wetlands perform important functions. Large or "listed" sites are not the only ones to be considered in project preparation.

Guidance for Environmental Assessments

8. In case a particular project is likely to impact a wetland, the following questions are usually relevant.

. Is the area on the Ramsar list? (List available from the Bank's Environment Department.) . Will there be changes in the hydrology of the wetland? . Will the project pollute or increase nutrients or physical disturbance in the wetland? . Will (parts of) the wetland be converted or will there be a change in use? . What is the socioeconomic value of the wetland as it is used at present? What would be the sustainable yield under better management? What is the replacement cost of the free goods and services now being produced by the wetlands if it were destroyed? . What institutions exist which can or could manage or protect the wetlands and what are their capabilities and limitations? . Are local people willing and able to adapt their traditional exploitation systems to the eventual changes in the wetland caused by the project?

9. In conversion of wetlands for agriculture, the costs associated with the loss of opportunity to exploit the wetlands sustainably should be incorporated into the economic analysis. However, many wetlands contain poor acid soils, hardly suitable for agriculture. Drainage and exposure to air exacerbates acidity, especially in mangroves.

10. When a project has potential adverse impacts on wetlands, the design should be modified to avoid them, or to mitigate or compensate for those that are unavoidable. Options include any or all of the following:

. selections of alternative sites to avoid impact on wetland; . design features to prevent disturbance of the flow patterns and hydrologic regimes critical to conservation of the wetland (e.g., flow regulating works, road crossings on trestles or pilings, rather than on embankments); . enhancement and/or protection of other weltands in substandard conditions to offset losses at project site; . artificial construction of wetlands to replace areas lost (where experience has shown that the wetland type in question can, in fact, be constructed); . strengthening institutions to manage and protect wetlands; . including local NGOs in the institutional arrangements for wetlands conservation; . promoting development of national wetland incentives and management strategies; . requiring wetland concerns to be considered in national and local

planning and law use decision-making processes; and . environmental education programs to disseminate knowledge on the importance of wetlands.

The section on "Wildlands" and OPN 11.02 on wildlands contain additional guidance for task managers.

Tropical Forests

The 1978 Forestry Policy is being completely revised and will be presented to the Advisory Board in May 1991. The main elements to this section will be inserted in the next revision.

Arid and Semi-Arid Lands

1. Drylands of the world constitute a natural low-productivity environment, where the major limiting factor to biological production is normally water. When limiting factors are overcome -economically and technically - drylands can become moderately productive. However, under intensive production systems they require careful management as they are highly prone to soil salinization, alkalinization, waterlogging, and wind and water erosion. Insect pests also threaten to agricultural production (e.g., locusts, grasshoppers, aphids, etc.), especially where the project reduces the natural pest control value of the dry season.

2. The drylands of the developing world, including lands receiving a long-term annual average precipitation of 200-1000 mm, harbor some 550 million people, many of whom are among the poorest and most vulnerable groups.

3. Recent degradation and famines in drylands, together with frequent economic, physical and health problems in major irrigation schemes, have demonstrated the difficulties involved in developing suitable mechanisms and the need for concerted actions. Yet, drylands have remained remarkably resilient over generations, producing magnificent civilizations, as well as untold human misery.

4. The famines of the last few generations, in China, India and recently in Africa, have revealed the fragility of these ecologically marginal areas. While the media have focused on famines and the worst affected areas, little attention has been paid to the less marginal and potentially more productive environments. Recent evidence suggests that the impact on the environment of growing populations and their needs for food, energy and water may in the long run prove more acute in the more productive areas than in the driest ones.

5. Much uncertainty has developed among lending institutions and the donor community in general on how best to support drylands development.

While some claim that investment in the drylands represents a low return, an unacceptable economic risk-taking, and a potential increase in debt-burden to borrowing dryland countries, others stress the need to avoid recent famines. It is important to consider the consequences of the economic (opportunity) costs of doing nothing.

Bank Policy, Procedures, and Guidelines

6. Although there is no separate, formal Bank policy on dryland intervention, the issue underlies policies in many related areas, such as agriculture, forestry, rangeland, energy, transportation, migration and resettlement. The different policy and guidelines of sector interventions will influence any dryland interventions and should be applied in an overall approach rather than restricted to sectors alone.

7. "Dryland Management Guidelines (DMG): The Key Elements in Dryland Project Design and Review" is a valuable reference. A presentation of strict standards may be too ambitious, given the many variations of physical, economic, social and cultural factors involved. The DMG has been developed as a tool for reflection and assistance to Bank staff in designing and reviewing dryland management projects.

Relationship to Bank Investment

8. By 1991 the Bank will have prepared and appraised at least twenty-nine projects with a direct impact on dryland areas and will have invested an estimated $200 million a year to restore degraded areas and improve agricultural production.

9. Two elements have emerged as crucial in dryland investment:

. an increased emphasis on the ecological and human consequences of individual projects; and . the integration of environmental issues into economic policy at all levels.

10. These changes are reflected by an 84% increase in Bank lending to dryland management-related sectors from 1982/85 to 1986/89 ($929.2 million and $1707.7 million, respectively) in Sahel and Sudan zones alone.

11. The issue of dryland intervention may be relevant to a large variety of Bank projects, such as:

. projects that affect the productivity of dryland irrigation schemes, flood control, agricultural and energy development, soil and water conservation, and forest and rangeland management; . projects that indirectly influence drylands through resettlement or construction of roads or high dams; and . policy interventions on the macroeconomic level (pricing, subsidies, taxation, and land tenure/rights).

Guidance for Environmental Assessment

12. The DMG discusses the limitations that sectoral and macroeconomic policies place on the sustainability of single projects. As long as incentives which may lead to deterioration of the environment (e.g., pricing policy on certain resources such as charcoal) are not dealt with, isolated interventions have proven to be unsustainable.

13. The DMG deals with three aspects of environmental assessment: an outline of development objectives; key indicators to be considered in project reviews; and an outline of essential project and policy issues. A selected bibliography is an annex. Some of the main points are outlined in the discussion below.

Overall Objectives for Interventions

14. Ongoing and potential dryland interventions should be evaluated, through active participation of the beneficiaries, on the improvement to physical, social and cultural wellbeing. This implies a long-term perspective where the resource base must be wisely utilized and conserved for future generations.

15. The environment, economic efficiency and equity must be considered when designing alternative interventions. The interventions should therefore have a solid economic, human, technical and scientific base. Once completed, these activities should prosper without a higher level of outside support or subvention than is justified by the returns from the project. This should also be achieved without unduly degrading the physical resource base that sustains it.

16. Consistency with Established Socio-Economic Systems. Utilization of traditional knowledge and strengthening of the cultural identity is important. The intervention must identify and support the welfare and cultural identity of affected indigenous people.

17. The intervention should also be consistent with existing systems for natural resources management at both national and local levels. In cases where management systems are shown to be in transition by the socio-economic analysis, a substantial monitoring and evaluation capability should be built into the activities to mitigate negative effects that may affect the population or the resource base. A longterm research activity should be carried out for large-scale interventions. As appropriate, follow-up design of a large-scale intervention should reflect the results of the research or lessons learned from a pilot effort.

18. Resilient Management of Natural Resources. Since dryland ecosystems are naturally dynamic, productivity will change despite any interventions. The capability of the land under given land use to return to its initial productivity should be sustained. Short-term (1 to 3 years) and long-term (5 to 30 years) studies of resilience may indicate degradation. Knowledge of short-term resilience should be included in planning, particularly in high risk areas; and long-term resilience should guide resettlement projects and long-term investments. Sustainable interventions must have a long-term perspective (15 years), where carefully selected incentives for the beneficiary population should be developed.

Operational Indicators in Project Design and Review

19. Objectives should be based on a non-sectoral approach. Siteand project-specific variations imply that the selection of key indicators and analyses must be flexible. However, it is crucial to identify the relative importance of each indicator. Systems approaches have proven to be promising tools in that respect. Rural Appraisal Techniques may also help the selection process in order to better reflect the concerns of the beneficiaries. The DMG provides a set of indicators (with subsets) to be considered at an early stage in the project cycle: . climate . population development . health and nutrition . energy . economic factors . access to land, goods and services . state of the natural environment . production systems and degree of risks . livestock/rangeland management . technological interventions and adoptions

Remedial Measures/Project and Policy Issues

20. The analysis of constraints and opportunities through selection of key indicators should reflect the overall objectives of intervention. The next step would be to formulate strategies and mitigating measures to reach those goals. The complexity of the problems and the site and project-specific conditions make it impossible to formulate one single strategy. The next step would be to outline principles which may be applied in project design and reviews. The following aspects should be dealt with (cf. DMG):

. Rainfed Agriculture and Recession Cultivation

. Water Harvesting and Conservation . Soil Fertility Technologies . Dune Stabilization

. Rangeland Management and Pastoral Association . Forestry and Agroforestry . Energy . Institutional Issues

. The Role of Central Governments . Institutional Reforms . Local Participation

. Land Security and Tenure . Pricing Policy and Subsidies . Migration and Off-Farm Income . Infrastructure . Natural Resources Inventory, GIS and Monitoring . Wildlife and Conservation Units . Women in Development

Coastal Zone Management

1. There is no precise definition of "the coastal zone." All definitions seek to include coastal waters, marine and estuarine (and nearshore waters of large lakes and inland seas), and some portion of the land along the coast in which human activities and natural processes both affect and are affected by those in the waters. The extent of land area included varies, because its limits are determined not only by ecological and geological characteristics but also by some concept of what is politically and administratively manageable. Thus while one might include the entire land area of watersheds which drain to the sea, and the entire water area out to the continental shelf, in practice, the coastal zone is a relatively narrow band of water and land along a shoreline. Its natural features include beaches, wetlands, estuaries, lagoons, coral reefs, and dunes. Man-made features include ports, commercial fisheries and aquaculture operations, industries, recreational and tourist developments, archeological sites and, above all, some of the largest and most densely populated urban areas in the world.

2. The economic significance of the coastal zone is vast. Virtually all shellfish used by humans live and are harvested there. Most of the world's commercially important finfish depend on the coastal zone, and much of the commercial fishery takes place in it. Coastlines have been the obvious locations for seaports and for the siting of industrial and commercial operations which involve movement and processing of large volumes of raw materials or finished products. The land is attractive and valuable for residential use; in many areas of the developing world, population growth rates and urban population are highest along the coasts. Coastal areas have been used for recreation for centuries, but tourism is now big business, sometimes the largest sector of a country's economy. Less obvious, but also important economically, are services the natural features of the coastal zone perform, without cost: shoreline stabilization, protection from storms, fish nurture, flood control, nutrient cycling, and waste treatment.

3. It is a particular challenge to manage development in the coastal zone in a way which is environmentally sound and sustainable: coastal and marine areas are among the most sensitive to the impacts of development and, as described above, especially attractive for it. Some of the activities associated with coastline development, such as extensive dredging and filling, intensive urbanization of watersheds, siting of industries, and conversion for agriculture or aquaculture are relatively irreversible transformations. Most economic development projects in coastal and marine areas have the potential to seriously affect the resources located in these environments and to present conflicts among competing resource uses. Consequently, EA alone is insufficient for coastal zone management. Special attention to regional planning is required, both to minimize or mitigate adverse impacts and promote optimal use of the resources available.

Relationship to Bank Investments

Projects Where Issue Is Relevant

4. The following types of projects have potential impacts on coastal and marine areas:

. Agriculture: coastal and upland; large irrigation dams. . Fisheries: coastal capture fisheries and mariculture/aquaculture, including conversion of marshes and mangroves. . Forestry: mangrove forest products harvesting; fuelwood and other renewable resources; large-scale forestry in uplands. . Energy: oil and gas exploration and operation; coastal power generation; large inland hydroelectric dams. . Transportation: ports and harbors; channel construction and maintenance dredging; dredge spoil disposal; roads, railroads and bridges. . Urbanization: shoreline modification; waste disposal; recreation and tourism; large-scale water resource development; urbanization of watersheds. . Industry/commerce: industrial plant siting; coastal and marine mining (e.g., sand); salt manufacture; and waste disposal.

Sectoral and Intersectoral Linkages

5. Three broad categories of issues are related to development of coastal and marine areas which are linked and interdependent with respect to sound management of associated resources. First, sectoral development programs tend to focus on large, single-purpose projects such as building a large port facility (amplified in the "Port and Harbor Facilities" section), implementing an extensive capture fishery project (see the section on "Fisheries"), or devising a scheme to convert mangroves to rice production and shrimp pond culture (see the "Natural Forest Management" section). Multiple-use resource management is particularly appropriate in the coastal zone.

6. Second, as a result of the economic interests associated with sector development, government agencies, lending institutions, and public constituencies tend to align themselves with one sector or another. Conflicts can arise between individual economic interests, among government agencies responsible for the management of the individual resources, or between those agencies and the organizations charged with broader planning responsibilities. These conflicts can manifest themselves ecologically and economically, since the productivity of coastal and marine areas and their ability to recover from heavy pollution or other perturbations are often diminished by the effects of one development activity on another. Integrated

approaches to planning and resource management are essential to avoid adverse in sectoral impacts and institute mitigative measures.

7. Third, coastal and marine zones encompass many different kinds of resources that are demonstrating, in many parts of the world, a decreasing ability to sustain development. This is evidenced by increasing pollution, rising human health hazards, declining fisheries, spoiled beaches, conflicts between local cultures and tourists (see "Tourism Development" section), and displacement of groups which subsist on coastal zone resources. It is a trend which can be reversed, when the unique management needs of the coastal zone are recognized.

Bank Experience

8. The Bank experience in coastal zone management projects is not extensive, but significant steps have been taken during the last ten years to incorporate coastal and marine environmental management principles in a number of projects, and also by controlling activities inland which have downstream impacts. A sample of this involvement follows.

(a) The Central Visayas Regional Project, Philippines, undertaken in 1983, is contributing to production of coastal fisheries by protecting vital mangrove and coral reef habitats and by partially rehabilitating selected fish habitats (e.g., by planting of mangroves and by construction of artificial reefs) damaged by non-product related activities.

(b) The Tourism Development Project, Honduras, completed in 1989, included an environmental control master plan for Roatan Island, relocated Tourasal beach development to protect mangroves and other coastal ecosystems of Quemada Lagoon, and established a small national archeological park at Copan.

(c) The Environmental Program for the Mediterranean, a regional study in 1988, consists of an assessment of environmental problems and priorities for 18 countries in the region, and eventual development of an action plan covering policy reform, institutional strengthening and investment needs. Many of the environmental problems of this region are coastal and marine in origin, providing a unique opportunity for the Bank to be involved in helping these countries set priorities to protect and manage aspects of the coastal environment.

(d) The Nakdong Barrage and Land Reclamation Project near Pusan, Korea, where changes in the design of the civil engineering works were made to protect a National Treasure; in addition, a nature reserve was established including the financing of studies and management programs to safeguard environmental, production and conservation values in the estuary.

9. In addition to specific project interventions, the Bank indirectly is promoting protection and management of coastal and marine resources through the implementation of sound environmental guidelines for infrastructure and urban development projects and through support to the Asia Wetland Bureau, an NGO located in Kuala Lumpur, Malaysia.

Bank Policy, Procedures, and Guidelines

10. There are no formal Bank policies or guidelines on overall coastal and marine area planning and management. However, a number of Bank policies and guidelines on other subjects have direct applicability to development activities in the coastal zones. Two of particular importance concerns dams and biodiversity. First, the policy on dams and reservoirs requires examination of downstream effects. (See the "Dams and Reservoirs" section for a list of references on this and related topics.) Second, conservation of biological diversity and environmental services are two of the basic elements of the Bank's wildlands policy, and they mean that coastal area developments should be planned to avoid impacts on mangroves and other coastal wetlands, coral reefs, or other protected and biologically important areas (see sections on "Wildlands" and "Wetlands"). A number of Bank policy and guidance documents are concerned with port and harbor developments and dredged material disposal (see "Port and Harbor Facilities" section). Finally,

the Bank has stated at the Oslo Conference on Sustainable Development, held in 1988, that it will not support projects involving the ocean dumping of hazardous waste. (See the section on "Hazardous Materials Management.") Guidance for Environmental Assessments

11. A growing number of developed and developing countries employ coastal zone planning as a basis for land and water resource use decisions. Such planning, which is characterized by its integrated approach to all sectors and resources, should be encouraged in country environmental strategies and sector work. Each investment project may present an opportunity for incremental progress toward the same objective. Integrated environmental planning is especially critical in the coastal zone because of the high social, ecological and economic values of the resources there; the intense demand for those resources for a variety of competing and potentially mutually inconsistent uses; and the extreme sensitivity of those resources to damage.

12. Such planning may offset the need to conduct detailed EAs for specific projects, if it has led to environmentally sound physical plans, standards and guidelines, and if adequate resource use control instruments are in place. In the absence of coastal zone planning, the EA process should be used to ensure that community involvement and interagency coordination are initiated at the project identification stage, that the full range of alternatives and intersectoral impacts are considered before the sponsoring agency makes its decision about the project, that appropriate implementation plans are prepared, and that institutions are competent to implement those plans.

13. A large number of treaties and international conventions exist to protect the coastal and marine environments (see the section on "International Treaties and Agreements on the Environment and Natural Resources"). Most countries have signed them, but adherence to them is inconsistent. Compliance with these agreements in design, construction and operation should be considered as part of EAs on projects in the coastal zone.

14. Several international organizations, including UNEP, EEC, the International Maritime Organization, and the International Association of Ports and Harbors have published guidelines for managing environmental impacts of various activities in coastal areas. The EA team should assess the extent to which applicable guidelines are being used in project planning and design.

15. Sociocultural impacts can be especially significant and should not be neglected (see Chapter 3: "Social Issues in Ecologically Sensitive Areas").

Land and Water Resource Management

1. The Sourcebook is not intended to be a guide for natural resource management. This section merely identifies some critical issues and key concepts the user should keep in mind when examining environmental impacts of projects which involve modification of the land's surface contour or cover or commitment of significant quantities of groundwater or surface water to various human uses. The discussion is particularly relevant to preparation and review of the plan for mitigating adverse impacts on land and water resources that must be included in every EA report.

2. The section is written with no particular type of ecosystem in mind; for land and water resource concerns related to sensitive ecosystems, the reader should consult the section on "Cross-Sectoral Issues." Sociocultural issues related to land and water resource management appear in Chapter 3.

3. Land and water resources are considered together because of the inescapable causal relationships between them. A change in the way one is managed is likely to have an effect on the other, especially if insufficient attention is given to the interactions in project planning.

Environmental Issues in Land Resource Management

4. Almost any development project will involve disturbance of the land surface. When the area involved is small, the environmental impact is likely to be minimal. However, the cumulative impacts of many separate small disturbances can be substantial. The kinds of alterations to the land that are of concern are listed below. Many of these topics are discussed elsewhere in the Sourcebook, as indicated by a cross reference in parentheses, and most are therefore discussed only in general in this section.

. clearing (Roads and Highways; Large-Scale Housing Projects) . topsoil removal (see above) . grading (see above) . filling (Wetlands; Coastal Zone Management; Roads and Highways) . draining (Wetlands) . landscape planting (Large-Scale Housing Projects) . cultivation (Agricultural Management; Forestry) . paving (Roads and Highways; Large-Scale Housing Projects) . building construction (Large-Scale Housing Projects) . waste disposal (Solid Waste Collection and Disposal Systems; Wastewater Collection, Treatment, Reuse and Disposal Systems)

The direct and immediate environmental impacts of these alterations can be grouped into four categories.

Loss of Habitat

5. Any of the activities listed result in loss of habitat. The seriousness of the impact depends on the type of habitat being converted, as well as on the way in which the conversion is carried out. When wildlands, wetlands, tropical forests or other sensitive ecosystems are involved, the EA team should carefully assess the impacts, examine the alternatives that were considered, and perhaps propose new alternatives. (See the "Wildlands" section.)

Loss of Soil Productivity

6. Certain forest soils, when stripped of natural cover, become laterized or subject to rapid erosion, and essentially unproductive. Removal of topsoil during grading also reduces productivity. Soil loss through erosion has the same effect, and in addition may degrade water resources. Conversion of high-quality agricultural land to urban uses also reduces productivity. Mitigation measures an EA might recommend include avoidance of construction on steep slopes, retention of forest cover, stockpiling and replacement of topsoil, conservation of prime agricultural land, application of good cultivation practices, and control of erosion and sedimentation through use of mulch during construction and rapid replacement of vegetative cover on slopes and construction of siltation basins and barriers of straw or filter fabric to protect waterways.

Modified Hydrology

7. Clearing, grading, filling, paving or construction of buildings alter patterns of surface runoff and infiltration. The results include local ponding and flooding, increased flood frequency and/or magnitude downstream, lowered water table, diminished groundwater recharge, and increase in low flows in streams. Management measures include design and construction techniques to maintain or replace local drainage channels, retention or detention structures to avoid increases in rates of runoff, measures to offset reduced infiltration (porous pavement, infiltration ponds, etc.), and conservation of open space on critical aquifer recharge areas.

Soil Contamination

8. Soil can be contaminated through salinization if irrigation systems are not properly designed and operated. It can also be contaminated by disposal of hazardous waste or improper operation of solid waste and land-base wastewater disposal systems. Mitigation measures for irrigation systems are described in the "Irrigation and Drainage" section. Measures for waste disposal, solid waste, and wastewater are discussed in Chapter 10.

Land Clearing

9. Land clearing for agriculture is discussed as a separate topic because of the environmental implications of the choice of land to be cleared and the method employed to clear it. In general, the impacts of clearing are more significant in tropical than temperate regions because the former experience higher temperatures which accelerate chemical degradation of soils and higher intensity of precipitation leading to more severe erosion.

Land Clearing Methods

10. There are three basic methods, and they are often used in combination on single project:

(a) Manual methods -felling or cutting vegetation, allowing a drying period, and then burning the debris;

(b) Mechanical methods -using heavy equipment (e.g., bulldozers, heavy chains and tractors) to fell trees and cut and lay down underbrush, windrowing (raking debris into rows or piles), burning, and final clearing of the residue;

(c) chemical methods -using herbicides to establish areas for crops, either leaving dead trees standing, felled, or burned.

Mechanical methods have significant adverse impacts, including topsoil loss or inversion, destruction of soil structure, and compaction leading to increased runoff. Both mechanical and manual methods involve burning, which often reduces soil nutrient content and the activities of beneficial soil organisms as well as contributing to elevated atmospheric carbon dioxide concentrations. Chemical techniques have been shown to have less drastic effects on soil. However, the long-term effects of herbicide use in the tropics are not well understood.

Post-Clearing Management

11. Inappropriate post-clearing management practices, such as lack of manuring, failure to employ soil conservation practices, and repeated fires have often led to reduction in soil fertility to the point at which economic agricultural production cannot be sustained. Abandonment and weed infestation are the ultimate results.

Environmental Issues in Water Resource Management

12. Water resource management issues that may emerge in an EA are associated with water use or land use decisions that affect the quantity or quality of surface water or groundwater. Changes in quantity or quality may in turn affect the range of uses the particular water resource can support or alter the functions of a natural system dependent on the water.

13. The actions related to development projects which can alter water quality or quantity include: contamination of surface water by directly discharged effluents (Chapters 8, 9 and 10); contamination of surface water by non-point or diffuse pollutant sources (Chapters 8, 9, and 10); contamination of surface water by atmospheric pollutants (Chapter 2); contamination of ground or surface water by wastes disposed of on or beneath the land (Chapter 9); increase in runoff by clearing, grading, paving, drainage or channel modification; decrease in surface water flow by diversion, impoundment, consumptive use; and reduction in water table elevation or artesian flow by interference with groundwater recharge or excessive groundwater withdrawals.

The first four topics, which concern water quality, have been discussed elsewhere in the Sourcebook, as indicated by the cross-references. The topics related to water quantity will be considered here in more detail.

Environmental Impacts of Increased Runoff

14. Increases in runoff, result from any activities which make the land surface less permeable, "smoother" or both. The rate of runoff, the total amount of runoff or both may be affected. The impacts include declining water tables, more frequent or more intense flooding, more prolonged or extreme dry-weather flows, and scouring or silting of channels. Changes in natural flow patterns can modify or eliminate wetlands and affect agriculture that depends on seasonal flooding for irrigation and maintenance of soil fertility. Where these impacts are predicted, structural and non-structural measures can be incorporated into projects to mitigate them.

Environmental Impacts of Reduced Surface Water Flow

15. When the overall flow of surface water is reduced significantly by impoundment, diversion, or consumptive use, downstream users and natural systems experience impacts. Two common causes of the flow reductions are growth in the watershed in excess of that which existing water resources can support or overcommitment of water resources from failure to take all uses and users into consideration in project planning. The immediate impacts may include: decline in water quality from diminished dilution of pollutants; seasonal or continuous shortfall in supply for downstream users; reduction in wetland area; and increases in salinity and changes in circulation in estuaries. Each of these impacts can in turn have secondary impacts, such as decline in shellfish harvests, loss of revenue from water-dependent industry and commerce, or reduced hydroelectric power output. Mitigating measures are few, and most are expensive; relocating industries or importing water from other watersheds are examples. The sound approach is prevention through water resource planning and management on a watershed scale. The terms of reference for the EA on any project involving large-scale water consumption or diversion should require an analysis of existing, planned and projected water availability and use to avoid these impacts from the outset.

Environmental Impacts of Lowered Water Table or Reduction in Artesian Flow

16. The most obvious impact is the increased cost of drilling deeper wells and pumping water from greater depths. More disruptive is interruption of previously reliable water supply as a result of overpumping from nearby wells or cessation of artesian flow. When the aquifers affected are near the seacoast, saline water may intrude as fresh-water flow diminishes, making coastal wells unusable. Finally, a long-term impact which can occur over a large area and be virtually impossible to reverse is subsidence of the land surface caused by reduced water pressure in unconsolidated rock. Mitigation measures are again few and difficult. They involve replacing lost or salt-contaminated groundwater supplies with surface water. Attempts at reversing saline intrusion have met with only limited success. Subsidence may be arrested but is not realistically reversible by any artificial means.

Watershed Planning and Management

17. Water use and land use are interrelated. Decisions regarding water use in one part of a watershed are likely to pose opportunities and constraints for users in another part. These circumstances argue for integrated planning on a watershed basis, to ensure that the basin's water is not overcommitted, that upstream water users do not deprive those downstream of opportunities, that projects meet their intended purposes, and that patterns and amounts of growth are kept in balance with the capacity of the water resources. Tools and technical knowledge exist to accomplish such planning and management. The difficulties are institutional. Water resources do not respect political boundaries and there is thus a need for an institution with sufficient capacity and power to influence land and water use decisions in mulitiple jurisdictions. This frequently entails a corresponding willingness on the part of those jurisdictions to subordinate their authority to the watershed institution. In projects which depend on watershedwide planning and management, EA teams should carefully analyze the institutional structure, the needs for strengthening it, and whether it is politically realistic to anticipate success in the effort.

Natural Hazards

1. Major areas of the world are subject to risks from natural hazards. Earthquakes, volcanic eruptions, droughts, floods and hurricanes hinder development through their direct, indirect and cumulative impacts. There is a two-way, direct relationship between environmental deterioration and natural hazards; that is, soil erosion, deforestation, desertification, and coastal degradation increase the risks of extreme events, and in turn, natural hazards exacerbate environmental degradation. Furthermore, the potential for human and economic losses in an area is directly related to its vulnerability to natural hazards.

2. The resilience and sustainability of development may be significantly improved by reducing disaster vulnerability. Reducing losses from natural hazards can be brought about through appropriate and sound planning strategies and management. Disaster-resilient planning and management must be based on a sound understanding of natural hazard risk and such understanding must be incorporated into social and economic planning. In addition, scenarios concerning climate change indicate a potential for sea level rise, increased severe droughts, shifting in agricultural zones and more frequent hurricanes which underline the need for efficient mitigation and preparedness.

Relationship to Bank Investments

3. Over the last decade, extreme events have increased in number and impact, seriously hampering the development process and requiring a substantial reallocation of resources from development to relief and recovery. Vulnerability to natural disasters is increasing due to continued environmental degradation, population growth, location of investments in high risk areas, and concentration of infrastructure and industry in disaster prone areas. Lending by the Bank as a response to major disasters has increased significantly in the last five years. In fiscal years 1988 and 1989, the total amount for emergency recovery - including both reallocations from existing operations and new emergency recovery projects -amounted to about four percent of the Bank's total lending portfolio. This significant amount indicates a need to (a) increase the resilience of member countries to disasters, and (b) incorporate natural hazard risk management into investment decisions.

4. Natural hazards are relevant in virtually every sector of Bank lending and in every region of Bank operations. Bank investments in different sectors -industry, energy, education, health, agriculture and urban development -are vulnerable to disruption from extreme events. In many countries the existing capacity in both the public and private sectors to address natural hazard risk and to integrate disaster prevention and mitigation into development programs is limited. In addition, understanding of the potential economic and financial impact of natural hazard risk is limited.

5. For example, in the industrial sector, the decision to locate a given investment in an area subject to extreme events implies taking a chance with such investment in general, and specifically with the physical plant and the well being of its employees. If the investment is destroyed by an extreme event, the true measure of the negative impact is not merely the value of the assets lost. The real measure is such loss, plus the revenues lost over the life of the industry, plus income and additional investments that would have accrued from the indirect and multiplier effects of an alternate, prospering, risk-resilient enterprise. Risk resilient enterprises in these cases, even if more expensive initially, ultimately would prove to be the more efficient use of resources. Similar examples can be drawn for other sectors, such as infrastructure, energy, agriculture, health, education and housing.

6. The most notable reasons for the failure to integrate natural hazard risk into development programs are: (a) inadequate understanding of mitigation options to prevent/reduce catastrophic losses, (b) weak institutions, (c) inappropriate mechanisms for collecting and processing the necessary information about natural hazard risk, (d) lack of a coordinated policy for risk reduction across sectors, and (e) inadequate emphasis on implementing and monitoring mitigation.

Bank Experience

7. Since its creation in 1947 the World Bank has been requested to provide assistance in about 100 cases of disruption after natural disasters, such as floods, hurricanes, earthquakes, volcanic eruptions, and forest fires. Examples of the countries that have received emergency recovery assistance are:

. Bangladesh, Pakistan, Sudan, Brazil, Nepal, Yemen AR, India, Honduras, Nicaragua, Peru, Romania, and Western Samoa (for floods); . Mexico, Nicaragua, Peru, Romania, Guatemala, Ecuador and Nepal (for earthquakes); . Costa Rica, Jamaica, Mexico, Madagascar, Dominican Republic, Swaziland, Fiji, Mauritius, and Bangladesh (for hurricanes); . Colombia and Iceland (for volcanic eruptions); and . China (for forest fires).

8. In the past few years there has been an increased concern for disaster reduction in Bank programs. The inclusion of disaster prevention and mitigation in emergency recovery projects was encouraged in an Operational Policy Note on emergency lending (1984), and more recently in a Policy Paper on emergencies (November 1988) and in Operational Directive 8.50 (October 1989) on emergency recovery operations. This recommendation was based on the notion that disasters provide a "window of opportunity" to introduce measures to reduce losses. The concern for vulnerability reduction goes beyond emergency recovery projects and recent efforts have been made to develop self-standing prevention and mitigation projects and to include those concerns in sectoral work and in country dialogue.

9. Disaster mitigation and prevention are now the main objectives of the International Decade for Natural Disaster Prevention, declared by the United Nations in the 1990s. Both international and national agencies are currently developing programs for the Decade, with significant participation from NGOs and from the private sector. Natural hazard risk reduction is also a main concern in the many initiatives currently under consideration concerning global climate change. Global climate change and the potential increase of extreme events is being discussed in a number of international fora, including inter alia the Intergovernmental Panel on Climate Change (IPCC) and the planning for the 1992 U.N. Conference on the Environment.

Bank Policy and Operational Directives

10. Operational Directive 4.01: "Environmental Assessment" (October 1991), recommends that environmental assessments review whether the project may be affected by natural hazards and if so that they propose specific measures to address those concerns.

The policy for "Lending by the Bank for Emergencies" (issued as Operational Directive 8.50: "Emergency Recovery Assistance") was adopted by the Executive Board of Directors on November 1988. According to the policy, the main criteria for mounting an emergency lending operation include:

. focus on economic reconstruction and recovery, rather than on relief; . demonstrable (even if not easily quantifiable) economic benefits; . significant scale, but nevertheless temporary nature of impact of the emergency; . urgency and effectiveness of short or medium-term action; and . prospects for mitigating the impact of future emergencies.

11. The policies for reducing the impact of future emergencies are: (a) attention in country strategy work and in national planning and investment programs to the risks of large-scale natural disasters; (b) close collaboration in this area with the official international and NGO communities; (c) increased focus within the Bank on technologies to reduce natural hazards; and (d) inclusion of prevention/mitigation components where appropriate in regular loans as well as in emergency lending operations.

12. Operational Directive 8.50 "Emergency Recovery Assistance" addresses procedures for recovery assistance after disasters of slow and sudden onset. The OD defines the main objective of recovery assistance as the immediate restoration of assets and productivity. It outlines special considerations for designing Emergency Recovery Loans (ERLs), including:

. early involvement of Bank staff; . limited objectives and realistic schedule; . conditionalities linked only to the emergency rather than to macroeconomic policies; . simple implementation arrangements and full use of existing institutions, including sector agencies, NGOs, and community groups, use of disaster-resilient reconstruction design standards; and . inclusion of measures for preventing and mitigating the impact of future disasters.

The OD also outlines special procedures for processing ERLs, including compact documentation and simplified processing.

Guidance for Environmental Assessments

13. The environmental assessment process provides a framework within which to analyze natural hazard risk and to evaluate the costs and benefits of disaster prevention and mitigation. It also serves as a vehicle for analyzing development alternatives which do not have negative impacts on disaster vulnerability and for identifying disaster prevention and loss reduction measures.

14. In assessing natural hazard risk it is important to consider the specific qualities and characteristics of different types of disaster agents, as well as their potential direct and secondary effects. For instance, damage caused by hurricanes could be due to the direct effect of violent wind and excessive rainfall, and from the secondary effects of river flooding, storm surge and landslides. Earthquakes can have numerous direct and indirect effects such as tsunamis, fires and landslides. It is also important to identify those activities that may increase the potential for extreme events. For example, deforestation degrades watersheds, promotes erosion and soil degradation, and increases flooding. The compiled information concerning the two-way relationship between natural hazards and development should give a status profile for risk assessment as well as for response purposes.

15. The EA of natural hazard risk includes the following:

(a) Identify specific natural hazards, including natural hazard characteristics, distribution, intensities, qualities, and historical records to review frequency, and probability of occurrence and regional and local characteristics.

(b) Identify the critical sectors in the economy and natural resources that may be impacted by the identified hazards, analyze the constraints and conflicts that may be imposed by the natural hazards on each relevant sector and on natural resources and examine the possible structural and non-structural actions required to mitigate risks.

(c) For each sector/area at risk, evaluate its degree of vulnerability including facilities, infrastructure and population exposed and specify mechanisms that would help in reducing the identified vulnerabilities.

(d) For each sector/area at risk, examine standards, design criteria and maintenance practices that may foster vulnerability and make appropriate changes to help reduce it.

(e) Identify the location of facilities such as hydroelectric plants, oil storage plants, gas storage plants, nuclear facilities or industries that may be exposed to natural hazard risks. (f) For the facilities/industries at risk, identify risk reduction strategies including alternate sites and analyze the cost and effectiveness of the different reduction alternatives.

(g) Examine the institutional capabilities for disaster prevention and mitigation at the national/regional/local levels, highlighting inter-institutional coordination mechanisms and the areas that may require strengthening.

(h) Analyze the role of the private sector (e.g., NGOs, insurance, banking, developers) both in promoting or in reducing vulnerability in the different sectors/regions under analysis.

(i) Identify the specific capabilities of local NGOs in vulnerability reduction activities, particularly concerning community involvement, education and training.

(j) Examine the existence and/or need for disaster prevention and mitigation policies and regulations both at the local and national levels.

(k) Analyze the development options in terms of their impact on natural hazards.

16. Most of the information in disaster-prone countries that could be used for natural hazard impact reduction or for post disaster planning and management has not been collected specifically for that purpose. Thus, adaptation will be necessary for using such information from disparate sources in risk reduction.

17. In every case analyzed, the capacity of existing institutions to develop policy on natural hazards and to implement it through regulations (ordinances), economic incentives/disincentives (taxation, credit, subsidies), land use and building codes should be evaluated. Likewise, the institutional capacity to develop and implement education and training programs should be assessed. Appropriate recommendations for institutional strengthening and for training and education programs that facilitate the participation of the concerned agencies and communities in disaster mitigation program should be included in the plan.

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