



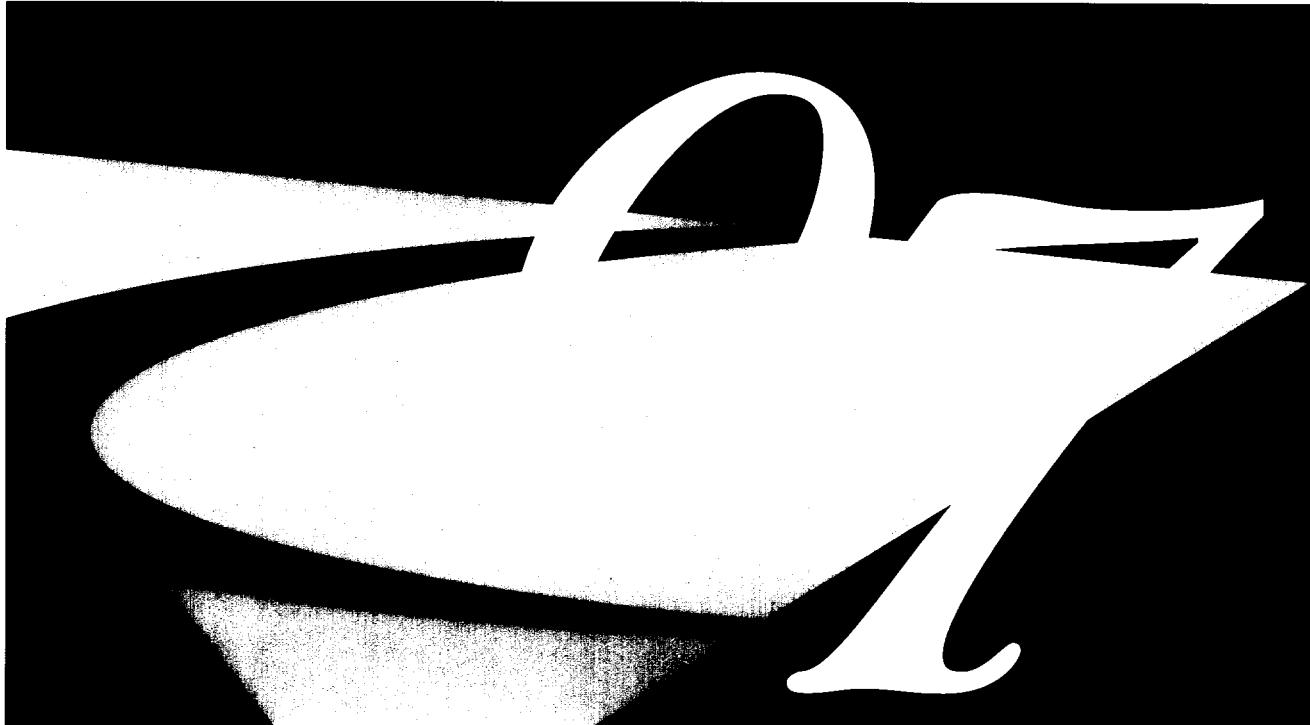
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ENVIRONMENTALLY AND SOCIALLY
SUSTAINABLE DEVELOPMENT

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Partnerships for Global Ecosystem Management

Science, Economics and Law



Proceedings and Reference Readings from
the Fifth Annual World Bank Conference
on Environmentally and Socially
Sustainable Development

Ismail Serageldin and Joan Martin-Brown, Editors

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Sustainable Development

*Held at the World Bank and George Washington University
Washington, D.C., October 6-7, 1997*

Ismail Serageldin and Joan Martin-Brown, Editors

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Preface

Beginning in 1993, each autumn the World Bank Group, under the auspices of the Vice Presidency for Environmentally and Socially Sustainable Development (ESSD), has convened an international conference on a theme related to advancing environmentally and socially sustainable development. The fifth conference (ESSD5) in 1997 was cosponsored with two other Bank Group entities, the Learning and Leadership Center (LLC) and the Economic Development Institute (EDI).

The theme for the 1997 conference was the scientific, legal, and economic requirements of global ecosystem management. Although international agreements are but one element of addressing global environmental issues—such as the loss of biodiversity, climate change, desertification, ozone depletion, and water degradation—they play a crucial role. It is essential that they reflect the best available scientific knowledge, that they embody the most sensible economic analysis to advance the most cost-effective means of achieving the desired results, and that legal arrangements responding to these agreements create a level playing field and opportunities for innovation in the marketplace.

The conditions of our global ecosystems reflect the aggregate of local practices and national policies. These practices and policies manifest themselves locally, nationally, and regionally in many ways, including urban air pollution, the degradation of water, and the loss of agricultural pro-

ductivity. Therefore, the bulk of the work required to respond to international environmental agreements must be done at the subregional, country, and local levels. In this context ethical questions of equity across societies and responsibilities between the rich and the poor nations must also be addressed.

The objectives of the ESSD5 conference were to engage external experts and Bank managers and staff; to provide a unique opportunity for major professional groups to interact on the requirements to link scientific, economic, and legal solutions for global ecosystem management at the country level; and to promote understanding as to how best practice and innovations can be used for shared ecosystem management in sustainable development planning.

The main results of the conference presentations, workshops, and dialogues were: a better understanding of the roles and relationships among global systems regarding national sustainable development plans, national legislation, and macroeconomics; access to examples of best practice and innovative processes; contributions to the content of country development strategies; and assistance to development practitioners in better assessing the global connections of their work.

*Ismail Serageldin
Joan Martin-Brown*

PART ONE

PLENARY SESSIONS

OPENING PLENARY

Welcoming Remarks

Stephen J. Trachtenberg

I am very pleased to welcome you to our campus for the Fifth Annual World Bank Conference on Environmentally and Socially Sustainable Development. As you may know, George Washington University has the unique distinction of being designated by the U.S. Environmental Protection Agency as the nation's "Green University." We offer over 115 courses dealing with environmental matters covering law, medicine, engineering, the arts, education and public health.

In 1994 our law school was selected to join with the American Bar Association to produce volume 1, number 1, of the *Environmental Lawyer* law journal, and we are proud to say that our environmental law program is rated among the best in the nation.

I am particularly intrigued with this year's conference theme, "Partnerships for Global Ecosystem Management: Science, Economics and Law." It strongly signals the need for linking disciplines, something that is always a challenge for us here in the university.

I believe that the best way to address global ecosystem issues is by addressing them in one's own backyard, which is why we have committed ourselves to the greening of our university. I salute Jim Wolfensohn for intensifying the greening initiative at the World Bank, and I applaud his aggressive leadership on advancing environmentally and socially sustainable development.

Welcoming Remarks

Ismail Serageldin

President Wolfensohn, distinguished guests, ladies and gentlemen. It is a pleasure and a privilege to welcome you to the Fifth Annual World Bank Conference on Environmentally and Socially Sustainable Development (ESSD5). It is a timely event. This is the year of Rio+5. It is the year in which we are preparing for Kyoto and rethinking many of our global and national commitments.

Fresh reminders of the urgent need for attention to local matters—and understanding of how linked they are to national, regional, and global issues—have come to us from pictures of the fires in Indonesia. The need is upon us to develop a better understanding of the science that undergirds these events—from El Niño to greenhouse gases and climate change that bring rains and floods to parts of the world—and to understand them and link them with the management of human beings. Many other indicators—malformed and dying frogs, rising insurance rates, warning signals everywhere—demonstrate that the time is upon us to change our behaviors.

So what do we do? Before we start, there is something we must do: listen to the voice of someone who inspired us, guided us, and warned us for many years, and who was instrumental in creating the momentum leading to Annual World Bank conferences on environmentally sustainable development. It is with great pleasure that, on behalf of President James D. Wolfensohn of the

World Bank and my many colleagues, we dedicate this entire week's events to his memory.

I am talking about a man who has meant so much to so many of us: Captain Jacques-Yves Cousteau.

Five years ago when the first of these conferences was being organized, the late president of the World Bank Lewis Preston asked me who I thought could best catalyze that event. I told him that I wanted a man of passion and compassion, a man of broad knowledge and deep conviction, a man of science but also a man of action, a man who was a teacher as much as a learner. He looked at me and asked, "Is there such an individual?" I said, "Yes, there is Jacques-Yves Cousteau." He replied, "How right you are." And Lew Preston personally introduced Captain Cousteau as the keynote speaker at our first ESSD conference.

During the subsequent five years Captain Cousteau and I worked very closely together; his thoughts and concerns are reflected in all the events of this week. The main event on global environment was one that he suggested last year as a potential focus for this year's events. The ethics event to be held this week is precisely a result of Captain Cousteau's convictions.

The education event planned for the end of the week was also scheduled at his behest. When he was with us last year we organized, at his request, a meeting with presidents of universities in the

Washington area on this topic. This week's events are the results of his drive for that meeting.

The indicators event for specialists dealing with measurement was another of his desires: that we pay close attention to improving our understanding of what is happening in the environment. Last but not least, there is nothing more closely identified with Captain Cousteau than the coral reefs event.

It is instructive to note the breadth of his commitments and how far almost every event this week has been affected by his input. Therefore it is only fitting that we pay homage to him by dedicating this week's events to his memory. But rather than say words on his behalf, let us hear from Captain Cousteau in his own inimitable voice. Ladies and gentlemen, I give you Jacques-Yves Cousteau.

[Videotape shown.]

It is now my pleasure and honor to invite President James D. Wolfensohn of the World Bank Group and Madame Francine Cousteau of the Cousteau Society to come to the stage. President Wolfensohn will be presenting to Mrs. Cousteau a plaque on behalf of the World Bank Group. It reads:

The legacy of Jacques-Yves Cousteau is powerful and unique. He was the world's tutor, dedicated to engaging us so that we might rejoice in the diversity of life and better understand the requirements of our planet to support life.

He took us with him under the seas that we might better know their wonder and see for ourselves how we have abused their bounty and shorelines.

He challenged us to look beyond ourselves to the sky and the universe so that, struck with all, we would consider our obligations to one another, to other species, and to our Earth's fragile atmosphere.

He helped us to meet our brothers and sisters in remote forests and on the shores of threatened lakes and rivers. He said that to ignore the wisdom of these ancient people is to deny hope for a humane future.

He encouraged us to rejoice in our cultural diversity as much as to value our planet's biodiversity. He counted our ever-growing numbers. Deeply concerned, he spoke about potential of overwhelming our own sustainability and that of other species.

He challenged us to assume our responsibility to the rights of future generations, to declare our commitment to protect their interests.

He was optimistic. His hope was in the power of the new generation, children and young people, that they will serve as fresh eyes and uncompromising voices for our obligations to one another and this planet's future.

There is much we can do to honor this noble heart. His poetry and graceful images remain with us. But we must honor his work in our work, and we in the World Bank who have benefited from his wise counsel in these last five years will work with the Cousteau Society and so many others to pursue his dream of better tomorrows.

The plaque is signed by James D. Wolfensohn, President of the World Bank Group.

Global Challenges for Managing Ecosystems

James D. Wolfensohn

There could be no more moving commencement to our deliberations this week than the very short tribute that we have made to Captain Cousteau, nor could there be a better framing of the issues that face us than the statements that came from his own mouth, the image of the Earth as seen from another planet, the need for us to face up to the inevitable challenges of the future—the five-fold increase in population during his lifetime and the doubling again in the next 35 years.

That is why we are here; because we are concerned and we know that unless we do something, our children will suffer. And it is why the World Bank Group, with leadership from Ismail Serageldin and his colleagues, is really redefining the role of our institution to ensure that environmental and social development is not just another department of our institution, but that these issues are central to everything that we do.

I tried very hard in a speech I gave in Hong Kong just a week ago to formulate these issues, to indicate that our concern relates not to those of us who are privileged, those of us from both the developed and developing world alike who have advantages, but rather to the issues facing those who are not here—those who are disadvantaged, who live in poverty, who do not have our benefits.

Our chief concern is for the 4.7 billion people who live in the countries that the World Bank Group deals with, especially the 3 billion people

who live on incomes of under US\$2 a day; the 1.3 billion people living on less than US\$1 a day; the 1.5 billion who do not have access to clean water or sewerage; the more than 2 billion who lack access to electric power; the 8 million who die needlessly every year; the 150 million children who do not get a chance to go to school.

Those who are here know these statistics; that is why you are here, so I will not regale you with them. I merely want you to know that the orientation of the World Bank Group is geared centrally to that issue. In my Hong Kong speech I framed it as the issue of inclusion, the problem of bringing with us those disadvantaged who are now living under these conditions, and whose numbers will increase annually by 90 to 100 million over the next 30 or 40 years.

The challenge is enormous. As Captain Cousteau said, this is an inevitability. It is an inevitability, but it is one that we can affect; indeed, that is our task. Our task is to deal not just with social issues and not just with environmental issues, but with social *and* environmental issues. If there is to be continuity, if there is to be sustainability, then we must bring together social, environmental, and economic issues.

You cannot just pick one thing and say, "that is my interest," because, as I have learned in the last several years, all these issues link together. And as Captain Cousteau correctly insisted, to address these issues we must also think of measurement, education, scientific research,

social consequences, and poverty. They all come together.

This is why the World Bank Group is trying to take steps to put social and environmental issues in a central position. I am sure that many of you will have seen that we are very serious about this new sense of direction.

But we also have a sense of ourselves. We recognize that we are not lords of the universe, that the World Bank Group is but a small part of our cosmos. Yes, we have some influence. But in terms of having an effect, we cannot have the overall effect. We have to do that together. And that is why we support so vigorously these conferences, of which this is the fifth; conferences that bring together the players from the private sector, the social sector, our colleagues in governmental agencies, bilateral and multilateral agencies, from science, technology, and education—all of you who are here today—to contribute to the discussion.

We offer you partnership, because we know that only with partnership can we be effective. Only with the sort of relationships that we can weld together to face a series of issues can we be effective in terms of establishing a better world for those who come after us. And that is why we at the World Bank Group are deeply committed to partnership, trying to put behind us the pocket descriptions that are given of each other, the stereotype of the World Bank as an aggressive, unyielding agency that never listens, always tries to impose its will.

If we were like that, I can tell you we are not like that now. We recognize that the problems are very tough. We are not playing games, trying to get a series of individual projects that we can mark as successful. We are trying new approaches because we think it is already late to face up to the issue of a systemic approach to the question of sustainability. And we know we cannot do that alone.

We are not seeking to come away with a sense that we got a project here right and a project there right. We are trying to approach this now on the basis that the only way that we are going to make a difference is if we can begin to develop systematic, global solutions on which we can work together.

Implementation, of course, is local, and there we need to work together with you and we need

to do our own work. But the concept has to be broader than it has been before.

You will be receiving this week a report the World Bank Group has prepared on rural development, which is a good example of how we are now looking at all these issues. We used to view agricultural development as a separate area. Seventy percent of the world's poor work in agriculture; there is an immense amount of soil degradation; 70 percent of all water is consumed in agriculture. These are all relevant issues in terms of the environment, as you well know. Now we see that we cannot view this as an agricultural issue alone. We have to view it as an issue that relates to rural development generally. We cannot just look at new crops and the work we are doing with the Consultative Group on International Agricultural Research and other research agencies. We cannot just look at our rural extension programs. We cannot just look at the soil conservation programs. We cannot just look at the water programs that we are actively involved in. We must try to bring these issues together, because unless they are viewed as a whole, getting one piece right does not guarantee that you will get the totality right.

Take crops. The easy part is to grow crops that are twice the size and twice the yield. I say it is easy because of science. But if you cannot sell them, if you cannot finance them, if you produce the wrong crops, if you cannot deliver them to your clients, if you do not have wholesalers, planning, roads, education, and support for women, the system will not work.

So what we are trying to do is not take just the individual pieces in which we are operating, but rather to approach our work in a more systemic format, understanding that unless you get the pieces together, you can be pleased that an individual part of it is successful, but the totality may not work.

This approach applies to many of the things that the World Bank Group is doing. For example, it applies to work in the private sector. We all know that in this current year private sector investment in the developing world is US\$240 billion, five times the size of official development assistance. Seven years ago, it was half the size. So we are pushing for private-sector investment, which is important in terms of generating jobs and economic well-being. But unless we think of

it also in terms of social and environmental development, the very actions being taken to bring in private sector could sow the seeds of disaster 10, 20, 30 years down the line.

So we cannot look at private sector investment simply as bringing money. It has to be socially responsible private-sector investment. It has to be environmentally sound private-sector investment.

Each of the elements of what we are doing is linked with the other, and the importance of our conference this week, which traverses such a broad range of subjects, is that we must start to think in terms of how we can develop global, systemic approaches to the issues of social and environmental development.

We can no longer just pick at one project after another. We have to raise our perceptions to a broader vision. We need to think not just in terms of the immediate objective, but in terms of the long-term impact, of what will happen 10, 20, 30, 40 years from now. If we do not do that, we have no chance of meeting the challenge posed by Captain Cousteau. We must raise our sights. We must forge partnerships.

As far as the Bank is concerned, we approach these challenges first, with a sense of enthusiasm to weld those partnerships; second, with a very strong desire to get away from past prototypes of each other; and third, with a sense of humility about the nature of the challenge. We regard the issues that are being discussed during these five days as central to our work, because without socially and environmentally sustainable development, we do not have anything. We may have a few short-term victories, but in a planetary sense, we will fail.

I think you might find interesting another of our publications, which is just coming out, entitled *Environment Matters*. It is a regular review of what is going on within the World Bank Group, and I refer to it because it contains a description of our activities. It addresses the issues of climate change, biodiversity and sustainable forestry, desertification and land degradation, water and ozone depletion—all issues that I addressed at the U.N. General Assembly session in June of this year.

The publication also sets forth our environmental strategy to proactively support the objectives of environmental conventions, to integrate

global environmental issues into our economic and sector work, to prepare greener national accounts for countries (another issue that Captain Cousteau was particularly concerned about), to develop new, market-driven products, and to support the global carbon initiative. It is worth noting that our number is depleted somewhat today, because at this exact moment President Clinton has taken what was to have been an internal discussion public at Georgetown University, where I will be speaking this afternoon, and where we will be looking at the very important issue of America's role at the Kyoto meeting and the problem of carbon emissions.

The World Bank Group is also looking at questions of training, at our Economic Development Institute and what we are doing there to establish learning and leadership activities. The idea is to create the Bank as a knowledge bank, as a source of information on environmental and social issues, on our work with the private sector, and on joining with others to promote standards of environmental and social performance for both public and private sector.

You will see in this book a description of what we are doing in each of the regions, 166 projects worth over US\$11 billion, including the Bank and the International Finance Corporation. At the back of the book you can learn what we are doing on such issues as building capacity; revitalizing rural development; promoting new directions in social development; ozone and the Montreal Protocol; mainstreaming climate change; strengthening environmental valuation; and the partnerships that we have established since the Rio Earth Summit, notably in forestry, water resource management, effective pollution control, and protecting the world's biodiversity.

I tell you this not to impress you with the book, but simply to underline the enormity of the task. And every one of these individual activities represents a world of activity in itself.

I want to open this conference by saying that I believe that the World Bank Group can be a good partner. We are anxious to work with others. We are committed to the issues that will be addressed here this week, and I have very great pleasure in declaring this conference open, welcoming everyone's participation, and pledging the enthusiastic support of the World Bank Group.

The Sovereignty and Systems of Nature and Nations: Challenges and Opportunities

Chair

Maurice F. Strong

I want to sound a note to reinforce Jim Wolfensohn's message. I have often characterized the environmental and sustainable development issue as a struggle between the world's egosystems and its ecosystems. The egosystems being, of course, governments, institutions, international organizations and, yes, even individuals, but largely structured on a sectoral and disciplined basis. Whereas the real-world system of cause and effect through which our policies and our actions

have their ultimate impacts is, indeed, systemic or ecological.

So the challenge we face is not just how to manage ecosystems, but how to apply the ecological, systemic approach to managing the whole range of activities through which we impact on our environment and, indeed, shape our future. That is what it is all about. It is intrinsically a partnership in which no one actor can determine the ultimate outcome, as Jim Wolfensohn has put it.

Panelist Remarks

Peter Doherty

My life changed dramatically about a year ago—exactly a year ago today, in fact—when I got the call telling me I had won the Nobel Prize. This award evidently confers on people the capacity to speak on almost anything, no matter what their background.

I am a research scientist who works in the laboratory. I study viral immunity in a children's cancer hospital. I had early training in veterinary science and animal production, and I served for about six years on the board of the International Laboratory for Animal Research and Animal Disease in Nairobi, Kenya, where I learned a little bit about the international scene. However, it has been quite a challenge for me to try to think about science in terms of sustainable development. This is a very, very complex issue with great subtleties and enormous ramifications.

The business of science, of course, is concerned with defining the nature of reality. The scientist classically tackles problems that are subject to a good measure of verifiable analysis, either by direct observation or, as in my own field, by experimentation. If an idea or a proposition cannot at least be subjected to a testable hypothesis, it is not really in the realm of the scientist. Science has little to say on many areas that are of enormous importance to human well-being, such as religious belief, and also bear tremendously on questions of sustainable development.

In point of fact, academic disciplines that use the word "science" in their title, such as political

science or social science, are usually pretty much on the outer limits of the social scientific spectrum. That doesn't mean that they are not enormously important for the human condition.

I do not think that any of us can be in any doubt whatsoever that the shape of the contemporary world is, in many ways, determined by science and technology. We are all acutely aware of the enormous changes that have resulted from recent advances in communications technology, a process that is still gaining momentum. The universal availability of the Internet, the fax machine, satellite television, and telephone linkages mean that no society can now be completely isolated in the political sense. Insurance companies in countries like the United States are, for example, now having their files processed by low-cost employees in developing countries. Hopefully this is going to result in some redistribution of wealth, not just in exploitation.

In the West the labor movements that so dominated the societies that grew out of the Industrial Revolution are seriously jeopardized, creating different realities for ordinary working people in the advanced countries.

Satellite technology also allows us to map the natural world and the available resources such as water and arable land. The pictures that result are vivid illustrations for all of us that we live on one planet, and that this planet constitutes a finite and irreplaceable resource.

The biological sciences have been revolutionized over the past 10 to 15 years by enormously rapid advances in molecular technology. Genetic engineering allows us to insert desirable genes into plant or mammalian genomes. Systematic, long-term breeding programs to produce disease resistance or high-growth variance are likely to be progressively supplanted by procedures that can be performed in fairly standard laboratories. Completely novel variants can be produced very rapidly. Such efforts have already resulted in the development of new life forms, such as ruminants producing human hormones.

Some environmentalists, particularly groups in Western Europe, are very concerned about the possible ecological dangers posed by the creation of creatures with modified genomes that have not been subject to the normal processes of natural selection. This type of activity needs to be properly regulated and monitored. However, the fact of the matter is that the use of the molecular technologies is almost impossible to regulate in the global sense, and those countries that move against innovation and experimentation in this area are likely to suffer a long-term economic cost. Some European countries with excessive regulation of molecular technology are finding this out, as they see industries move to other societies where such controls are not so rigorous.

It is also very obvious that, for instance, increasing animal production by genetic manipulation offers few solutions, unless possible ecological consequences are considered and dealt with. For example, could the problem of bacterial contamination of fish populations that we are currently dealing with in Maryland and North Carolina, which is being blamed on high-density pig and poultry operations in adjacent states, have been avoided if appropriate waste-management procedures had been put into effect at the outset? Does the technology for such solutions exist on the necessary scale?

Sustainable development cannot depend solely on the entrepreneurial spirit. Agencies that supply funds for economic development have a very clear obligation to assess the possible environmental consequences, and to act accordingly.

Application of the new molecular technologies is also changing the face of medicine, and has enormous potential for the future. Current ex-

amples of reagents that are being produced by molecular technology include the recombinant protein vaccine for human hepatitis and the protease inhibitors that are being used to treat AIDS. The protease inhibitors were designed from knowing the structure of the molecules at the tertiary level—this is advanced science—and the first example is designer drugs that are being universally used in an affected community. We are going to see many more drugs like this, which target very specific steps in, for instance, the differentiation of a cancer cell. Such drugs will be much less toxic than the sort of reagents we deal with at the moment.

These sorts of approaches raise major new ethical questions. The whole of the human genome will have been completely sequenced within the first decade of the next millennium. Every month we read of the identification of a new susceptibility gene for one or another human disease. There are very genuine concerns that such information could, for example, be used to deny people health insurance. But at the same time it is possible that we may be able to correct genetic defects permanently by inserting or knocking out a particular gene in stem cells. Much research, very expensive research, in fact, is currently being oriented in this direction in this country. There is also a continuing debate about how feasible a lot of these approaches will be in the short term. There is no doubt that we shall see this type of genetic engineering of human populations to overcome genetic disease emerging as a powerful force in the long term.

In biology the contemporary advances tend to result very much from the efforts of multi-disciplinary teams. My own research is concerned with the nature of immunity to viruses, which is a very difficult problem. The experiments that we do in Memphis, Tennessee, involve people with expertise in virology, molecular biology, and cell biology. The experimental animals that we use may lack a particular key molecule due to the knock-out of a particular gene engineered by, for example, groups in Germany or Massachusetts. We purchase monoclonal antibodies and cell growth factors that are being produced by biotechnology companies using contemporary recombinant technology techniques. These sorts of reagents are often devel-

oped as a consequence of government-funded research in university laboratories.

The read-outs that we use are largely electronic, and are constantly advancing in power as detector and computing systems are progressively refined. The technologies are changing with enormous speed, and this is something that we have to consider in the international context—that technology will often outdistance anything that we do by way of regulation or legal control. Those that ignore the technological advance, at least in the research community, are rapidly left behind.

No topic could be more complex and multifaceted than sustainable development. There is a very obvious need to use multidisciplinary teams of economists, ecologists, water and earth scientists, and experts on pollution control to evaluate situations as they are, and to develop rational policies for change. Some of this effort should be undertaken by fulltime employees of the organizations administering the international development programs, while other things can be done by independent investigators, normally working in organizations such as research universities.

A key element of any good science is peer review, both before and at some time after particular interventions are put into effect. Insofar as possible, the effort should be made to develop well-researched protocols, so that we are not doing everything for the first time. The lesson from science and medicine is that we need to learn from our successes and mistakes by looking carefully and continuously at the data.

In science, as in many areas of human endeavor, he who ignores history is condemned to repeat it. Of course, there are some scientists who only repeat things anyway.

Medicine provides very good examples of the necessity for a multidisciplinary approach. You may not realize it, but if you develop cancer, what happens to you can be somewhat of a lottery. I am not trying to frighten you, but you should know about this. Perhaps your primary care provider may refer you to a surgeon, perhaps to a physician. There are no guidelines mandating how your particular tumor must be dealt with, particularly if your condition is comparatively rare. The treatment that you will receive will de-

pend on the training and prejudices of your doctor. Radical surgery may excise the tumor mass, but failure to use the appropriate radiation and/or chemotherapy that might prevent residual cancer cells from rapidly growing back can lead to a bad conclusion. Too much radiation, however, can cause brain damage and the risk of mutation that will lead to the development of another type of cancer later in your life.

The ideal is that you should find yourself in a situation in which your condition is being evaluated by an interactive team, including at least a radiologist, a surgeon, and a physician. You may also need the support of an occupational therapist and a psychologist. This is one situation in which even the most committed economist among you would probably hope that one of your financial colleagues is not part of the team calling the shots for your therapy. This is a widespread fear arising from the current trend to develop for-profit health-maintenance organizations in this country.

We should be careful before we wish such options on others, whether they be individuals or societies. Even so, there is always the underlying economic reality. How much of our increasingly scarce resources should be devoted to the individual who is terminal or noncompliant with recommended treatment? The doctors of both medicine and sustainable development mechanisms have to face the limits of compassion.

My understanding of the term "sustainable development" is that we are discussing mechanisms for increasing the overall well-being of the human population in the context of the finite physical resources of our limited global ecosystem. Long-term prosperity and development is also inextricably linked to cultural, religious, and political factors over which even the most powerful international agency can have very little control.

Though much of what has been happening over the last few years may tend to dim our optimism, it is a fact that sustainable development is for the very long haul, and we must think accordingly. We need to focus initially on those elements that we can influence directly, and to facilitate mechanisms that are likely to promote positive cultural change. This is optimally done

in the context of a detailed and continuing analysis of environmental and social consequences.

It is very obvious, as we heard from Jacques Cousteau, that the paramount necessity for our planet, the stabilization of human population growth, operates as a self-regulating mechanism under the conditions of good public health that result from economic prosperity. People cannot be expected to limit the size of their families if they are not reasonably sure that their children will survive them. Advances in hygiene, control of water purity, and the development of vaccines in Western societies have long removed this concern. High levels of childhood mortality continue to be a major factor in the developing world, where a family may be the only social safety net for the elderly.

Realizing this, and also from compassion, last year was designated the year of the vaccine, reflecting the initiation of a major international effort involving governments, pharmaceutical companies, volunteer organizations, and the biomedical community to immunize all the world's children against the common pediatric infectious diseases. Ten million children were given polio vaccine in India on one day alone. It is likely that poliomyelitis will be eradicated globally by the year 2002, and there is a possibility that measles may also disappear within that decade.

A problem is arising in the developed countries; some who have never seen these diseases are refusing to immunize their children, emphasizing how even the most altruistic effort can be damaged by absurd cultural perceptions and the lack of a sense of collective responsibility. There is at least one instance of measles virus being reintroduced from Europe into a developing country that had used a very effective control vaccine program. The Europeans concerned were not vaccinating their children.

We have no vaccines for other infections that kill or debilitate large numbers of children. This is currently the case for malaria, though some early trials are in progress. The malaria problem is even more complex, because those that are infected with it can also be somewhat immunosuppressed in the very long term, which can influence how effective other vaccines will be.

Enormous numbers of poor children still die from preventable respiratory and enteric infec-

tions that cause little problem in the West. The prevalence of infection with the human immunodeficiency virus, the virus that causes Auto-Immune Deficiency Syndrome (AIDS), is increasing throughout much of the developing world and culturally alienated groups in countries like the United States.

Current therapies are at best a stopgap measure that can only be afforded by wealthy communities. AIDS, of course, can largely be prevented by changing human behavior. The lack of success in this direction underlines the enormous difficulty of modifying entrenched cultural positions.

As President Clinton has emphasized recently, we desperately need a vaccine for the human immunodeficiency virus. The United States is currently devoting about US\$1.5 billion a year to AIDS research, and will devote a significant proportion of that—10 percent, I think—to developing a vaccine.

The AIDS problem is an extremely difficult and dangerous one. There is a related virus of sheep, visna virus, that spreads by the respiratory route. We had 20 million or more deaths after the first great war, in 1918-1919, during the global influenza pandemic. That pandemic showed us very clearly there is absolutely no way of protecting the world community against a respiratory pathogen. Those were in the days when global communication and travel were much less rapid than they are now.

My worst nightmare is that the basic biology of the human immunodeficiency virus could change, particularly under selective pressure of some of the drugs that are being used to treat it at the moment and are modifying its behavior. We should understand very clearly that humanity is in a race with this rapidly evolving virus.

Humans often outlive their diseases, which is currently the best that we can hope for with AIDS therapy. That is to say, we enjoy our four-score-years and 10—or 20 or 30—in a reasonable state of health and we outlive our disease by dying from something else. Currently treatment, for example, for some forms of prostate cancer are designed with this assumption.

We do not have this option for humanity as a whole. The resources available on this planet have to be maintained for the millennia. There

can be no sustainable development that ignores the ultimate reality of a finite physical and biological system. The best that the international agencies can do is to facilitate the application of comprehensive, well-evaluated,

multidisciplinary approaches to the problem of sustained development. Hopefully, cultural and political attitudes will follow if policies are appropriately administered and seen to be successful.

Stepping toward Balance: Addressing Global Climate Change

Joseph E. Stiglitz

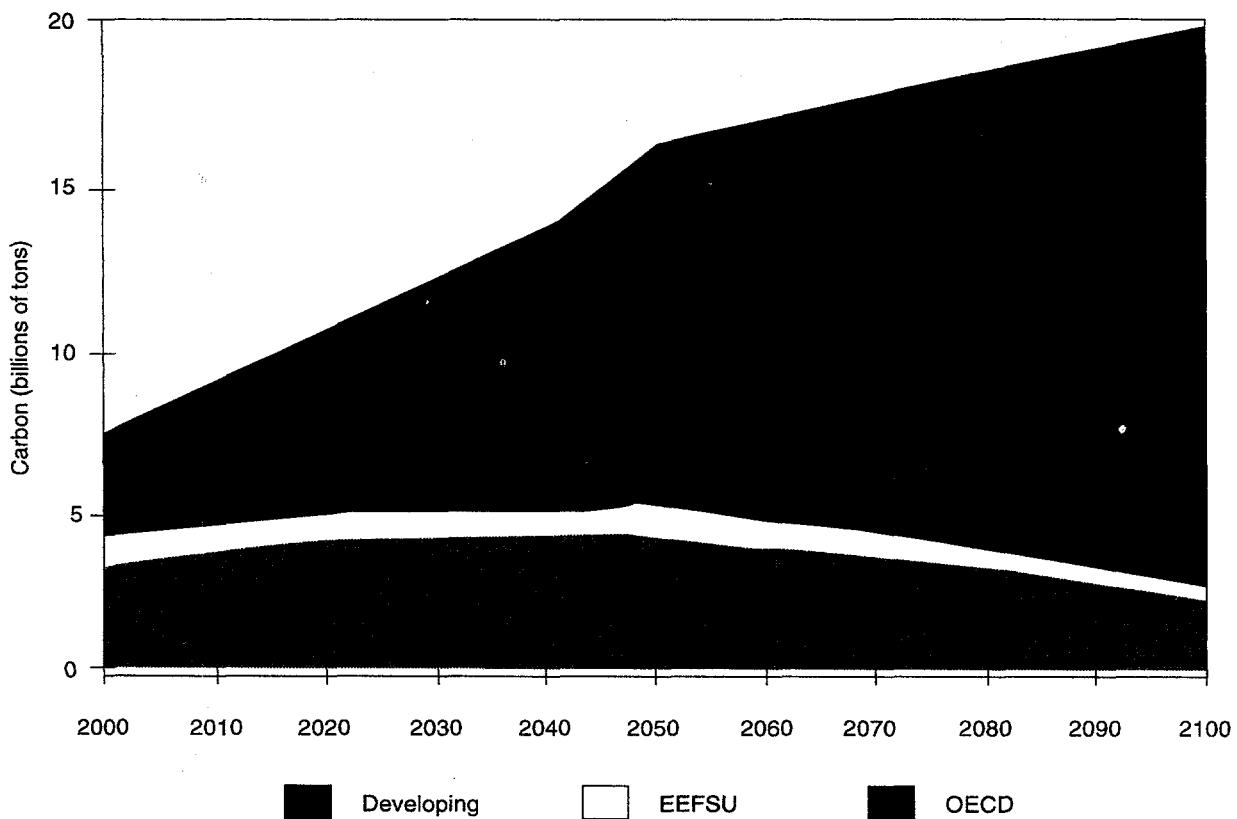
In two months negotiators from all over the world will meet in Kyoto, Japan, to discuss one of the most important challenges facing the world: reducing the threat of global climate change. They face great uncertainty in the problems they are negotiating, since the likely changes in temperature and climate, and their consequences for humanity, are all subject to dispute. Negotiators face huge lags between actions taken today and consequences decades hence. And they face policy choices that could have enormous distributional consequences.

These difficulties should not stop us from addressing climate change now and addressing it globally. We cannot address climate change without an international framework. A ton of carbon emitted in the United States and a ton of carbon emitted in China have the same effect on the climate of Washington, D.C. Only through concerted action by all countries in the world, developed and developing, will the problem of global climate change be meaningfully addressed.

Today developing countries produce as many metric tons of carbon dioxide from industrial processes as do developed countries. Before the middle of the next century, carbon emissions by developing countries are projected to be more than twice those of all of Europe (see figure 1). Even draconian measures by the industrial North will only buy a few years for the global commons.

The prospects for effective action by developed countries alone are even worse than this projection suggests. Unless developing countries are included, much of the carbon reduction in developed countries could be offset by so-called "leakages," as carbon-intensive industries are driven to developing countries. In other words if developed countries were to take serious measures to reduce their consumption of fossil fuel, carbon emissions by developing countries would rise. For example, consider an aluminum plant located in a relatively energy-efficient country in, for example, Northern Europe. If the consequences of that country's attempts to reduce its emissions were that the aluminum plant moved to a less energy-efficient developing country, then total global emissions would rise. In this extreme example the leakage is more than 100 percent.

Leakages also come from the fact that reduced demand for fuel in developed countries would lower its price, and thus lead to increased consumption in developing countries. Estimating the likely extent of leakages is very complex, and depends on forecasts about capital flows, exchange rates, and the price of oil—to name a few key variables. But intuition suggests that they rise over time because of the costs of quickly adjusting production locations. Consequently, any effective steps to keep the Earth in balance must engage both rich and poor countries. And that is why it is imperative that the World Bank Group

Figure 1 Common action is necessary: Possible regional emissions by 2100

Source: Manne and Richels 1997.

be involved in the quest for meaningful solutions to the problem of global climate change.

I would like to provide an economist's perspective on the threat of global climate change. In particular, I would like to explore strategies that recognize the inevitable uncertainty and distributional consequences of our policies and the importance of achieving emission reductions in an efficient way.

Sequential Decisions and "Halfway Houses"

In thinking about how to address climate change, it is important to remember that we learn more as time passes. We are engaged in a process of sequential decisionmaking, and our decisions today must be framed in that way. This is not to suggest that we should put off dealing with the problem until we understand it better. On the contrary, recognizing the sequential nature of the

problem gives us an added incentive to address climate change now. The benefits of our policies include not only emissions reductions and the consequent mitigation of global warming, but also the possibility of learning more about the costs and consequences of our policies. This learning could be used to alter policies, when necessary. Restoring climatic equilibrium will be a long process. Rio was a first step. Kyoto is a second. There will be many more steps. We should have some idea where we hope to eventually wind up, lest our route to that end be too circuitous and too costly. As we prepare for Kyoto and think about future actions, we need to focus on intermediate steps, "halfway houses" that move us in the right direction, even if they are partial and incomplete. In evaluating some of the policies I am going to discuss we need to ask, do these help? Are they moving us in the right direction? What options do they open up for future policy changes?

We do not need to, nor can we, "solve" the problem in Kyoto. Instead, we need to think about the proper steps that lead toward a solution. As we observe the outcomes of our policies and learn more about the process of global climate change and our options for dealing with it, our policies will necessarily have to evolve and change.

Consequences and Causes of Global Climate Change

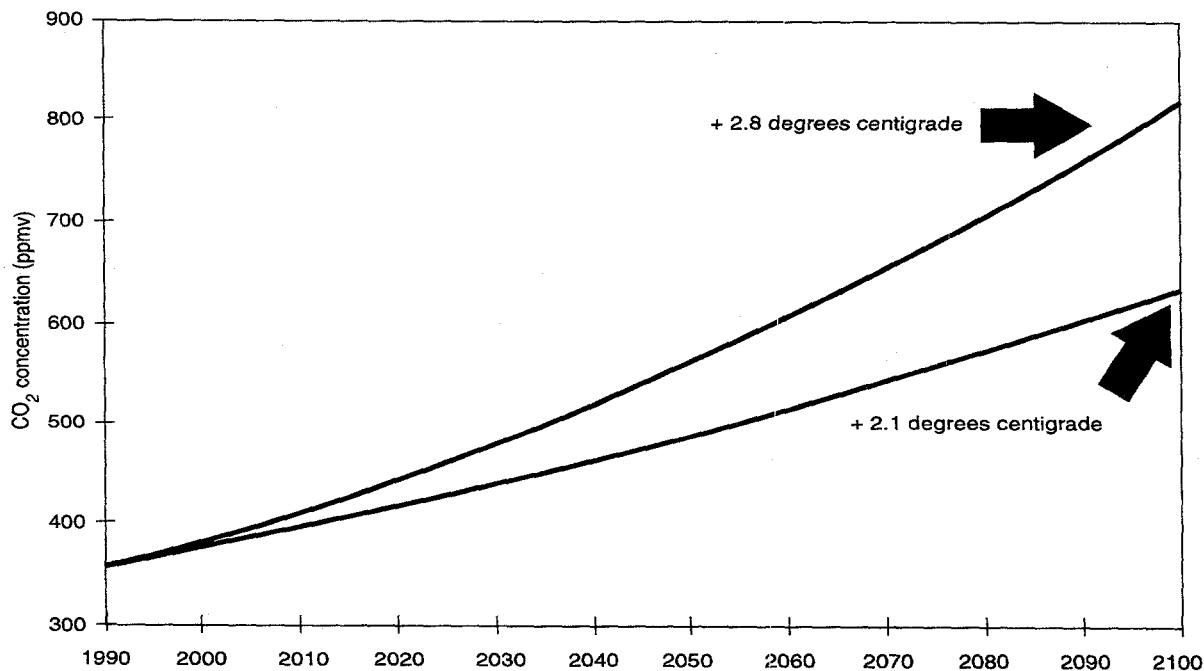
To develop appropriate policies, we need to understand the science of global climate change, its causes and consequences, and the many links between our actions and their effects. These include the likely path of greenhouse gas emissions, the effect of emissions on atmospheric concentration, the effect of atmospheric concentration on temperature and climate, and the effects of changing temperature and climate on humanity. These links are complicated by the existence of discontinuities (in which a small change has a huge effect), irreversibilities, and long lags. Some of these links are more certain than others.

It is an indisputable fact that the atmospheric concentration of greenhouse gases is rising. And

a scientific consensus holds that this will lead to increase in mean global temperatures. Figure 2 portrays the projected consequences of inaction. Even allowing for considerable uncertainty, by the year 2100 we may triple the preindustrial CO₂ concentration in the atmosphere. This could increase global mean temperature by as much as three degrees centigrade.

The variability of the temperature is likely to increase with its mean. Also, temperature increases will vary over time and space. The poles, for instance, will likely be warmed more than the equator. Shifts in the temperature gradient will result in broader changes in climate, including shifts in wind patterns and precipitation. Some areas will probably enjoy longer growing seasons and more benign living conditions. Other areas will suffer more violent storms and flooding; the continental interiors could become warmer and much drier. If we had a credible global insurance agency, we could at least mitigate some of the uncertainty facing individual countries. But nothing can insure against the possibility of net harm to the world. It would be irrational and irresponsible for us to ignore this problem.

Figure 2 The cost of inflation: Rising CO₂ and global warming



Source: Jacoby and others 1997.

Zero-Cost Policies and Efficiency-Improving Measures

Some policies to reduce the threat of climate change can be undertaken at no cost and may even improve efficiency. These should be undertaken, regardless of other policies or international frameworks. Some cite the existence of inefficiencies in the economy that could be eliminated, resulting in monetary savings for consumers and companies, while also reducing emissions. One frequently noted example is "green light bulbs." Green light bulbs themselves cost more than ordinary light bulbs, but they are supposed to repay the expense through lower energy costs. If this is true, the continued use of ordinary light bulbs by so many is irrational, and shifting toward green light bulbs would benefit both the economy and the environment.

We should be frank: there is a huge debate about the quantity of carbon reduction that could result simply from eliminating these kinds of irrational inefficiencies. Economists are prone to think that people do not often leave money lying on the sidewalk—at least not huge amounts of money—hence they think the scope for such efficiency-enhanced emission reductions is limited. But there are irrationalities and market imperfections, including imperfect information about the gains to be had from these alternative technologies.

But there is no question that governments throughout the world have introduced policies that subsidize carbon-emitting activities, to the detriment of both the economy (because it is an economic distortion) and the environment. Eliminating these policies would both increase efficiency and reduce carbon emissions, and the gains on both accounts are potentially significant. In many countries, for example, governments tax income spent on public transportation but either fail to tax, or undertax, the value of a company-provided parking space. Also studies suggest that virtually all road damage is caused by heavy trucks, which pay only a small portion of the expense of building and maintaining road systems. This subsidy for trucking—compared to rail or barge transport—probably increases greenhouse gas emissions. Many countries subsidize coal mines; many, including the United States, sell the electricity produced by hydroelectric power

plants at below-market prices (below the opportunity costs, even if at, or above, production costs.)

Finally, certain policies could improve efficiency in other areas while producing collateral benefits in terms of lower carbon emissions. One example is pay-at-the-pump automobile insurance. With pay-at-the-pump insurance a tax would be levied on gasoline, and earmarked to pay for insurance premiums. This would raise the cost of gasoline at the pump, but lower insurance premiums. And it would make auto insurance more efficient by making drivers pay for the extra chance of having an accident that comes from driving more. In the process people would be encouraged to purchase more fuel-efficient cars, carpool, or shift to public transportation.

Balancing Costs and Benefits of Global Action

Although there is some scope for costless, or even beneficial, action, these policies by themselves do not go far enough. Costly actions will almost surely be required to curb emissions to a level that reduces the risk of global climate change to acceptable levels.

It is in the interest of any country to free-ride off costly emissions reductions undertaken by other countries. Consequently, reducing emissions requires collective action by sovereign nations.

In thinking about these costly actions, we need a plan which will hold the Earth in *appropriate* balance—between damage inflicted by global warming and damage inflicted by overly expensive emissions abatement in a world still afflicted by mass poverty. Few question that some balance is required: we could obviously eliminate the risk of global climate change by vast reductions in the level of economic activity. That is a high price to pay. Global climate change has its costs, but so too do the poorer nutrition and poorer health that developing countries would face in a world in which their economic progress is retarded.

The concept of balance is clear. Economists have a proclivity for trying to make such notions precise, by referring to balancing incremental benefits with incremental costs. The difficulty is in the implementation, especially given the great uncertainty about both the costs of reducing emissions and those of failure to do so.

But while considerable uncertainty about the overall level of costs persists, there is strong reason to believe that the manner in which emissions reductions are accomplished can have a major effect. The costs of reducing emissions are likely to be significant and cannot be ignored; emissions-reduction strategies must be designed to minimize overall costs.

This concern about costs and efficiency does not just reflect an economist's obsession. Everyone knows that addressing global climate change requires collective action at the international level. The ability to achieve the required political accord may depend crucially on the magnitude of the costs. An appropriate treaty framework may lead to high benefits at low cost; an ill-designed strategy could lead to low benefits at high cost. Two aspects of an efficient emission-reduction strategy require comment.

Timing

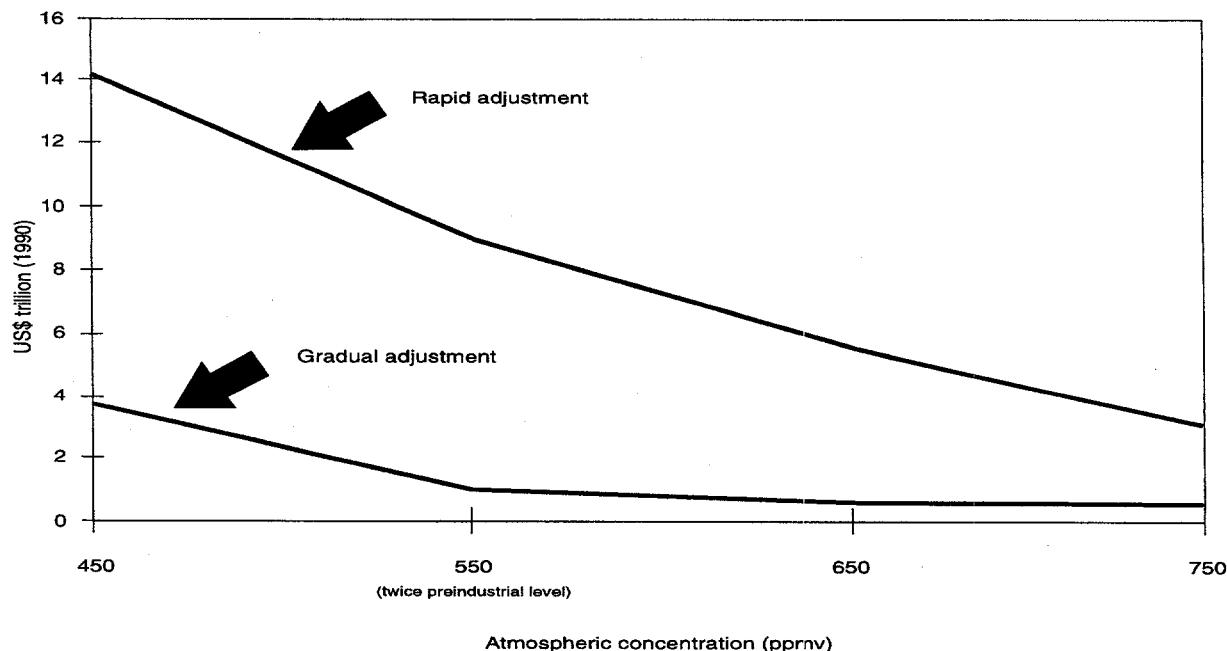
The first is timing. Rapid emissions reductions, however they are accomplished, are much more costly than reductions phased in over long peri-

ods. If, for instance, the United States were to require extremely tough emissions standards for cars by January 1, 1998, the cost could potentially involve replacing roughly 200 million cars in America today. If people had more time to comply with the standards, they could wait until the point at which they would have purchased a new car anyway, and buy one with lower emissions. The cost of the regulation would only be the marginal cost of the more environmentally friendly car—not the total cost of the car.

The same logic applies to another method for reducing carbon emissions: taxes. The sudden imposition of a heavy tax on carbon emissions would administer severe sectoral and regional jolts to many economies. Phasing the tax in would allow time for additional research and development into emissions-reduction technologies, and would not lead to the forced obsolescence of much of the capital stock. One estimate of the difference in costs is shown in figure 3.

Although timing is very important on the cost side, it matters relatively less on the benefit side. Global temperature and climate depend mostly on the concentration of greenhouse gases in the atmosphere; emissions over the course of any

Figure 3 Cost of stabilizing atmospheric concentrations
(discounted to 1990 at 5 percent)



Source: Manne and Richels 1997.

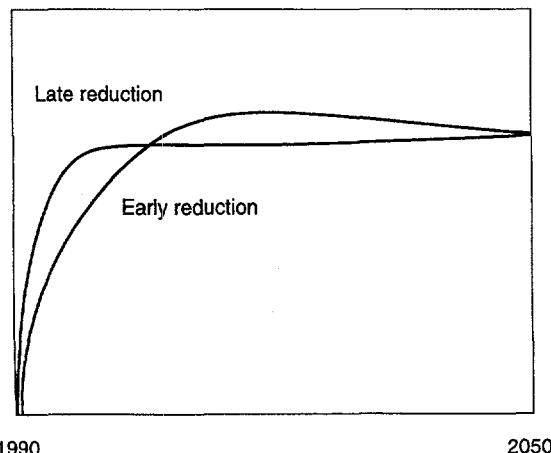
decade have only a small impact on overall concentration. Figure 4 shows two hypothetical emissions paths: one is for very rapid reduction in the growth of carbon emissions, followed by a leveling off, and the other for a more progressive reduction in the growth of emissions. Both paths produce the same concentration (and thus benefits) in 2050, although their costs are very different.¹

Joint Implementation

The second aspect of an efficient strategy for emissions reductions is that the marginal costs should be the same everywhere in the world. This could be achieved in a number of ways. The most natural way is a carbon tax. There is clearly a global externality—the emission of carbon dioxide—and there is a well accepted way of addressing externalities: imposing charges reflecting the costs associated with the externality.

But there are other ways of accomplishing global efficiency in emissions reductions. One is tradable permits, and another, closely related means is joint implementation. Joint implementation gives developed countries (or companies within them) credit for emissions reductions that they would not otherwise have undertaken anywhere in the world. It may be a feasible first step toward designing an efficient system of emission reductions, because it only requires commitments from developed countries, and therefore does not entail resolving the complex distributional issues

Figure 4 Different emissions paths; same ultimate concentration



involved either in systems of tradable permits or obligations by developing countries.

The premise of joint implementation is that the marginal cost of carbon reductions may differ markedly in different countries. In particular, developing countries are typically less energy-efficient than developed countries. As a result the marginal cost of carbon reduction in developing countries may be substantially lower than in developed countries. The World Bank has offered to set up a carbon investment fund that would allow countries and companies that need to pursue emissions reductions to invest in carbon-reducing projects in developing countries. For developing countries this plan would offer increased investment flows and proenvironment technology transfers. Such projects would also be likely to reduce the collateral environmental damage caused by dirty air. Joint implementation would allow developed countries to reduce carbon emissions at a lower cost. This strategy is designed to benefit developing countries as it improves the global environment.

To be sure, issues of effectiveness are involved in joint implementation. But we should not allow the perfect to be the enemy of the good. The problems of putting joint implementation into practice are no greater than those involved in the effective implementation of the Global Environment Facility, which seeks to fund the incremental costs associated with environmentally sound projects; that is, costs incurred beyond those associated with the technology that would be in a country's narrow self-interest, given current and projected prices. I believe that joint implementation could be implemented in a such a way as to achieve meaningful emissions reductions at far lower costs than would be the case without it.

Uncertainty about Costs

Any meaningful strategy to deal with global climate change must confront great uncertainties. A huge conflict exists over the costs of addressing the greenhouse gas problem. Many in the environmental community see the benefits as high and the costs of mitigation as low. Others, including some in the business community, see the benefits as low and the costs as high. (I see no inherent reason why estimates of these two variables should be so systematically inversely

correlated.) One approach to resolving this uncertainty would be to take those who say the costs are low at their word: if the problem can be cured by, say, a US\$15 per ton tax, then impose that tax, or sell emissions rights at that price. If they are right, these measures should be enough. But if they are wrong, it will not be a disaster. As I have been arguing, addressing climate change is a problem of sequential decisionmaking under uncertainty, a problem we will constantly revisit. If we see that emission levels are not being adequately curtailed at my purely hypothetical US\$15 per ton, then we can decide to raise the price. After all, the major concern appears to be with long-run atmospheric concentrations (although there may be some impact of rates of changes as well).

A number of ways of fine-tuning such proposals could be cited, such as making the price depend over time on the quantity sold, or pre-announcing increases in the rate over time. The latter could be an important ingredient in responding to concerns about timing of reductions.²

Common Targets for Emissions

The issues that I have addressed so far, contentious as they may be, are the easy ones. Joint implementation, while desirable, is only a half-way house. It does not address the issue of gross leakages. Aluminum plants could still move to carbon-intensive developing countries—although emissions increases would be offset by jointly implemented reductions elsewhere. Given the projected paths of emissions I showed earlier, binding commitments by developing countries will eventually be necessary. The issue is how to accomplish this, because the manner in which it is done will have huge distributional implications. The distributional consequences cannot be ignored, and it does little good to try to sweep them under the rug.

The Rio Convention entailed a framework with two properties: (1) quantitative targets for emissions imposed on each country; and (2) targets based on historical emissions levels.

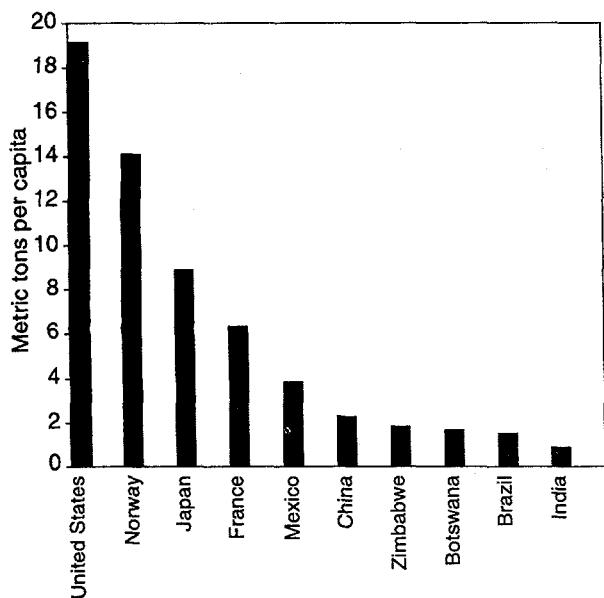
The setting of targets, including (perhaps especially) those embodied in the Rio Convention, involves inequities. Why should a country that has invested in increasing its energy efficiency

prior to 1990, and has exhausted accessible options, be obliged to reduce as much as a profligate country? But we will never balance all the equities: How can we allow for differences in nature, such as extremely cold or hot weather that induce heavy use of heating or air conditioning? Or vast spaces that force large expenditures on transportation? Or large resource endowments of coal? The great success of the Rio Convention was the recognition by the countries of the world that it was more important to grapple with the problem of global climate change than to squabble about precise equities. But going forward, as we think about eventually bringing the developing countries into the framework, the historical standard used in Rio simply will not do.

Why should developing countries, simply because they were poor in the past—and thus had lower levels of per capita emissions—not be entitled to have at least the same level of emissions per capita as the more developed countries? If anything, their relative poverty means that the burden of emissions reductions should fall less heavily upon them. This indeed was the principle embodied in the Rio Convention, but by imposing no obligations, it went too far. One target that I think would receive wide assent, especially from the developing countries, would be a given level of emissions per capita. Currently, per capita emissions of carbon dioxide from industrial processes are usually much higher in developed countries than in developing countries. (see figure 5.)

Reducing these to a feasible common level seems to be the target for which we should be aiming. But we need to recognize that this is a target which cannot, and probably should not, be imposed in the short run, for it would impose politically unacceptable costs on the high-emitting countries, even with joint implementation. The distributional burden would, in the short run, be too large. The Rio Convention needs to be seen as setting intermediate targets, but unfortunately, the historical nature of the obligations imposed does not provide a framework for going forward. There are alternative intermediate targets, more likely to provide a framework that will ultimately lead to an agreement embracing all the countries of the world—targets such as given levels of emissions per dollar of GDP. One could imagine transition paths beginning with

Figure 5 Per capita carbon emissions in selected countries



this and eventually moving to per capita emission levels.

Targeting per capita emission levels raises another problem: when to measure the "capita." Basing the ceiling on population at any point in time would reward countries for population increases, which is surely the wrong incentive. Furthermore, it would probably be politically unacceptable to developed countries. One alternative is to target emissions per capita as of 1990.

Common Measures to Reduce Emissions

But there is an alternative framework to common quantitative targets—sometimes called common measures—that may be more acceptable, simply because it raises fewer distributional issues. The common measures approach would not require us to solve the problem of allocating emissions rights. Instead it would commit countries to undertake equal efforts at emissions efficiency. Several different ways to accomplish this can be cited.

International Standards

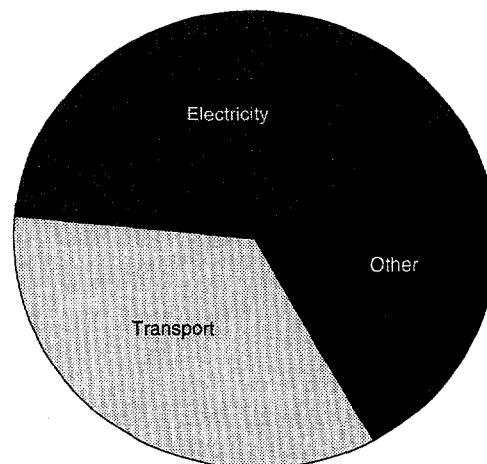
One common measure would be to adopt international standards for energy efficiency. This could be done in electric power generation and transportation—which together account for two-

thirds of carbon emissions in the United States (see Figure 6). International standards have the advantage that they are often more politically palatable than other alternatives. They would also be relatively easy to monitor and enforce, because they are extensions of existing laws. At best, however, the standards would be an intermediate step. Imposing, monitoring, and enforcing standards in some areas—such as heterogeneous industrial-energy use—would be difficult. And international standards, like any command-and-control measure, could not ensure that emissions reductions and innovations to improve technologies were being undertaken in the least costly areas. In order for this to happen, private agents would have to make their own choices about where it is least costly to reduce emissions and most beneficial to innovate. This could be accomplished by another measure, internationally agreed-upon carbon taxes.

Taxes

Carbon emissions are, as I have said, associated with what economists call a "global externality." In making decisions about energy use, consumers and producers take into account only the direct costs of consuming the energy; they ignore the costs of global climate change, because these are spread evenly across the world. The natural remedy for an externality, as I have noted, is a corrective tax. In a common measures scenario,

Figure 6 U.S. carbon emissions, by sector



Source: U.S. Department of Energy, *Annual Energy Outlook 1997*. Data for 1995.

such a tax could be applied uniformly across the world, but collected by national governments.

A corrective tax would increase the cost people pay for energy, especially carbon-based energy, forcing them to internalize the consequences of their energy use and thus to conserve or substitute fuels. Evidence suggests that decisions about energy use are responsive to price. Figure 7 shows, for instance, that gasoline consumption per dollar of GDP is substantially lower in countries with higher gasoline prices (although other factors, such as reduced distances between cities, also affect gasoline consumption). More generally, statistical studies have shown that a 20 percent increase in the price of energy or fuel would result in a 10 to 20 percent decrease in the demand for energy or fuel over the medium-to-long term. These estimates are, however, imprecise, and we could well be surprised by the very long-run responsiveness of energy consumption to price changes.

If each country retained the revenues from its corrective tax, distributional issues would be minimized. Most of the tax would not be a true cost to society—at the same time one group paid the taxes, another group would receive the revenue. There will still be some cost (what economists call a Harberger triangle). The important point is that these costs are likely to be small (sec-

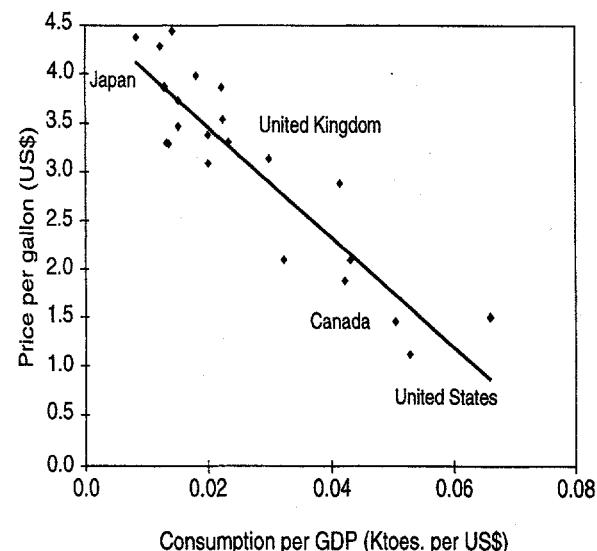
ond order, in the terminology of economists). The international distributional issues arising from the differences between these small costs would be smaller still (third order, in the terminology of economists) and would provide far less to quibble over than the distribution of emissions rights themselves.

If the revenue from carbon taxes were used to reduce other distortionary taxes, such as income taxes, the losses would be smaller still, although it is unlikely that this “double dividend” would be enough to fully offset the costs of emissions reduction.³ The important point is that the overall taxes paid by businesses and individuals would not go up, although their distribution could, and likely would, change. To be sure, there is always the worry that new taxes would lead to an increase in the overall tax burden, and it is imperative that the carbon tax increase be matched by offsetting tax decreases elsewhere.

We need to recognize too that even this proposal will not fully address the international distributional implications of global climate change. Any scheme for reducing emissions means that the value of carbon-producing natural resource assets will be less. Owners of those assets, such as oil-producing countries and those with large coal deposits, will be worse off. Those with other energy sources will be better off. But these are little different from the kinds of distributional effects that arise from any new technology that makes assets more or less valuable. Owners of these resources have already enjoyed a windfall gain from the fact that users have not had to pay their full cost—the cost of emitting carbon into the atmosphere.

Let me say one more word about the issue of quantitative targets versus taxes. The issue of whether, or under what circumstances, quantitative restrictions are more or less effective than price mechanisms in achieving environmental goals has been well studied. The long-term nature of the problem of global climate change, the fact that it is a problem that we will have to revisit repeatedly—setting either new targets or new tax rates as the uncertainties surrounding costs and benefits are resolved—suggests that the downside risks sometimes associated with the use of price mechanisms are of far less force here. If emissions levels are, for a while, higher than had been projected—if the response to price in-

Figure 7 Price and consumption of gasoline



Source: Council of Economic Advisors; calculations from OECD countries.

centives is weaker than had been projected—there will be considerable opportunity for revision, and the ultimate impact on long-run concentration levels will be relatively small.

Enforcement

Before concluding I want to touch on one more issue. As I have noted, consensus that this global problem must be dealt with by global collective action is building. The danger of "free-rider" problems has led to a recognition that emissions reductions must be binding. But imposing binding commitments, without an enforcement mechanism, raises problems. What does it even mean? Will peer pressure suffice? Why should we expect that it should do so in the future, when it seems to have been so ineffective in the past? As countries engage in negotiations over the nature of the commitments, they should also begin discussions over how to enforce them. Should, for instance, offsetting, or possibly even punitive, charges be imposed on imports from countries that have failed to live up to (or make) commitments for greenhouse gas reductions?

Conclusion

I have not tried to spell out detailed solutions to the threat of global climate change. Instead, I have tried to advance a framework for thinking about global climate change as a problem of sequential decisionmaking under uncertainty. I think this framework holds out the promise of directing us toward solutions to what sometimes seem to be unresolvable conflicts. Fixing the costs of carbon abatement through taxes or setting a price at which emission permits can be sold, for example, can help avoid political disagreement over the likely cost of reductions. Economics teaches us that taxes would also be a relatively efficient way to curtail carbon emissions; and beyond lowering the overall cost of

abatement, internationally uniform taxes could minimize the arguments over the international distribution of those costs.

Whatever policy we adopt, some general principles are clear: we must include all countries; efficient strategies for emission reductions have the potential for significantly reducing overall costs, and thus making a credible strategy more politically acceptable; provided it is credible, gradual adjustment is cheaper than rapid adjustment; and energy-efficient technologies, whether transferred through joint implementation or other means, are essential. Acting with these principles in mind, I believe we can move toward balance in addressing global climate change. The test of Kyoto's success will be not whether the problems of global climate change are solved for once and for all, but whether the meeting moves us toward a framework reflecting these general principles.

Notes

1. Some have recently argued that the rate of change of atmospheric concentration may have impacts, particularly on climatic variability, but the differences in the rate of change of atmospheric concentration in these alternative scenarios are likely to be too small to have noticeable consequences.

2. If our major concern is the ultimate level of atmospheric concentration, then the pollution charge should be constant (in present value terms). But the tradeoff between distributional effects and emission reductions changes over time, and therefore it may be appropriate to have pollution charges increase (even in present value terms) over time.

3. To be sure, there is some disagreement about the magnitude of this double dividend, and some question whether it exists at all. In the second best world, there are complicated interactions among taxes, so that reducing one distortion may increase the losses associated with another. Still, the reduction in the distortions in wage and capital taxes that a carbon tax would allow is likely to increase, or at least not significantly decrease, overall economic efficiency.

Panelist Remarks

Christopher G. Weeramantry

I am delighted to have this opportunity to address this important conference, which brings together the disciplines of science, economics, and law. The task of the law is to provide a working framework of rules and principles, concepts, and procedures that will enable environmental law and conservation of the environment to develop in the future.

Environmental law is a rapidly developing branch of the law, and sustainable development is a rapidly developing branch of environmental law. Just last week the International Court of Justice delivered a judgment in which for the first time in its jurisprudence it referred to the concept of sustainable development, thereby giving it a very definite status of recognition under the law.

Environmental law has certain special characteristics. First, when we deal with environmental law we are in the realm of internationalism, because no country, however powerful, can regulate its environmental affairs by itself. Problems of the environment and pollution know nothing of national frontiers. They do not stop at national borders, so we have to treat these problems as universal.

Second, we are not merely in the realm of the present generation; we must also consider future generations, which have no leaders to advance their point of view. The law must protect them. One of the duties of environmental law would be to see what mechanisms and pro-

tection it can provide for the generations that will come after us.

Third, it is useful to note that modern, international law is moving from the realm of mere passive coexistence of a number of countries, each having to recognize somewhat reluctantly the existence of other sovereign states, to an era of active cooperation. As this trend continues, one of the areas that will require active cooperation in the future is environmental law.

We are also in the realm of collective rights rather than a concentration on individual rights. In the past legal systems concentrated on the rights of individuals, and international law concentrated on the rights of individual states. We are now passing from that era into an era of collectivism. We have to act together if we are to survive.

Finally, we are now in a realm in which the traditional wisdom of humanity must be drawn upon if we are to develop the concept of environmental law in a meaningful way.

Sustainable development is not a new concept. It is a very ancient concept. Humanity has lived with it for millennia, because humanity has not rested content with the streams and rivers and natural systems as they were. It has always tried to improve them. But in improving them it has always had regard for the environment. I shall try to illustrate that point briefly as I proceed.

In this connection I was delighted to see in the citation in memory of Jacques-Yves Cousteau a

reference to the importance of heeding the wisdom of ancient peoples. We must look at the traditions, experience, and wisdom of the past when trying to shape the destiny of humanity in the future.

I would also like to mention to those of you who are not international lawyers that when Hugo Grotius, the founder of modern international law, began to devise a system of international law in this as yet uncharted area, he looked very much to the traditions of the past. He tried to collect what wisdom he could from all the civilizations upon whose records he could lay his hands. From these records he extracted such wisdom as he could find to shape the principles of the international law of the future.

In the field of environmental law we are in as uncharted a field as Grotius when he was starting this new discipline of international law. And like Grotius I think it is our duty to look to past generations to see what wisdom we can derive from their collective practices, and try to inject some of that wisdom into the developing field of environmental law.

The concept of sustainable development is beginning to gain recognition for two main reasons. First, there is growing recognition that the right to development is an inalienable human right. This has been mentioned in various declarations, and it is part of accepted human rights discourse today. So first we have the right, the undeniable right, to development.

Second, we also have an undeniable right to protect the environment, because if the environment is not protected almost every human right is eroded, starting from the very right to life itself. The right to health and all the other rights that we have built into the current system of universal human rights will be eroded at their very foundation if we do not protect the environment.

So we have the right to development, on the one hand, and we have the right to environmental protection, on the other. But these two rights can be in a collision course, because if you permit either one of them an unbridled career of its own, it will clash with the other and destroy it. We therefore must create a harmonizing principle that reconciles these two—and that is the principle of sustainable development.

In the brilliant words of Maurice Strong it is a clash between egosystems and ecosystems, and

we must find a balance between them. Sustainable development is that balance.

In finding this balance—as far as lawyers are concerned—we have to look at the sources related to international law. The sources from which international law is derived are set out in the Statute of the International Court of Justice. That is the authoritative formulation of those sources, and they include treaties, customary international law, general principles of law recognized by civilized nations, judgments, and the writings of jurists. From all those we must cull whatever principles we can derive that have a bearing on this question of sustainable development.

I do not have the time to go through all the treaties, all the declarations and writings of jurists, that refer to principles of sustainable development and environmental law. There are declarations ranging from the Stockholm Conference through the Rio Declaration, the Copenhagen World Summit, and others. Not to be forgotten is the leadership provided by international financial institutions, particularly the World Bank Group, in awarding recognition to the concept of sustainable development.

State practice also demonstrates recognition of the concept. I could list a number of instances of collective declarations by states, such as the Commonwealth Declaration (known as the Lankavi Declaration of 1989) and the Dublin Declaration of the European Council on Economic Imperatives. These and others show that state practice recognizes this concept of sustainable development. A host of multilateral treaties recognize the concept as well.

But in this talk I want to concentrate on the various traditional systems from which we can derive some relevant principles of customary international law. This takes me back to what I described earlier as the ancient wisdom of humanity. Let me start with my own country, Sri Lanka, because in my country development has gone on for 2,500 years—particularly in the field of massive irrigation works—that paid due regard to environmental principles.

In Sri Lanka there are between 25,000 and 30,000 small, manmade reservoirs that are linked together and fed from enormous reservoirs—as large as 20 miles in circumference—that were constructed over a period of 2,500 years. They

are connected by an intricate network of canals, making the dry zone of the country enormously productive.

It is particularly significant that in our ancient literature this concept of sustainable development was implicitly recognized. One of our ancients kings is recorded as ordering that not a drop of water should be permitted to flow into the sea without first serving the purposes of man. Not only was the principle of development recognized, but a whole host of environmental principles were also built into our ancient legal system and recorded in our ancient literature.

Let me begin by referring you to an element of tradition that is crucial to our history. In the third century B.C. the great Emperor Asoka was reigning in India, and we had a noble king in Sri Lanka who was also concerned with humanity in the broadest sense.

On one occasion this king was out on a hunting expedition and Asoka's son, who was a famous Buddhist monk, accosted him saying: "Oh, king, what are you about? What are you trying to do? These poor defenseless creatures have every right to this environment that you have. They have every right to roam around freely in this country as you have, because you are not the owner of this country. You are only the trustee. You are looking after it for the benefit of all creatures and for future generations."

Thus was spelled out the first principle of environmental law, the principle of trusteeship. The king was told: You are not the owner, you are the trustee; look after this land. And the king, in consequence of that sermon, started sanctuaries for animals. He protected the forests. He created edicts protecting certain forests, and he even began a practice of creating small reservoirs of water for the animals so that their needs would be met.

So the idea that the environment must be looked after and protected was there, alongside the tradition of development.

In another part of the world, Tanzania, certain tribes had complicated networks of irrigation farrows that transported water over long distances. These systems were in operation for hundreds of years. According to their tradition it was the sacred duty of each generation to protect that irrigation system. If it ever fell into disrepair, if there was any trouble with one of those farrows,

a call was sounded known as the "call to the farrowers," and every able-bodied person had to come and serve to put the farrow back in working order—that was the sacred duty they had towards future generations.

In Iran there are underground channels linking sources of underground water supply that are thousands of years old. Statistics show 22,000 such channels comprising 170,000 miles of underground channels, which until recently supplied Iran with a considerable amount of its irrigation and domestic water.

In China there were also great irrigation works; stone tablets erected at some of these sites say that they were erected to last for 1,000 autumns. The basis on which they were created was that there should be no action contrary to nature. That principle is laid down in some of the ancient Chinese writings.

All of these traditions combine the notions of development and protecting the environment.

In the Pacific Islands there is a tremendous love of the land. I remember reading some of the evidence given by Pacific Islanders before a Land Reform Commission in the British Solomons, in which they said that the land is something they revere and respect. It is not like a box of merchandise you can buy off the counter and chop up into little pieces and sell. That is not their view of land. Land is a living, breathing thing that is part of the community and must be respected. We must look after it, because if the land grows and prospers, the people grow and prosper. If the land withers and dies, the people wither and die.

Likewise the aboriginal cultures in Australia have a long tradition of conserving the environment. They would live on a block of land and then move away from it, returning only after five or seven years, when the land had had time to regenerate.

Ancient civilizations such as the Incas created elaborate systems of swamp drainage. They expanded their irrigation to cover terracing hillsides and thus reclaimed large quantities of land, but their goal was always the same—maintaining an equilibrium between protection and consumption, between use and conservation. Writers on this civilization have said that, in this respect, the Inca civilization was triumphant.

African civilization has a threefold view of humanity; it views humanity not merely from the

perspective of those who are alive in the here and now, but also from the past and future: those who went before us, those who are with us now, and those who are to come after us. The community of humanity comprises three parts, and we must show due regard to all three. Therefore, we must have due regard for the rights of future generations, including protection of the environment.

In the United States I should mention the American Indians, who had the tradition that before they interfered with land they should think of the impact of their act of interference for seven generations to come. There is a famous letter referred to in all the texts from one of the chiefs to the U.S. President in relation to treating land as an article of merchandise that can be sold. He said: "How can I sell you land? Can I sell you a piece of the sky? Can I sell you the freshness of the air or the sparkle of the water? Those things are sacred to my people."

Likewise, Islamic tradition says that all land is the property of God. We are not the owners. We are only the trustees, harking back to that same Buddhist idea; we are the trustees. We look after it for the benefit of those who are to come.

Similarly, in Hindu law a principle was laid down in ancient texts more than 3,000 years ago stating that even in time of war it is contrary to the law of nations—contrary to international law—and to Hindu law to cause wanton damage to the countryside of your enemy. Weapons were available at that time, according to the ancient texts, that enabled warring parties to devastate their enemy's countryside. But the rulers who wanted to use those weapons were told that devastating the enemy's countryside, devastating the environment, goes beyond the purposes of war and no one is entitled to resort to such means.

These were tremendous traditions embodying the wisdom of the human family for millennia. I believe that modern environmental law can draw upon this. Likewise, the European tradition is reflected in writers such as Wordsworth in England, Thoreau in America, Rousseau in France, Tolstoy and Chekhov in Russia, and other Euro-

pean literature. Showing a love for the environment goes all the way back, even to Virgil's Georgics written between 37 and 30 B.C., extolling the beauty of the Italian countryside and praying for its preservation in the face of a drift to the cities.

All these ancient traditions of humanity contain important principles that we can draw on in fertilizing the environmental law of the future.

Why did the ancients succeed in developing systems that lasted for thousands of years and why do moderns fail? That is something we must look into. The answer may well be that they had due regard to the principles of the environment when they were constructing their developmental schemes. All of these principles are found in ancient traditions—the principle of trusteeship; the intergenerational principle; the principle of rights owed to others, which lawyers call rights ergonomies, duties ergonomies; the concepts of respect for land, impact assessment, sanctuaries for animals, protected forests; the idea that rights are not restricted to human beings, that short-term development does not prevail over long-term stability, and that collective rather than individual ownership for natural resources is important; practices ensuring maximization of the use of natural resources; equity in the sharing of resources; the affirmative duty to protect and conserve the environment. All of these concepts are based on the philosophy that human beings did not weave the web of life. It was woven by a higher source and we have no right to interfere in such a manner as to damage it. Human beings must look after it for future generations.

I do hope that in the future the law will be able to give a growing measure of support to all these various movements of all the disciplines that are converging on the principle of environmental protection. As environmental law develops, the concept of sustainable development will certainly become a very important part of the environmental law of the future and a very important source of support for all of our activities.

The Global Environment: Linking the Sciences

Robert T. Watson

This talk discusses the science behind major global environmental issues, and shows how the issues are linked.

Table 1 at the end of this presentation lists a number of the major development challenges facing the world today. Alleviation of poverty and underdevelopment are the two primary thrusts of the World Bank, given that nearly 3 billion people live on less than US\$2 a day; over 1 billion people are without clean water, and 2 billion people lack sanitation or electricity. People without electricity use traditional fuels for cooking, leading not only to global warming (because of an inefficient combustion process), but also to higher concentrations of indoor air particulates, which put the users at great risk of adverse health effects and premature death.

Sustainable development has to be sustainable from an ecological, social, and economic point of view. This paper primarily focuses on sustainable development from an ecological perspective and will show that the very foundation of sustainable development is being undermined by environmental degradation on local, regional, and global scale.

The Earth's ecological system provides numerous goods and services that are essential to human well-being. We are all familiar with ecological goods such as food, fiber, energy (via biomass), recreation (ecotourism), and health (through pharmaceuticals). These ecological goods trade in the marketplace; therefore, society places a value on them.

However, a wide range of ecological services that do not trade in the marketplace are probably much more important to human well-being and survival, such as flood control, soil erosion, and control of the local environment—especially air quality at both the local and regional level and pollination services. Because no market exists for these and many other ecological services, society has not placed an economic value upon them, and hence there is no market signal to prevent their loss on a global scale. However, the value of ecological systems is not limited to their economic value, but also includes their aesthetic, cultural, and moral value.

Major Environmental Issues

The major environmental issues are climate change, stratospheric ozone depletion, loss of biological diversity, unsustainable forestry and deforestation, desertification, land degradation and soil erosion, and degradation of water resources. Four major environmental conventions now cover the issues of stratospheric ozone, climate change, biodiversity, and desertification. Unfortunately, most policymakers and scientists think of these as isolated environmental issues, both from the scientific and policy perspectives. This is not the case; they are, in fact, highly linked from the science perspective, and they need to be equally linked from the science perspective, and they need to be equally linked from the policy perspective. In other words, we need to find solutions

(policies, practices, and technologies) that will be a "win" for more than one of the environmental conventions, while at the same time meeting human needs (food, water, energy, and shelter). Even more important we have to avoid solutions to one global environmental problem that may cause or aggravate other problems.

In the case of climate change one of the most commonly discussed approaches to reducing dependency on fossil fuels is the use of renewable energies. One of the most promising renewable energies is modern biomass, or short-rotation woody crops that can be grown in plantations and then burned to avoid using fossil fuels, such as coal, oil, and natural gas. However, improper plantation techniques could lead to deforestation, soil erosion, and water contamination. Modern biomass plantations could be a "win" for the climate system, but a tremendous loss for biodiversity and water resources, if designed incorrectly. Plantations designed correctly, and it is certainly possible to design them correctly, could make modern biomass a win for the climate system, without adversely affecting biodiversity and water resources, while also meeting the human need for increased energy services.

Connections among Environmental Issues

Figure 1 illustrates how global environmental issues are interconnected. For example, climate

change is predicted to lead to loss of biological diversity by changing the boundaries, structure, and functioning of ecological systems. Complex ecological systems, such as coral reefs and forests, are predicted to be sensitive to changes in both the absolute magnitude and the rate of change of climate (temperature, precipitation, and sea level). In turn, changes in biological diversity and forests will affect the major cycles of carbon, nitrogen, and water that affect climate at both the regional and global scales. Changes in climate are also expected to have a significant effect on water resources, especially in arid and global scales. Changes in climate are also expected to have a significant effect on water resources, especially in arid and semiarid regions. Until all of the key linkages are understood, it will not be possible to deal with these issues in an integrated manner.

As noted earlier, the major challenge is to meet a series of human needs: adequate food, clean water and energy, safe shelter, and a healthy environment. However, it is important to recognize that meeting a human need may cause global environmental degradation. As the global environment degrades, it threatens our ability to meet that human need: it is a cyclical process. Figure 2 shows how food production can affect the global environment, and how changes in the global environment can affect agricultural productivity.

Figure 1 Linkages among environmental issues

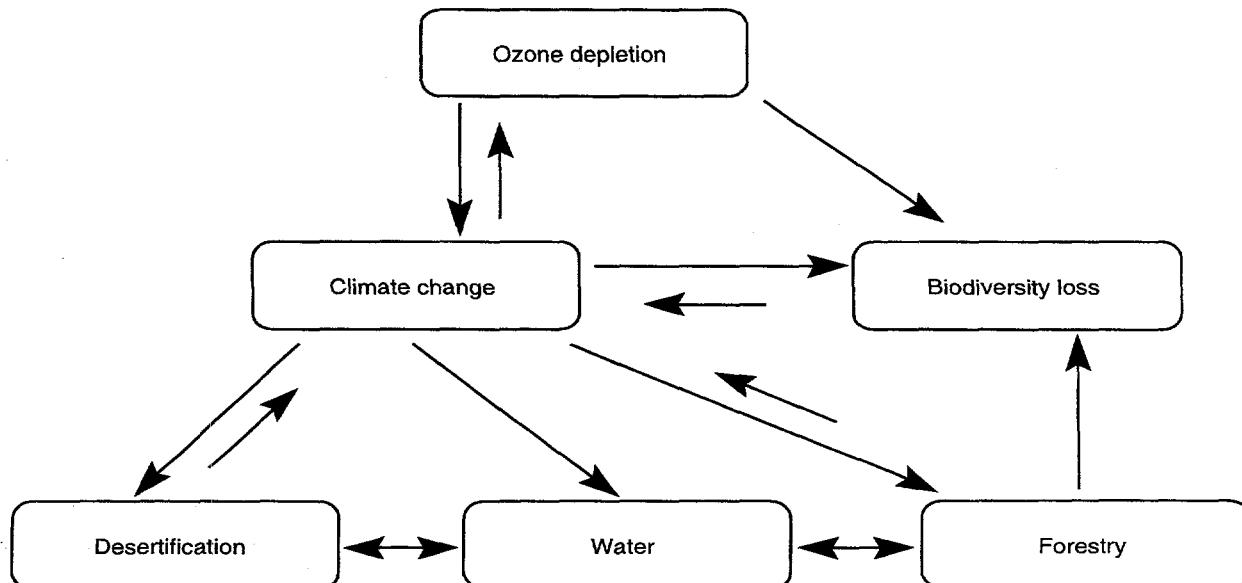
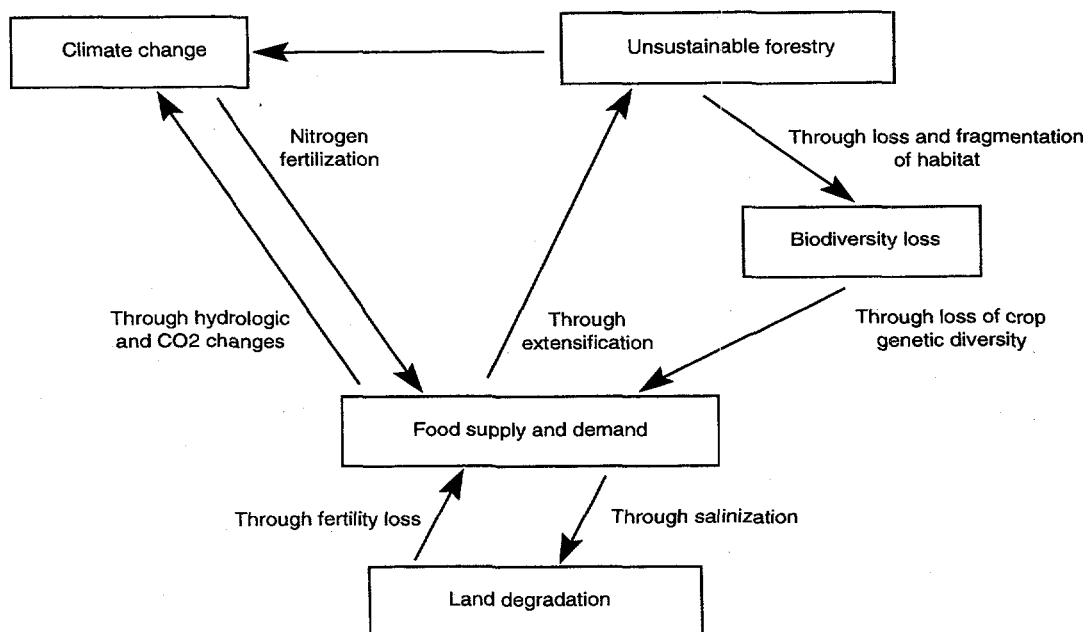


Figure 2 Linkages for food production

Increases in food supply have been accomplished either by intensification or extensification practices. Intensification is achieved by adding large amounts of nitrogen fertilizers to boost crop productivity. However, increased use of nitrogenous fertilizers leads to an increase in nitrous oxide emissions (a greenhouse gas) into the atmosphere, thus affecting the climate system. Changes in the Earth's climate; that is, changes in both temperature and precipitation patterns, are projected to have an adverse effect on food supply, especially in the tropics and subtropics. As more land is used to increase agricultural production, a significant amount of pristine natural forest is destroyed, resulting in the loss of biodiversity at the genetic, species, and ecosystem level. Genetic diversity is critical to ensuring a sustainable supply of food. Hence agricultural production, so critical to poverty alleviation, can affect climate change, biodiversity, and land degradation, and they in turn affect climate change.

Similar figures can be constructed for energy services, water services, and other areas of human needs. The key message is that as human needs are currently being met, the local, regional, and global environment is being degraded. And as the environment degrades there is even less chance of meeting human needs in the first place.

Causes of Global Environmental Change

A key question is what are the underlying causes of global environmental change? It appears that no matter whether the issue is climate change, loss of biodiversity, or one of many other issues, the underlying causes are very similar. The primary causes, not in order of priority, include:

- Population growth
- Increased demand for both biological resources and energy as a result of population growth and economic growth
- Inappropriate use of technologies
- Failure of economic markets to realize the true value of natural resources
- Failure to appropriate the global values at the local level
- Failure to internalize environmental externalities in the price of goods.

As stated earlier, the goods that ecological systems provide (food, fiber, and medicines) trade in the marketplace. But ecological services do not trade in the marketplace, hence no value is placed on them. Even if a value could be placed on them, however, the critical issue would be to create markets to appropriate their value, especially at the local level. Appropriation of value at the local level is critical if biodiversity loss is to be slowed and forests managed more sustainably. For example, what is the incentive today for a

poor, landless Indian peasant not to cut down a tree to sell as timber? The answer is that at this moment, there is not much incentive. The unfortunate Indian peasant does not have very many options. Hence it is critical to create markets and appropriate the value to the local level.

Environmental externalities are rarely internalized into the price of commodities in the marketplace. For example, combustion of fossil fuels, particularly coal, adds particulates and sulfur dioxide to the atmosphere causing local, regional, and global environmental problems. The true price for coal should internalize the environmental externalities for which society has to pay, such as primary healthcare costs and lost worker days.

Another major problem is that, in many cases, institutions and governmental infrastructures are weak, resulting in a failure to regulate the use of biological resources and energy. A good example is the United States, although many other places around the world might be selected, where fisheries are collapsing even though there is a good understanding of what a sustainable fish stock is. The problem is not a lack of scientific knowledge or even a lack of good regulations; it is a lack of *enforcement* of those regulations.

And last but certainly not least, we seem to live in a society that cares only about today—not about the long-term consequences of our actions. With many of these global environmental issues the *full ramifications* of changes will only be felt by future generations. That is particularly true of climate change. Society must recognize the intergenerational aspects of these issues.

Many people ask why it is only now that human activities are threatening the local and global environment. Part of the reason is the very rapid increase in global population since the 1800s. However, it is not only the population increases to date, but also the projections of future changes, accompanied by economic growth, that threaten the environment.

How Much Will the Climate Change?

The answer to the question, "How much will the climate change in the future?" will depend on a number of factors, including the number of people on Earth, the rate of economic growth, the amount and type of energy used (which depends

on energy prices, the rate of energy technology development, and what policies are developed to get new energy technologies into the marketplace), and land-use practices.

Hence the issue of population growth is very important. The meeting in Cairo two years ago recognized how the rate of population growth could be addressed. At Cairo it was acknowledged there are three key elements in any population program: culturally acceptable forms of contraception, education of girls and women, and microenterprise lending to women. The empowerment of women will be absolutely critical in limiting population growth, and thus in dealing with environmental issues.

Another driving force is the insatiable appetite for energy services, which are absolutely essential for poverty alleviation. The question for countries such as the United States and Europe, however, is whether we are *producing* and *using* our energy efficiently. The answer is that energy production and use could be much more efficient and much cleaner. Therein lies the challenge, which is exactly why U.S. President Bill Clinton and Vice President Al Gore held a meeting on the same day as this conference to try to persuade the American public that they must change the way energy is produced and used.

But the world's need for increased energy services is not the only factor; land-use is another important issue. Unsustainable forestry and deforestation practices, agricultural practices, and industrial practices all create problems. They affect greenhouse gas emissions, which affect the climate system, which in turn affect human health and ecological and socioeconomic systems.

Land-use policies, which have a major effect on climate change, desertification, and biological diversity, have resulted in some fairly significant changes in land use and land cover. The major changes in land cover in Europe and North America occurred early this century and during previous centuries, while the changes in developing countries have been more recent.

Most of the world's critical ecosystems are in the tropics and subtropics, and many of them are threatened. There is a need not only to conserve but, much more important, to *understand* them for sustainable use. The time of simply "protecting" critical ecosystems with national parks has passed. While it is an important element in any

strategy to save biodiversity, it is equally important, as the Convention on Biological Diversity states, to sustainably use biodiversity and to ensure an equitable sharing of its benefits.

Effects of Ozone Depletion

One of the inappropriate, although inadvertent, uses of technology, was the use of chlorofluorocarbons (chlorine-containing compounds) for aerosol propellants, and foam blowing agents, solvents, refrigerants, and halons (bromine-containing compounds) as fire retardants. Chlorine from long-lived chlorofluorocarbons and bromine from halons are transported into the stratosphere and cause ozone depletion. Stratospheric ozone has been depleted by these anthropogenic gases at all latitudes, except the tropics and subtropics, during all seasons. Ozone depletion has been particularly severe over Antarctica since the late 1970s. In the early 1970s the total column content of ozone above Antarctica in the springtime averaged about 300 Dobson units of ozone. By 1993 the amount of ozone in springtime was only about 100 Dobson units. Every spring anthropogenic chlorine and bromine chemicals destroy two-thirds of the ozone over Antarctica. Changes in ozone in the lower stratosphere not only cool this region of the atmosphere, but lead to a partial cooling of the troposphere, hence affecting the Earth's climate.

Although the scientific evidence that human activities were causing stratospheric ozone depletion was quite robust in the late 1980s, there were a number of skeptics who said: "Wait for perfect knowledge; there is uncertainty in the ozone models." Unfortunately the skeptics were absolutely right. The models were inaccurate³ they underestimated the impact of human activities on stratospheric ozone. This means that even with the Montreal Protocol and its subsequent adjustments and amendments, society will have to live with stratospheric ozone depletion not only over Antarctica, but over all of the globe, except for the tropics and subtropics, for at least another 50 years. Some of the same skeptics are now saying that not enough is known about climate change.

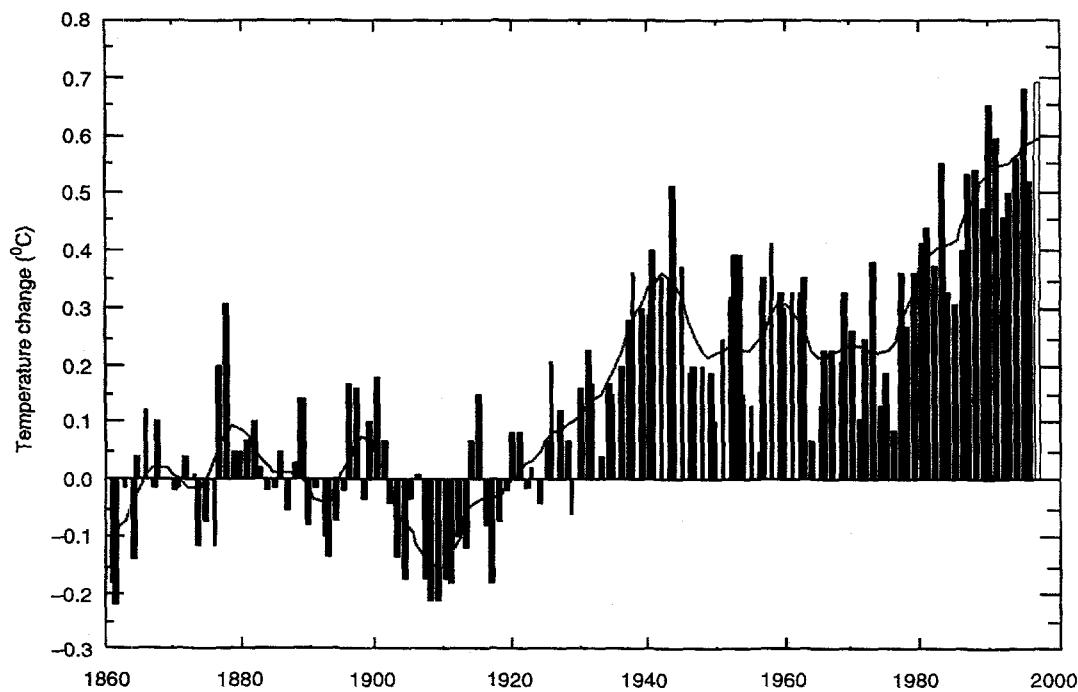
The basic physics of the greenhouse effect is quite simple. Emissions of greenhouse gases into the atmosphere are increasing, resulting in an increase in the atmospheric concentration of

greenhouse gases—primarily carbon dioxide, methane, and nitrous oxide. As this occurs some of the outgoing terrestrial radiation is trapped by these greenhouse gases and radiated back to the Earth's surface, causing the temperature of the Earth to increase, which in turn leads to changes in precipitation patterns and a rise in sea levels. Changes in temperature, precipitation, and sea level are projected, in most cases, to cause adverse effects on ecological systems, socioeconomic systems, and human health.

A key issue that must be recognized by decisionmakers is the long-lived nature of greenhouse gases, especially carbon dioxide and nitrous oxide. If governments wait for perfect knowledge; that is, until the relationship between greenhouse gases and climate change is established unambiguously, and society does not like the new world with a changed climate, it would not take years or decades, but rather *centuries* to reverse the climate change—even after a complete cessation of greenhouse gas emissions, which is clearly not practical. Hence, decision-makers need to recognize that they need to make decisions despite the scientific uncertainties associated with our knowledge of the climate system.

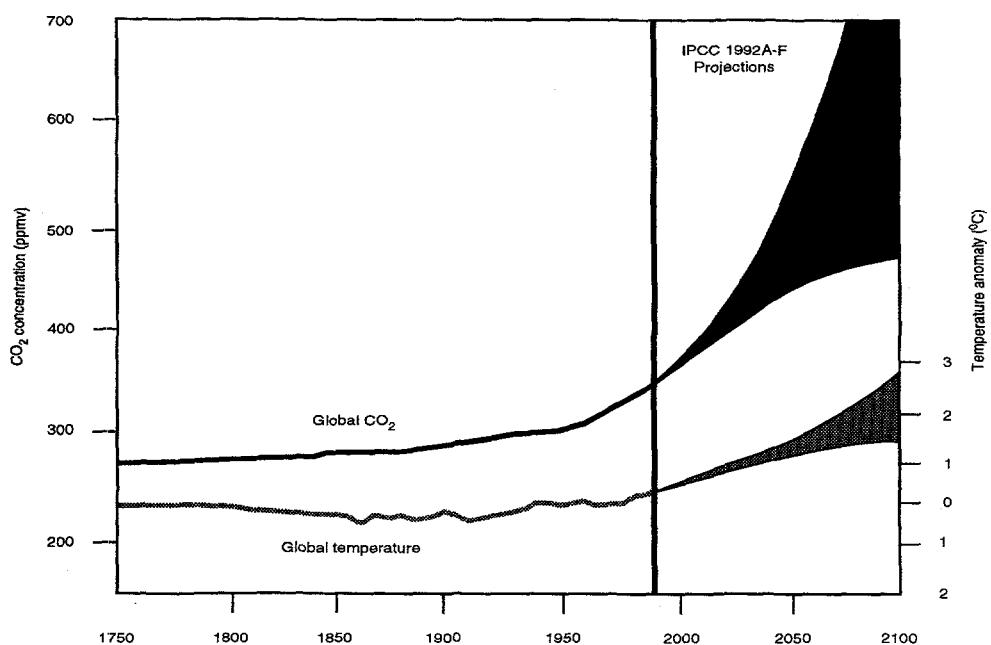
Surface temperatures are increasing, literally, all over the world. Figure 3 shows the observed increase in global mean surface temperature over the last 100 years, which is broadly consistent with that simulated by climate models. It is also important to note that the latitudinal and altitudinal changes in temperature, as measured by a network of balloon-borne radiosondes, is quite consistent with the model simulations that take into account changes in the atmospheric abundance of greenhouse gases (including stratospheric ozone) and aerosols. These comparisons of observations and model simulations led the Intergovernmental Panel on Climate Change to conclude that "there is now a discernible human influence on the Earth's climate system." Furthermore, if there is not a global agreement to limit greenhouse gas emissions over the next 100 years, global mean temperatures are projected to increase between 1.5 to 6.5 degrees Fahrenheit—a rate increase not seen during the last 10,000 years. Figure 4 shows the projected changes in the atmospheric concentrations of carbon dioxide and temperature over the next 100 years.

Figure 3 Global temperatures, 1860–2000



Note: Surface observations, over land and sea, build up a record of global average annual temperatures since 1860. (The temperature for 1997 (white bar) includes observations up to the end of September.)
Source: Hadley Centre for Climate Prediction and Research.

Figure 4 Projected changes in atmospheric concentrations of carbon dioxide and temperature, 1750–2100



Rainfall patterns have also changed, with some parts of the world becoming much drier, for example in Africa, while others have become much wetter. In the United States changes have occurred not only in the amount of rainfall, but also in the type of rainfall. There has been an increase in the amount of rain falling in very heavy precipitation events (two inches within 24 hours), and far less in light rain (0.1 to 0.5 inches within 24 hours). Changes in the temporal distribution of rainfall, paradoxically, can lead to increase in both floods and droughts. In addition more rain is projected to fall in the winter season and less in summer.

Why Does Climate Change Matter?

The key question is why does a change in the Earth's climate matter. The answer is that change in the Earth's climate can adversely effect human health, ecological systems, and socioeconomic sectors, such as agriculture. One major conclusion is that while most emissions of greenhouse gases are due to human activities in the developed world, the developing countries are much more vulnerable to climate change.

Human Health

A warmer world is projected to lead to a significant increase in the incidence of heat-stress mortality in cities, and even more important, to an increase in the incidence of vector-borne diseases such as malaria and dengue. Today there are over 300 million new cases of malaria per year, with over 2 million deaths. An increase in surface temperatures of three to four degrees Centigrade could increase the incidence of malaria by about 25 percent and extend the geographic range of potential transmission.

Agricultural Production

Models project that agricultural production on the global scale will not be significantly affected. Any decreases in global productivity due to changes in climate will likely be offset in increased productivity, because of the greater abundance of carbon dioxide—the so-called "carbon fertilization effect." However, significant regional changes in productivity are projected, with an

increase in the high latitudes of the Northern Hemisphere (North America and Russia) and a decrease in the tropics and subtropics, where famine and hunger already exist today. Agricultural models project productivity losses of up to 30 percent in a doubled carbon dioxide world in Africa and Latin America, even after allowing for the beneficial affects of carbon dioxide, but not allowing for the potential adverse effects of increased pests and climatic variability. It is important to remember that unless there is concerted international action to limit greenhouse gas emissions, the atmospheric abundance of carbon dioxide could easily triple or even a quadruple. Indeed, limiting atmospheric carbon dioxide to a doubling will require some fairly strict near-term limitations on greenhouse gas emissions.

Rising Sea Levels

Sea-level is projected to rise between 15 and 95 centimeters over the next 100 years, with a best estimate of 50 centimeters. A sea-level rise of up to one meter will mean the displacement of tens of millions of people in the low-lying deltaic areas of Bangladesh, China, and Egypt; whole cultures, such as small, island states, could be wiped out. The problem is not only the displacement of people and the creation of environmental refugees, but in Bangladesh, for example, a significant decrease in agricultural productivity would also take place.

Another important point is that once the sea level starts to rise, it is very difficult to slow it down. Even if the atmospheric concentrations of carbon dioxide and other greenhouse gases are stabilized, sea levels will continue to rise for hundreds of years. So, again, policymakers have to think through the precautionary principle—do they want to set into motion an increase in sea-level rise that cannot be turned around for millennia?

Today, 19 countries are water-stressed or water-scarce, and this number is expected to double by 2025—even without a change in climate. Climate change will cause significant changes in precipitation patterns, which will mean that many countries will have increasing difficulties in dealing with water resources. In particular many arid and semiarid areas will become even more water-stressed in the future as a result of climate change.

Loss of Biodiversity

The world has already witnessed the extinction of a record numbers of species resulting from human activities. The current extinction rate for birds, animals, and plants is controversial; some experts suggest that the current rate is between 50 and 100 times higher than natural, while other experts would argue that the rate is already much higher. If the tropics continue to be deforested at the current rate (nearly 1 percent per year), and if there is additional climate change, we could witness an extinction rate potentially 1,000 to 10,000 times the natural extinction rate—a mass extinction caused by human activities.

As genetic, species, and ecosystem diversity is lost there will be a feedback on the climate system by changing the biogeochemical cycles, which will change the net emissions of carbon dioxide, methane, and nitrous oxide. Changes in vegetation can also affect climate regionally, through changes in albedo, surface roughness, and water vapor.

As noted earlier, changes in climate are projected to adversely affect ecological systems, particularly forests and coral reefs. Tropical forests and coral reefs are the most biologically diverse of all terrestrial and marine ecosystems, respectively. Models project that one-third of all tree species could change in a warmer, doubled carbon dioxide world, and as many as two-thirds of

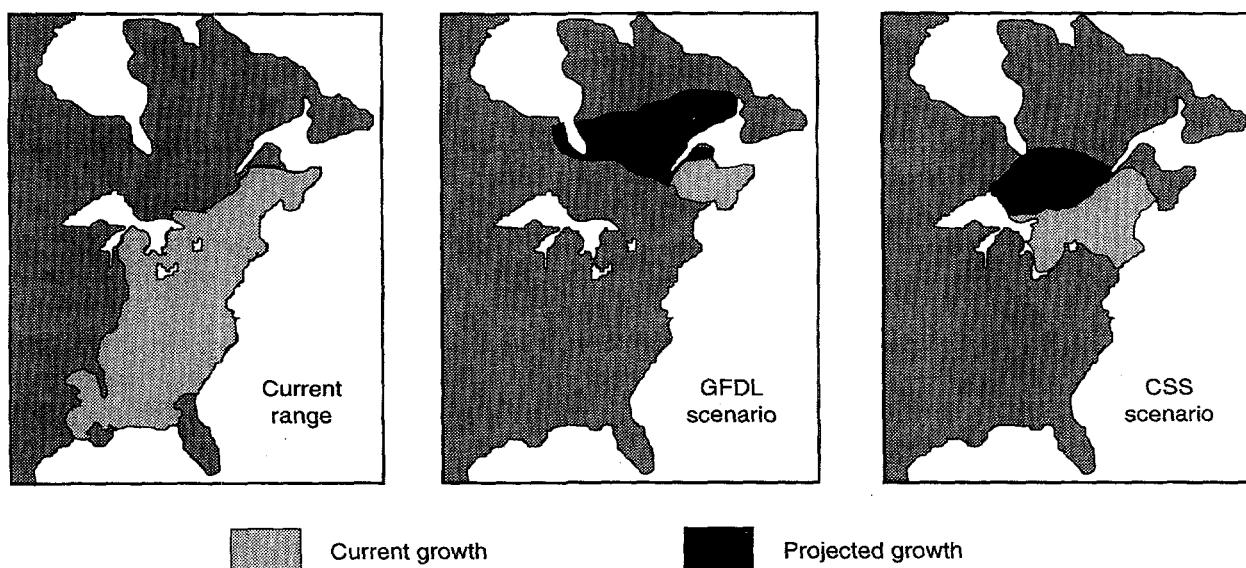
all tree species in the boreal forests. The boundaries of major biomes would migrate polewards by as much as 650 kilometers during the next century, and a major question is whether tree species can adapt to these rapid projected changes in climate or whether there would be a significant die-back. Major changes in forested systems could mean a loss in biodiversity, and as stated earlier, a biogeochemical feedback on the climate system.

Different ecological models project different amounts of change in the vegetation distribution for the Eastern part of the United States due to a change in the climate. While most of the East Coast is still projected to contain forests, a significant change in species composition is projected. Sugar maples would no longer survive, nor would beech trees. The current range of beech trees is from Florida to Canada, but in a doubled carbon dioxide world, they would grow only in Canada (figure 5). The same is true of sugar maples.

Coral reefs can probably adapt to the projected increases in sea-level rise, but probably cannot adapt to a world that is three or four degree warmer; hence, a significant die-back in coral reefs around the world might be expected.

In addition to understanding and quantifying the many impacts of changes in climate on biological systems, it is important to understand the effect of carbon dioxide on living species—the

Figure 5 Possible changes in vegetation distribution with doubled carbon dioxide



so-called "carbon dioxide fertilization effect." Increased atmospheric abundances of carbon dioxide can have a beneficial effect on plant productivity, especially in monocultural, or agricultural, systems. Hence, as stated earlier, model projections of future agricultural productivity simulate the effects of both changes in mean climate and carbon dioxide, but rarely allow for changes in climate variability and pests. However, the response of complex ecological systems, such as forests, is not as well understood, except that there will almost certainly be changes in competition between various types of species. Some species will thrive; some will not, but the full ramifications are not understood.

Conclusion

In conclusion meeting human needs is currently causing environmental degradation, and envi-

ronmental degradation is threatening our ability to meet human needs. Consequently, there is a critical need to take a holistic approach and ask how we can meet human needs while protecting the local, regional, and global environment and recognizing the linkages among global environmental issues. Unless such an approach is adopted, it will not be possible to realize the vision of sustainable development.

While many scientific uncertainties persist, there is absolutely no doubt that human activities are affecting the global environment. We must redouble our research efforts, but even more important, we must redouble efforts to reach political solutions. Science can only inform policymakers. Scientists should not try to make policy decisions. But what it will take to protect the Earth's climate system and protect biodiversity is political will, which at this moment in time seems to be in somewhat short measure.

Table 1 The major challenges for development**Reducing poverty**

- 1.3 billion people live on less than US\$1 per day; 3 billion people live on less than US\$2 per day.
- 1.3 billion people live without clean water, 2 billion without sanitation, and 2 billion without electricity.
- The development path is diverging. Poverty is increasing in Africa, where average incomes are 1.4 percent lower than at the time of the Rio Earth Summit. In contrast incomes in East Asia are up 9 percent.
- 130 million children are not enrolled in primary schools (103 million are girls).

Doubling available food without excessive use of synthetic chemicals, conversion of natural habitats, or degradation of marginal lands

- Today 800 million people are malnourished.
- Available food will need to double in the next 35 years due to population and economic growth.
- The last doubling occurred over 25 years, using irrigation, chemical inputs, and high-yielding seeds. The next doubling is expected to be more difficult and may require an expansion of land used for agriculture, including forested and marginal lands.
- 25 billion tons of topsoil is lost annually.
- 1.5 to 2.5 million hectares of irrigated land has been lost to agricultural production due to salinization.

Providing energy services without environmental degradation

- Many countries are promoting *fossil fuel* energy policies and practices that are environmentally unsustainable and cause local (particulates), regional (acid deposition), and global (climate change) environmental degradation.
- Most of the 2 billion people without access to electricity cook using traditional fuels, leading to a high incidence of respiratory infections, diseases, and deaths in women and children.
- Today 1.4 billion people are exposed to dangerous levels of outdoor air pollution, leading to millions of deaths.
- Energy use is projected to double within 30 years, in large part from improvements in the standards of living in developing countries.

Providing access to water to meet basic needs

- One-third of the world's population lives in water-stressed areas where lack of water is the major reason for lagging economic development.
- In 2025 it is projected that two-thirds of the world's population will live in water-stressed areas.
- Poor water and sanitation contribute to infant mortality and low life expectancy.

Developing healthy urban environments

- In 1960 less than 25 percent of the developing world's population lived in cities. This figure is projected to increase to over 50 percent by 2020, when 4 billion people will live in urban environments.
- By 2015 there will be 33 megacities with populations of 8 million people and 500 cities with populations of 1 million people.
- Within 25 years the number of urban poor is expected to reach 1 billion, more than double the number today.
- In developing countries 220 million urban residents do not have access to potable drinking water, 350 million no access to basic sanitation, and 1 billion have no solid waste collection service.
- Air pollution is a serious problem in more than half the world's 20 major cities, primarily particulates and lead, leading to significant numbers of premature deaths and economic losses.

The Global Environment for Sustainable Development

Caio Koch-Weser

Mr. Chairman, ladies and gentlemen: It is a pleasure to be with you today. I appreciate this opportunity to address such a large and distinguished audience on such an important topic at this particular moment in time—a time when the world is analyzing the results of the United Nations General Assembly Special Session to Review Implementation of Agenda 21 in June, in preparation for the Climate Convention Meeting in Kyoto in December; a time when the new millennium is fast approaching, and we need to have in place effective policies and institutions for addressing its unique challenges.

This morning you heard a great deal about the Rio and Kyoto meetings, so let me begin with a change in scenery to Hong Kong, which hosted our Annual Meetings two weeks ago. Global issues were very much on people's minds in Hong Kong: the global revolution in communications technology which was everywhere apparent; the globalization of financial markets worries about contagion from the turbulence in Thailand's capital markets were a recurring theme. The global environment the rampant effects on air quality of the fires in Borneo and Sumatra made this a very real issue for residents and visitors alike throughout much of East Asia.

Clearly the world is growing smaller. Increasingly, we are moving toward a single *global* conversation; a single *global* market; a single *global* environment. These trends have profound impli-

cations for developing countries our clients—and in turn profound implications for the World Bank. The global context is increasingly the right context for our country assistance strategies.

Much has already been said on the global environmental challenges we face at present. I share the widely felt disappointment that the actions and achievements since Rio have been too meager; that the challenges, particularly at the global level, have grown faster than the solutions; that we have fallen behind the curve. Like others, I am worried. But on this I have little to add to what others have said, or will say, in the course of this conference. Instead, I will focus on the challenges of implementation, from the perspective of World Bank Operations, to see what light the practical issues of implementation can shed on the task ahead.

My remarks this afternoon are organized around three topics: first, Bank activities in the post-Rio period; second, our partnerships with the private sector, donors, and civil society; and third, the role of developing countries themselves and the challenges they face in confronting global environmental issues.

The World Bank's Response to the Environmental Challenge

I will begin with the Bank's involvement in global environmental issues. Our work on the global environment began in earnest in 1990,

when we responded to calls from France and Germany to establish the Global Environment Facility (GEF). As many of you know the GEF was created to deal with special problems of the global environment, particularly to help developing countries and transition economies meet their obligations under the Climate and Biodiversity Conventions, and with their efforts to manage shared water bodies and protect the ozone layer. The GEF became operational in 1991, and was established as a permanent facility in 1994.

Since its inception GEF financing through the Bank has risen to over US\$ 1 billion. It includes 98 projects in 70 countries, and carries over US\$4 billion in associated cofinancing. Over 40 percent of the Bank's GEF portfolio supports climate change mitigation. Another almost 40 percent supports biodiversity. Nearly 10 percent is devoted to the protection of international waters.

In partnership with the Multilateral Fund of the Montreal Protocol, and with the U.N. Development Programme, U.N. Environment Programme, and U.N. Industrial Development Organization as implementing agencies, the Bank is the largest financier of projects to protect the ozone layer. We have a US\$250 million portfolio of 360 projects in 25 developing countries and another US\$125 million of GEF investments. Taken together these projects are eliminating 30 percent of the global consumption of ozone-depleting substances. As Jim Wolfensohn announced at UNGASS, in collaboration with the Russian Government and with funding from seven other countries, we have negotiated closure of the last chlorofluorocarbon production facilities in the world.

But our interest in global environmental issues goes beyond individual GEF and Montreal Protocol projects, although they tend to be the primary point of entry of global issues into our country assistance strategies. Another, albeit less frequently used, conduit is analytic work. Complementing our GEF work, the Bank in 1994 launched a donor- and nongovernmental organization (NGO)-sponsored "Global Overlays Program" designed to integrate global concerns into regular Bank country analytic work. In the Ukraine the Global Overlays Program financed a study of greenhouse gas mitigation, and prepa-

rations are now underway for a GEF-financed project designed to capture methane leakage from coal mining. The Overlays Program is currently funding a biodiversity study in Vietnam, which includes an estimation of incremental environmental costs of agricultural growth in environmentally vulnerable portions of the Mekong Delta, and will facilitate the design and implementation of rural development programs that provide both biodiversity protection and sustainable agriculture.

Looking beyond GEF- and Montreal Protocol-financed investments and Global Overlays-financed studies but often building on them the Bank is the world's largest financier of targeted environmental projects. Each year we commit over US\$1 billion for more than 20 such projects, and probably an equal amount for environment components in other projects. Our active portfolio of 166 projects in 70 countries totals almost US\$12 billion: 60 percent for the "brown" agenda, 30 percent for the "green" agenda, and 10 percent for institutional strengthening. This is a young portfolio that requires a close watch, and we are subjecting it to particularly intensive screening learning lessons and feeding them back into new operations to ensure quality in achieving results on the ground.

The portfolio also includes support for energy, where many opportunities exist for win-win solutions that both generate cost-effective energy supplies and reduce carbon emissions. Our 1993 Energy Policy has driven reductions in energy subsidies and price distortions, and in turn the carbon intensity of borrowers' energy industries and our energy portfolio. Looking at the US\$20 billion in energy loans since 1990, the percentage of "win-win" projects rose from 27 percent during the 1990-93 period to 63 percent for lending between 1994 and 1996. We are now preparing an Energy and Environment Strategy that will chart our course in this critical nexus of issues for the coming years, taking into account the important global externalities of carbon-based energy use.

This all adds up to the fact that the environment has become a major activity in the Bank. But although progress has occurred, there is no room for complacency. Looking forward, I see three key priorities for the immediate future:

- Ensuring that compliance with our “do no harm” environmental policies is absolutely 100 percent. All of our projects are routinely reviewed for environmental impact; last year we carried out full or partial environmental assessments for 100 projects, representing US\$10 billion in new commitments. We have upgraded the quality of our environment assessments and their timely disclosure. But more progress is needed.
- Ensuring that the environmental components of our country assistance strategies are of the highest quality, reflecting the most-up-to-date thinking on these critical issues. In the first instance this is the job of our new environmental Network, which covers the International Finance Corporation and the Bank.
- Ensuring that global environmental issues are fully mainstreamed in the menus we present to our clients. To this end we have launched analytic work on the global agenda and its links with our core mission of poverty reduction.

Partnerships and Participation

The Bank can only do so much working on its own partnerships and participation are essential, and they must involve the private sector, the donor and United Nations community, and civil society.

Private international flows to developing countries have been the good news of the road from Rio, as foreign investors have responded very positively to the improved economic conditions in developing countries. Since 1992 net private sector flows to developing countries have tripled; last year they reached US\$245 billion five times the flow of official development assistance. Flows of this magnitude have vast implications for developing country recipients—for good or for ill. In recent months we have seen good turn to bad on the financial side in some countries where the domestic policy framework did not ensure prudent use of the funds.

Major policy risks are also present on the environmental side although by their nature, the adverse repercussions are likely to take longer to appear and be more difficult to reverse. Recent studies suggest that international firms tend to adhere to stricter standards and bring in newer,

and hence cleaner, technology. Unilever Corporation, for example, which owns 40 percent of the global seafood market under several brand names, has pledged to obtain all of its seafood from sustainable sources by the year 2005.

There are still insufficient national and international environmental standards governing new investment in developing countries, and it is far from clear that the bulk of such investment respects environmental safeguards. Hence a major challenge for the international community is to help ensure that developing countries establish and enforce sound environmental policies, and that the private or quasi-private financiers of this burgeoning private investment adopt rigorous environmental standards. The Bank stands ready to work with countries on establishing the policy framework, and with the private sector on developing voluntary safeguards.

But an even bigger challenge lies in the fact that three-quarters of these private flows to the developing world are going to just 12 countries. Excluding South Africa, Sub-Saharan Africa received just 1 percent of total private capital flows over the past three years. In other words the poor countries of the world are generally excluded from this club. Hence the veritable explosion of private sector flows in recent years cannot be relied upon to finance poverty reduction and sustainable development where it is needed the most.

Developing countries thus continue to need the support of bilateral donors, through official development assistance, and multilateral donors such as the International Development Association (IDA). Recent research confirms that aid can be highly effective in fueling sustainable growth and poverty reduction in the presence of sound policies and conversely *ineffective* where a sound policy framework is lacking. At the time of Rio almost all industrial countries recommitted themselves to raising their foreign assistance levels toward the target of 0.7 percent of gross domestic product. Unfortunately, this target has not been met. In 1995 development assistance as a share of donor country gross national product fell to 0.27 percent, the lowest level in 45 years. This downward trend urgently needs to be reversed, coupled with a more selective approach by donors to ensure a higher quantity and quality of aid aimed at results, equity, and sustainability.

NGOs, meanwhile, continue to play a significant role on environmental issues and are increasing their involvement in the Bank's environmental work. Over one-half of the environment projects approved by our Board last year involved intensive participation by NGOs—piloting innovative approaches to conservation, encouraging local ownership of management plans, or providing technical expertise for design and implementation. On broader initiatives we have major partnerships with the World Wildlife Fund on forests and the World Conservation Union on dams. NGOs are also important partners in the Brazil Rain Forest Pilot Program, which is demonstrating the importance of building partnerships that last.

Developing Countries

But we must face the fact that none of our partnerships will go very far or last very long without the developing countries. As Jim Wolfensohn said in Hong Kong, they must be in the driver's seat. Without their buy-in all of our well-laid plans will lead nowhere. Where do *they* stand on the critical issues of the environment, and particularly the global environment?

I am happy to see that many developing countries are represented at this Conference, and can therefore speak for themselves. As a group the developing countries have formally recognized the importance of the environment through their commitments to Agenda 21 and their actions to implement those commitments. One hundred developing countries have prepared national environmental strategies, setting priorities for action. In about half of these countries we are beginning to see implementation, although there is still a long way to go. This embracing of the environmental agenda as central to these countries' own development agendas augurs well, I believe, for ownership and sustained implementation. Indeed, the mainstreaming of environmental issues into our country assistance strategies comes with the full support of our clients.

Developing countries have also signed and ratified the global environment conventions: 143 developing countries have ratified the Biodiversity Convention; 138 have ratified the Framework Convention on Climate Change; 119

have ratified the Montreal Protocol of the Vienna Convention to protect the ozone layer.

But in terms of *action*, the priorities for developing countries are less clear-cut. Even "win-win" opportunities that simultaneously internalize global environment externalities and promote national development objectives must be vetted against the many other competing claims developing countries face for their very scarce financial and institutional resources. And in the "win-lose," or trade-off options—in which gains are global but costs are local—it is difficult to imagine or encourage strong action by developing countries at all without compensation. This was the rationale for the GEF to compensate developing countries for the costs they were bearing in the pursuit of benefits that accrued more globally. This year will see the replenishment of the GEF. It deserves your full support, as a tried and true method for making real-time progress on global environmental issues *here and now*. But we must be honest: As good as the GEF is, given its voluntary nature it will never be large enough to deal with the scale of the problem we face on climate change.

In this area much will thus depend on whether international agreements are reached at Kyoto in particular, on (a) limits for CO₂ emissions and (b) reliance on investments in carbon offsets in economies in transition, in the first instance, and soon after in developing countries, for meeting a part of Organisation for Economic Co-Operation and Development emission-limits obligations. If so, the way will be opened for carbon trading and market-based compensation for developing countries for both the "win-win" and the "win-lose" options they face on carbon use. We stand ready to facilitate the implementation of agreements reached at Kyoto through our recently established Global Carbon Initiative. Prospective private sector and government investors in the GCI's first Carbon Investment Fund of \$100 million met last week and agreed on the key issues for the Fund's design. But without supportive agreements at Kyoto, the scale of this effort like that of the GEF will inevitably remain small. The larger consequence is that the world will have missed an important opportunity.

Clearly, we stand at a difficult juncture on the eve of the new millennium.

The world faces a grave problem that we have been discussing all day. We know how to solve it *technically*. The roadblock to solving it as in so many development issues lies in the political economy of change: Who will gain? Who will lose? How should the burden of adjustment be shared, in this case, across countries? And in particular, how should it be shared between developed and developing countries? Cutting through this Gordian Knot will require courageous leadership in developed and developing countries to establish ground-rules and formulas that embody fair and just burden-sharing.

Conclusion

In conclusion, we all have much to do on the environmental front. The private sector, developing country and donor governments, civil society, and international agencies all have important roles. And we must act together both jointly and severally. The challenges are simply too great for any of us to go it alone.

- The private sector must exercise corporate responsibility and leadership, respecting environmental laws and regulations when they exist and voluntarily adhering to sound environmental standards when they do not.
- The challenge for national policies will be to establish credible environmental legal regula-

tory systems for private investment—both foreign and domestic—to make it environmentally friendly in a cost-effective way.

- The challenge for international policies will be to ensure that the incentives are in place for all of us to behave in ways that help to preserve the global commons—so we can think globally but act locally, confident that others are doing the same.

Speaking for World Bank Operations I pledge our assistance to all partners as they play their respective roles, given the vital importance of sustainable development to our central mission of poverty reduction. Indeed, poverty is both the biggest cause and the biggest effect of environmental degradation. As the new millennium approaches, we must step up our efforts to work together as partners in these critical pursuits. Together we must take steps to maintain the funding of IDA and raise the level of development assistance—bilateral, IDA, and GEF—to help developing countries address national and global priorities. We must also be prepared to look beyond existing instruments, to deal with the new mainstreaming requirements that *hopefully* will emerge on the road from Kyoto.

Nor can we afford to wait. No less than the future of the planet and the quality of life it affords mankind are at stake. The time to act is now on the road to Kyoto.

The Global Treaties: Making Connections for Efficiencies, Effectiveness, and Equity

Chair

Mostafa K. Tolba

Before beginning the panel presentations I would like to make a couple of points. Some people seem to think that international environmental treaties are a sort of international legislation or regulation. I cannot go along with this view.

My reading of the situation is that all these international treaties are basically a result of a great deal of signals coming from the scientific community, signals that there is something really going wrong with one or the other component of the environment.

The exception to this is probably the Basel Convention on the Trans-Boundary Movement of Hazardous Waste, which did not come about as a result of scientific indications, but rather an outcry from the media and public over the legal traffic in hazardous waste.

This is probably the only exception, but when you go to the forerunners of all these international treaties, the regional ones, such the Regional Seas Programs, started back in 1974 with the Mediterranean Action Plan and the Barcelona Convention, thanks to the signals and cries of our distinguished late colleague, Jacques-Yves Cousteau. He literally said that the Mediterranean was dying, and based on scientific findings and observations, this led the governments of the region surrounding the Mediterranean to agree to the Barcelona Convention and its Action Plan.

This, in turn, led to a series of subsequent regional conventions. Then came the wave of glo-

bal issues, starting with the Montreal Protocol, then the Framework Convention on Climate Change (FCCC). The Basel Convention came before the FCCC, and the Convention on Biological Diversity was adopted at exactly the same time as the FCCC.

All of these began with signals from the scientific community that something was likely to go wrong, or was going wrong. In the case of biodiversity people saw the extinction of species. So it was clear that something was going wrong.

In the areas of climate change and ozone depletion, things were not so clear-cut. Discussions and negotiations began long before the firm establishment of the existence an ozone hole in Antarctica by scientists, and later on by NASA, with the ozone hole images that Bob Watson explained earlier this afternoon.

These were all assumptions. The early period of negotiations of all these conventions was based on assumptions modeling. It is really surprising that the international community accepted modeling as an indication that something was going wrong with the environment. So, in fact, they were applying the precautionary principle on the basis of scientific findings, when scientists spoke with the same voice.

Action began to accelerate when the medical community started linking some of these changes in an environmental component, such as the stratospheric ozone layer, with human health or human survival. The cry in the me-

dia and by nongovernmental organizations, and hence by the public, was so great—once the ozone depletion was noticed and accounted for and then shown on photographs from NASA—that people started listening carefully to the medical community, which was saying that ozone depletion will induce more ultraviolet radiation, which means more skin cancer, eye cataracts, and loss of human immunity, as happens with AIDS.

Hence the public actually started pushing governments to move faster. It is a known fact that governments normally act, or would like to lead, from behind. So they wait for the public, to see how it is going to react. Once the public starts reacting, the governments start moving.

Then why should we have an international treaty? For one simple reason: no one country or group of countries is capable of dealing with the problem on its own, however powerful. Whether it is ozone depletion or climate change or biodiversity loss, it cannot be treated by any one country or group of countries. It is a matter of a necessity for international cooperation.

Hence the international treaties, which are based on what has been stated here several times: common but differentiated responsibility. Those who are the main causes of the problem should take the lead in finding solutions, and then can expect the others to join them.

The other reason for international treaties is equity. There should be enough parity in the re-

sponsibilities of each of the groups involved to achieve equity. Another factor is the “polluter-pays” principle, which was taken into account when everybody was asking the developed countries to contribute to finances needed by the developing countries to meet their obligations under these conventions.

So several principles were advocated in Stockholm and then confirmed again in Rio, and have been followed in these international treaties several times.

The essence of what we are talking about is first, does the treaty deal with the problem? Is it responsive to the problem? Does it meet the assumptions that have been the basis of that convention or that treaty?

Second, is it more efficient to have international cooperation, or to have regional or subregional activities rather than a global exercise? To what extent is the economy affected in the different regions by these treaties? And the latter is the element of equity.

I think that if we first look at some of these issues from the science perspective, then look at nongovernmental actions and response to the scientific information made available, and go from there to the treaties and what are we expecting, for example, in the exercise on climate change—which is the talk of the town today—and how the actions of developing countries might be financed, our panel will have made an useful contribution.

Panelist Remarks

Yolanda Kakabadse

I am neither a scientist nor an expert in any of the fields that our conventions deal with. Sometimes I have been called an activist. I have gone through a process of bridging gaps between different sectors, countries, and cultures, and now I am a conflict manager. From creating fires, I am turning into a fireman.

I would like first, to refer to the name of this conference: "Global Ecosystem Management: Science, Economics and Law" and point out that science dealing with research is not addressing education and learning processes. Other sectors of society are not aware of these accomplishments.

As to economics, when we limit the discussion of economics to a sector of society, the experts on economics, we are not necessarily linking growth and economic growth to equity and the distribution of wealth.

And then law—where we talk about equal rights and obligations, but do not necessarily think about the shared needs of the different countries and continents around the world.

Second, I want to refer to the title of this panel, "The Global Treaties: Making Connections for Efficiencies, Effectiveness, and Equity." I would like to focus on the two conventions I am most familiar with: biodiversity and climate change.

The question five years after the Rio Earth Summit of 1992 is: Were these two conventions a result of euphoria shared by all of us who were interested and involved in creating Agenda

21 and in producing the drafts of these conventions and promoting participation? If it was only the result of euphoria, have we failed during these five years or not? And if we have failed, why?

When I think about these two conventions, the obvious answer that comes to us as non-governmental organization (NGO) or civil society members is that there is a very important difference between these two conventions and some others. That happens when economic interests are affected—we experience serious obstacles in acceptance of global agreements, and we start looking for all kind of excuses to get away from them.

Having economic interests may also be a dynamo, and it should be considered a good element with any of these treaties because it should force us into further negotiation, further dialogue, and greater understanding.

I believe the weak point of these conventions is the lack of a common understanding. I believe, as someone mentioned this morning, that this was a game in which some countries in some continents were playing a key role, but the capacity of others to play such a role was being underestimated.

I do not see many solutions being brought forward that represent a win/win solution for all parties involved. I do not see real participation from all those sectors of society who should be participating. I believe that until now it has been

limited to government and intergovernmental sectors, and although in 1992 we did break some new ground in bringing NGOs into the discussions, there are few NGOs in these fora. There are other groups of civil society that also should be brought into the discussion.

Another weak point is that when we discuss science and technology we continue to discuss the transfer of technology, when I believe the issue really is *access* to technology, which implies economic as well as training capacity.

In addition the investments made in these last five years to overcome some of these weaknesses are really addressing the issue from a distorted point of view, which is getting tangible products that you can hold, touch, measure, and quantify. What we really need is behavioral changes, but we do not want to invest in processes that are not tangible, measurable, or quantifiable.

Based on all those weak elements, we should rethink the new approaches for the future.

I do not think anyone would deny that this is an age of globalization. We cannot stop it; we must face it and address it. But within this context of globalization and of the role of World Trade Organization (WTO), for example, the discussions on the conventions must refocus. All of our countries, no exceptions, are paying much more attention to WTO negotiations than, for example, to the conventions on biodiversity and climate change. We are not giving the latter the same weight.

I feel that we have managed (and I say we, because we are decisionmakers and we should do something about it) to compartmentalize all these issues, all these subjects, all these themes that are of common concern, of global interest. Biodiversity, climate change, the WTO, education, and health are seen as separate issues; we do not see a thread linking all of these national and international processes.

That is a problem, of course, but where do I see solutions? First, put much more effort into trying to understand what sustainable development is about. There is a need, opportunity, and political will to put more resources into creating consultation processes and promoting dialogues between different sectors of society. This does not mean excluding governments. It means governments communicating with the private sector, the church, NGOs, trade unions, women's groups, and any other sectors that have a stake. I do not think that there is a single sector that does not have a stake.

I would like to reinforce something that was said this morning, the need to integrate environmental rights as a human right in all of our discussions, in our proposals, and in all the plans that we have for achieving sustainability.

There is also a tremendous need to accept each other's differences. Just a week ago I attended a meeting where I was quite amazed to see the speaker point to some as "the good" and to others as "the bad." At this moment, at the end of this century, there is not one person, one culture, or one country safe from the possibility of being accused of misconduct in relation to the use of the resources of this planet. All of us are in the same boat.

NGOs and civil society groups have the capacity to bring to this whole discussion a human touch. I fear that too often, and maybe permanently, we are limiting the discussion to lots of numbers, to facts, to scientific facts. Numbers and science are necessary ingredients, but they are not the only basis for developing a formula to satisfy human needs.

I would like to end by quoting a good friend whom many of you know, Dr. Swaminathan, who is now talking about the "ecology of hope." I am not very sure about all that that implies, but it gives us something to think about.

Panelist Remarks

Carolyn McAskie

I am here to represent Huguette LaBelle, the president of the Canadian International Development Agency (CIDA), who had hoped to be with you today but was unable to be present. She is on her way back from participating in the China Council on International Cooperation for Environment and Development, so she has a very environmentally friendly excuse for not being here. It is certainly an honor for me to be part of such a distinguished company.

It is hard to believe that it has already been ten years since the publication of the report of the World Commission on Environment and Development. The Brundtland Report was a watershed document. It introduced into common parlance the notion of sustainable development, and helped to transform and expand the very concept of development itself for those of us working in the field.

Development, as we now know by heart, can only be sustainable if it fulfills today's needs without compromising the capacity of future generations to fulfill their own needs. This simple observation, repeated over and over again this morning, has profound implications; it introduces environmental and intergenerational considerations into the development equation.

This defining moment has brought us from the notion that economic growth is sufficient to eliminate poverty and underdevelopment to the now entrenched gospel that if development is to be

real and lasting, it must be implemented on several fronts, employing a variety of means.

The environment, democracy, human rights, social justice, gender equity, the equitable distribution of wealth, and peace and security are now considered essential to sustainable development.

It is now time for us to take this concept even further and use it as a framework for even more integrated analysis and decisionmaking. There is still a tendency in science to view individual disciplines in isolation, and we have only begun the work on understanding the multiple and spiraling effects of various factors.

The growing knowledge of the poverty-population-environment nexus is an excellent example of the way in which we must go.

With the publication of the United Nations Development Programme's Human Development Report, the notion of meaningful development has been further refined. People and their needs have been put back in the center of the development process.

With this concept of human development, we have moved from a paternalistic and economics-centered understanding of development to a more multidimensional and cooperative one that is sustainable economically, environmentally, socially, politically and, as we were reminded this morning by Christopher Weeramantry, culturally and traditionally.

This entails a recognition of the holistic and integrated nature of the development process. We

cannot be bound by linear thinking and simple, cause-and-effect interpretations of development. Too often in the past such thinking has led to distortions of development that are destructive to the natural environment and exceedingly difficult to correct.

The big picture concept is not enough. It is more the image of the helix. Maurice Strong evoked it clearly in calling us to apply an ecosystems approach to all development phenomena.

It has not been an easy lesson for international development organizations: moving from a top-down approach to one that encompasses the whole of society, recognizing the importance of the contributions of each individual, acknowledging more fundamentally that it is the right and responsibility of individuals and nations to determine their own future within the global community, and recognizing the global common good.

The theme of this conference is a critical one—partnerships, links, and connections both within and among the countries of the world; recognition of the interdependence of issues and the need for complementary approaches to address them.

It would be premature to say that we understand interdependence at a global level, but I think it is safe to say that we are learning that global consensus is growing. Perhaps ten years later we are now catching up with the title of the Brundtland Commission, "Our Common Future."

Our scientists tell us, rightly so, that the world of the global ecosystem is in serious trouble. Poverty, inequitable distribution of wealth, and conflict all place intolerable strains on the globe; with disease, starvation, resource depletion, and environmental degradation, we see the horror everyday around us.

The world is listening. Innovation greets us daily and the conventions, however imperfect, show that we must cooperate in spite of ourselves.

At a more fundamental level people are working within their communities to fix the problems that touch their everyday lives. In many ways civil society has moved far ahead of governments and scientists, employing ready-to-hand solutions to tangible issues. The whole truism of "act locally and think globally" is, in fact, a truth.

Here is where we must harness the three elements of science, economics, and law to link the technology, the regulatory and convention frame-

works, and the need for sustainable growth if we are to meet Captain Cousteau's challenge of welcoming up to 10 or 11 billion people on this Earth.

Canada and the World Bank recently held an international conference with the theme of "Knowledge for Sustainable Development." That knowledge is the essential building block is emerging as an axiom in the international development community. Knowledge and how to share it is the backbone of capacity development, the tool with which people will build their own futures within the framework of a healthy global ecosystem.

This axiom, however, must be translated into action. It is not enough that knowledge—be it technology, pure science, or simple common sense—be held at the level of the national or global decisionmaking apparatus. I mentioned the drive and innovative spirit of civil society. It is at the level of civil society that most of the action for sustainable development will take place. We depend on people to mobilize the resources they have at hand to address local problems, because it is at the local level that the challenge of global sustainable development finds its roots.

There is a clear role for governments here. We are well aware that most research and development is taking place within the private sector or at government-supported research institutions. Governments can build the partnerships necessary to get knowledge and information into the hands where it can be most effective and provide the framework that ensures full protection of the law for the common good.

Such an approach can assure equitable benefits, and it is also much more efficient to society as a whole. This is what is too often lost sight of in the drive for profits and attracting foreign investment.

What we have learned to date is that the development puzzle has many pieces, and development cannot be sustained if pieces are missing. Science, economics, and law each provide important pieces of the puzzle. But beyond those disciplines lies the undisciplined reality of our world. Science, economics, and law have traditionally sought to classify the world into systems. In moving from strictly linear patterns of understanding the world around us, we must also move beyond compartmentalized systems to adapt science, economics, and law

to our changing needs and aspirations—again, the ecosystem approach.

Sustainable development demands partnerships; real, time-consuming, difficult, no-one-in-charge type partnerships. The resources required for sustainable development are too great and the tasks too diverse for any one agency or organization to go it alone. The ultimate partnerships of the decade have been the global treaties, the conventions. Development demands cooperation among all actors and at all levels of society.

Global treaties and conventions provide an effective framework for such cooperation. They not only bind nations together to work towards common objectives, but the very process leading to agreement on these instruments encourages the sharing of ideas and appreciation for a wide variety of perspectives.

These agreements represent the shared commitment of developed and developing countries alike, and create a framework for cooperation and support between North and South. But we know that intergovernmental agreement is not all that is required. When governments meet to negotiate international agreements, they are representing the people of their countries and all of their diverse interests and capacities. It is the task of governments to carry a message forward from civil society into the international forum, translate that message into clear and globally agreed goals and objectives, and carry the latter back to the people to guide them in their individual efforts towards sustainable development.

Agreements are most easily respected when the people involved understand why. International agreements serve another important purpose. They promote and guide international cooperation on a very tangible level. International cooperation for sustainable development is not simply a matter of goodwill. Virtually every global agreement negotiated to date addresses in some manner the problem of unequal capacities to meet the challenges of sustainable development.

But again, this problem cannot be addressed in a linear cause-and-effect fashion. It is critical to remember that capacity cannot be developed without the careful application of technical and financial resources where they can be the most effective within a holistic approach to the process of development.

Country-to-country aid programs are one of the most effective tools available for this process. They allow us to continue to share the knowledge and experience that form the basis of sustainable development. Global treaties give us a framework in which to do this effectively, and to ensure that bilateral cooperation fits within a broader program of multilateral and global cooperation for sustainable development.

Truly effective international agreements help us to address common problems that have local origins but global implications. The Convention to Combat Desertification provides an ideal illustration of this. Desertification is a scourge that threatens sustainable development at every turn, and it does so worldwide. Combating desertification is a common concern that requires a cooperative effort.

The convention provides a framework for this effort at the national, subregional, and regional levels. It demonstrates at the international level an ongoing willingness by nations to cooperate and to focus desertification projects in a concerted attack on one of the most threatening problems we face in the world, and it harnesses in this enterprise the best scientific knowledge accumulated over decades of research.

It is significant in this regard that in Canada CIDA shares responsibility for implementing the convention with the International Development Research Center. This partnership recognizes that the more our efforts to combat desertification are grounded in empirical and scientific research, the more effective those efforts will be. The critical job then becomes involving the people in developing solutions, rather than just handing the science down.

The desertification convention and the global conventions on climate change and biodiversity represent a convergence of science, economics, and law, and include a strong recognition of the role of individuals and civil society in finding and implementing solutions to global problems. These conventions form an increasingly comprehensive package of international law in support of sustainable development.

There are other frameworks that drive us. The global commitment to Agenda 21 and recognition of the importance of the social, economic, and environmental targets established in the Organisation for Economic Co-Operation and

Development's new strategy entitled "Shaping the Twenty-First Century," produced by the Development Assistance Committee (DAC), are equally important steps towards global sustainable development.

While not treaties, they form a key part of the evolving global vision of what constitutes sustainable development and identify means to move us towards achieving that goal. The DAC strategy is not a donor-driven approach; rather, it is a commitment by the donor community to meet the targets of Agenda 21 and other international conferences (such as Beijing, Cairo, and Copenhagen) and to meet those targets soon—before too many people die in poverty.

As a representative of a bilateral aid agency, I can tell you that we are ready to work in full partnership with international financing institutions (IFIs) in developing countries to carry out our share of the development commitments as they are spelled out in the DAC strategy. Key to its success is giving development back to the developing countries. They must be in the driver's seat.

I would just like to make one final point. It is very important for aid agencies to assist developing countries to achieve their part in these goals. We need strengthened cooperative efforts

through existing international bodies, perhaps the DAC's Working Party on Development Assistance and the Environment, in which aid agencies, along with the World Conservation Union, UNDP and other U.N. agencies, the World Bank Group, and other IFIs meet to discuss environment and development.

This approach could also include a focus on the coordination of efforts to address commitments made under the various global environmental conventions. The Global Environment Facility can perhaps help here. Developing countries are seriously over-burdened by the need to produce environmental action plans and different convention strategies. Surely, we can design a single umbrella strategy and action plan.

Development cannot be sustained unless the effort and support of it is equally strengthened. We need to design cost-effective policies, programs, and treaties that in all instances are sustainable over the long-term. Sustainability is defined by feasibility, social acceptability, environmental soundness, political viability, and cultural sensitivity. The key is to understand the complex and integrated nature of development and to translate that understanding into planning and action that encompasses the needs and aspirations of all.

Panelist Remarks

José I. Vargas

I would like to start by saying how strongly I agree with the formulation of Mostafa Tolba that science, and the preoccupation of the scientific community, have been traditionally the origin of the legal instruments that later on became treaties and have been the object of our consideration today.

I shall be describing the present situation facing my own country and how science has been the basis for the formulation of a proposal that will be under consideration.

I wish first to congratulate the World Bank Group for maintaining the momentum of the discussion of environmentally and socially sustainable development issues.

Three weeks ago, the Third World Academy of Science, which I had the honor to chair, held its first general conference in Rio de Janeiro, with the participation of more than 77 countries and more than 400 scientists. We dealt not only with substantive issues related to scientific development in the South, but also, and most emphatically, with the complex issues pertaining to sustainability.

Our discussions took place a mere two months after the Rio-Plus-Five Conference. This coincidence highlighted the various emerging issues of a global nature that we face as we approach the new century, particularly climate change from global warming, biodiversity conservation, new biotechnolo-

gies, ozone depletion, pollution of interior waters, and the advance of desertification.

For the purpose of our panel I wish to focus my remarks on the Framework Convention on Climate Change (FCCC) and the difficulties involved in its implementation.

Today, five years after the 1992 Rio Earth Summit, our common engagement for sustainable development is, unfortunately, slowing down, while science and technology are creating a new and deepening—and perhaps unjust—division of labor.

During the special session of the United Nations General Assembly, the Rio-Plus-Five Conference last June, the discomfort with which several industrialized countries approached the discussion of the forthcoming Kyoto negotiations was evident. This is their dilemma: Will their citizens willingly change their lifestyle to achieve the necessary stabilization of the concentration of greenhouse gases?

Furthermore, will they do it to solve a global problem that apparently lies far in the future and is thus difficult to explain to the taxpayers of today? We see today in the United States an exercise in trying to explain to the taxpayers the questions that face all of us.

Or is it that this global partnership would entail only conservation of the South's natural resources until new, clean technologies produced in the North are ready to be forcibly introduced—

at a price, of course—in place of all the technologies in poorer countries?

The great political importance of climate change negotiations concerning the establishment of legally binding targets for the reduction of greenhouse gas emissions in industrialized countries was not lost on the scientific community meeting in Rio.

As President Fernando Henrique Cardoso of Brazil stated at the Rio-Plus-Five U. N. General Assembly Special Session in June, Brazil will continue to contribute toward fostering the process that brought about in 1992 one of the most meaningful moments in international understanding. At the June meeting Cardoso announced that an "Action Pact" had been concluded with the leaders of Germany, Singapore, South Africa, and China to seek to overcome the present roadblocks to the solution of global environmental problems, especially those linked to global climate change.

It is also in this spirit that Brazil has presented a proposal, including elements of a protocol for the FCCC, that tries to instill practicability, flexibility, fairness, and scientific common sense in dealing with climate change issues.

This proposal of elements for the protocol also contains several important features that promote the economic efficiency that is deemed to be indispensable.

Brazil proposes that a direct, objective functional link be established between the two variables that are the subject of the provisions of the FCCC:

- The annual rate of greenhouse emissions
- A measure of the magnitude of climate change, the increase in global mean surface temperature.

It is proposed that all important reduction targets be established in terms of the change in the climate to be tolerated. The introduction of the increased global mean surface temperature as the measure to be used in the establishment of the targets in the Kyoto Protocol has the advantage that every citizen will have a clear, quantitative idea of the result of their actions and of the commitments of their governments under the protocol.

The proposal recognizes that present greenhouse concentrations are the result of a slow accumulation of emissions, mostly from industrialized countries, over the past 150 years or so.

Therefore, it takes as a basis the time series of emissions by individual countries published by the U.S. Oak Ridge National Laboratory for the period 1950 to 1990, and extrapolates it to incorporate the contribution of each country for the period before 1950.

It is apparent that even at the present rate, developing countries will not match the volume of greenhouse gas emissions by the industrialized countries before the year 2030. Furthermore, the increase in the global mean surface temperature will become equal for the developing and industrialized countries only about 100 or 150 years from now. It is for this reason that industrialized countries have been called upon to take early steps to mitigate global climate change.

It is not Brazil's position, however, that the issue of emissions ceilings for developing countries should be considered only in the twenty-second century. This date can and should be negotiated, as developing countries reach the appropriate level of well-being for their populations, after having a cleaner development path than that of present industrialized countries. Indeed, the contribution of developing countries to address climate change should be encouraged and supported.

The Brazilian proposal introduces a constructive and flexible mechanism that will, hopefully, break the deadlock around the global climate change issue and reconcile mitigation objectives with the need to promote development along a cleaner path.

The Brundtland Report, *Our Common Future*, Agenda 21, and the FCCC all identify the need for financial assistance by industrialized nations in support of developing countries' efforts in that regard. This objective has eluded us so far.

Brazil proposes that a Clean Development Fund be set up, based on the "polluter-pays" principle. Annex I countries, the industrialized countries, would contribute to such a fund in proportion to their overall noncompliance with voluntarily adopted targets. This would open up opportunities for emission avoidance in developing countries at a lower cost than that incurred in industrialized ones.

Furthermore, the Brazilian proposal contains provisions that allow for maximum flexibility by individual countries for adjusting the emission of the various greenhouse gases within a five-

year period, to achieve previously agreed-upon maximum temperature increase targets.

In short the Brazilian proposal contains four key points that widen the range for constructive negotiations.

First, the absolute magnitude of the overall reduction target for all Annex I parties, expressed in terms of temperature, is open for negotiation.

Second, the recurring period for the commitments and the review of their performance, proposed to be five years, is also open for negotiation.

Third, the initial year for consideration of historical emissions, leading to 1990 concentrations for Annex I parties, is open for negotiation.

Finally, the value of the assessed contribution to the Clean Development Fund per unit of effective emission above the commitment ceiling is open for negotiation.

The Brazilian proposal is a constructive contribution to bridging the perceived gap between industrial and developing countries that squarely

addresses issues of efficiency, effectiveness, and equity involved in implementation of the FCCC. We can seize a wonderful opportunity to change for the better the relationship between North and South and to open the way for the universalization of the current scientific and technological revolution.

Brazil sincerely hopes to discuss this and any other proposal that is advanced in the same constructive spirit. In truth the challenges we face condemns us to cooperate over and above the various difference that may divide us.

Let me hope that our discussions here will contribute, albeit modestly, to promote a better, more livable world.

These considerations are not very different from those that have been advanced previously, but they contain a new element, an opening for an unbiased discussion of the role that developing countries would eventually play, when the means for taking a cleaner development route are made possible through contributions from the industrialized countries.

Reflections on the Future: Global Ecosystems Management

Mohamed T. El-Ashry

It is very fitting that I follow the distinguished panel on international treaties, because like the Multilateral Fund to the Montreal Protocol, without the Global Environment Facility (GEF) the climate change and biodiversity conventions would have joined their predecessor international treaties in collecting dust because of lack of finance to help developing countries in implementing their commitments under these conventions.

I was asked to look at the future. I am not sure that my crystal ball is any better than yours, but I will do my best.

If the present is an indication of what the future might look like, I am afraid the near future, at least, does not look very good.

Five years ago at the Rio Earth Summit countries committed themselves to the pursuit of sustainable development. They also signed the convention on climate change and the convention on biodiversity, pledging to reduce emissions and conserve biological diversity.

Agenda 21 was agreed upon as the blueprint for action—epitomizing, above all else, our interdependence and the need to strengthen international cooperation and forge new partnerships.

Instead of making good on these promises, we have too often chosen to conduct business as usual, with results that range from steady increases in greenhouse gases to the widening gap between rich and poor. Just in these five years we have added another 450 million people, in-

creased carbon emissions by 4 percent and let waste another 3.5 percent of the world's tropical forests. Ecosystems critical to the functioning of Earth's life support systems continue to be undermined, and land degradation threatens food security and livelihoods, especially in Africa.

Another worrisome statistic underscores the stagnation, even the decline, of financial support from governments for sustainable development. For example, overseas development assistance as a percentage of donor country gross national product is at 0.27 percent—its lowest point in half a century.

We have been productive at the margin but have not been decisive at the core—in governments, international institutions, or legislative assemblies. At the United Nations Special Session in June many good interventions were made, but overall the can-do spirit of Rio was replaced by handwringing, finger-pointing, and inaction.

I do not mean to be the bearer of gloom, but unless current trends are reversed significant progress on global environmental issues and global sustainability is not possible. There is no escaping the fact that the future is what we make it.

Building on What Works

What are the bright spots, if only on the margins? First, foreign direct investment (FDI) in developing countries has more than tripled since 1992, reaching US\$285 billion in 1996. Unfortunately,

this is no panacea for sustainable development; this investment has not yet become prominent in the environmental and social sectors, and 73 percent of FDI goes to just 12 countries. If investments were directed into environmentally benign technologies and activities, the returns could be significant.

Second, civil society has become an important force in implementing Agenda 21 and increasing public awareness of global sustainability, particularly at the local level. At the GEF, for example, almost one-third of the project ideas submitted by governments came from nongovernmental organizations (NGOs), and 20 percent of all activities financed by GEF involved NGOs in design, planning, or implementation.

Also on the positive side is the emergence of the restructured GEF. In March 1994 the GEF was restructured in a way that responds fully to the provisions of Agenda 21 and replenished with a US\$2 billion trust fund. The restructured GEF ensures universality in membership, flexibility in operations, transparency and democracy in governance, and predictability in funding.

Without a doubt the GEF represents the first, and most significant, financial commitment arising from the Rio Summit. In the three years since its restructuring the GEF, through its implementing agencies (the United Nations Development Programme, the United Nations Environment Programme, and the World Bank) has worked in more than 110 countries. It includes 161 participating nations and, on an interim basis, operates a financial mechanism for the Convention on Biological Diversity and the U.N. Framework Convention on Climate Change.

Of course the GEF cannot by itself solve all the environmental problems we face. Rather the GEF is a catalyst, a facilitator, and a mechanism for integrating global environmental concerns into the development process. The GEF's brief is to make the connection between local and global environmental challenges and between national and international resources in the areas of climate change, biodiversity, ozone depletion, international waters, and land degradation.

Above all the GEF is a financing instrument that also leverages and mobilizes private sector resources and seeks cofinancing opportunities with other bilateral and multilateral development institutions. The GEF has now au-

thorized more than US\$1.8 billion in grants to recipient countries, while leveraging more than US\$4.5 billion from other sources for global environmental concerns.

But the GEF has its limits, because US\$2 billion—or even US\$10 billion—cannot solve the problems of the global environment. So we continue to focus our programs, streamline operations, build new investment partnerships with bilateral and multilateral institutions and NGOs, and leverage private-sector resources. In this way we can multiply our high-value grant resources many times over.

This is one reason why the international community has been especially keen to see much closer strategic and operational integration between the GEF and the global environment agenda, on the one hand, and the implementing agencies, on the other. One obvious reason is the special nature of the GEF as an "add-on" financier to regular aid budgets. Another important reason is the relatively large size of World Bank lending and other development budgets.

It is not difficult to imagine the tremendous positive impacts on the global environment and global sustainability when the World Bank and other multilateral and bilateral development institutions fully integrate global environmental concerns and actions into the wider development agenda; in other words, into all economic and sector work—in energy, agriculture, forestry, water resources, industry, and infrastructure.

Also, in another year or so developing countries, with the help of the GEF, will be completing their national communications strategies and plans under the Rio Convention. These are important tools for mainstreaming climate and biodiversity concerns into the countries' own thinking and priority setting, as well as for formulating country assistance strategies by the World Bank or cooperation strategies and longer-term GEF support. Three such reports have already been completed, by Argentina and Jordan for climate change and by Ukraine for biodiversity.

Today we have the opportunity, indeed the responsibility, to address with renewed urgency the actions required to put our lifestyles, our consumption patterns, our population growth, and our human settlements on a sustainable path.

We are confronted with an enormous task. However, there was no reason to believe that the implementation of Rio would be easy. Protecting the global environment, while alleviating poverty and promoting sustainable development, is a complex undertaking that requires both global and national responses and an unprecedented level of effort, scientific knowledge, and international cooperation.

The Road to Kyoto and Beyond

Two months from now in Kyoto the international community will have an opportunity to move from rhetoric to action and help shape the future. We need to muster the political will and adopt effective and binding targets within a reasonable time frame for reducing greenhouse gases, and thus begin the large-scale pursuit of sustainable energy development.

There is clear consensus that we are modifying our atmosphere—and potentially other important ecosystems—in an unprecedented way by the carbon emissions we are pumping out. Yes, there are some scientific uncertainties on the degree and distribution of regional impacts. But the time to act on climate change is not when all uncertainties are removed and the links are proven beyond a doubt—we must act when the possibility cannot be discounted. This is exactly the approach we have taken in the past to deal with priority environmental concerns such as air pollution, acid rain, toxic chemicals, and the banning of carcinogenic pesticides.

We should not be confused about responsibilities. The biggest responsibility falls on those with the greatest emissions. Solutions for such major global problems, however, need to be wide-ranging, cost-effective, and based on co-operation among *all* nations, without jeopardizing the right of the developing world to sustainable development.

In this regard incentives—particularly financial incentives—for facilitating large-scale transfer to developing countries of energy-efficient and renewable energy technologies can go a long way toward achieving both developmental and environmental objectives. The GEF clearly stands ready to assist the international community in this endeavor, particularly in its role as operator

of the “financial mechanism” of the climate change convention.

The GEF has already provided modest help to developing countries and economies in transition as they take their first steps toward addressing the problem of climate change. In a short time and with limited funds we are increasing the worldwide output of photovoltaic energy more than five-fold. In India alone a US\$26 million GEF grant helped to raise industry-wide capacity of wind and photovoltaics from 30 to over 700 megawatts over the past five years.

Last but not least, no one doubts the importance of the private sector to the fulfillment of global environmental objectives. Net private capital flows to developing countries are almost six times higher than official development assistance. Energy policy and investment in global environment-friendly technologies are key pillars of any climate-change strategy, and the private sector—not government—is the key player in the technology-transfer arena. The GEF is keen to enter into a new partnership with the private sector in which our funds and those of others augment, rather than displace, private capital, and our interventions facilitate and catalyze demonstration projects with significant replication potential.

In closing let me say that we should not continue to bemoan the disappointment and lack of progress at the U.N. Special Session last June. Perhaps it was one “conference” or one “summit” too many. We in international institutions and governments have clear mandates and financial resources to help implement them. We should get on with the job and vigorously address the important challenges entrusted to us.

When the GEF succeeds in mainstreaming the global environment in its implementing agencies’ actions and activities and in recipient-countries’ sustainable development thinking and planning; when the World Bank practices in a big way what it preaches, and fully integrates environmental concerns into country assistance strategies; when governments in the North honor their commitments under the conventions; and when countries in the South adopt the necessary policy reforms to put their energy development, natural resources management, and population growth on a sustainable path, then the future will certainly be brighter.

Summing up

Ismail Serageldin

Thank you all for being with us today during these stimulating presentations. Let me move on to a few other observations, the first of which is that a passerby commented, "It is surprising the number of Egyptians associated with global environment. There is Dr. Tolba and there is Dr. El-Ashry and there is you." I said, "Well, you ain't seen nothing yet. The Executive Secretary of the Montreal Protocol is Amma Al-Reeny, another one."

Perhaps it has something to do with a long-lasting concern for our country, which is so dependent on the quality of environmental management. Many of you may not know, for example, that from the Egyptian tombs of the pharaohs there is a statement from a supplicant to the gods saying: "I have not killed; I have not lied; I have been kind to my parents; and I have not polluted the Nile waters. Therefore, I am worthy to enter into your domain."

It seems that the concerns we discussed today go back a long way, and many of us on the contemporary scene are trying to find ways of reminding our compatriots of that wisdom that Justice Weeramantry said has existed in so many traditions, going back thousands of years.

My friends, today we are starting a unique event. As all of you know, this is a special time. It is a special time not just because of this year's Kyoto meeting to agree on an international protocol to reduce greenhouse gases, but because it is Rio+5. It is time to take stock.

We started the day with inspiration from Captain Jacques-Yves Cousteau, who challenged us to open our arms and welcome the additional population—but noted that to do so, we will have to modify our behavior. It was a major challenge, and several of the speakers have referred to it. The President of the World Bank, in honoring Jacques Cousteau, committed us to honor his work in our work. And he committed us to deal with these issues in a supportive fashion, as we do in the national and local dimensions and also at the global level.

How to do that? This question was the beginning view of the thematic partnerships that came up so many times in today's discussions—partnerships that need to be linked in terms of scale, cutting across the local, national, regional, and even the global levels. We also have to think in terms of the multiplicity of actors who must be brought together in international bodies, national governments, local governments, private sector, public sector, civil society, informal groups, community-based groups—for none of this can be done by any one actor alone. These are among the themes that arose many times.

But we did keep the discussion focused on those three pillars that we tried to address—science, economics, and law. Under science I believe that Bob Watson's presentation helped to highlight the links among the global environmental issues, and to stress that they cannot be separated. We all knew something about the fact that they

are interlinked, but Bob did a good job of really describing how these links operate and reminding us that many of these global issues are aggregations of local and national actions that need to be taken, both in terms of policy and practice. We are all accountable at the local and national level in terms of redressing these global issues. They are not somebody else's business.

Addressing science, Peter Doherty reminded us of its advantages in defense of human health and of the need to bring science to bear on environmental problems. He specifically talked about biotechnology. I would remind many of you that a special Associated Event on Biotechnology and Biosafety, in which we will have a very distinguished group of people addressing these issues takes place later this week. In many ways it is important that we bring to bear the understanding of science on all of these issues, and then frame that understanding within a context in which informed decisionmaking can take place.

The second pillar, economics, was addressed by Joe Stiglitz. He highlighted several points, of which I would like to repeat two or three for your consideration. First, he stressed the need to internalize environmental and social costs in the valuation of investments and national accounts. He talked about efficiency, using instruments from economic incentives, such as joint implementation and training, the polluter-pays principle and the user-pays principle. We need to address these issues of efficiency, but we also must address equity, and this is not always easy. Equity issues are hard ones; they pose problems.

We have heard several times today about levels of carbon emissions. If we were to compare the relationship between the United States and India, if my figures are correct, the U.S. emits roughly seven times as much carbon as India, and on a per capita basis Americans emit 24 times as much as Indians; but India's emission are growing at a faster rate. If we look at the efficiency of use for which we are paying with these emissions per unit of gross domestic product or gross national product, India is three times less efficient than the United States.

So technology sharing, the ability to increase efficiency, must go hand-in-hand with equity, and equity must take into account the many factors comprising the reality of the problems we are dealing with.

On top of that we had a lot of questions about the need to engage the private sector. Jim Wolfensohn, Caio Koch-Weser, and others talked about amounts invested by the public sector, by international agencies such as the World Bank, and by the private sector. Private-sector flows are running, we have been told many times today, as much as five times those of all official development assistance. This is a major issue. It does not mean, as Mohamed El-Ashry reminded us, that conditions are automatically moving in an environmentally friendly or socially responsible fashion. The question, therefore, is: what sort of economic incentives do we need to make this happen?

This is one of the key instruments by which transformations must take place, if these partnerships will bring everybody together in a way that enables the private sector to respond. The private sector has the power to respond through fiscal frameworks and trade regimes that would, if motivated by the public good and equity considerations, redress some of the market failures implicit in the absence of the internalization of these environmental and social costs. Not an easy task but an important one.

To make that happen, the GEF is an essential instrument. We have just been reminded not only of the role and scope of the GEF and the principle of incremental costs, but very rightly Mohamed El-Ashry observed that the GEF is very much seen as a litmus test by the developing world, to see whether the industrialized world has a substantive commitment to these issues. I would hope that we can, in fact, fulfill that commitment, because I see the GEF as a central piece of the future in dealing with global environmental issues.

What about the tremendous disparity between private- and public-sector funding? How about it? Are we becoming marginalized, we who are active in the public domain, those who claim to be concerned about the public good? My answer is not at all. Let me use a metaphor. The difference between the DNA of a human being and a chimpanzee is about 1 percent. So the question with public financing flows is not their total volume in comparison to private sector flows, but rather how well they are deployed. Are they indeed the equivalent of that critical 1 percent difference in the DNA, or are they just more of the

redundant DNA that would make no difference at all?

It is here that we have to design sensible instruments, not only on the economic side, but also on the legal framework side. The instruments should try to ensure that this fragile, scarce resource of public funding is accompanied by a legal framework and a total partnership regime that will enable its impact to multiply many times. That, in turn, would enable it to influence private sector flows so that they do, indeed, become environmentally friendly and socially responsible.

And that is how we arrive at the third pillar, which is so essential: the law. Justice Weeramantry reminded us that these issues are at the center of everything that we should be discussing; that environmental rights are human rights; and that in pursuing them, we should be seeking the wisdom of the ancients. In that he echoed the comments of Captain Cousteau. He reminded us of the common threads in so many traditions: the right of community, the needs of future generations, and the voluntary surrender of a portion of sovereignty for the greater good as the basis of international law—not regulations and sanctions. It is not easy, but it is important that we pursue this way of thinking, for indeed this morning, I think, we have been talking about linking past and ancient practices to our vision of the future.

We must link considerations for people, especially the poor and women, who are carrying the burden of the current inequities, and who are indeed the ecosystem managers at the micro scale, which we have said is the basis for aggregation to the local, regional, national, and global scales. For it is through them and through their welfare that we interface with the welfare of coastal areas, forests, and fields that are so essential in their role of interface between human beings and ecosystems.

In dealing with the law, Mostafa Tolba rightly reminded us of the nature of existing agreements: they are embedded in the view that no nation

alone, or even any subgroup of nations, can achieve an answer to these problems. By their very nature the problems we have been discussing require the collaboration of all of us on this planet. This is important, and it is a powerful thing to remember, since we each have contacts with so many decisionmakers. It is not one against the other; we are all part of this together.

My good friend Henry Kendall, chairman of the Union of Concerned Scientists, keeps saying that we have to remind people that a lifeboat cannot sink from only one side; if it sinks, everybody sinks together. That is not sufficiently understood.

But indeed some of the participants in corridor talks and luncheon talks reminded us of the difference between understanding the long-term underlying trends with which we are dealing and the politics of reaching agreements in international conventions. This is a task, of course, where we need to mobilize public opinion and bring its influence to bear on changing the political will.

Yolanda Kakabadse reminded us of the importance of consultations, participation, and partnership at the national and international levels. On the other side of town we witnessed today the President and Vice President of the United States and a number of Cabinet Members trying to influence public attitudes and forge a consensus around a position that would allow the U.S. to play a major role in advancing the debates in Kyoto.

But these are not just debates for Kyoto. I think the sense of urgency that we must bring to them is upon us. All of us have been struck by the disaster of forest fires in Indonesia. We must remember that it had to do not only with misguided human actions, but also accelerated drought—the El Niño effect.

All of these are topics that we must address again and again. As we become better informed, we can become better artisans of public opinion and help to shape the political will that we say is lacking. For that is not somebody else's job; it is *our* job to make it happen.

CLOSING PLENARY

Global Ecosystems Management: Innovations and Opportunities in Public/Private Partnerships

Macroeconomics and Sustainable Development

Alassane D. Ouattara

It is indeed a great honor for me to join you today, five years after the Rio Earth Summit and five years after the nations of the Earth made a pledge that together, they would change the way we live on this planet. The hope was to halt and reverse the effects of environmental degradation, and to promote environmentally sound and sustainable development.

But what does sustainable development mean? At last count, back in 1992, a World Bank study estimated that there were at least 33 definitions surfacing in the literature—all covering one or more aspects of economic, social, and environmental objectives. Over the years, as all of you have searched to define the term, so have we at the International Monetary Fund (IMF). Perhaps the definition we are most comfortable with is one that takes the viewpoint of the economist, with the concerns of a sociologist and ecologist at heart.

We see economic growth and the efficient use of resources as the paramount objectives. But we also believe that these objectives must be achieved in ways to allow the simultaneous pursuit of social and ecological objectives. Where there are tradeoffs—and that is inevitable—we support the adoption of complementary policies, such as targeted social safety nets, protection of essential public education and health care expenditures, and fiscal and nonfiscal measures to help conserve natural resources and control pollution.

This definition fits nicely with the IMF's concept of "high-quality growth," which we believe is central to sustainable development. We define such growth as "economic growth that brings lasting employment gains and poverty reduction; provides greater equality of income through greater equality of opportunity, including for women; and protects the environment." The third element, protecting the environment, may sound odd coming from an institution so concerned with macroeconomic stability. So let me first say something about this link and then reflect on how the necessary resources can be raised for sustainable development, and how the IMF can help countries pursue high-quality growth.

Link between Macroeconomics and the Environment

At the time of the Rio Earth Summit the link between macroeconomics and the environment was largely unexplored. But since then much research has been carried out; we know now, without doubt, that macroeconomics and the environment are inextricably linked. The old concept of environment as a constraint to development has given way to one of environment as a partner in growth and development.

How does this link work? Studies show that macroeconomic stability is a minimum necessary condition for preserving the environment. Sta-

bility enhances growth prospects, increases employment and incomes, and ensures that the right price incentives work to preserve the environment. Furthermore, any strategy to preserve the environment will be undermined by macroeconomic instability. It is true that macroeconomic policy reforms may hurt the environment, but the only time this occurs is when sound environmental policies are lacking. Thus the answer is not to forego the necessary macroeconomic policy reforms but to ensure that sound environmental policies are in place.

We also know that environmental problems, including those relating to specific regions and the world as a whole, hurt growth. Human welfare is reduced by ill health and premature mortality caused by environmental problems. Moreover, health problems can lead to higher outlays aimed at mitigating or avoiding the health and other direct welfare impacts of environmental degradation, further constraining growth. Studies also give abundant evidence of lost labor productivity resulting from ill health, foregone crop output from soil degradation, and lost fisheries output and tourism receipts from coastal erosion.

Where Financing Stands

But where are we going to find the money to finance sustainable development? The Earth Summit's Agenda 21 puts the annual cost for developing countries at about US\$600 billion, with about US\$125 billion of this amount needed as grants or concessional external financing. Can such resources be found? On this score we are optimistic.

Agenda 21 emphasized official development assistance (ODA) as the main source of external financing for developing countries. Yet despite the pledges made by developed countries in 1992 to increase ODA from 0.34 to 0.7 percent of gross national product (GNP), ODA has languished well below, reaching—unfortunately—an historical low of 0.25 percent in 1996.

Moreover, progress in reducing the burden of external debt has been mixed. Middle-income countries have made significant strides, but many low-income countries still shoulder a heavy debt burden. It is for this reason that the IMF and the World Bank now have underway a debt initia-

tive for the heavily indebted poor countries (HIPC), most of which are in Sub-Saharan Africa. The HIPC Initiative is designed to ensure that all heavily indebted poor countries that pursue strong reform countries reach a sustainable external debt position, and thus can exit from the debt rescheduling process.

Three countries—Uganda, Bolivia, Burkina Faso—have already won commitments of assistance. Preliminary discussions for three others—Côte d'Ivoire, Guyana, Mozambique—have been held, and we hope that a decision on assistance can be reached over the next few months, provided they continue with their necessary reform policies. Next in line, in 1998, we expect to be Ethiopia, Guinea-Bissau, and Mauritania.

While official financing remains essential for many low-income countries, no doubt the brightest spot on the external financing front have been the unexpected surge in private capital flows to developing countries, which more than doubled since Rio. But much remains to be done to harness this resource. The poorest countries have not been able to attract these flows, and in middle-income countries, very little is flowing to the critical social and environmental sectors.

Against this backdrop domestic resource mobilization looks to be the main hope both for better using existing resources and mobilizing additional ones. So far no large amounts have been raised, but most countries are moving in the right direction. There are at least three areas where we see enormous potential.

The first area, *raising additional fiscal revenues*, builds on the reality that developing countries typically have complex tax systems with a narrow tax base. Add in poor tax and customs administration, and the result is high collection costs, high rates of tax evasion, and low tax revenues. Where the taxable base is typically limited, there is a scope for increasing tax to GDP ratio, not as a rule by raising tax rates, but by a *comprehensive reform of existing tax systems* to broaden the tax base, simplify the tax structure, and improve tax and customs administration.

If developing countries raise their tax-to-GDP ratios by perhaps one percent—and this would not be unrealistic, given that several low-income Sub-Saharan African countries did so in the early 1990s—it could yield some US\$65 billion, a sum somewhat larger than total current ODA.

Another way to raise revenues is by *levying appropriate levels of user fees and charges* for energy, water, forests, fisheries, and mining resources. In many countries these fees are set too low, leading to rent-seeking, excessive exploitation of natural and environmental assets, and low government revenue.

Yet another way to raise revenues is *imposing environmental taxes*, always mindful that should the incidence of some of these taxes be regressive, a portion of the revenues would need to be used to compensate the poor and the needy. Industrial countries and some developing countries have started down this road with the imposition of taxes on the use of energy and carbon emissions—although progress is extremely low.

Harmonizing these taxes across countries would facilitate adoption and improve global welfare.

The second area where we see potential for boosting finances is increasing public saving through rationalizing expenditures. This could be done in several ways:

- *Unproductive expenditures need to be reduced*, in particular military expenditures. It is well known that in too many countries, particularly in too many poor countries, government bureaucracies remain excessively large. Curtailing the share of the cost of government by even a small margin could release large amounts of resources.
- Policymakers could also *remove or reduce subsidies* that are costly to the budget and detrimental to environmental or social objectives. The World Bank estimates that the global resource costs of subsidies for energy, transportation, water, agriculture, and fisheries exceeds US\$870 billion—split 50-50 between developed and developing countries. This is not small change.

Finally, let me turn to the third area for raising finances: *macroeconomic and structural reforms*. This is more of an indirect path that aims at redirecting existing available financial resources toward the private sector, and allowing it to generate additional savings. Over the years a growing number of countries have shown that sound macroeconomic policies often result in higher economic growth. Structural reforms can also help redirect financial resources and improve efficiency, but they are most effective when

undertaken along with macroeconomic stabilization.

How the IMF Fits in

How does the International Monetary Fund fit in this picture? Certainly, we see our *main contribution* to sustainable development in the *economic arena*. That is, encouraging countries to adopt policies that foster stable macroeconomic environments. In recent years, taking note of the new globalized world, we have broadened the reform agenda, as was evident at our recently concluded Annual Meetings in Hong Kong.

- Our new agenda seeks the orderly liberalization of capital markets, in the interest of better allocating saving and investment, thereby enabling countries to grow more rapidly in a more sustainable manner.
- Our new agenda encourages countries to pursue good governance—and by that, I mean transparency, accountability and the rule of law—which is absolutely essential if countries are to realize the benefits of the global economy and manage its risks.
- Our new agenda is one that emphasizes “second-generation reforms” as essential ingredients of high-quality growth. These include comprehensive trade reform, restructuring and privatizing public enterprises, reforming the financial sector, and improving the environment for private investments. Without such reforms the poorest countries risk being marginalized. But with them, they stand to benefit by fully integrating into a globalized world.

At the same time we remain mindful of the *social objectives*, which is why social issues are increasingly entering into our policy dialogue. We are conscious that, too often, the criticism is voiced that structural adjustment is harming human development. However, the evidence—even allowing for problems with the quality of the data, such as the failure to capture the efficiency of spending—speaks to the contrary. While the range of experiences across countries is considerable, available data in 27 countries that have used our concessional facilities show that, on average, real spending on education and health increased by 5 percent and 7.5 percent per year, respectively, during the program period.

Social indicators—such as literacy, primary and secondary school enrollments, infant mortality, life expectancy, and access to health care and safe water—have also shown gains.

But we know we can do more. We need to focus on the level and quality of social spending in a more systematic manner, in close collaboration with the World Bank. We also need to better understand and improve the links between social spending and social indicators, and we are moving in this direction. I am pleased to note that the Fund is giving more attention to helping countries improve data on government spending on health and education. It is also strengthening the monitoring of social policies and basic social indicators, including through social spending targets in Fund-supported programs. In particular, programs for countries qualifying under the HIPC initiative will incorporate monitorable targets for social spending and social indicators. The Managing Director has also issued guidelines to IMF staff, specifying ways to strengthen our work on health and education outlays, given the crucial links between efficient health and education outlays and growth.

As for *environmental objectives*, many IMF-supported programs involve the adoption of “win-win” policies that benefit both the economy and the environment; for example, curbing environmentally damaging subsidies and stabilizing farm prices. Nonetheless, in certain countries, especially in the developing world, we realize that environmental issues—such as weak forestry management and severe air and water pollution—can have significant macroeconomic implications.

Here, too, working closely with the World Bank, we have increasingly tried to integrate environmental concerns into our policy dialogue. Bank and Fund staff work together to help member countries prepare Policy Framework Papers that incorporate economic, social, and environmental concerns in a consistent manner. In fact, a number of country programs supported by our concessional facilities have featured environmen-

tal concerns. Let me give you a few examples. In Cambodia the preparation and publication of a forest management code constituted a benchmark in the program, and the completion of the mid-term review of the program hinged on the implementation of an effective forestry policy.

In Mauritania the preservation of fishing resources constituted an important element of the medium-term adjustment strategy. In the Lao People’s Democratic Republic a key consideration was the need to quickly develop the hydropower sector to reduce dependence on timber and wood exports and to conserve forest resources.

Finally, in order to enhance the environmental content of our policy dialogue, the Fund has initiated country-specific studies to analyze the links between macroeconomics and the environment and assess the scope for improving environmental conditions through appropriate policy and institutional reforms. In fact, in our talks with some industrial countries of late, energy taxation and ecological tax reform have been key concerns.

Where does this leave us? Clearly, environmentally and socially sustainable development is a mammoth task—one that urgently requires an unprecedented global partnership. For real progress to take place, governments need to take the objectives seriously, politically commit themselves, and be willing to redesign policies. Specialized institutions need to improve to provide advice in a consistent manner. International financial institutions need to ensure that adequate funding is available, and nongovernmental organizations need to bring information to the debate, and help to build a national consensus for sound policies.

For our part, the Fund stands ready to do its share. We can advise countries on how to strengthen macroeconomic policies and structural reforms—including good governance—that will help mobilize the maximum financial and economic support from all who are able to contribute. So together, I do believe that we can change the way we live on this planet.

The Search for New Technical Solutions for an Environmentally Sustainable Future: Recycling Carbon Dioxide into Useful Fuels

George A. Olah

World resources have difficulty keeping up with a rapidly growing population (1.6 billion at the beginning of the 20th Century; now approaching 6 billion) and an increasingly technological society. Society's demands need to be satisfied, but at the same time we must safeguard the environment and allow future generations to continue to enjoy planet Earth as a hospitable home. To establish an equilibrium between providing for mankind's needs while safeguarding and improving the environment is one of the major challenges facing society. People need not only food, water, shelter, clothing, and many other perquisites, but also energy. Our early ancestors discovered fire and started to burn wood. The industrial revolution was fueled by coal; the 20th Century added oil, gas, and atomic energy.

When fossil fuels such as coal, oil, or natural gas (all hydrocarbons) are burnt as fuels in power plants to generate electricity or to heat our houses and fuel our cars and airplanes, they form carbon dioxide and water. They are thus used up and are not renewable. Nature has given us—in the form of oil and natural gas—a remarkable gift. However, that which was created over the ages, man is using up rather rapidly. The large-scale use of petroleum and natural gas to generate energy, heat our homes, propel our vehicles and planes (gasoline and diesel oil), and also as raw materials for diverse manmade materials and products (such as plastics, pharmaceuticals,

and dyes) all developed during the 20th Century. Use has grown to the point where world consumption is approaching 55 to 60 million barrels (a barrel equals 42 gallons, or 160 liters) a day—totaling some 10 million metric tons.

Oil and gas are mixtures of hydrocarbons; that is, compounds of the elements carbon and hydrogen. When we burn hydrocarbons they are irreversibly used up and are not renewable on the human time-scale. Fortunately, we still have significant worldwide reserves, including heavy oils, shale, and tar-sands, and even larger deposits of coals (a complex mixture of carbon compounds more deficient in hydrogen) that can be eventually utilized, albeit at a higher cost. I am not suggesting that our resources will run out in the foreseeable future, but it is clear that they will become more scarce and will not last very long. With the world population approaching 6 billion and rapidly growing (it could reach 10 billion within a few decades), the demand for oil and gas can only increase.

It is true that in the past dire predictions of fast-disappearing oil and gas reserves have not been correct. The questions are, however, what is "fast," and what is the real extent of our reserves? Proven oil reserves, rather than being depleted, have nearly doubled in the last 30 years and now exceed one trillion barrels. This sounds so impressive that most people assume that there is no oil shortage in sight. However, with increasing consumption, coupled with a growing world

population, a more realistic gauge would be to consider *per capita* reserves. If we look at per capita reserves, it becomes evident that our known reserves can last for no more than half a century. Even if we consider all other factors (new findings, savings, alternate sources), by the first half of the 21st Century, we will increasingly face a major problem. Oil and gas will not become exhausted overnight, but market forces of supply and demand will inevitably start to drive prices up to levels nobody even wants to contemplate presently. By the second half of the century, if we do not find new solutions, we will face a real crisis.

All mankind wants the advantages an industrialized society offers its citizens. We essentially rely on energy, but the level of consumption is vastly different in different parts of the world. Oil consumption per capita in China, for example, is presently only five barrels per year; the figure is ten times higher in the U.S. China's oil use is expected—according to the most conservative estimates—to double during the next decade. This increase alone would equal U.S. consumption, which reminds us of the size of the problem we are facing. Imagine the further demand if the Chinese (and others) are no longer satisfied to ride bicycles, but increasingly expect to drive cars and use other conveniences common in developed countries. Do we in the industrialized world have a monopoly on a better life? I certainly do not think so. With the unresolved problem of the world's population growth, the question is not just how to feed and provide shelter for all mankind, but also how to provide energy and all the other perquisites for a reasonable standard of living.

Generating energy by burning nonrenewable fossil fuels (oil, gas, and coal) is feasible only for the relatively short future—and even then we face serious environmental problems. The advent of the atomic age opened up a wonderful new possibility, but also created dangers and safety concerns. It is tragic that the latter considerations have practically brought further development of atomic energy to a standstill in most of the world. Whether we like it or not, we have no long-run alternative other than an increasing reliance on clean atomic energy; but we must solve safety problems, including disposal and storage of radioactive waste-products. Pointing out difficul-

ties and hazards and regulating them (within reason) is necessary. Finding solutions to overcome them, however, is essential.

If we continue to burn our hydrocarbon reserves to generate energy and use them as fuels, diminishing resources and sharply increasing prices in the approaching 21st Century will lead inevitably to the need to supplement or replace them by producing them ourselves, through synthetic manufacturing. Synthetic gasoline or oil products will be, however, much costlier. Petroleum oil and natural gas are the greatest bargains we will ever have. A barrel of oil still costs only around US\$20 (with some market fluctuation). No synthetic manufacturing process will be able to come even close to this price, and we will need to get used to this—not as a matter of government policy, but as a fact over which we have little control.

Synthetic oil is feasible, and can be produced from coal or natural gas via synthesis-gas (a mixture of carbon monoxide and hydrogen obtained from incomplete combustion of coal or natural gas—although the latter are nonrenewable resources). Coal conversion was used in Germany during World War II and in South Africa during the boycott years. This route (the so-called Fischer-Tropsch synthesis) is, however, highly energy consuming, yields unsatisfactory product mixtures, and can hardly be looked to as the technology of the future. New and more economical processes are needed. Some of the basic science and technology we need is evolving. For example, more abundant natural gas can be directly converted—without first producing synthesis-gas—to gasoline or hydrocarbon products. Using coal and natural gas to produce oil will extend its availability, but new approaches based on renewable resources are essential for the future.

When hydrocarbons are burned they produce carbon dioxide (CO_2) and water (H_2O). The challenge for the future is to reverse this process and produce efficiently and economically hydrocarbon fuels from carbon dioxide and water. This may sound like science fiction, but it is not. In principle we chemists already know how to convert carbon dioxide with hydrogen gas (H_2) into methyl alcohol. Catalytic processes using metal or highly acidic catalysts can be used for this conversion. The limiting factor is that to produce needed hydrogen, such as by electrolytically

splitting water, much energy is needed. In the long run this could be provided by atomic energy, once it is improved and made safe. Alternative energy sources can also contribute. Use of photovoltaic solar energy is possible in suitable locations, such as desert areas. Energy from the wind, waves, tides and other natural sources can potentially also be used. In the more immediate future our existing power plants, either burning fossil fuels or using atomic energy, have substantial excess capacity in off-peak periods. As we still cannot store electricity efficiently, in off-peak periods our existing power plants could even now produce hydrogen as a way of storing energy. Other means to cleave water may also evolve, such as the use of enzymes or sunshine for energy. Nature recycles CO₂ by photosynthesis in plants, trees, and ocean algae to carbohydrates and cellulose, thus renewing plant life. Some plants even produce hydrocarbons, such as natural rubber. What I foresee is the need to supplement nature by producing synthetic hydrocarbons from carbon dioxide and water on a large scale in new efficient and economical ways.

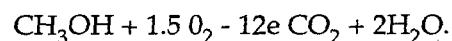
A practical approach would involve recycling carbon dioxide from industrial emissions to usable new hydrocarbon fuels. The average carbon dioxide content of the atmosphere is very low (0.033 percent); therefore, CO₂ is difficult to separate from the air economically. It can be, however, readily recovered from emissions of power plants that burn carbonaceous fuels (coal, oil, natural gas), from fermentation processes, the calcination of limestone, or other industrial sources.

When power plants and other industries emit large amounts of carbon dioxide, they contribute to the so-called greenhouse warming effect of our planet, which causes grave environmental concern. Recycling carbon dioxide into useful fuels would thus not only help to alleviate the problem of diminishing fuel resources, but would at the same time help to mitigate this serious environmental hazard.

A highly efficient way to produce electricity directly from fuels, via their catalytic chemical oxidation, is effected in fuel cells. Whereas the principle was known for a long time, large-scale practical use is still under development. In its usual application hydrogen and oxygen gases are burned in an electrochemical device producing

water and electricity. The process is clean, but handling hydrogen and oxygen gas is not only technically difficult but also dangerous.

The use of fuel cells, however, is gaining application in static installations or in specific cases, such as space vehicles. Hydrogen gas can also be produced from hydrocarbon sources using reformers, which convert them to a mixture of hydrogen and carbon monoxide that are then separated. Hydrogen burning of fuel cells, however, has limited applicability. In contrast a new approach uses liquid fuels, such as methyl alcohol (or its derivatives). Such a direct oxidation, liquid feed, methyl alcohol-based fuel cell was developed in our cooperative effort with Caltech-Jet Propulsion Laboratory, which built all the fuel cells for the U.S. space program. It relies on a reaction of methyl alcohol with oxygen or air over a suitable metal catalyst, producing electricity while forming CO₂ and H₂O



The process can also be reversed. Methyl alcohol or related oxygenates can be made from carbon dioxide, via aqueous electrocatalytic reduction, without prior electrolysis of water to produce hydrogen, in what is termed a "reversed fuel cell." This process can convert CO₂ and H₂O electrocatalytically into oxygenated fuels; that is, formic acid or its derivatives, including methyl alcohol, depending on the cell potential used in the fuel cell in its reversed operation. The reversed fuel cell accomplishes the electrocatalytic reduction of CO₂ outside the potential range of the conventional electrolysis of water. In its reversed mode the fuel cell is charged with electricity and produces oxygenated methane derivatives such as methyl alcohol dimethyl ether, dimethoxymethane, trimethoxymethane, trioxymethylene, dimethyl carbonate, methyl formate and the like from carbon dioxide in aqueous solution. The fuel cell thus acts as a storage device for electric power, much more effectively than any known battery. Recycling of carbon dioxide provides not only the regeneration of fuels but at the same time helps diminish atmospheric build-up of carbon dioxide, the most harmful greenhouse gas.

Recycling of CO₂ into CH₃OH or dimethyl ether can subsequently also be used to make eth-

ylene as well as propylene. These allow ready preparation of gasoline range or aromatic hydrocarbons, as well as a wide variety of other hydrocarbons and their derivatives upon which we rely in our everyday life.

The discussed approach describes a new way to produce hydrocarbons, while simultaneously mitigating carbon dioxide build-up in the environment. Greenhouse warming of our planet resulting from excessive burning of fossil fuels that produce carbon dioxide is considered such a serious problem that in December, 1997, the Kyoto Conference will enact an agreement establishing and dividing carbon rights. Each country will have an agreed-upon quota for the combined fossil fuel allotment that it will be able to burn. Excessive use will be forbidden, necessitating either expensive ways to remove carbon dioxide or use alternative energy sources or atomic energy. Nations will be also able to trade their carbon quo-

tas. Poorer nations thus could sell their allotment to richer industrialized countries.

However we are all citizens of the same planet Earth. Whoever burns fossil fuels will put carbon dioxide into the atmosphere that we all share. This agreement, although it may have noble goals and some beneficial effects, cannot be considered, in and of itself, as a solution, nor will it necessarily significantly decrease atmospheric CO₂ levels. Recycling carbon dioxide emissions, in contrast, while producing new hydrocarbon fuels at the same time, will remove excess harmful carbon dioxide from the atmosphere. If successful, this approach holds great promise. Clearly, much must be done to move ahead. The basic science, however, which is the foundation for this new technology, is well on the way to being developed. With sufficient determination and support, it is considered to be very feasible.

Public/Private Partnerships: Applications and Best Practices

Chair

Sven Sandstrom

This panel session will be on public-private partnerships, applications and best practices. As you know, partnerships have become very central to sustainable development for some time now. The Rio conference was a prime example where constituencies drawn broadly from both the public and the private sectors met to discuss issues of mutual concern. Indeed, in many ways, Rio established environmental common ground for these various constituencies to come together in a partnership.

The concept of partnership was also a cornerstone of the agreements that came out of Rio. The principles and the treaties embedded in Agenda 21 rely heavily on the need for broad-based participation. The Global Environment Facility (GEF), which was restructured in the wake of Rio, is one example of these partnerships. At the level of implementation, for example, a partnership has been formed between the World Bank Group and the United Nations Development Programme and Environment Programme—the first such partnership of its kind among international organizations.

So in many ways there is already an emerging political and legal basis for partnerships in

addressing global environmental issues. At the local level, too, one thing that we have learned is that successful projects depend on the creation of sound partnerships between national and local governments, between governments and other stakeholders, between the public and the private sectors. Strong partnerships between the public and the private sector are particularly important; first, because of the magnitude of private capital flows now going to the developing countries. We need sound public policies to ensure that these resources are used in environmentally benign ways. Second, because the private sector can help with improved environmental management by helping to develop new processes, products and technologies.

The private sector, for example, is increasingly providing environmentally beneficial services, such as potable water supply and sanitation, in developing countries. So the potential for market-friendly approaches also to be environmentally friendly is large and exciting.

Our three panelists are very well placed to discuss the issues relating to public-private partnerships and how we can strengthen them.

Panelist Remarks

Henry J. Hatch

My basic theme is that engineers can and should play a significant role in partnerships that seek to ensure that sustainable solutions are available, considered, and implemented. Scientists have played a significant role in helping us to understand the fundamental impact of human interactions on the global environment and developing policy to support the decisionmaking debate. But it is engineers who use that science to plan, build, and operate the infrastructure that will directly contribute to—or detract from—the goals of sustainable development.

Background

Today I represent the World Engineering Partnership for Sustainable Development (WEPSD), a nonprofit organization that unifies engineers and organizations throughout the world to incorporate the principles and practices of sustainable development. WEPSD is affiliated with the three largest international engineering associations, representing 10 million engineers worldwide. Through its programs and initiatives the partnership enhances public awareness and brings together engineers, environmental organizations, and sustainable development practitioners throughout the world to solve critical environmental problems.

The World's Challenge

WEPSD was formed to advance sustainable development through engineering. The organization joins progressive engineers, environmental nongovernmental organizations, and financial interests throughout the world to identify solutions, share knowledge, and educate others on sustainable development that will lead to environmentally sound, economically beneficial projects, particularly to address man's most overwhelming ecological problems.

For example, today, more than 1.5 billion people do not have access to clean water, and 2 billion have no access to sanitation. One-fifth of our world's population breathes air the World Health Organization categorizes as poisonous. It is not possible to find a sample of ocean water with no sign of human waste. These problems will grow as Earth's population continues to expand: by 2025, 2 to 3 billion more people will share our resources, 95 percent of whom will be living in developing countries.

One of our greatest challenges is, and will continue to be, the ability to find and implement sustainable ways to provide clean water, minimize air pollution, and manage human waste without further harming the environment. These challenges must be addressed in innovative, cost-effective ways. Sustainable development projects,

ranging from new sewage systems to air pollution avoidance techniques, are designed to endure longer, have lower environmental impacts, and provide better cost/benefit ratios.

Ultimately, most of these solutions will be designed and implemented by engineers. Engineers are society's problem-solvers. They possess the technical expertise to ensure that the most appropriate knowledge in natural and social sciences meets the needs and aspirations of mankind in a sustainable manner. While some environmental pollution is inevitable in the future, engineers can offset the damage of development through carefully engineered projects. A few examples in which engineers advance sustainable development include:

- The widespread implementation of human waste recycling methods, in which highly treated sewage is used to fertilize crops. This approach can not only reduce the use of chemical-intensive farming techniques, but will also benefit developing regions facing both limited sanitation systems and food shortages.
- The improvement of gravity-flow irrigation systems to water fields evenly, and the greater use of trickle or drip irrigation systems in arid regions to minimize evaporation, which can improve food production.
- The creation of biodegradable or environmentally benign materials to substitute scarce or harmful materials needed in production, which can significantly reduce industrial pollution.
- The development of new energy sources, such as improving or advancing practical solar, geothermal, wind power, and biomass generation, which can reduce the emissions of carbon dioxide caused by the use of fossil fuels.

Recognizing the challenges and opportunities posed by the need for sustainable development, engineers in 1990 began discussing the concept of a partnership. We chose the term "partnership" to best reflect the spirit, the attitudes, that must characterize our behaviors. In the U.S. Corps of Army Engineers public or stakeholder involvement became our way of life, largely through the passage of the National Environmental Policy Act in 1969, when public involvement was mandated. Today we are actively involved at the Hanford site, our nation's largest public works project, requiring some US\$25 to US\$30 billion in clean-

up. Stakeholder involvement—including federal, state, and local governments and a wide variety of other public and private interests—plays a strong role in this activity.

WEPSD was formed just prior to the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, through the combined efforts of member associations, including engineers from industry, private practice, academia, nongovernmental organizations, government agencies, and professional societies.

Three founding associations were:

- The World Federation of Engineering Organizations (WFEO), the largest global engineering professional organization, representing approximately 10 million engineers in 80 countries
- The International Federation of Consulting Engineers (FIDIC), a worldwide affiliation of national associations of consulting engineers in 50 countries representing the majority of the world's consulting engineers
- The International Union of Technical Associations (UATI), a group of 26 international, non-governmental technical associations in over 120 countries.

WEPSD's mission is to assist and interact with engineers and environmental organizations to promote sustainable development; develop constructive relationships with other stakeholders; promote and facilitate the development of projects, programs, and technologies that support sustainable development; and influence public and private decisions toward creating a sustainable future.

WEPSD's Current Programs

To fulfill its mission WEPSD has initiated a number of projects to promote sustainable development and establish relationships with the public and private sectors that can result in lasting environmental benefits for the world. WEPSD's projects are centered upon information-sharing and public awareness, education, and promoting sustainable technology. One of our most interesting projects, for example, is entitled "Recycling Waste for Agriculture: The Rural-Urban Connection."

Two of the world's most fundamental needs are to produce enough food and to manage hu-

man waste. Meeting the demand for food of the world's rapidly growing population is complicated by competition for water and soil degradation. At the same time each year over 5 million people die from diseases caused by the improper disposal of sewage and solid waste. In developing countries, less than 10 percent of urban waste is treated.

In partnership with the World Bank, the United Nations Development Programme, the World Health Organization, and the private sector in September, 1996, WEPSD held a conference, "Recycling Waste for Agriculture: The Rural-Urban Connection." Said Maurice Strong, Secretary General of the Rio Earth Summit, who spoke at the conference's opening session: "Though urban waste may be a very mundane topic to some, no topic will have greater real impact on the lives and the relief of suffering of the human community."

Over 150 global experts attended the conference, which included presentations on reclamation of wastewater and urban sludge for irrigation in Chile and the Western U.S.; turning municipal solid wastes into compost in India; and social and cultural acceptance of recycling in Mexico. Said one participant: "This conference reminds us of the obligation of the developed world to provide forums like this to share information with the developing world so that we do not repeat the mistakes of the past."

The World Engineering Network (WEnet)

WEPSD represents over 10 million engineers worldwide through its affiliation with organizations such as the World Federation of Engineering Organizations. Finding effective—and cost-effective—ways to share information and communicate with members and the public at large is vital for WEPSD's success.

With support from the National Science Foundation and the Global Environment and Technology Foundation, WEPSD developed WEnet, a Website dedicated to sustainable engineering practices. WEnet is located at www.wenet.org. WEnet was designed to share information and act as an accessible forum for engineers located throughout the world. International engineering organizations use WEnet to share ideas and develop sustainable engineering solutions by working together on-line.

WEPSD also supports ongoing efforts to advance the concepts and ideas of sustainable development within the engineering community. These include:

- Readdressing and broadening engineering responsibilities by incorporating sustainable development principles into the codes of ethics of engineering organizations throughout the world. In 1985 the World Federation of Engineering Organizations developed the WFEO Code of Environmental Ethics for Engineers. This was followed by the Hong Kong Institute of Engineers' revision of its bylaws to recognize the environmental responsibilities of its members. After 20 years of debate, in 1996 the 120,000-member American Society of Civil Engineers revised its Canon of Ethics; it now requires its members to address sustainable development principles in their work. Sustainable development is now on a par with public safety in the ASCE Canon of Ethics. Engineering associations around the world are considering similar revisions to their code of ethics. WEPSD challenges the scientific community, as well as economists and lawyers, to incorporate sustainable development into codes of conduct to accelerate progress on global environmental issues. Supporting statements of policy concerning sustainable development are now part of every major U.S. and international engineering organization's guiding principles.
- Another is incorporating long-term environmental impacts and costs into the analysis of alternative solutions. It used to be engineering and economics, but now the third "e" is environment. There is a common misconception that engineers only calculate technical elements of projects; today engineers are involved in the concept phase, and manage the entire implementation team—supervising design, construction and operation. As engineers manage projects, they can play a powerful role in the implementation of sustainable development by incorporating long-term, lifecycle environmental impacts and costs into the analysis of alternatives.
- A third is finding near-term solutions to critical global environmental issues, such as the availability of fresh water and global climate change, for application in both developed and

developing countries in all regions of the world. Engineers, business leaders, and government policymakers can put these solutions in service in a one to three year time-frame. Many complementary efforts are underway; for instance, the program of the World Business Council for Sustainable Development and the World Federation of Engineering Organizations, Committee on Transferring, Sharing, and Assessment of Technology (ComTech).

Our societies need technically competent engineers creating their "built environment" and engineers that understand the broad ramifications of the enterprise or project. Our societies need, whether they clamor for it or not, our involvement. Public and private decisions, to be sustainable, must be not only environmentally and socially sustainable, but also economically, politically, and technically sustainable. That alignment can only occur with the input of engineers and scientists. We have value to add across that entire spectrum to better serve society.

As we continue the dialogue centered on sustainable development, I am reminded of the

challenges we face in the area of technology transfer—the efficient movement of new, innovative technology from the research world to the job site or factory floor, and hence into the end result. It does not happen unless both the supply and demand sides are working. This is complicated because the lifecycle of any project or product includes many players, and if any one is not engaged, efficient technology transfer will not take place.

Clients, customers, users, and publics must demand—and science and technology should supply—*pull* from the ultimate beneficiaries and *push* from the providers. Without engineers in this chain, we are missing an essential link.

In discussing this issue with engineers I urge them to "pull" from science and "push" sustainable solutions to their customers and consumers, both public and private. I urge you to "pull" engineers into these discussions. Partnerships are bridges, and we must be bridge builders to better promote what we all seek—a sustainable future for the generations that follow.

Panelist Remarks

K. Madhava Sarma

For the last two days we have heard many references to the Montreal Protocol, and how wonderful it has been. I have been listening to Ismail with a smile about the nice words said about it. Many said that it is a simple problem which is not really relevant; others disagreed, especially Dr. Tolba.

When I recall my experience during the initial days of the Montreal Protocol, in 1987 and 1988, I recall hearing the same arguments that are being repeated today about climate change: how Europe is different from the U.S., different from Japan, different from the developing countries, and how impossible it is to do some things, how costly it is, how impossible it is. So, perhaps there are some parallels.

This protocol today, as you are aware, is an agreement to phase out 95 chemicals, used very widely in many industries, in a time-bound manner by all parties. The number of parties is 162, representing about 95 percent of the world's population. The 5 percent that are not members are countries like Afghanistan, Somalia, which are not stable at the moment. So almost the entire world, including developing countries, is committed to phasing out these chemicals used in thousands of industries.

The results already achieved are remarkable. During the last 10 years something like 75 percent of these ozone-depleting chemicals have been phased out, and scientists who observe the atmosphere through satellites, balloons, and air-

craft have assured us that the protocol is working and the ozone layer will begin its recovery in another four to five years. Full recovery will take a long time—until the middle of the next century—because the chemicals already released have quite a long life. The parallels to climate change are quite clear.

The success of the protocol, which I hope will continue, is ascribed by many to partnerships. Partnerships are not created in a day. You cannot suddenly say "let us become partners." The governments and the United Nations Environment Programme (UNEP) have worked on this partnership since 1977. So bear with me while I explain the process through which these partnerships have been achieved, and perhaps we can use this process to solve other problems.

When U.S. scientists discovered in 1974 that these chlorofluorocarbons (CFCs) caused ozone-layer depletion, there was an immediate reaction, thanks to the U.S. media. The U.S. took immediate action by banning the use of these chemicals in aerosols, because it was a shock to many people that you can destroy the world through these spray cans, deodorants, as effectively as you can through nuclear weapons.

This initial action by the U.S., prodded by the media, spread to many other countries, and UNEP took this up as a global issue. The first thing they did was to have what was called a "coordinating committee on the ozone layer." They did not appoint a consultant to study the prob-

lem, but they had a committee with broad representation. This is, I think, the first lesson in problem-solving; do not study a problem by yourself and offer a solution: involve everyone concerned. Very wisely, UNEP did it under the strong leadership of Maurice Strong and Mostafa Tolba at that time.

Then in 1981 they started the intergovernmental negotiations, again involving everyone. These were the two principles with which they began: involving all of the stakeholders from the beginning, and scientific assessment—you must know what the reason is, what the problem is, what the causes are, what the impacts are, and provide the details of solutions. Maybe for some of the global issues being discussed today we lack some of these essentials. Maybe we do not know the causes, or we do not know what to do, or we do not know what the impacts are.

It is true that obtaining this consensus took a very long time, if we compare it with the solutions for climate change or biodiversity, which came about very quickly. From 1981 it took four years for governments to agree on the Vienna Convention, which is a very vague type of convention, basically saying, "We will all protect the ozone layer."

And while everyone agreed that CFCs will deplete ozone—they could not deny the science—many people asked for actual proof. Where is the proof? You will see many parallels to what is happening today: Where is the proof that something happened? That proof was supplied in 1985 by the Antarctic team of the U.K. and, of course, by Bob Watson and others in 1986 through their aircraft experiments, which provided the "smoking gun," so to speak. They were able to link ozone depletion to CFCs.

But even this did not convince many people by 1987. They asked: "What are the alternatives?" Invariably, the argument is that the current chemicals may be bad, but their benefits outweigh the costs. So the same argument was used. They were concerned about the availability of alternatives. Every country, every industrial power was afraid that they would lose their markets or their competitive edge, since these chemicals had only recently been considered to be wonderful chemicals and used in hundreds of industries.

When the protocol was actually arrived at in 1987, it was a very, very weak step. It called for a

50 percent cut in consumption of some chemicals and a freeze in the case of the most ozone-depleting chemicals.

However, at the same time they included what has now become a precedent for every other agreement; the signatories agreed that they would rely on a scientific assessment at least once every four years, and would strengthen the protocol in accordance with that advice. This was unprecedented, and it was a very good step. That, again, is another good principle to follow: start with a small step. It does not matter; you do not have to do great things all at once, but keep your options open by getting solid advice from science.

This protocol also established the "precautionary principle" in practice for the first time. I think in 1985 or 1987 most parties were not certain—even scientists were not completely certain—of all of the aspects of the ozone layer. They did not have conclusive proof that reducing CFC consumption would protect the ozone layer. They did not have any demonstration of its adverse effects. In fact there were no adverse effects at that time. They were all in the future, if you allowed ozone depletion to continue.

But the scientists gave very correct advice, and everyone understood that if you wait for 100 percent certainty, it will lead to very serious ozone depletion and unacceptable adverse effects, and the recovery will take a very long time. And, as you already know, even in spite of the action by the Montreal Protocol, there have been certain adverse effects, and recovery will take a very long time. This precautionary principle now is being talked about for many issues, and is worth emulation in other cases.

It was always understood that the solution to this problem, or any other environmental problem, would have to depend on industries. In this particular case the industries were completely in the private sector. There are huge industries for huge companies like DuPont and absolutely tiny garage-size companies in India and China in many cases, and it was understood that the challenge was to make thousands of companies throughout the world change their technologies in a very short time, with no exceptions.

In the industrialized countries industries react to only two things. Either you give a signal from the market, or you create government regulations. Industries will not react very well to ei-

ther scientific discoveries or police for the protection of the environment. In the case of ozone depletion, until 1986 industry denied the problem. But thanks to all of the scientists they finally had to accept the problem, particularly after the U.S. banned the use of these chemicals in aerosols. One company tried developing an alternative, but discontinued the effort after a few years.

Then, with the discovery of the ozone hole, the same company announced in 1986 that it would phase out CFC use completely. They got the signal at the right time, and they said that they would completely stop the production of these ozone-depleting chemicals as soon as possible.

This entire halocarbon industry has set up a cooperative mechanism to test all of the alternatives. This was another first—so many competitors setting up a mechanism together to test the alternatives. The signals given by governments helped the alternative technologies to become viable. Because the governments regulated halocarbons, a market for alternatives emerged, and industry felt confident to go ahead with the development.

There are many examples of industry cooperation, once signals are clear. For instance, Northern Telecom not only eliminated CFCs as solvents very quickly, but they provided world leadership in helping others. McDonald's stopped using packaging made with CFCs in 1987, and thus forced the foam industry to shift to alternatives. Even Greenpeace, which normally confines itself to sounding the alarm, helped promote and develop hydrocarbons for use in domestic refrigeration.

This is a very valuable lesson for the other problems. Governments must take firm regulatory action in order to provide the right signals to industry. Without such regulation, the market will not develop; it will not take care of the problems. Listen to industry, but do not be led by it. Scientists and technologists give better advice.

Developing country industries react to different signals. Most of them bought their CFC technologies or, in the present case, other technologies, from the industrialized countries. They are in no position to invent new technologies by themselves in a short time or to invest the money

needed to acquire and introduce new technologies. They are also much smaller in size compared to the industrialized countries.

You are aware now of the work done by the Multilateral Ozone Fund and its implementing agencies in this regard. This fund supports preparation of country programs, institutional strengthening, information exchange, the whole gamut of activities needed to actually introduce new technologies. This is another lesson: in case of any environmental program: if you want to do anything, go the whole way. Do not make pious statements and then go away, but help other countries from step A to step Z.

The universal participation in the Montreal Protocol is another lesson. Many a time, the question is what to do in case of these negotiations. Many a time there is a temptation to say okay, let's leave this country alone; they are not listening. But in the Montreal Protocol, they have continuously attempted to take everyone along. If you examine the protocol closely, there is a clause there to satisfy Russia. In 1992, I recall, on CFCs, there was a clause about some percentage, 3 percent. Everyone agreed. The last day, everyone was sitting on the podium, and they were about to approve it. One country, I think it was Japan, rushed to the podium to Dr. Tolba saying sorry, we can't manage with 3 percent.

He did not say "you are only one country; let us overrule Japan." No, he asked "what will satisfy you?" They said 3.1 percent. So that was included in the protocol. You will see all kinds of seemingly absurd features in the protocol just to accommodate individual countries. I think an important lesson is that it is better to include everyone. Even the weakest, poorest country like India can develop their own technologies if forced to do so, and it is better not to allow them to do so.

NGOs have played a very important role, although in the beginning they were not very interested. The media played a great role. And the media and NGOs, particularly in the developed countries, have an enormous role to play. Ultimately, we must realize that when there is money to be put up, it is the G-7 that puts it up. Not the G-77; the G-7, which, being very strong democracies, will not put up money unless their citi-

zens want it. And their citizens are convinced by NGOs and the media. It is up to the negotiators and the scientists to find the popular, easily understandable arguments. I think many of the ozone scientists have done a fantastic job. Even cab drivers, when I tell them that I work on the

ozone layer, they immediately say: "Oh, I have to change my air conditioner." This kind of popularity has been achieved by scientists translating complex ideas into simple language. This is one of many lessons of the Montreal Protocol that may be applicable today.

Panelist Remarks

Jemal-ud-din Kassum

Let me start with a point made by President Jim Wolfensohn yesterday, and echoed to day, which is that private capital flows to emerging markets simply dwarf official development assistance. But these private flows also have an unrivaled potential for both positive and negative environmental impact. The challenge that faces us in the business, nongovernmental organization (NGO), and development communities is how to harness the unique financial, technical, and managerial force of the private sector toward environmentally and socially sustainable development (ESSD).

As an institution that invests exclusively in the private sector of developing countries on a commercial risk basis, the International Finance Corporation (IFC), the organization I represent, began to confront this challenge in the early 1980s, when it introduced environmental reviews. Our role is to promote environmentally and socially sustainable development (ESSD) at the micro-, or firm, level. For those of you not familiar with the IFC, we are the private-sector investment affiliate within the World Bank Group. We have a portfolio of about US\$19 billion, covering 110 countries and about 1,100 companies, and we are the largest multilateral source of debt and equity financing for the private sector in developing countries.

We promote ESSD by ensuring that the projects we finance meet uniformly high environmental standards consistent with World Bank Group

guidelines—including environmental and social impact assessment, disclosure and public consultation, and risk mitigation planning and implementation. Is this working, and is it helping? And where, in practice, has the partnership between the public and private sectors become indispensable to meet the challenges of the future?

I will divide my remarks into two broad sections: first, where I think the market is working or beginning to work; and second, where the market is failing and significant gaps exist.

On the “market working” side, I want to strike a cautiously positive note. Our experience is that the many forces of globalization are provoking a growing number of firms to associate sound environmental and social performance with long-term growth, sustainability, and profitability. This is the case not only for general manufacturing and service projects, but also for infrastructure projects, where the private sector is increasingly providing services previously provided by governments, such as water and power.

Four developments in particular can be cited as provoking this change. First, an increase in the perceived value attached to environmental resources; second, an increase in information available on environmental damage. News media, as Madhava Sarma just emphasized, give stakeholders much improved and swifter access to information on incremental environmental impacts. Third, a corresponding increase in the resulting effects on company actions; and fourth,

an increase in public pressure on companies to respond.

Thus notwithstanding the many systemic weaknesses that have been highlighted at this conference, we are seeing more and more companies who recognize that failure to safeguard environmental standards constitutes managerial negligence and a breach of the manager's duty to shareholders. So even profit-maximizing managers do seek to manage environmental risk and the corresponding contingent liability at the firm level. This means that economic decisions are starting to reflect stakeholders' concerns, and in some cases—such as reduction of waste and improvements in energy efficiency—the economics are becoming more self-evident for shareholders.

But since the stakeholders affected are more than just the shareholders, a partnership between the private sector and the public at large is needed to strengthen the framework for integrating stakeholder concerns. This is where the process of disclosure, consultation, and participation between private-sector owners and operators and affected stakeholders in the broader sense becomes essential, and is often well-assisted by NGOs. Our experience has been that only if disclosure and participation in analysis of alternatives occurs early in the project preparation stage is it feasible to reflect stakeholder concerns effectively. Within the IFC's operations, strengthened disclosure requirements now reflect a dominant belief that community support is a precondition for the long-term viability and sustainability of a project.

Furthermore the combination of what I have referred to as self-evident ecoefficiency and environmental risk management at the firm level can provide powerful incentives for making sustainable development operational. So, at least in some sense, progress at the micro level is being made, and I think it will continue.

What about market failures and market gaps, the second part of my remarks? Well, the firm-level decision clearly breaks down when it comes to global externalities that do not yet have a price consequence for the firm—such as global climate change and biodiversity considerations. Varied economic instruments may internalize these costs, and therefore encourage market development. In most cases, though, these charges (or taxes, or incentives) simply do not exist, thus

eliminating the opportunity for a direct private-sector response to market signals. Even where the market might exist and a return is theoretically possible, high barriers to entry, or low perceived profitability, in practice deter the private sector.

In my opinion it is critical that public-private partnerships address such market failures and inefficiencies in such a way as to accelerate market development and encourage the private sector to invest in projects it would not otherwise pursue. Two problems, in particular, require attention if private sector funding is to become more attractive to the environmental goods and services sector. First, investments in this sector can have high relative transaction costs; second, investments in this sector are perceived by investors as having high risk.

So public-private partnerships play a key role in reducing these market inefficiencies. In terms of transaction costs at the investor level, investments could be bundled together into funds—thus increasing access, particularly for small- and medium-sized enterprises. At the sponsor level measures might include the reduction of transaction costs by introducing concessional public financing that buffers the excess costs of pioneering investments.

To reduce risk, initiatives might include guarantee mechanisms for long-term contracts or concessional public financing to provide credit extensions where maturities need to be extended, as well as concessional cofinancing to provide access to environmental projects due diligence and expertise, as well as to build institutional capacity in the financial sector to enhance environmental risk mitigation.

What are we doing about all of this? The IFC has entered into several partnerships to promote public-private sector collaboration to address these very issues. The most important of these partnerships are with public agencies with global environment objectives, particularly in relationship to the Global Environment Facility and the Montreal Protocol. Through this cooperation we are implementing a number of initiatives that address both market failure and market inefficiencies. The current portfolio totals approximately US\$100 million in publicly funded investment, expected to catalyze private financing at ratios between 5-to-1 and 11-to-1, so it is a very highly leveraged effort.

Perhaps the best way to describe this is to give some specific examples of what the IFC is doing. I am going to focus purely on environmental project initiatives, as opposed to the general area of private participation in public infrastructure, which I referred to earlier in my remarks and which is a very important and growing part of our business.

In the area of specific environmental initiatives I will quickly mention five. First, a biodiversity investment fund that we call the Terra Capital Fund. The market for biodiversity-related products and services is growing. Markets include organic farm products, sustainable forestry and aquaculture, and tourism. Both transaction costs and project identification costs are high. The objective of the Terra Capital Fund is to establish a US\$20 to US\$50 million investment fund for biodiversity projects in Latin America. We are going to target medium-sized projects (US\$500,000 to US\$10 million total cost) with concessional financing of US\$5 million from GEF for incremental fund management costs. Of course the GEF financing makes the whole exercise possible.

Second, another kind of investment fund: the renewable energy and energy efficiency fund. Projects in this sector clearly have potential to generate both financial and environmental benefits. But within emerging markets no fund exists to provide financing for this sector at acceptable costs. This fund is more ambitious in size, at US\$50 to over US\$200 million in global investments, and is structured to provide debt and equity financing for mid-sized renewable energy and energy efficiency projects under 50 megawatts. Here, too, the GEF is providing important concessional support that the market simply cannot offer.

Third, an efficient lighting project in Poland that involves compact fluorescent lights (CFLs), which have the potential to help achieve climate change and commercial objectives simultaneously, by reducing both cost to the consumer and emissions of carbon, SO₂, and NOx. But at present, for CFLs to become a viable alternative for consumers, price discounts are needed to promote demand, and they need to be passed right through the supply chain to the consumer. This particular program uses an innovative demand-side management program with a public-private

partnership to deliver the GEF subsidy direct to the manufacturer. As a result a US\$5 million GEF grant translated into savings of US\$40 million and 725 gigawatt/hours in consumer electric bills, or about 206,000 tons of carbon offset.

Fourth, let me mention a photovoltaic market transformation initiative, which we call PVMTI for short. We all know that the costs of providing PVM-generated energy can be lower than that of extending the grid, in certain applications. It is a potentially cost-effective means of bringing electricity and water pumping services to the poor, for example. Companies tapping this market face shortages of capital and underdeveloped sales, marketing, and distribution networks. Through this initiative The IFC will provide US\$30 million in concessional financing to reduce startup and expansion costs and provide technical assistance components in India, Kenya, and Morocco.

The important factor here is that generating an overall increase in the market size, increasing the scales of production, and reducing unit costs will lead to an enlarged market of possible applications, thus getting closer to a freer market solution.

Finally, let me mention a small- and medium-sized enterprise fund. Transaction costs for environmental projects are really highest for small- and medium-scale enterprises. This proposal aims to provide concessional financing to financial intermediaries to be on-lent or invested in small projects specifically targeted at climate change and biodiversity projects. Here again, the GEF is proving very helpful. It has provided US\$4.3 million in a pilot funding phase. The IFC then replenished it with another US\$16 million. Five financial intermediaries have been selected, and to cut a long story short, we have already committed several million dollars and 38 sub-projects have been approved, with an average size of only US\$17,000.

In conclusion I want to stress the importance of getting public concessional financing in partnership with private management, if we are to drive this whole area in the direction of market solutions. I hope these few examples show how some of the partnerships are already working; clearly, much remains to be done, but we are trying to play our part.

Aggregating Knowledge for Policy: Global Information Systems

Kass Green

As technology advances and population increases, our planet is changing more rapidly than ever before. Today, land managers and policymakers struggle to understand the effects and implications of change. Because as the world's population continues to increase, the land base remains fixed. The result is increasing resource scarcity, evidenced both by rising resource prices and expanding controversy over land use.

We are challenged to increase or sustain yields, while also maintaining ecosystem balance and function. We are challenged to discover efficiencies that increase ecosystem health and societal wealth. We are challenged to identify trade-offs that affect the distribution of wealth within countries, between nations, and across generations. Now, more than ever before, decisionmakers need timely and accurate information and tools to analyze spatial information in meaningful ways.

Resource management and policy have always required models that describe resources, predict what will happen to those resources if certain actions are undertaken, and prescribe the best course of action given specified goals. Until the 1980s most of the models were nonspatial, relying on economic models of behavior. However, past focus on yield, rather than place, left a gap in our understanding of conflicts over resources and land use. Because much of the discussion about resource issues really is a discussion about

how a particular area is to be used, we must understand spatial interrelationships.

The recent advent of geographic information systems (GIS) has enabled the development of spatial models. Geographic information systems are tools used to organize and display spatial information and analyze the spatial impacts of alternative decisions. They link maps to a database. But more importantly, a GIS provides a system approach to integrating information. Its power lies in the ability to manage *spatial* relationships over time. Drought, storms, fire, war, environmental degradation, floods, pest outbreaks, disease, and famine all have spatial dimensions. Because the World Bank focuses on simultaneously sustaining two systems, our ecosystems and our economies, GIS can be a powerful tool for system inventory, monitoring, and projection.

Every GIS is comprised of four components:

1. Computer software that provides the ability to enter, store, manipulate, analyze, and display the spatial data and attributes
2. Computer hardware needed to run the software
3. Data used as inputs for the analysis of alternative management decisions
4. People needed to operate the systems.

Data are the most expensive component of a GIS, often comprising 60 to 90 percent of the system cost. The need for inexpensive, accurate, and timely GIS data has created a collateral demand

for remote sensing. Remote sensing is the capture of data from a remote vantage point. Our eyes and ears are remote sensing systems. Manmade remote sensing systems usually rely on airplanes or satellites with cameras to capture the data, which are then turned into a computerized map, or GIS coverage, based on the landscape characteristics of interest.

One of the most compelling uses of GIS and remote sensing is in agriculture. World food organizations and regional agricultural agencies often use AVHRR, Landsat TM, IRS, and SPOT satellite data to identify crops, assess water use, monitor crop health, and predict commodity prices across vast areas of the world. Growers and agricultural companies use airborne digital systems to assess field crop stress. Farmers measure crop yield using GPS-equipped tractors. Information on yields, weather, slope, and soils are combined in a GIS to plan future plantings, time tilling and harvests, and to adjust fertilizer and pesticide applications.

Ecosystem managers use GIS to map and monitor wildlife habitat and the impact of human activities, such as harvesting and forest conversion. The World Wildlife Fund has used remote sensing and GIS to map remaining rainforests throughout Southeast Asia. Public and private organizations utilize GIS to manage and regulate resources to achieve a desired mix of future habitats across space and time. Other organizations use satellite imagery to monitor and stop illegal harvesting.

Disaster assistance organizations use GIS and remote sensing to monitor events such as fires, toxic waste spills, hurricanes, and floods. Weather satellites and GIS models are combined to warn populations of impending severe storms, and to mobilize disaster relief efforts. GIS can be used to better prepare for and react to disasters. For example, satellite imagery can be used to map fuels. Fire managers combine fuels maps with slope maps, weather data, and fire behavior al-

gorithms to predict where and when a wildfire will burn under varying conditions. This information is then used to reduce high fuel loads and to prepare for worst case scenarios before a fire starts. During a fire, thermal scanners are flown over fires to map current fire perimeters. The perimeters are linked to a GIS model to increase firefighting efficiency and safety.

Urban planning agencies use GIS and remote sensing to monitor residential and commercial development and to plan for infrastructure investments, such as water treatment plants. Other uses include tracking the movement of infectious diseases to discover and interrupt vectors of transport, and evaluating alternative mass transit plans to locate the most effective routes.

This paper has explored how geographic information systems and remote sensing can be used for discovery, modeling, investigating problems, and most importantly, seeking solutions. Both technologies have advanced substantially in the last 20 years. They are being used to address real world problems. They are no longer prohibitively expensive; they are now accessible worldwide.

However, GIS and remote sensing can be both a panacea and a Pandora's box. The panacea is the promise of the technology to meet the challenge of ecosystem inventory monitoring, planning, and policy analysis. The Pandora's box is poor data capture, miscommunication, conveying the wrong results, using the tools incorrectly, and overselling the capabilities.

One of the only ways to avoid the Pandora's box is to create ownership in the technology and in the process—to build a constituency. GIS and remote sensing are extremely powerful tools. However, if technocrats impose them from above, they will not be adopted. Rather they must be the tools of those affected, enabling them to better understand their world and the impacts of their decisions, for better care of this, our home.

Closing Remarks

Moving Forward: From Words to Deeds

Ismail Serageldin

We have come to that moment when we try to reflect on everything that has been said and done in the last two days, and see what we can pull together in terms of common threads. Recall that we started from the very structure and the title of this conference with the three pillars of science, economics, and law.

In that context during our discussions on the law and the legal framework, one issue arose several times today and will surely come up again tomorrow, when we deal with ethical issues. That was the need to recognize that we have to go back to basic principles in dealing with issues like the global environment. We must recognize that some things are beyond what can be regulated or legislated; they call for recognition of basic principles: the public good; responsibility toward others—the voiceless, future generations, other species; and the concept of trusteeship. Justice Weeramantry reminded us of the traditions from which we come. He also pointed out that the basic principles of international law, constructed around the building blocks of sovereign nation-states, involves not forced decisions, but the voluntary relinquishing of some sovereignty by each nation for a perceived greater good. This topic was also explored during the evening panel at American University, where a number of interesting papers were presented.

Are we seeking impossible new agreements? Have we progressed satisfactorily with imple-

menting what agreements we have made? Let us reflect briefly on what has been achieved. We have summarized all of the international agreements that have already been reached (see appendix __), which represent that consciousness, that collective will, to move toward solutions to global problems that we recognize as important. We have shown by such agreements and conventions that the important is not always pushed aside by the urgent or the mundane.

Climate change already has a framework convention; we are seeking, in Kyoto, to put some teeth into the protocol. Ozone depletion, which was ably discussed just now by Madhava Sarma and earlier by Mostafa Tolba is, of course, a case of a mature agreement, where we are moving toward the phaseout of ozone-depleting substances. In the case of biodiversity we have moved very far. I think more countries have signed the Convention on Biological Diversity than almost any other international convention. The difficulties are more in linking the science with effective actions and dealing with different regions, particular species, and entire ecosystems.

But that, too, is advancing around the collective will. In terms of endangered species, the CITES convention—with which you are familiar from the stories about elephants and ivory—is an effective agreement, as we all know from its impacts. The Ramsar Convention, dealing with wetlands; agreements on international watercourses such as the Zambezi River Accord, the

Nile River, and many others; the seas and the oceans. We have the law of the seas, but you also have 13 regional sea accords; the hazardous waste convention; the Basel convention, the World Heritage Convention, and many others.

So we are not so much faced with asking for something that is not being done. Rather the challenge is to build on that which has already been done—to deepen the collective consciousness and determine a common ground on which we all can act. Today we carried that perception further. We had four roundtables this morning discussing water, climate, desertification and forests, and biodiversity. Throughout the discussions that were summarized at the end of the morning session, there were common threads. Among these common threads were the need to work together and to find a way of overcoming existing obstacles.

In his summation Rudolf Dolzer referred to Eileen Claussen's summary of nine issues remaining outstanding before Kyoto, and her reminder that we have only 60 days in which to deal with them. I reflected on that and thought again of the wise counsel of Mostafa Tolba yesterday. He reminded us that the way to approach this is to ensure concepts of equity and fairness, not necessarily according to a mathematical formula, but so that the people who participate, who represent the interests of their nations, feel that they are being treated fairly: a concept of inclusion.

For those of you who have not seen it, I urge you to read President James Wolfensohn's speech to the Governors of the IMF and the World Bank, addressing the ministers of finance and the governors of central banks of the whole world, in which he said that *the challenge is one of inclusion*. In international agreements on the environment, many feel excluded: small states that feel forgotten; small states that feel they lack the power or authority to operate on a level playing field. And there are more who are truly excluded, the voiceless in so many states who do not have a say about either policy or agreements.

Yet we do not ask for mathematical formulae. We ask simply for a sense of fairness, and I think that is achievable and understandable by everybody, from the most distinguished researcher to the most ill-educated person. People have an innate sense of when something is fair and when it

is not. What we need, therefore, is to find ways to translate that sense into workable agreements.

Tomorrow we are going to devote the day to discussing ethics. I invite those who will be staying to participate in that debate, because so much of what we have been talking about will come up again: the sense of responsibility, trusteeship for this planet Earth and for future generations. This planet Earth, after all, as the wisdom of the ancients states, is not one that we inherited from our parents; it is one that we borrowed from our children.

That way of thinking offers a profound approach to the issues at hand. If we take that view, we say that nothing is really impossible; everything is possible and within our reach. This afternoon we heard from Alassane Ouattara, who reminded us that there are resources that can be saved, and not insignificant resources—US\$65 billion could be saved. That is about as much of the entire global ODA flow! It is simply a case of waste not-want not.

So it is possible to look for and find resources, if we have the political will. George Olah challenged us to think about imaginative, new solutions and not remain locked into perspectives or prejudices. Whatever the specifics of the particular proposal he presented, he certainly elicited a lot of discussion among us.

The final panel said: "We have talked a great deal about public-private partnerships: what can we do about it?" Sven Sandstrom, in summarizing the contributions of Henry Hatch, Madhava Sarma, and Jemal Kassum, pointed to the mobilization of a profession, the bringing together of the actors to recognize that much is already being done, and to build upon that. All that is true; I salute these efforts, and I think that all of them together give us grounds for optimism that we can move forward from rhetoric to action.

The last presentation, by Kass Green, was an exceptional one that brought in an essential dimension that is missing in much analytical economic work, and frequently from international treaties and scientific discussions, which move in averages. Her presentation brought in the physical, spatial dimension. So much of what we have to deal with, in terms of sustainability and the environment, is location-specific. Now we have the tools. Now we have no excuse.

When I studied economics, I decided to take a course on spatial economics, because I came from a physical planning tradition. The first sentence in the course just completely blocked my mind. They said: "Imagine a flat, featureless plain." I replied to the professor: "I can imagine a flat plain, but it is very difficult to imagine it featureless. The moment I see a plain, I start seeing some swaying grass, and birds flying, and mountains and sky."

It is not easy to completely abstract in this way, and we frequently forget that these abstractions, while they are very useful in terms of determining isoquants of equal transport costs in different directions, they are but artifacts of the mind that should not blind us to reality, which is always so variegated and so location-specific. And now, we have the tools, so let us use them.

But again what we are all about, as I reminded you yesterday with Margaret Mead's words, is to move from words to action. The fact that our numbers are small should not discourage us, because our coalition of the caring has history and rationality on its side; so let us act. The premises of action are important to reflect upon, and that is where I would like to spend the next few minutes with you.

We have talked about markets and the morality of actions, and I think that what came across in our discussions and debates yesterday was that markets are efficient instruments and tools. They are not necessarily either moral, immoral, or amoral. It is the law that must embody values, or else it will not be sustained and supported. If, indeed, as Daniel Bell mentioned in his *Reflections on the Cultural Contradictions of Capitalism*, there has been a disassociation of legality and morality, then there is truly no sense of purpose. That which may be legal may not necessarily be fair, or just, or equitable; it is these latter characteristics that can move people and bind them together.

But if societies today lack moral purpose, what is to be done? We need to mobilize people—people such as ourselves, and the NGO movement and civil society—to create the political will that transforms values into action. This is not impossible. Reflect on the abolition of slavery. Those who argued for the abolition of slavery and the slave trade in the early 19th Century were

known as the abolitionists. They did not talk about the need to provide incentives to reduce the levels of slavery. They talked about the fact that it needed to be abolished; that it was morally wrong.

That sense of moral outrage is somehow missing in so many things that we deal with today: the abolition of hunger—800 million people going hungry every day in a world that can afford food. Shouldn't we be able to abolish that? Surely, we should. Why not? Fix the environment on a global, national, regional scale? Why not? Let us reflect on the inspiring words of the late Robert Kennedy, who said: "Some people look at the world as it is and ask 'Why?' I look at the world as it could be and ask 'Why not?'" We must ask: why not?

The issue is one of public education to create that political will. President Clinton's conference across town has contributed to the public education campaign. But we live in a new world, where the technology of massive communication has also contributed to a greater difficulty in the mobilization of that sense of purpose we are talking about. It is a double-edged sword. Yes, technology and pictures allow us to reach millions and millions of people with a rapid and almost immediate presence. But at the same time the complexity and subtlety of messages get lost.

A study by Kiko Adato of Harvard University found the following statistic: The average sound bite on television, statements by presidential candidates in presidential debates, went from 42.3 seconds in 1968 to 9.8 seconds in 1980 to 8.4 seconds in 1992. That is the reality of the world with which we deal—not to mention the 500 channels and the ability to switch off whenever the discussion becomes less than inspiring or the discourse unsettling.

So we have to mobilize public opinion in each nation in the democratic tradition, which is by debating and engaging others; by marshalling the evidence (and that is what we have done); by finding the common ground (which we have done; and by identifying avenues and lines along which we can work—and that is what we have begun to do).

I say begun to do because part of the obstacle that we are dealing with is still the redefinition of the role of the state. Whereas in the legal con-

text the state is still sovereign, and it remains the essential building block of all international agreements—Justice Weeramantry reminded us that all international law is based on the voluntary relinquishing of part of that sovereignty for a greater good—we are still left with the fact that the state, even though it is sovereign in legal terms, is a strange amalgam in reality. It is retreating in its role as “do-er,” both in respect to the expanding role of the private sector and the market, on the one hand, and the expansion of the civil society, on the other.

A dual advance of market and civil society is redefining the role of the state, against a backdrop of globalization, which is making the state both too big and too small—too big to deal with its individual citizens and their local problems in an effective fashion from a centralized level, thus requiring devolution, and too small to have an impact on the broad trends of globalization.

This is where we must revisit what is happening globally. I know that many of the environmental friends and those who are concerned with global issues decry globalization. I would like to read to you the following comment about globalization:

Through its exploitation of the world market, it has given a cosmopolitan character to production and consumption in every country. To the great chagrin of reactionaries, it has drawn from under the feet of industry the national ground on which it stood. All old-fashioned industries have been destroyed. They are dislodged by new industries whose introduction becomes a life and death question for all civilized nations. In place of old wants, we find new wants, requiring for their satisfaction the products of distant lands and climes. In place of the old local and national seclusion and self-sufficiency, we have intercourse in every direction, universal interdependence of nations.

Friends, this quotation is from Karl Marx in 1848. It is not new. It is just the scale that is different. Therefore, it is up to us to ask: what is it that is qualitatively different now from what happened before with trade? What is posing these global problems for us today on that scale?

I think Daniel Bell, again, in his *Reflections on the Cultural Contradictions of Capitalism*, brought out two important points: that a startling socio-logical transformation took place, which was the shift from production to consumption as the fulcrum of capitalism. This was accompanied by the rise of consumer durables (cars, refrigerators, TVs). Then came the devastating invention of the installment plan, the most subversive instrument of all, because it undercut the Protestant ethic of thrift and saving. Against the traditional fear of going into debt has emerged the new fear of not being creditworthy.

This is a totally different perspective, one in which there is no need to save for the good things of life, because one can buy them and pay later. Marketing and hedonism are all part of the consumption mode. This is frequently reflected in indirect ways when we talk about the differential between emissions in the North and in the South, the differential between the ecological footprint of consumption in the North and in the South.

So what can we do? We have to harness these very same forces for the benefit of the poor and the weak, and that is the challenge of the partnerships that we have been trying to forge. For at the same time that global transactions total over US\$1.3 trillion a day—enough to buy and sell the entire U.S. GNP in a week—that same globalization opens avenues for the weak countries. They no longer need to rely exclusively on their domestic savings; they do not need to sell only in their domestic market; with good ideas they can reach out to the capital markets of the world for investment and sell to the entire world as their backyard.

The World Trade Organization, much maligned in environmental circles, is, in fact, one of the few agreements that has true symmetry. The smallest country, as a member state, can take the United States to arbitration.

So we have a new infrastructure emerging, and it is up to us to recognize that it is now favoring the educated, the nimble, and the powerful. Therefore, if we want to create opportunities and reach out to the poor of the world, making sure that they are included in that globalization, and ensuring that they benefit from it.

I am convinced that it can be done, and I am convinced that the fact that private-sector flows

are so large and public-sector flows so small is not something to be afraid of. It simply requires us to learn to design activities in such a way that the small amount of concessional and grant money that is available is used, merged, and married with the vast sums of private money to create imaginative solutions. The objective is not just to leverage total amounts, but to remove the obstacles and impediments, to reflect the internalization of social and environmental costs in a manner that will bring about the desired actions.

It is not impossible to do that, and I believe that we have come a long way in these last two days in discussing what it is that we should do.

William James has said concepts without precepts are empty, and precepts without concepts are blind. So, we have concepts. I think Bob Watson, in his eloquent presentation, showed us that everything is interconnected, and that sci-

ence is moving inexorably toward giving us sufficient knowledge on which to act. The economists, from Joe Stiglitz on, have mentioned that we can find the right incentives, and today we heard again that we can mobilize the private sector with adequate incentives to work together.

So how can we now mobilize civil society to create the political will that should enable us to move forward on the consensus and the common ground we have created? This precious shared perspective we have: that we are all citizens on planet Earth and that we are all responsible for its future. I believe that each and every one of us must, in events such as this one, confront our shortcomings but also celebrate our achievements, and then go forth with renewed vigor to create a better world.

Thank you each and every one; we have completed this year's ESSD conference.

PART TWO

SUMMARIES AND RESOURCE READINGS FROM CONFERENCE ROUNDTABLES

THEMATIC ROUNDTABLES

Climate Change

Summary

The theme of this meeting, Partnerships for Global Ecosystems Management: Science, Economics, and Law, is a most appropriate heading for those who want to seriously discuss climate change, since it links these disciplines in a unique manner, as well as North-South issues, and politics in general.

The panel discussed all of these issues; no one will not be surprised to hear that we did not reach any solutions. The negotiations in Kyoto still remain on the table. I think we have heard excellent reports on all of the various fields and had some quite remarkable insights.

On the science side, no one disagreed with Bob Watson, who spoke to this assembly earlier and also addressed our panel. He stressed that scientific evidence points clearly to human activities as the cause of increases in the atmospheric concentration of greenhouse gases and resultant climate change. Recorded changes cannot be explained on the basis of natural variability. If current trends continue, he warned, the result will be higher Earth-surface temperatures and sea levels, as well as significant changes in precipitation patterns worldwide, all of which has already begun.

Business as usual—continued economic and population growth and a consequent worsening of emissions levels—will have disastrous consequences for health, agriculture, food security, habitats, and waters and could create the potential for millions of refugees from droughts and

floods. Even worse, because there are long lags in the climate system, stabilizing current levels of greenhouse gas emissions now is not enough. In order to stabilize the current concentrations of gases, emissions must be *decreased*.

We have a special responsibility in this respect to our children, and also to the developing world, which will be the most vulnerable. The developing world must also begin to reduce emissions levels, he said, if acceptable global levels of climate stabilization are to be achieved.

Bob Watson also pointed out that if we take climate change seriously, the time to act is now, because of financial and economic considerations. If we act now we have more time, the disruption will be less severe, and the economic consequences can be better controlled.

We had a very fascinating contribution from Rajendra Pachauri, who began by pointing out that North America and the Organisation for Economic Co-operation and Development(OECD) countries are the biggest energy users. They have made by far the largest contribution toward cumulative emissions of CO₂ over the last 100 years. A large part of the developing world still uses biomass energy, mainly for cooking. Responsibility has to be defined in terms of who has contributed to the stock, or concentration, of gases.

If present trends continue, however, growing populations and high growth rates in developing countries are likely to result in a situation in which their emission rates outstrip those of de-

veloped countries. The most important factor in mitigating such a situation is technology. International organizations such as the World Bank Group could play a role in developing technology programs based on broad partnerships that could bring the technology needed to reduce greenhouse gas emissions in developing countries. One area where this could make a significant difference would be biomass energy use.

Regarding equity, Rajendra Pachauri noted that while the developed world continues to emit CO₂ into the atmosphere, more than 2 billion people in developing countries do not even have electricity. Imposing restrictions on developing countries will mean that millions of poor people will continue to go without such basic services.

He repeated a very memorable expression coined, I think, by Paul Ehrlich: There are developed countries, developing countries, and maldeveloped countries. Pachauri suggested that maldeveloped countries are those whose use of energy and natural resources are imposing a burden on the global community, and that if such countries would begin to set examples that demonstrate new paths toward sustainable development, by changing consumption patterns and lifestyles, instead of focusing exclusively on developing countries, others would be more likely to follow.

Rajendra Pachauri also pointed out that it is not true that developing nations have not made any progress with regard to climate change. He referred to initiatives with regard to renewable energy, photovoltaics, solar heating, and oil production. He closed by noting that one of the most important tasks of the World Bank Group may be to better inform both the developing and developed world about the issue of climate change, and to act as honest broker and ensure that the right actions to protect the atmosphere are taken.

We then had a very interesting contribution by David Roodman, who discussed the limitations of the current market in regard to renewable technologies. He began from the premise that climate change is not just about costs and benefits, but also about rights and wrongs. Economic models, he stressed, cannot really address the issues of the risk to future generations posed by not acting quickly on climate change. He said that we need a massive jump-start at the moment—

new subsidies for new technology and heavy taxes for those technologies that are not clean.

He suggested that a proper approach would be to raise the price of carbon emissions very gradually, but predictably, over several decades. If developed countries could agree to a large abatement of emissions and developing countries to a smaller abatement, the result could be a win-win situation—both groups of countries would protect their climates at prices reasonable for them. He suggested that the World Bank Group or other international institutions could serve as broker for such an arrangement. One of the practical implications for climate policy of such a move would be to influence technology planners to develop new, clean technologies.

We then moved on to Eileen Claussen's discussion of law and politics. She said that while the science is clear enough, progress on negotiations is not far enough along. We are only 60 days away from meetings in Kyoto, and she pointed out quite correctly that we have nine open issues at the moment, with no consensus in sight.

The first issue is binding targets and timetables. Japan, the European Union, and the small island states have all put forward different proposals. The United States does not yet have a formal proposal. So on the major issue: so far, no consensus.

We have no consensus on emission trading or on joint implementation. We have no consensus, obviously, on the demand of oil-producing countries for compensation. We have no consensus on the demands of the European Union to have a so-called "European bubble" in which the entire European Community would act as one unit, meeting targets jointly, but not individually. We have no consensus on the modalities under which the protocol would enter into force, or on what the developing world should do after Kyoto. Nor is there a consensus with regard to setting a timetable for agreeing to move on emissions reduction.

Eileen Claussen pointed out quite correctly that in the end, all of the arguments center around issues of fairness and equity. The U.S., Europe, Japan, and the developing countries all complain that other groups are not being fair; not taking certain key facts and factors into consideration. She suggested that the numbers and statistics

around which these arguments focus could and should be quantified and put on the table so that equitable formulas can be arrived at.

The disagreements are all quite fundamental, and the question is whether we will be able to make progress on these nine issues within the next 60 days. If major issues are not resolved in Kyoto, she concluded, they will have to be addressed in other meetings, because the problems are not going to go away.

My own view was a bit more optimistic. I think we have some major elements of a future strategy already in place. We need the details, the fine print. We already have the Framework Convention on Climate Change (FCCC), which does speak about the precautionary principle, common but differentiated responsibilities, and about the fact that developed states must take the lead. The FCCC also defines economic efficiency as one of the major criteria for global action.

We also have the Berlin mandate, and I want to make this point especially clear today, given what we read in the newspapers. Two years ago the international community decided during a conference what to expect from the developing states in Kyoto, as well as what not to expect; that was a binding decision. The decision was not to expect any new obligations for the developing states in Kyoto. However, it was added that after Kyoto there would be a review process to be completed by the year 2002, in which the issue of new obligations would be reconsidered.

So whoever demands at this point that the developing states accept new obligations in Kyoto places themselves out of the process, which has already been agreed on at the international level. However, at the same time, most of us agree that the developing states eventually will have to come into the picture—by the year 2030 or 2025.

By then, presumably, the annual output of greenhouse gases by developing states will be equal to what is now emitted by the developed countries. I do not think that developing states should take the negotiating position they have taken. They are the most vulnerable, and they should take a more proactive position. It is not in the interest of the developing world to remain a passive player in regard to this important topic, in my opinion.

My comment also refers to the position of the developing states opposing joint implementation. I think we need to use the funds we have at the moment in a very efficient way, and joint implementation is one way to move forward in the area of climate change. I do not share the concern of those who think that joint implementation will mean that many businessmen will be going around the world looking for projects in the developing world. The experience of the last two or three years has been exactly the opposite. I think that the developed states should agree that about 80 or 90 percent of the reductions that they undertake will be taken at home, and that should not be a serious problem.

In summary there was a significant consensus on the science of climate change, but considerable pessimism in relation to the next few months. There was one point on which most of us—perhaps all of us—agreed, and that was the role of the World Bank Group. All of us agreed that the World Bank has already become a major player with regard to climate change. Robert Watson pointed to what the Bank has already done, and noted that more might be done in the future. The World Bank Group has the finances and human potential and is in a better position than any other international institution to become the most effective actor in this very important field—as a broker between North and South.

Environmental Health Dimensions of Climate Change and Ozone Depletion

Reading

James A. Listorti

Executive Summary

According to the Intergovernmental Panel on Climate Change, the World Health Organization, the World Meteorological Organization, and the United Nations Environment Programme,¹ the overall health effects of climate change and ozone depletion are likely to be wide-ranging and negative. Developing countries will probably be the hardest hit and most constrained in finding options to prevent or adapt to the changes.

- *The most salient message of this report is that the indirect health effects of climate change and ozone depletion far outweigh the direct effects.* However, instead of complicating the issues, consideration of the indirect effects could furnish a wide avenue of opportunity to solve them. A World Bank study points to the vast untapped potential for the infrastructure sector (water, sanitation, transport, housing, and urban development) to help resolve health problems.
- *Current evidence points to a changing face of disease, with the reemergence of "once-conquered" infectious diseases, even in developed countries, and the emergence of new diseases.* Moreover new research on pollution-related diseases shows that the combined effects of many common pollutants can be more than 1,000 times stronger than when they act alone.

- *Solutions are possible, but they need to be included on agendas as preventive measures, where they do not yet appear.* Recent studies show that pollution prevention, at a minimum, can pay for itself; the U.S. Clean Air Act saved US\$16 in health damages for every US\$1 spent. Environmental literature shows that health is typically not included as a benefit, except for pollution control. If other factors are included, it could change the justification for environmental investments.

Considerations of environmental health can enhance the overall impact of projects dealing with natural resource management and ecology, in particular by improving the economic analysis used to justify investments. Too often health is considered as a separate issue rather than an integral facet of ecology. Economic analyses have concentrated more on costs than on benefits; health analyses have concentrated more on solutions for the healthcare system than on external preventative measures; and environmental analyses have concentrated on localized pollution, while neglecting other equally important factors. This paper makes a modest attempt at changing those emphases. This is not a "sky is falling" report, but one that alerts policymakers that they will confront these issues willingly or not.

Editor's note: This reading was prepared by James A. Listorti, tel: (202) 473-7044; fax: (202) 522-3240, Email: jlistorti@worldbank.org. This publication is based on research undertaken by the author with support from the Global Environment Facility (GEF). The views expressed are those of the author and do not necessarily reflect the views of the GEF.

Chapter 1 Global Environmental Health: Background and Context

We live in a changing world where the medical advances of the past half century have imparted a false sense of security about human capabilities and technology to overcome the vast array of killers of the past. In this second half of the 20th Century "public health as a whole was caught by surprise" and continued to expect the decline and eventual elimination of infectious diseases.² The emergence of new diseases, such as Acquired Immunodeficiency Syndrome (AIDS); the resurgence of former killers (tuberculosis); and possible reintroduction of vector-borne diseases (malaria) into areas thought to be eradicated all argue for a cautious approach and underscore the need for preventive measures. Climate change and ozone depletion are only two facets of these "changing unknowns"; both have a wide range of health consequences that have only begun to be addressed. Enormous progress has been made in phasing out ozone-depleting substances. Nonetheless, the spin-off effects may be even more important than direct effects, and may continue to pose threats to human health well beyond the day that the Montreal Protocol can be called "a job well done" (see box 1).

International transportation and trade have made the world smaller and humans more vulnerable to the resultant changes, many of which

are still unknown. Changing unknowns require careful scrutiny for two distinct reasons that are currently being overlooked. First, the synergistic effects of pollutants have been poorly studied, relative to extensive examination of single pollutants. A recent study, for example, showed that some pesticide residues can be 1,600 times stronger in combination than when acting alone!³ Second, many diseases have multiple causes, but, because of the current penchant for specialization, often only one aspect is considered. Lead, for example, has been studied throughout the world as a vehicle-related pollutant; much less emphasis has been placed on the wide range of equally deleterious sources of lead. This penchant to search out single factors—"reductionism" to scientists—frequently misses opportunities for remedial measures or misplaces their emphasis, especially those beyond pollution control. Consequently, the benefits of remedial measures are underestimated or their costs overestimated, making it harder to justify health interventions as sound investments rather than social overhead. Thus, considerable health benefits that are possible from interventions outside the healthcare system are *not* being systematically tapped. For example, recent studies indicate that the benefits of many health interventions clearly outweigh the costs. According to the U.S. Environmental Protection Agency (EPA), reducing air pollution from 1970-90 saved US\$16 for

Box 1 Direct and indirect sources and their effects: The case of ozone and lead

Policymakers could develop a mistaken notion that CFC reduction, however successful, has addressed health repercussions by analyzing its direct effects, such as skin cancer, cataracts, and immune system suppression. But these may pale against potential *indirect* effects, such as compromising food security and worsening of infectious diseases, which have been inadequately explored. A glance at lead may help make the point; by comparison, it has been extensively explored.

The toxic effects of lead, documented by the Romans and Greeks 2,000 years ago, show why we should look comprehensively at environmentally induced death, disease, or injury. Only for the past few decades have measures been taken to reduce human exposure, and these measures have been only partial, typically reflecting biases of a single profession,

such as engineering or medicine, rather than a coordinated effort to improve health. For example, in Mexico City more people are exposed to lead from traditional blue-glazed pottery than from automobile emissions, yet the thrust of remedial measures has been toward transportation. (In one study of school children with high lead blood levels, 40 percent was attributed to walking to school near heavy traffic, but another 40 percent resulted from chewing pencils!) By all means, the *perceived direct* effect, vehicle emissions, should be reduced, but the danger is that once vehicle emissions are amply reduced, authorities will consider the job done, neglecting other equally or more important, but *less obvious indirect* sources, such as lead from everyday household products, food, and water.

Source: E. Palazuelos, "Plomo y salud: Impacto ambiental de la reformulacion de las gasolinas en la zona metropolitana de la cd. de Mexico: Una evaluacion economica," Grupo interinstitucional de estudios en plomo, Noviembre de 1993, 29.

every US\$1 spent.⁴ A World Bank analysis of Sub-Saharan Africa suggested that more of the burden of disease might be alleviated through infrastructure improvements than from focusing strictly on the health sector.⁵

Since 1950 astronauts have gone to the moon and surgeons have replaced human hearts; it seems contradictory to suggest that some of the scourges of early this century, such as tuberculosis (TB), cholera, and malaria are returning. Cholera used to be seen as a disease resulting from poverty and poor sanitation. It is now clear that the cholera *vibrio* lives in small crustaceans (copepods), and is transported farther and lives longer than formerly assumed, when cholera was thought to be transmitted through drinking water and poor hygiene. Global warming plays a role, in that algal blooms that harbor the copepods have spread over larger areas, indeed, as far north as Norway.⁶

Besides a resurgence of old scourges 29 new infectious diseases have been discovered in the past 20 years. New diseases such as *Ebola* are not confined to remote areas, such as the forests of former Zaire. In 1990 in the U.S. city of Milwaukee, Wisconsin, *Cryptosporidium* in drinking water caused 100 deaths and 400,000 cases of sickness, of which 4,000 required hospitalization. Until then the disease had been associated with poverty and poor sanitation; but the source of Milwaukee's problem was farm runoff. The same economic growth that contributes to climate change also plays a role with *Cryptosporidium* because the pathogen, not killed by most disinfectants, used to be filtered naturally by wetlands.⁷ It is not clear to what extent these reported increases are a result of better science or changes in other causal factors. It is clear, however, that the complexities of these changes are not fully understood and call for a policy of caution. Climate change and ozone depletion are linked to all of them.

Lessons from the Literature

A recent World Bank study, *Bridging Environmental Health Gaps*, contained an extensive literature review, which concluded that:

- Literature dealing with health and environment emphasizes pollution

- Complicated, multisectoral problems are still being addressed by single-sector solutions
- Health is generally not considered in policy-making, outside the health sector.⁸

The Intergovernmental Panel on Climate Change (IPCC) has produced five significant reports.⁹ The first (1991) gave health only a passing reference, but the latest (1996) concluded that the health effects of climate change will be wide-ranging and predominantly negative.

The Stage Is Set

Even though many health linkages are marked by uncertainty, a confluence of several well-established trends has set the stage for a possible worsening of health related to environmental factors that are exacerbated by climate change. This phenomenon is already occurring in urban areas, but should not be viewed only as an urban crisis or limited to megacities. It is evidence of a set of broad changes linked to economic growth that are outstripping the management capability of governments.

Such potential problems are by no means limited to developing countries. In Washington, D.C., for example, the health commissioner alerted the elderly and people with weakened immune systems to boil drinking water because of high bacterial levels in July 1996. The commissioner learned of the situation through the press, because water quality is not reported to the Health Department. The alert, called off the next day, stemmed from the city's failure to periodically boost chlorine levels to kill bacteria that build up in the pipes over time. After a month of boosted chlorine, bacterial levels remained high enough to be considered unsafe for high-risk groups.¹⁰ The example is pertinent to climate change because:

- Bacteria multiply more rapidly at higher temperatures.
- Cash-strapped cities across the globe routinely sacrifice maintenance.
- It confirms that health is often handled without involvement of health professionals.
- It causes confusion, can lead to panic, and erodes public confidence in government.
- Most important, it opens the door for consideration of remedial measures that have not

typically been identified as related to the health effects of climate change.

A Juggling Act of Risks

We can no longer rely on the traditional paradigm that posits a positive health transition in conjunction with economic development. According to the paradigm as countries progress up the economic ladder they shift away from infectious diseases traditionally linked to poverty, such as influenza, diarrhea, and malaria, to the more "modern" diseases linked with industrialization, such as heart disease and cancers. The revised paradigm now needs to account not only for a combination of *both* types of known diseases, but also a *combination of new* risks related to changing global environmental phenomena.

The evolution of food production and uses of pesticides and fertilizers is a good example of this set of changing linkages; new evidence is confirming dangers only postulated before. Malaria has been combated effectively for 50 years, but the mosquitoes have built up resistance to pesticides and the parasite (in blood) is becoming resistant to medications; cases are now appearing in temperate areas where malaria was thought to have been eradicated. New studies point to dichlorodiphenyltrichloroethane (DDT), once

deemed safe for humans in public-health uses such as mosquito spraying, as possibly carcinogenic.¹¹ Animal studies link pesticides to human reproductive disorders and hormone disruption, ranging from breast cancer to short penises in children of agricultural workers.¹² Other research shows that fertilizers may contribute to the growth of algae that can potentially cause cancer, and that the algae can be transported long distances in air.¹³ Thus a better understanding of pesticides and fertilizers may show that their socioeconomic costs outweigh their perceived benefits to food production—indeed, the contribution of fertilizer emissions to global warming has probably been underestimated.¹⁴ These are not easy choices, but they will have to be made in the process of addressing climate change and ozone depletion.

Chapter 2 The Knowns

The health dimensions of climate change and ozone depletion cover a broad spectrum of *distinct* effects, but they are treated together in this paper to provide a more workable breakdown for decisionmakers than the traditional disease-based approach used in health reports. To highlight interrelationships, these distinct health problems are presented in table 1 in two catego-

Table 1 Health effects of climate change and ozone depletion

Potential main direct effects	Potential main indirect effects
Ozone depletion <i>UV radiation:</i> skin cancer, cataracts (maybe depression of immune system)	<i>Impairment of photosynthesis:</i> compromised food production (may exacerbate problems of groups with already compromised immune systems)
Climate change <i>Thermal stress:</i> death, illness, injury	<i>Habitat alteration:</i> infectious diseases, epidemics <i>Food production:</i> malnutrition <i>Water quantity and quality:</i> diarrheal diseases <i>Aggravation of air pollution:</i> aggravation of existing illnesses <i>Storms:</i> loss of housing; mental/physical stress of displaced persons <i>Floods:</i> (same as storms) <i>Desertification, droughts:</i> malnutrition; stress (as above) <i>Brush/forest fires:</i> (same as storms but to lesser extent) <i>Rising sea level:</i> susceptibility to storms, water pollution, salt water intrusion; vector-borne diseases; malnutrition <i>Social/demographic dislocations:</i> loss of infrastructure; mental and physical stress of displaced persons.
<i>Storms:</i> drowning and injury <i>Floods:</i> (same as storms) <i>Brush/forest fires:</i> injury & death	

ries: *direct* and *indirect*. This simplified breakdown emphasizes the need for a broader perspective if we are to find remedial measures inside and outside the health sector. When we perceive these broader effects and their spin-offs as inter-related elements of a changing world—one that links changes to climate with those of disease patterns—the *potential* for overall adverse health consequences becomes staggering. Many indirect effects also have substantial spin-offs, such as mental stress from loss of home or job after a disaster. The main link, which is still not fully accepted by the public, revolves around ecological disturbances that either cause or worsen health problems.

Overall Health Status

A World Health Organization (WHO) overview of the health situation in developed and developing countries—and by inference the different potential repercussions of climate change—is shown in table 2 (which, however, has not factored in climate change.) Since death rates do not capture the full socioeconomic impact of disease and injury, these are shown as Disability-

Adjusted Life Years (DALYs), a recently derived measure that combines premature deaths and years lived with disability (YLDs). The main characteristic of the developing countries is the predominance of infectious and parasitic diseases and the higher share of disability relative to death—an important distinction (see box 2).

Direct Effects

The direct effects of climate change and ozone depletion are the easiest to understand *and* to misinterpret. Because they are not among the most significant causes of disease, debility, and death (see table 2), they can create the mistaken notion that their health repercussions are not significant. This occurs for several reasons. First, many people equate global warming with heatwaves, when in fact the subtle temperature increases occur during the cooler seasons. Second, most of the health effects tend to be caused by disturbances of complex ecological systems, not single events. Heatwaves and storms, for example, are both manifestations of increased climatic *variation*, a related, but different aspect of climate change. Third, focusing on direct out-

Table 2 Top ten diseases/conditions (1990) by Indicative DALYs

Cause	World		Developed		Developing	
	DALYs (1,000s)	Deaths (1,000s)	DALYs (1,000s)	Rank	DALYs (1,000s)	Rank
Infectious, parasitic	372,539	9,454	5,757	7	366,782	1
Cardiovascular	147,920	14,345	39,118	1	108,802	3
Respiratory infections	122,790	4,314	3,902	11	118,888	2
Unintentional injuries	112,562	2,794	14,244	4	93,318	5
Perinatal causes	99,658	2,491	3,432	12	96,226	4
Neuropsychiatric	92,768	832	20,311	3	72,458	6
Malignant cancers	80,015	6,129	26,684	2	53,330	7
Nutritional/endocrine	53,183	651	2,185	15	50,999	8
Intentional injuries	50,100	1,432	6,488	5	43,612	9
Chronic respiratory	47,406	2,845	5,708	8	41,698	10
Total of top ten	1,178,941	45,287	127,829	—	1,046,113	—
Grand totals	DALYs 1,361,803	Deaths 49,971	DALYs 151,698	Deaths 10,883	DALYs 1,210,105	Deaths 39,088
Proportion DALY/Death		27		14		31

Source: C.J.L. Murray and A.D. Lopez, eds., *Global Comparative Assessments in the Health Sector* (Geneva: World Health Organization, 1994), 33-36, 53-54, Annex Tables 1, 2, and 3.

Box 2 Environmental health data for decisionmakers

Decisionmakers outside the healthcare system need help in prioritizing remedial measures to health problems, because traditional health data do not reflect causes or solutions. Two points are salient: (1) health-related policy is still heavily influenced by premature death rates, but (2) for environment-related diseases, long-term disability is more significant and tends to be underrepresented, even by Disability-Adjusted-Life-Years. For example, the ratio of disability to death measurements for developing countries is roughly twice that of developed countries (27 vs. 14, table 2). The impact on disability of intestinal worms, still a widespread problem

in developing countries, is seldom even listed because mortality is so low. Yet Years-Lived-With-Disability due to worms are triple those caused by malaria. (Table 3).

The predominance of the use of death rates in health-related policies is changing, partly due to new work on the economic evaluation of pollution-related morbidity. Nonetheless, decisionmakers need to realize that the role of the high levels of injury and disease (as opposed to death rates) linked to environmental health problems may be underplayed in interpreting the effects of climate change and ozone depletion. Similar arguments are appropriate for economic evaluation techniques, which likewise need interpretation of their face value (box 5).

comes of climate change (heatwaves and drought) could result in missing the far more profound aspects of long-term desertification, and their longer-term repercussions, such as mass migrations.

Skin Cancer

The main predicted effect of stratospheric ozone depletion is skin cancer caused by ultraviolet radiation (UV-B). A depletion of 10 percent over several decades would cause a 20 percent global increase in skin cancer in fair-skinned people, or about 250,000 additional cases annually.¹⁵ This is already a problem in the U.S., which has about 1 million new cases a year.¹⁶ UV-B increased at 7 percent per decade over central Europe and Canada, and at 10 percent per decade over Chile and Argentina.¹⁷

Cataracts

UV radiation contributes to the cause of cataracts, which account for nearly half the world's estimated 25 to 35 million cases of blindness. Current estimates indicate about a 0.7 percent cataract increase for every 1 percent decrease in stratospheric ozone. In poor countries cataract frequency is high because of micronutrient deficiencies and multiple diarrheal episodes, both of which contribute to cataract formation.¹⁸

Immune Suppression

Ozone depletion *might* also contribute to the frequency, severity, and duration of some infectious

diseases. The most disconcerting potential effect, UV radiation, is immune suppression. Many of the resulting problems are *postulated*: increased susceptibility to existing infections, triggering of latent viral infections,¹⁹ links with AIDS, and compromising the success of vaccination programs.

Thermal Stress

Thermal stress reflects abrupt changes in temperature that occur before the body can react gradually. Heatwaves, the most likely health effect of climate change, are more pronounced in temperate climates where sharp rises can double mortality,²⁰ as was the case in Chicago, Illinois in July, 1995, when 700 extra deaths occurred over four days in temperatures of 33-48°C (93-119°F).²¹ In Athens, Greece hospital admissions and mortality quintupled on the third day of a 1987 heatwave.²² Higher heatwave mortality has been documented in Canada, Germany, Greece, the Middle East, the Netherlands, and the U.S. Studies in North America, North Africa, and East Asia postulate several-fold increases in urban, heat-related deaths, especially in very large cities.²³ Thermal stress hits the poor and elderly hardest because they do not have cooling and heating systems to offset extreme temperatures.

Extreme Weather Events

The discussion below on indirect effects is most relevant for this category, since the collective human suffering in the aftermath of such events seems to be greater than the immediate effects of death and injury.

Indirect Effects

Interpreting the aggregate of indirect health effects is far more challenging than is the case for direct effects, since the range of technical determinants and their economic consequences are broader. Following breakdowns suggested by WHO, the United Nations Environment Programme (UNEP), and the National Science and Technology Council, these include:²⁴

- Infectious disease
- Food production
- Water for irrigation and drinking
- Diseases aggravated by air pollution
- Extreme events
- Sea level rise.

The vast array of *realistic* potential repercussions ranges from malnutrition to reproductive system disorders to injury from storms. Other effects are postulated, but cannot be proven—either because too many variables are at play or because effects on animals cannot be accurately compared to those on humans. Overall, it is likely that indirect effects would far out weigh direct effects.

Infectious Diseases

Infectious diseases consist of vector-borne diseases; that is, those with an intermediate host such as a mosquito or snail, and non-vector-borne diseases, or those spread mainly by direct human-to-human contact, such as TB or diarrhea. The deleterious effects differ for developing and

developed countries; not all would change due to climate change. In developing countries climate change would probably worsen existing problems overall, because it would exacerbate *many* infectious diseases. In developed countries climate change might alter the balance, returning circumstances to a disease profile similar to that of 50 years ago.

*Vector-borne diseases.*²⁵ Like malaria, many diseases involve an intermediate host; thus a key issue is how climate change and ozone depletion might alter habitat, feeding, and breeding habits of the vectors or intermediate hosts, or, likewise, exposure of humans (see box 3). Whatever the variables, there are already enough indications that argue for a better understanding of the relationships and the preparation of preventative or remedial measures. The major effect of climate change would be on the geographic distribution of the vector habitat and alterations to the lifecycles of mosquitos and snails, the impact of which is anticipated to be substantial and highly adverse to human health. Half the world's population is potentially at risk of exposure (see table 3). The top ten vector-borne diseases account for about 2.5 million annual deaths, mostly from malaria. Depending on control strategies, climate change, for example, could increase the portion of the world's population potentially exposed to malaria from the current 45 percent to 60 percent.²⁶ Potential increases would draw the temperate regions of China, Southern and Central Europe, Japan, Russia, Turkey, and the northern

Box 3 Why vector-borne diseases such as malaria are important

"Of all infectious diseases...malaria has caused the greatest harm to the greatest number."¹ Malaria, one of the oldest human afflictions, is still endemic in over 100 countries. Currently, 2.4 billion people are at risk; nearly 2 million people die annually from it, more than half children; about 350 million new cases occur each year.² Malaria accounts for 5,400,000 years lived with disability.³ Tropical, vector-borne diseases like malaria mainly afflict rural areas, but climate change could change that.

Historians cite malaria as contributing to the fall of Rome, Greece, and ancient Ceylon; but they sometimes forget recent events linked to climate change. In 1934 in Ceylon (now Sri Lanka) the monsoon did not appear,

transforming the well-watered, densely populated southwestern part of the country, where malaria was not present, into an area similar to the dry, sparsely populated north, where it was present. Malaria erupted into an epidemic, exacerbated by malnourishment that resulted from the fact that food production was curtailed by the drought. Malaria patterns, however, did not change in the north, where the climate did not change.⁴

1. Sir Macfarlane Burnet and David O. White, *Natural History of Infectious Disease* (Cambridge, U.K.: Cambridge University Press, 1972), ch. 18.

2. McMichael and others, *Climate Change and Human Health*, 77.

3. Murray and Lopez, *Global Comparative Assessments*, 53, 93.

4. Burnet and White, *Natural History*, ch. 18.

Table 3 Death and disability of top-ten vector-borne diseases (1990)

Disease/ condition	DALYs (thousands) ^b	Deaths (thousands) ^a	Population at risk (millions) ^c	Likelihood of change
Malaria	35,728	2,000	2,400	Highly likely
Schistosomiasis	4,529	200	600	Very likely
Dengue	N/a	23	1,8000	Very likely
Filariasis	845	6.4 ^d	1,100	Likely
Leishmaniasis	2,813	197	350	Likely
Trypanasomiasis	147	55	55	Likely
River blindness	1,783	35	123	Very likely
Chagas' disease	2,739	45	100	Likely
Guinea worm	N/a	—	100	Unknown
Yellow fever	N/a	30	450	Very likely
Total	48,584	2,585	Not applicable	Not applicable

Sources: (a) WHO, *World Health report 1995* (Geneva); (b) Murray and Lopez, *Global Comparative Assessments*, Annex Table 12; (c) Conference on Human Health, table 1; (d) World Bank, *World Development Report 1993: Investing in Health* (Washington, D.C., 1993), tables B.2, B.3.

U.S. into the malaria-risk sphere, as well as extend the current range to higher altitudes in the eastern highlands of Africa, the Andes in Latin America, and the western mountainous regions of China.²⁷ Predicted increases cite an additional climate-related 50 to 80 million annual cases by 2100, mostly in tropical and subtropical areas where mosquitoes already exist, but without the malarial parasite.²⁸ (These increases, however, do not include factors such as potential changes due to infrastructure improvements, urban/rural land use patterns, or social behavior.)

The variables are not simple and clear-cut. In areas where temperatures get too hot for vector survival, incidence of some diseases could actually decrease. And, even if reintroduced into temperate climates, the diseases would probably not be as devastating as they were before public health measures (spraying, habitat destruction, bed netting, education, and medication) reduced their spread.²⁹ Nonetheless, the situation is complicated by the parasite's resistance to medications, and no vaccines are on the immediate horizon. In 1976 drug-resistant malaria was confined to Southeast Asia; now it is global. This is further complicated by the mosquito's resistance to DDT, and its potential carcinogenicity, because an ecologically suitable—and equally effective—substitute is not yet available.

Viewed from another perspective, traditionally rural vector-borne diseases are adapting to urban conditions. Technically, India is the

only country with endemic urban malaria, but others could be added to the list. In addition to urbanization other forms of changing land use are already playing a key role in the changing pattern of vector borne-diseases, and global environmental change could aggravate or mediate those patterns. For example, in Indonesia and South America two species of mosquitoes that spread malaria have disappeared following deforestation; the reverse occurred in the Indo-Australian region with the intrusion of three species.³⁰ Periurban agriculture and recreation also play key roles, by changing land use and increasing human exposure. Ecotourism, golf, camping, and hiking are increasing throughout the world—as are diseases such as Lyme disease (spread by ticks) and giardiasis, spread by human and animal fecal contamination of drinking water.

Adaptation to urban conditions is not limited to developing countries. Malarial species still exist in the northern industrialized countries, where, in 17th-century Europe, "very few countries escaped [malaria]."³¹ The parasite in humans has been "eradicated," but the same is not true of the mosquito. International travel is changing that too. After a 50-year lapse, malaria has been locally transmitted in New York City, Houston (Texas), suburban California, Netherlands, and Russia.³² In Ethiopia, Indonesia, Kenya, and Zimbabwe mosquito breeding has already been observed at higher altitude (ranging from 1,700

to 2,100 feet).³³ In this vein the rapid spread of the current epidemic of dengue fever throughout Latin America might prove ample warning.³⁴ Dengue-free since 1960, some 1,146,750 cases were reported there between 1980 and 1990 (in addition to 1,315 in the U.S.)—and this is considered an underestimate.³⁵ The species that spreads dengue has migrated as far north as Washington, D.C. and Chicago.³⁶ The *Aedes* mosquito that spreads dengue favors breeding in small containers, so water storage and waste disposal may have a greater impact on its spread than global warming. The *Anopheles* that spreads malaria, by comparison, favors marshes and irrigation canals, where climate change would play a greater role.

Non-vector-borne infectious diseases. Non-vector-borne diseases cover a wide range: diarrheas due to poor sanitation (including cholera epidemics), food-related infections, and respiratory diseases. Changes in water distribution, humidity, and temperature would involve pathogen proliferation, while temperature has an impact on air pollutants. However, many infectious diseases depend on transmission by rats, rodents, flies, roaches, and bats (technically not “vectors,” since they merely transfer pathogens mechanically.) Cholera and rodent-borne illnesses are discussed below because of their unusual links to climate change, especially the El Niño Southern Oscillation (ENSO) and marine ecology, and because they may be benchmarks for other health repercussions related to climate change.

Cholera was once considered a highly communicable water-borne disease linked to poor hygiene. The *vibrio* could survive a week in water, but still depended on humans to maintain the link. That notion changed when the *vibrio* was recovered from crabs, water mains, rivers, sea water, and even dialysis containers in sanitary landfills. The cholera reported in Norway (1993) probably came from seafood.³⁷ A more virulent form of cholera has been spreading from South Asia toward Eastern Europe.³⁸ Recently it has become clear that cholera's survival outside human hosts is actually linked to marine ecosystems, particularly algal blooms, where it remains “dormant” in copepods in response to acidity, salinity, nutrients, and surface temperature—all directly influenced by climate change, urban waste, and agricultural run-off, among other factors.

Rodent-borne illnesses and the plague are also significant because climate change can alter rodent habitats, with considerable economic repercussions (see also below). What should have been a local epidemic of the plague in Surat in northern India (1994), for instance, evolved into an international incident. Indeed, Mother Theresa, coming from Calcutta, was almost banned entry into Rome. The plague-infested rats were driven into Surat by the combination of 90 consecutive days at 100°F and a long monsoon season. Expanded habitats for rodents, coupled with ever-increasing amounts of waste across the globe, portend significantly enhanced conditions for rodent-borne illness.

An otherwise obscure disease, leptospirosis, helps put the issue into perspective. The most widespread animal-to-human disease, it is spread by mammal urine (often rats), and is generally an occupational hazard for those working in waste management, animal husbandry, and meat processing. In low-income areas it readily becomes a public health problem when poor drainage and heavy rains cause flooding, which carries animal excreta. Even so, it is of little global significance presently—except for a rare observation in the US: 16 percent of inner-city adults in Baltimore and 31 percent of inner-city children in Detroit show antibodies, indicating exposure.³⁹ One epidemiological presumption is that increasing rat populations are increasing exposures. Global warming *might* be a key determinant for changes in rat population. Other factors could also be important; for example, an increase in garbage that attracts rats. One U.K. study even implicates the spread of pizza parlors and fast food in cities.⁴⁰ Identifying the determinants and relative linkages is a challenge requiring more attention, if we are to understand and be prepared for the potential effects of accelerated change.

Food Production

The main health consequences of climate change and ozone depletion on food production are malnutrition and exposure to pesticides and fertilizers. Currently, over 800 million people are chronically malnourished. Adverse consequences of malnutrition include a weakened immune system; new evidence is clarifying how malnutri-

tion predisposes the body to infectious diseases.⁴¹ In the context of the reestablishment of infectious diseases, new evidence points to malnutrition as a factor facilitating the evolution of benign viruses into pathogens in selected cases.⁴² In addition scenarios of compromised food production typically call for application of fertilizers and pesticides, whose use might have some of the most worrisome spin-off consequences: the potential for hormone disruption and reproductive disorders (see below). Drought and desertification also compromise food production (see below).

Crops, Fisheries, and Livestock. The IPCC has estimated that the overall medium- to long-term effects of climate change on crop production would be negative, on a modest scale, and concentrated in the tropics. Regrettably, this is precisely where malnutrition is common; that is, parts of Sub-Saharan Africa, southern and eastern Asia, and some Pacific Islands. The extent of these effects, however, is still uncertain, but a 2 to 3°C warming could have enormous economic consequences. Changes in temperature and rainfall could affect the productivity of animals and food crops, as well as their pests, predators, and diseases. Lower yields could be experienced in the global breadbaskets of southeast Asia, western Australia, parts of southern Europe, the Sahel, the Ukraine, and the U.S. Great Plains. By comparison, higher yields could be expected in Canada, Patagonia, and Siberia. Present models indicate that the world could still produce enough food to feed itself,⁴³ even though these shifts would affect thousands of current producers and potentially involve a transition adjustment with a range of possible consequences—including localized shortages and high prices, the health consequences of which have not been examined in detail. Food production could also be reduced because of UVB radiation.

Pesticides. The deleterious effects of pesticides, ranging from direct poisoning to potential cancers, have been extensively published, and thus will not be treated in detail in this paper.⁴⁴ Some of the most disconcerting news comes from recent studies on humans and animals,⁴⁵ and the disproportionate effect of pesticides on children.⁴⁶ Until recently, the dominant focus of literature on pollution was human cancers and animal mutations. This is now changing, as at-

tention shifts to reproductive disorders, in particular, endocrine disruption (endocrine glands produce the sex hormones estrogen and androgen). The greatest impact seems to be coming from widely used pesticides, organochlorines (which dissolve in body fat and accumulate to harmful doses) by mimicking natural estrogens.

Developing countries also bear the greatest burden of the negative health effects of pesticides. In 1985 WHO estimated that industrial countries used about 80 percent of the world's agrochemicals, but probably suffered only 1 percent or less of deaths due to poisoning.⁴⁷ The problem has not changed markedly since then. Many health repercussions remain poorly explored; for example, repackaging bulk containers for illiterate users, or farmers who increase doses improperly, thus contributing to building up resistance, rather than killing more pests.

Fertilizers. Compared to pesticides, fertilizers are relatively harmless to wildlife, livestock, and humans, but do cause two serious regional diseases: blue-baby syndrome (methemoglobinemia) and cancers (stomach, bladder, and esophagus). Blue-baby syndrome stems from ingestion of nitrates in some foods and from fertilizers and animal waste, which pollutes drinking water as run-off or as manure. Gastric cancer is common in Brazil, Chile, China, Colombia, Costa Rica, and Singapore. In Egypt bladder cancer accounts for about 30 percent of all cancers in males, and 12 percent in females, although it is also linked to schistosomiasis. Esophageal cancer is common in northern China, where mortality rates are as high as 150 per 100,000 inhabitants.⁴⁸ Such effects are important to take into account in case climate change has an impacts on food production that requires increased fertilizer application, with the concomitant linkages to algal blooms and greenhouse gases.

Diseases Related to Fresh Water Quality and Quantity

Linkages between health and water are broad and complicated. In development projects water management has been considered part of the agriculture or infrastructure sector. This sectoral separation meant that many lessons from the 1980s International Drinking Water Supply and Sanitation Decade have been missed. One key

health lesson entails the need to deal collectively with water supply, sanitation, drainage, irrigation, and vector-borne diseases; as well as pollution control. Globally, the most significant repercussions of not addressing these questions are diarrheas and vector-related diseases, followed by various pollution-related diseases tied to inadequate waste disposal. Adequate water quantity for personal hygiene is as important as water quality.

Absence of basic services. Without taking into account the impacts of climate change, today 1 billion people still lack clean drinking water. Fresh water availability is expected to decline in developing countries with high population rates. Even more people lack access to sanitation to keep water clean (table 4). Climate change could aggravate the situation in several ways, but two are indicative. First, reduced water supply could have negative health ramifications for food production. Irrigated agriculture, which produces about 30 percent of the world's food, consumes about 70 percent of its fresh water.⁴⁹ Pressures on irrigation might result in increased use of untreated wastewater, adding toxic exposure to the list of health problems. Second, higher temperatures will require higher standards in sanitation because pathogens in water are more prolific at higher temperatures. This could exacerbate other pressures, such as population growth, urban immigration, and tightening budgets. (See also section on rising sea level.)

Waste management. As solid waste increases globally, so do the risks of drinking water contamination, toxic exposures, spread of vectors,

and air pollution from disposal sites. To accommodate this increase and new chemical wastes, higher standards are needed for solid waste management, especially for toxic and hazardous wastes. This is all the more true in light of municipal budget constraints. However, water supply, sanitation, solid waste, and drainage are seldom planned as integrated services. With temperature increases, diseases related to inadequate services could worsen. Curiously, solid waste management in the 1800s aimed at getting waste away from people because of insects and rodents, and only later was water pollution regarded as an equally important hazard; today the roles are being reversed!

Irrigation and vector-related diseases. With global warming, vector-borne diseases, such as malaria and schistosomiasis (spread by snails), would be likely to increase (see table 3).

Diseases/Conditions Aggravated by Air Pollution

Respiratory diseases remain a leading cause of death and disability globally; in developing countries, the top cause of death for children under five years of age. Under various scenarios of climate change, the health effects of air pollution would worsen by: enhancing formation of secondary air pollutants, contributing to synergistic effects of existing pollutants, increasing formation of acid aerosols, accelerating chemical reactions that produce ozone, and promoting spores and pollen, which can aggravate allergies and lead to infections. These health effects could

Table 4 Populations served with water supply and sanitation

Region	Percent of population with water				Percent of population with sanitation			
	1980		1990		1980		1990	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Africa	66	22	79	32	54	20	68	22
Americas	78	42	90	52	56	20	82	36
Southeast Asia	64	31	73	64	30	6	50	12
Eastern Mediterranean	83	30	91	51	57	7	79	20
Western Pacific	81	41	91	66	93	63	92	76
Totals	75	34	85	59	60	31	74	40
Total urban and rural		46		68		39		51

Source: WHO, *The International Drinking Water Supply and Sanitation Decade: End of Decade Review* (Geneva: World Health Association WHO/CWS/92.12, Aug. 1992), Tables A.3 & A.4.

be especially pronounced in two areas—indoor air pollution and allergens—as global energy production leads to higher pollution levels, coupled with the exacerbating factors of increased temperature and ultraviolet radiation, with the concomitant effects noted above.

Indoor air pollution. Apart from tobacco smoke, the environmental health effects of indoor air have been poorly studied relative to ambient air pollution, which has concentrated on six “criteria pollutants” used to set air quality standards. Fossil fuels (coal, petroleum, and natural gas) and biomass (wood, charcoal, grass, crop residues, and dung) will remain the main energy sources for the next 50 years. About half the world’s population still cooks with biomass fuels, often in poorly ventilated houses. Fine particles (less than 10 microns in diameter) are serious offenders for indoor pollution because people spend so much time indoors; fossil fuel exhaust and wood smoke are the major culprits. Coal used for cooking and heating adds lung cancer to the list of respiratory ailments. Chinese women, for example, have the highest rates of lung cancer globally for women who do not smoke tobacco.

Allergens. The frequency and severity of allergic disorders such as asthma and hayfever would probably increase, due to higher concentrations of pollen and spores (mold) caused by wetter, hotter climates.⁵⁰ While allergens may sound insignificant, asthma is one of the most sensitive respiratory diseases and is often used in setting environmental policy (air pollution standards). It is a frequent cause of emergency room visits; hence costs can be very high. Again, indirect effects become significant: as irritants, allergens predispose the body to infections such as flu, colds, and bronchitis. Given that respiratory infections remain one of top disease groups in developing countries, a worsening of the situation would be significant.

Disease/Injury Related to Extreme Weather Events

Droughts, storms, floods (and possibly earthquakes) are likely to occur more frequently as a result of climate change.^{51, 52} Floods account for about 40 percent of damages. Tropical storms produce the most fatalities; about 20 percent.

Death and damage from such disasters appear to be increasing, but better monitoring systems are needed to confirm this globally.⁵³ The Intergovernmental Panel on Climate Change has concluded that no clear evidence exists that extreme events have become more intense or frequent over past decades.⁵⁴ (This does not mean data do not exist, only that proof is not definitive.) The combined effects of extreme events have hit developing countries hardest, in part because of poor preventive or responsive measures, and, in the tropics, because of their location in areas prone to extreme events. About 95 percent of 250,000 annual deaths from natural disasters occur in developing countries; major disasters account for about 140,000.

Floods. The main health repercussions from floods are deaths (mostly drowning), injuries, lost housing and jobs, contaminated water and food, malnutrition, electrocution (from power lines), and inoperable emergency services. Mortality ranges from 500,000-800,000 in China (1969) to 2,000 each for the Netherlands (1953) and Italy (1963).⁵⁵ Epidemics can also be significant. In Bolivia ENSO-related flooding (1983) led to a 70 percent increase in salmonella;⁵⁶ similar examples were reported in Bangladesh, Brazil, Chile, Mauritius, Sudan, and the US. In July, 1996, some 1,500 people died in floods across China; in the city of Hubei alone tens of thousands were sick or injured and nearly 400 died, while 2.36 million were left homeless.⁵⁷

Storms. Three of the cyclones with the highest recorded mortality hit Bangladesh in 1970, 1985, and 1991 with a collective death toll of 450,000 people.⁵⁸ More recently, in May, 1996, a tornado in Bangladesh killed 440, injured 33,000, and flattened 80 villages.⁵⁹

Desertification and Droughts. The health repercussions of droughts consist mainly of malnutrition, coupled with infectious diseases related to poor personal hygiene resulting from inadequate water and waste disposal. Both factors are worsened when victims are dislocated. The Sahel has been hit hardest as a region. During the 1973-74 drought, about 750,000 were adversely affected. In early 1991 some 4.3 million people faced starvation in northeast Africa due to drought. In 1985 malnourishment affected 70 percent of the children in Ethiopian refugee

camps.⁶⁰ There are no estimates of the collective toll of desertification.

Fires. Forest and range fires are likely to increase in frequency if temperatures increase and soil moistures decreases. The major health effects from such fires are injuries from burns and smoke inhalation and the release of particulate matter into the atmosphere. Secondary effects include erosion, which can increase subsequent hazards of flooding and landslides.

Rising Sea Level

Many health impacts would be associated with rising sea level; 13 of the world's 20 largest cities are located on a coast. Damage to waste management infrastructure would likely be significant if the sea were to flood drinking water sources and sewage treatment plants, causing backflows in sewers and storm drains. In developing countries infectious diseases would likely increase, as a result of exposure to coastal pollutants from agriculture and industry. Saltwater intrusion of groundwater might occur, complicated by pollution from waste sites. Vulnerability to storm surges would increase, as would injuries and loss of life. Diseases such as malaria might spread more rapidly due to changes in vectors. Aquaculture could be jeopardized, and coastal farmland inundated by salt water. Collectively, these factors could lead to population migrations and civil unrest from the combination of reduced housing stock and mental and physical stress on displaced persons.

Social and Demographic Dislocations

Most of the effects of social and demographic dislocations were discussed above, under ex-

treme weather events and rising sea level, the major difference in impact being the *reason* for and *length* of the dislocation.

Economic Dimensions

A considerable gap still exists between environmental and health economics. Whereas health economics concentrates on healthcare systems and individual diseases, environmental economics concentrates on natural resource management and pollution. Health considerations of climate change and ozone depletion can help bridge the gap by: first, clarifying that indirect effects are more important than direct effects; and second, expanding the horizon of economic benefits that might otherwise be overlooked. Too much attention has focused on costs and not enough on benefits. A U.S. Environmental Protection Agency (USEPA) assessment of benefits contains a powerful message: "In 1990, Americans received roughly 20 dollars of value in reduced [health] risks, and other adverse effects for every one dollar spent to control air pollution."⁶¹ (See box 4.) This assessment and the examples below show that many solutions to climate change and ozone depletion considered to be too expensive *are* feasible and affordable. Much depends on approach and economic analysis.

- The plague in India, attributed in part to increased temperatures, was estimated to have cost the international airlines and Indian tourist industry between US\$2 and US\$5 billion.
- Cholera in Peru cost its fishing industry US\$775 million and about US\$250 million in lost tourism, for a total loss of US\$ 1 billion in export earnings.⁶²
- The Caribbean's US\$12 billion tourist industry could be adversely affected by fear of chol-

Box 4 The power of economic costing of health benefits

A USEPA study gives evidence of the benefits of investing in health improvement based on the Clean Air Act. From 1970 to 1990, carbon monoxide emissions (mainly from vehicle exhausts) were reduced by 50 percent, sulfur dioxide (mainly from heating fuels) by 40 percent, and airborne lead (from automobiles and lead smelters) by 99 percent. Costs of US\$436 billion produced US\$6.8 trillion in health benefits, a return of 16-to-1!

Initially, environmentalists estimated that reducing SO₂ would cost US\$300 per ton; industry estimated US\$1,500. Today's costs are about US\$65 per ton. Moreover, it was also thought that reducing carbon monoxide, particulates, and chlorofluorocarbons would cost more. They too have been reduced, the latter by 90 percent. Disagreements over the accuracy of costs, benefits, or methodology may continue, but clearly, the salient point for decisionmakers is that benefits are sizable, and, at an minimum can pay for themselves!

- era associated with algal blooms and dengue fever that have become common locally.⁶³
- In Sakai, Japan (population 800,000), a heatwave-related outbreak of *E. coli* claimed nine victims, caused 9,000 illnesses (30 critical), and shut down 70 percent of city restaurants.⁶⁴
 - In Sub-Saharan Africa, where per capita incomes are as low as US\$300, some people spend US\$65 a year for mosquito nets and coils—20 percent of income to combat mosquitoes!⁶⁵

Natural Disasters

The annual global cost of natural disasters now exceeds US\$50 billion. About two-thirds of this figure represents direct damage; one-third reflects the cost of prediction, prevention, and mitigation—which help decrease costs. Such damages in developing countries are 30 times higher relative to GNP than in wealthier countries. In Bolivia, Chile, Ecuador, and Peru flood and drought losses associated with ENSO amounted to about 10 percent of GNP, or about 50 percent of annual public revenues. A 1970 Bangladesh cyclone destroyed two-thirds of its fishing along the coast and plains and 125,000 livestock animals.⁶⁶

Insurance

Insurance companies are concerned about climate change because their highest payouts come

from natural disasters.⁶⁷ Health costs often include damages to victims, the cost of remedial measures, and emergency medical services. However, uninsured losses are not always included. Table 5 gives a notion of the top ten most costly climate-related disasters, accounting for US\$27.5 billion in uninsured damages (in addition to US\$44.1 in insured damages). Figures are not available for personal injuries or for lost labor and food production.⁶⁸

Air Pollution Damages

Some economic dimensions of air pollution are being compiled and could serve as valuable inputs to determine the partial costs of aggravated air pollution caused by climate change. In Jakarta, Indonesia, respiratory infections are responsible for twice as many deaths as in the rest of the country, and 45 percent of morbidity. Reducing particulates to WHO guidelines could reduce considerable costs due to mortality, hospital admissions, emergency room visits, asthma attacks, and restricted activity days. (See box 5.)

Chapter 2 Uncertainties in a Changing World

Along with changes in disease patterns have come changes in research. Two are noteworthy. First, wildlife studies of the Great Lakes help answer questions about linkages between pollutants, fish, expectant mothers who ate the fish, and developmental effects in children.⁶⁹ The work is

Table 5 Ten most costly climate-related disasters worldwide, 1960–1993

Year	Type	Place	Deaths	Economic damage (US\$ millions)	Insured damage (US\$ millions)
1992	Hurricane Andrew	U.S.	74	30,000	16,500
1990	Winter storms	Europe	230	15,000	10,000
1991	Floods	China	3,074	15,000	410
1993	Floods	U.S.	41	12,000	1,000
1989	Hurricane Hugo	Caribbean	61	9,000	5,200
1991	Typhoon Mireille	Japan	62	6,000	4,500
1993	Winter storms	U.S.	246	5,000	1,750
1987	Winter storms	U.K., France	17	3,700	3,100
1992	Hurricane Iniki	Hawaii	4	3,000	1,600
1991	Cyclone/floods	Bangladesh	140,000	3,000	100
Totals			143,735	71,700	44,160

Source: McMichael and others, *Climate Change and Human Health*, 125.

Box 5 Caution using economic estimates of health damages

However useful economics may be in quantifying damages for decisionmakers, figures should be taken as guidelines, because they seldom reflect the full range of variables at play—mainly because many are still not measurable. Lead analyses, for example, tend to focus on vehicle emissions, but they do not calculate other sources that can be *equally or more important* (see box 1). The salient point for decisionmakers is that these estimates are useful at best as indicators; but even rapidly changing, cutting-edge changes should be regarded as “best available data.”

significant because it shifts the focus from pollution, which heretofore concentrated on cancer, to hormone disruption and reproductive disorders. These new research findings are *not* conclusive for humans, but raise a myriad of questions, the seriousness of which is underscored in the second study. The latter shows that the potency of some common pesticide residues increases markedly when they act in combination; their effects are actually increased by 160 to 1,600 times.⁷⁰

Uncertainties fall into three rough categories and are discussed below. Each has policy and investment implications. This discussion provides just a sample of such issues:

- Subtle linkages
- Gaps in information
- Gaps in understanding.

Subtle Linkages

Subtle linkages merely repackage existing information. They are important because solutions already exist, but are not being acted upon because of poor communication among professional groups. The three examples given below come from the infrastructure sector.

1. *The nondramatic effects of intestinal worms.* The literature deals very little with the changes in soil moisture that would affect the habitats of groundworms (nematodes), which cause intestinal worms and are still a major problem in developing countries. A 2°C increase in mean temperature would probably cause nematodes to increase.⁷¹ Intestinal worms do not kill, but the cost of lost labor can be high. In 1990 intestinal

worms accounted for 17,059,000 years-lived-with-disability globally, roughly triple the impact of malaria.⁷²

2. *Technology choice for solid waste management.* Development agencies have been promoting sanitary landfills to replace open dumps. Although covering waste with soil reduces insects, rodents, and burning, it also causes methane to develop under the surface. This trade-off has been recognized in terms of its contribution to global warming, but the attendant health risks have not been equally noted. Moreover, the global risk of spreading dengue, already an epidemic in Latin America, from “cleaner” landfills has not been systematically examined.

3. *Backlashes from environmental and economic development successes.* An increase of several degrees by 2100 could double vector capacity to transmit disease in tropical countries and cause a 100-fold increase in temperate countries.⁷³ Little attention has been paid to the potential contribution of the countless water bodies that have been resuscitated over two decades (such as the Hudson in New York and the Thames in London) to the spread of vector habitats, since mosquitoes generally breed in unpolluted waters. Similarly, little work has been done on contributions to changing vector habitats by water supply, waste management, housing, agricultural development, irrigation, and transportation projects.

Gaps in Information

Gaps in information exist in areas where technical factors are largely understood, but have not yet been applied broadly enough. Three examples are:

1. *Global warming, indoor air pollution, and respiratory disease.* The relationship between respiratory ailments and global warming has been poorly explored; for example: (a) the role of allergens as irritants predisposing to infection, and (b) indoor air pollution and the effects of more people spending more time inside because of higher temperatures.

2. *Behavioral issues.* The behavioral dimensions of change in vector habitat have been poorly explored; for example, what should *households* do differently; how would they respond to change? In July 1996 the Peruvian army ordered the city

of Pucallpa to clean up "tins, bottles, coconut shells, or any other junk," that had been facilitating breeding *Aedes* mosquitoes.⁷⁴

3. *GIS.* Geographic information systems have only begun to scratch the surface of health applications. In South Africa GIS is used to track malaria and monitor preventive spraying; the International Institute for Environment and Development (IIED) has developed mapping that overlays factors such as localized flooding and population distribution.

Gaps in Understanding

Gaps in understanding exist when technical factors are poorly understood; they are more serious than other gaps, since how and when they will be filled is hard to predict. Three are indicative:

1. *Acid aerosols that we breathe.* Understanding of the mechanisms of air pollution on the human metabolism is advancing rapidly, especially in the area of devising techniques for evaluating the economic dimensions of related health damages. Nonetheless, the actual chemical reactions, such as when air-borne pollutants react with ambient air or the mucus lining of the respiratory tract, are still limited to laboratory conditions. The continued burgeoning of cities and ranking of respiratory disease as one of the top global health problems both argue for a better understanding of climate change.

2. *Food security and food chain contamination.* A 1991 environmental health workshop on research priorities for the next decade listed food-chain contamination as one of six major gaps. No studies look at health and *regional* pesticide consumption, human exposures, crop uses, watersheds/airsheds, and food consumption.⁷⁵ Most climate change analyses concentrate on production (temperature changes and UV radiation), but significant gaps include: (a) increase in molds (mycotoxins) that cause loss/spoilage and can also contribute to immune suppression, (b) growth of marine biotoxins (as opposed to their ecological implications), and (c) spread of vector habitats that would preclude farming.

3. *Privatization.* Global privatization of public services, such as infrastructure, is increasing; but the potential health repercussions of this trend are *not* being examined. These could be signifi-

cant for services such as sanitation and rural energy, which still fall short of meeting basic needs.

Chapter 4 Recommendations for Remedial Actions

In June 1996 *The Economist* carried a discouraging article entitled "Protecting the Ozone Layer May Prove Easier than Curbing Global Warming." It conveys a common misconception that the hurdles that inhibit reductions in greenhouse gases will be far greater than those encountered in trying to reduce CFCs.

The cost of cutting carbon dioxide output will be higher—in the case of America perhaps \$30 billion a year initially, rising later to 1 to 2 percent of GDP. Curbing the costs of fossil fuels, the main man-made source of carbon dioxide, is tougher than doing without CFCs: the main substitute, nuclear power, has environmental problems of its own...And far from being wholly negative, climate change may actually be welcomed if it brings warmth to, say, Russia or Canada.⁷⁶

Part of the negative tone stems from a mentality that focuses on direct sources, reverting to one of the lessons from the literature: "define half a problem, devise half a solution." In this vein a recent World Bank infrastructure study might prove helpful.⁷⁷ It suggests that 44 percent of the burden of disease in Sub-Saharan Africa is potentially amenable to infrastructure interventions, compared with 32 percent from health sector interventions.⁷⁸ The figure was derived by merely rearranging diseases by their potential for remedial measures rather than by the traditional listing of their seriousness as health problems. The health problems examined in the study cover the same spectrum as the indirect effects of climate change (see table 6). Another World Bank study makes a similar point for infrastructure. It suggests that health benefits can be anchored through health components for as little as 2 percent of the cost of water supply, sanitation, and urban projects that were designed for objectives other than health improvement.⁷⁹ The salient point here is financial, not technical: in-

Table 6 General potential for remedial measures outside health sector

<i>Disease/condition</i>	<i>Remedial measures</i>
Respiratory disease (including TB)	Housing and air pollution abatement
Tropical cluster (including malaria, schistosomiasis)	Vector control, sanitation, and drainage
Diarrheal diseases (including intestinal worms)	Water and waste management
Unintended injuries	Household and traffic injury reduction
Childhood cluster (including whooping cough, measles)	Health care and education

vestments outside the health sector have already been justified economically, in large part, on perceived benefits other than health. Thus the addition of health benefits potentially costs much less than it would in a health project alone, which can also help justify projects in other sectors.

Despite debates over statistics and costs, it is clear that the potential for cross-sectoral collaboration is high, and related interventions can, at a minimum, pay for themselves. Thus expanding the range of direct health problems to stress those that are *indirect* actually extends the possibilities for their resolution. Air pollution provides an important, but often overlooked, area for linking energy and health policy—particularly in devising economic justifications for investments—because the same activity that produces

greenhouse gases produces outdoor and indoor air pollutants. Moreover considerable progress is being made—literally by the day—in devising better techniques to evaluate human health damages from air pollution. The addition of health criteria to ecological criteria can also help redefine priorities. For example, the deleterious effects of ozone depletion are more harmful to the natural environment than they are to human health. It is often harder to eliminate items from a budget than add them; including health criteria can help in the process.

Information Flow

An important factor overlooked in the health dimensions of climate change and ozone depletion is the potential for helping reverse the information flow, which now goes from industrialized to developing countries. In the areas of vector biology and indoor air pollution, there is potential to learn from the developing world. This potential should be tapped.

Recommendations

Recommendations fall into four categories:

- Synthesis of other recommendations
- Multinational vs. global issues
- Investment potential
- Targeted research.

Synthesis of Other Recommendations

Several conferences have been held and several books published on the subject of climate change, ozone depletion, and human health, many of them with recommendations; but very few weave the issues together in a cross-sectoral fashion.⁸⁰ These works should be summarized and fed into “Targeted Research” (below).

Box 6 Solutions outside the health sector

World Bank studies that suggest that more potential health benefits in Sub-Saharan Africa are available from infrastructure than from health projects (44 percent vs. 32 percent) for only a fraction of the cost (2 percent) are important more for their focus than for the thumbnail calculations. The salient point for decisionmakers is that substantial opportunities for solving health problems have not been tapped because of a tendency to follow single-sector approaches. Reducing respiratory disease via a combination of interventions from the health, infrastructure, and energy sectors, for example, can have repercussions in which the whole is greater the sum of its parts. In this case improved stoves, fuels, and household ventilation can also help to address one of the single most important global health problems, as well as reduce greenhouse emissions. These thumbnail calculations should be applied to climate change and ozone depletion to see if they can identify realistic estimates of specific interventions, which can help justify, on health grounds, investments that appear otherwise too costly.

Multinational vs. global issues

Elements of global significance—as opposed to national problems that exist globally—such as transnational air and water pollution, need to be identified and their health dimensions analyzed. Funding implications need to be thought out, especially in view of bureaucratic compartmentalization that often blurs institutional direct responsibility. Initially, linkages in the following areas could be examined:

- Human health and biodiversity, especially linkages to pesticides
- Human health and pollution of international waters
- Dirty dozen air pollutants selected by UNEP/WHO
- Indoor/outdoor air pollution linkages and air pollution linkages with water pollution.

Investment potential

Identify issues that could lead to investments. The inclusion of health dimensions could considerably enhance investment potential; for example, the combined benefits of improved stoves that could reduce respiratory disease as well as greenhouse emissions. Criteria could include:

- Measures outside the healthcare system to help reduce greenhouse gases and CFCs
- Linkages to established animal/ecology research, especially pesticide research

- Potential for economic incentives to reduce greenhouse gases and CFCs
- Prioritization and evaluation of issues identified in this paper, bearing in mind that these are a representative sample, not a comprehensive listing (see table 7).

Targeted Research

Limited research could be based on assessments of gaps identified by the IPCC, *Climate Change and Human Health*, and this paper, such as:

- Development of monitoring indicators for global, regional, and local uses; indicators that would carry the force and common usage of factors such as GNP/GDP⁸¹

Potential health risks that could come from private sector solutions to global problems, for example, how the profit motive could positively or adversely affect health, and the policy and economic incentives that could evoke those responses.

Notes

1. See A.J. McMichael, A. Haines, R. Sloof, and S. Kovats, eds., *Climate Change and Human Health: An Assessment Prepared by a Task Group on Behalf of the World Health Organization, the World Meteorological Organization, and the United Nations Environment Programme* (Geneva: World Health Organization, 1996).

2. Richard Levins. "The Challenge of New Diseases, in *Disease in Evolution: Global Changes and Emergence of*

Table 7 Worksheet for priority setting of health issues related to climate change and ozone depletion

Issue	Potential priority	Issue	Potential priority
<i>Vector-borne</i>		<i>Pollution control</i>	Medium
Malaria	High	<i>Air pollution</i>	High
Others	High	Allergens	Low
<i>Non-vector borne</i>	Medium to high	Other pollutants	Medium to high
Cholera	Medium	<i>Extreme events</i>	Medium
Leptospirosis	Medium	Storms	Medium
Algal blooms	Low	Floods	Medium
<i>Food production</i>	Medium to high	Desertification/droughts	Medium
Crops	Medium	Fires	Low
Pesticides	High	<i>Rising sea level</i>	High
Fertilizers	Low	<i>Dislocations</i>	High
<i>Water quality/quantity</i>	High	<i>Thermal stress</i>	Low
Basic services	High	<i>Skin cancer</i>	Low
Waste management.	High	<i>Cataracts</i>	Low
Irrigation	High	<i>Immune suppression</i>	Low

- Infectious Disease*, in Mary E. Wilson, Richard Lewis, and Andrew Spielman, eds., report of a workshop, *Annals of the New York Academy of Sciences* 740 (1994), xvii.
3. Steven F. Ford and others, "Synergistic Activation of Estrogen Receptor with Combinations of Environmental Chemicals" *Science* 272: 1489-492 (June 7, 1996).
 4. EPA, *The Benefits and Costs of the Clean Air Act, 1970-1990* (Washington, D.C.: United States Environmental Protection Agency, May 3, 1996), draft.
 5. James A. Listorti, *Bridging Environmental Health Gaps: Volume I, Lessons for Sub-Saharan Africa Infrastructure Projects*, World Bank, Africa Technical Department, Environmentally Sustainable Development Division (AFTES), Washington, D.C., 1996.
 6. A.Z. Henriksen and others, "Severe Gastroenteritis after Infection with *Vibrio cholerae* non-01," *Tidsskrift Norsk Laegeforening* 113 (24): 3017-18 (Oct. 1993).
 7. G.Thomas Strickland, *Hunter's Tropical Medicine* 7th ed. (Philadelphia: Harcourt Brace, 1988), 573.
 8. James A. Listorti, *Environmental Health Components for Water Supply, Sanitation and Urban Projects*, World Bank Technical Paper 121, Washington, D.C., 1990, ix.
 9. (1) J. Jager and Ferguson, eds., *Climate Change: Science, Impacts and Policy: Proceedings of the Second World Climate Conference* (Cambridge, U.K.: Cambridge University Press, 1991); (2) *Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment* (Cambridge, U.K.: Cambridge University Press, 1992); (3) *IPCC's Second Assessment Report: 1995*; (4) *Climate Change 1995: Vol. I- The Science of Climate Change, Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel Change on Climate Change*; and (5) *Climate Change 1995 (Vol. II), Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses—Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, U.K.: Cambridge University Press for the World Meteorological Organization and United Nations Environment Programme, 1996).
 10. *The Washington Post*, July 10, 1996, A16; Aug. 8, B3.
 11. L. Lopez Carrillo and others, "Is DDT Use a Public Health Problem in Mexico?" *Environmental Health Perspectives* 4 (6): 584-88 (June 1996).
 12. Devra Lee Davis, G. Friedler, D. Mattison and R. Morris, "Male-Mediated Teratogenesis and Other Reproductive Effects: Biologic and Epidemiologic Findings and a Plea for Clinical Research," *Reproductive Toxicology* 6(4): 289-92 (1992).
 13. W. W. Carmichael, "Toxins of Cyanobacteria," *Scientific American* 270 (1): 84 (Jan. 1994); personal communication with Prof. Xue Shouzhen from Shanghai Medical University.
 14. This refers to the contribution of nitrous oxide from agriculture; "Environmental Data Service" (UK), 264, Jan. 1997, 11-12.
 15. A.J. McMichael, "Climate Change and Human Health Risks," paper presented to the Conference on Human Health and Global Climate Change, National Academy of Sciences, Washington, D.C., September, 1995, 9; UNEP, *Environmental Effects of Ozone Depletion: 1994 Assessment* (Nairobi: U.N. Environment Programme, 1994); J.D. Longstreth and others, "Effects of Increased Solar Ultraviolet Radiation on Human Health," *Ambio* 24 (1995) 153-65.
 16. McMichael, "Climate Change and Human Health Risks," 12.
 17. Jay Herman, *Geophysical Research Letters*, Washington, D.C.: The American Geophysical Union, Aug. 1, 1996.
 18. A.J. McMichael, A. Haines, R. Sloof, and S. Kovats, eds., *Climate Change and Human Health: An Assessment Prepared by a Task Group on Behalf of the World Health Organization, the World Meteorological Organization, and the United Nations Environment Programme* (Geneva: World Health Organization, 1996), 166-67.
 19. McMichael and others, *Climate Change and Human Health*, 167-79.
 20. McMichael and others, *Climate Change and Human Health*, 51; J.A. Longstreth, "Human Health," in J.B. Smith and D. Tirpak, eds., *The Potential Effects of Global Climate Change in the United States*, U.S. Environmental Protection Agency (EPA-230-05-89-050) (Washington, D.C., 1989), 525-56; G. Tan, "Potential Effects of Global Warming upon Human Mortality in Shanghai and Guangzhou," *Acta Scientiae Circumstantiae* (14): 368-73 (1994).
 21. CDC, "Heat-Related Mortality—Chicago, July 1995," *Morbidity and Mortality Weekly Report* 44(31): 577-79 (1995); Jan Semenza and others, "Heat-Related Deaths during the July 1995 Heatwave in Chicago," *New England Journal of Medicine* 335 (2): 84-94 (July 11, 1996). Curiously, the latter article concludes that those of greatest risk of death were those with illnesses who were socially isolated and did not have air conditioning.
 22. McMichael and others, *Climate Change and Human Health*, 52.
 23. McMichael, "Climate Change and Human Health Risks," 5.
 24. McMichael and others, *Climate Change and Human Health*, 12.
 25. Vector-borne diseases involve intermediate hosts (such as mosquitoes and snails) necessary for development of the pathogen that eventually infects human beings. Mosquitoes must first bite an infected host; the parasite undergoes development inside the mosquito, which then passes it on to another human in its next bite. *Anopheles*, which spread malaria, breeds in clean water, such as marshes, irrigation canals, and ponds, whereas *Aedes*, which spreads dengue, breeds in water storage containers and clean refuse. Insects such as

- flies and roaches, which mechanically transfer pathogens, are not considered to be vectors.
26. McMichael and others, *Climate Change and Human Health*, 82.
 27. W.J.M. Martens and others, "Climate Change and Vector-borne Diseases: A Global Modelling Perspective," *Global Environmental Change* 5 (3) (June 1995): 204, 209.
 28. McMichael and others, *Climate Change and Human Health*, 82; W.J.M. Martens and others, "Potential Impact of Global Climate Change on Malaria Risk," *Environmental Health Perspectives* 103 (1995): 458-64; P. Martin and M. Lefebvre, "Malaria and Climate: Sensitivity of Malaria Potential Transmission to Climate," *Ambio* 24 (1995): 200-07.
 29. Strickland, *Hunters Tropical Medicine*, 592.
 30. McMichael, "Climate Change and Human Health Risks," 73.
 31. Frederick F. Cartwright, *Disease and History* (New York: Mentor Books, 1972), 140.
 32. Marcelle Layton, Monica E. Parise, and others, "Mosquito-Transmitted Malaria in New York City," *The Lancet* 346 (8977): 729-31 (Sept. 16, 1995); A.J. McMichael, "Global Environmental Change and Human Health," paper presented at the "Global Changes and Human Health" Seminar, Royal Swedish Academy of Sciences, Stockholm, May 29, 1996.
 33. McMichael and others, *Climate Change and Human Health*; Pim Martens, *Health Impacts of Climate Change and Ozone Depletion: An Eco-Epidemiological Approach* (Netherlands: University of Maastricht, 1997), 55.
 34. Dengue fever, on the increase over the past 30 years, is spread by the *Aedes* mosquito, which can breed in water storage containers, flower pots, and discarded tires; the mosquito has adapted well to global urbanization.
 35. PAHO, *Dengue and Dengue Hemorrhagic Fever in the Americas: Guidelines for Prevention and Control*, Pan American Health Organization Scientific Publication 548 (Washington, D.C., 1994), table 1.
 36. Jane Stevens, "Dengue Cases on the Rise: Mosquito-borne Tropical Fever Still Rare in U.S.," *The Washington Post*, June 6, 1995, 7.
 37. Henrikson, "Severe Gastroenteritis," 3017-18.
 38. Paul R. Epstein, "Emerging Diseases and Ecosystem Instability: New Threats to Public Health," *American Journal of Public Health* 85 (2): 168-72 (1995).
 39. James E. Childs and others, "Risk Factors Associated with Antibodies to Leptospires in Inner-city Residents of Baltimore: A Protective Role for Cats," *American Journal of Public Health* 82(4): 597-600 (April 1992); James H. Gallop and others, "Rat-bite Leptospires," *The Western Journal of Medicine* 159 (1): 76-78.
 40. Thomas Gray, "Rat Race, 1993," *World Health* 46 (3): 28 (May-June, 1993).
 41. A. M. Tomkins, "Protein-Energy Malnutrition and the Risk of Infection," *Proceeding of the Nutrition Society* 45 (1986): 289-304, cited in *Climate Change and Human Health*, 107.
 42. Also worrisome in a context of reestablishment of infectious diseases is that malnutrition may facilitate the evolution of benign viruses into pathogens, which has occurred in one instance for selenium-deficiency; see M.A. Beck and others, "Rapid Genomic Evolution of Non-virulent Coxsackie Virus B3 in Selenium-deficient Mice Results in Selection of Identical Virulent Isolates," *Nature* 1 (5): 433-36, cited in McMichael and others, *Climate Change and Human Health*, 107.
 43. McMichael and others, *Climate Change and Human Health*, 111.
 44. Gordon R. Conway and Jules N. Pretty, *Unwelcome Harvest* (London: Earthscan Publications, 1991), ch. 3.
 45. Theo Colburn, Dianne Dumanoski, and John Peterson Myers, *Our Stolen Future: Are We Threatening Our Fertility, Intelligence and Survival? A Scientific Detective Story* (New York: Dutton, 1996).
 46. John Wargo, *Our Children's Toxic Legacy: How Science and Law Fail to Protect Us from Pesticides* (New Haven: Yale University Press, 1996).
 47. Editorial, *British Journal of Medicine* 42 (1985): 505-06.
 48. Conway and Pretty, *Unwelcome Harvest*, ch. 5.
 49. Ismail Serageldin, "Water Resources Management: A New Policy for a Sustainable Future," *Water International* 20 (1995): 15-22, cited in McMichael and others, *Climate Change and Human Health*, 138.
 50. J. Emberlin, "The Effects of Patterns in Climate and Pollen Abundance on Allergy," *Allergy* 49 (1994): 15-20.
 51. Disasters fall into four categories: (1) sudden natural events, such as avalanches, floods, and cyclones; (2) long-term natural events, such as droughts, desertification, or famine; (3) sudden, human-made events, such as structural collapse of buildings, (4) long-term, human-made, such as climate change.
 52. McMichael and others, *Climate Change and Human Health*, 134.
 53. D. Alexander, *Natural Disasters* (New York: Chapman & Hall, 1993), cited in McMichael and others, *Climate Change and Human Health*, 135. One data base, EMDAT, held by the University of Louvain in Belgium, is making statistical analyses of these events and is being used, for example, to make linkages with El Niño and people affected by disaster, and by the Red Cross.
 54. McMichael and others, *Climate Change and Human Health*, 124.
 55. McMichael and others, *Climate Change and Human Health*, 131.

56. A.V. Telleria, "Health Consequences of Floods in Bolivia," *Disasters* 10 (1986): 88-106, cited in McMichael and others, *Climate Change and Human Health*, 138.
57. CNN, "Flooding Takes Heavy Toll in China, India and Bangladesh," CNN Interactive World News Story Page, July 26, 1996.
58. McMichael and others, *Climate Change and Human Health*, 125.
59. *The Washington Post*, May 15, 1996.
60. Alexander, *Natural Disasters*, cited in McMichael and others, *Climate Change and Human Health*, 133.
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Biodiversity

Summary

Seven main points sum up the discussion of this panel. The first was a recognition that biodiversity is a major challenge for world survival and constitutes one of the key environmental problems facing us in the coming years. The rate at which biodiversity is being extinguished today is estimated at 1,000 times the replacement rate of the last 66 million years; between 1,000 and 10,000 species become extinct for each species that evolves on earth.

At the same time panelists recognized that many scientific uncertainties persist (as is the case in other environmental areas), and these uncertainties are undermining policy work. But, the panel stressed, we do not have the luxury of waiting for certainty before acting.

Two responses to the "knowledge gap" were mentioned. One was the need for more research into biodiversity issues. The other was the need for an expansion of what could be called "ecoculture," or the promotion of knowledge and understanding of the importance of maintaining biodiversity at all levels of society.

A better understanding of biodiversity's contribution to the provision of a wide range of goods and services might help decisionmakers address the many market failures that lead to socioeconomic problems, which in turn result in loss of biodiversity. Most of these market failures have to do with the tendency of policymakers to focus on the short term and their blindness with regard to externalities.

A second important point was related to financing, which obviously is insufficient to address all the challenges of biodiversity. A striking comparison was made between the enormous resources and knowledge devoted to the exploration of other planets and those devoted to the knowledge and exploration of our own planet and its species.

A third point also made very strongly was that all existing instruments to address these challenges should be used, including the "dusty, old conventions" developed to play a role in the war against this major challenge. Not only must these instruments be used, with all their accumulated experience, but they should be reinforced and more emphasis should be placed on implementation.

The fourth point was a question about the direction of our policy work; the consensus was that it should include mainstreaming, simplifying, and broadening.

Mainstreaming has to do with expanding biodiversity concerns in major policy arenas, including—and this was underlined several times—macroeconomic issues, especially global macroeconomic issues. International Monetary Fund programs and major economic conferences, especially on trade, are important places for introducing logics other than short-term economic ones into the overall logic of policymaking. Biodiversity should not continue to be perceived as a sectoral issue, but rather as one that perme-

ates the whole spectrum of the development equation, from North to South.

Simplifying is also a very important message for policymakers. The public is overwhelmed by many messages; they need access to simple, comprehensible messages in order to change their behaviors. If people in government agencies feel that biodiversity is "too complicated," they will ignore it. The importance of people defining their own agenda and solutions, as opposed to feeling that an agenda has been imposed on them, was also mentioned.

Finally, broadening the agenda to include the cultural dimension is very important, as local and global cultures have a great deal to say about these species that are their backbones; species that they use and that are closely tied to their way of life. Without addressing issues of cultural diversity, it will be very difficult to handle issues of species diversity.

The fifth point discussed by the panel was the need for more and better communication, education, and social awareness. Obviously, expanding an ecoculture, especially with regard to biodiversity, can only be accomplished if everybody is involved: policymakers, public opinion, school children, the populations directly involved in the areas of greatest concern, and the political class. Costa Rica, through its National Biodiversity Institute, is setting a useful example in this regard. Communication, education, and involvement of all stakeholders are all critical.

The sixth point concerned prioritizing our work. The agenda is enormous, and there is a need to agree on the key priorities. The tradeoffs are very difficult to make; more discussion and

debate is needed. Two of the important tradeoffs mentioned during the roundtable deserve mention. One was the tradeoff between local and global. Do we have to get involved in the protection (or mainstreaming) of biodiversity at a local level, trying to protect 100 percent of species in a specific place? Or is the right policy to try to save and promote fewer species at a more global level and across the board?

Another example of tradeoff was in relation to unique species versus a mix of species, this distinction being the underlying reason for very different policies. The problem of biodiversity is that of the mix of species, the way in which the combination of species support the provision of goods and services. If the value of biodiversity is seen only in terms of the value of specific products, we miss the point.

Finally, the seventh point was the respective responsibilities of developing and developed countries. Obviously, biodiversity has to be protected, and sound economic principles dictate that efforts must focus first in the places where it is already very rare, which is in the North. But at the same time, it is clear that letting the situation deteriorate in the South, where sometimes the biodiversity situation may be better, is not acceptable.

Nevertheless, the responsibility of the developed countries for maintaining biodiversity is absolutely key. This says a great deal about the role of the World Bank, whose mandate is primarily with the developing nations. The World Bank has to be active in working on the global biodiversity agenda and in discussions between North and South, not only in promoting biodiversity in the South.

Desertification and Forests

Summary

The panel began by stating and taking a measure of the problems of desertification and deforestation. Speakers noted that nearly half the Earth's forest cover has been destroyed, much of it during the past 30 to 40 years alone, and that 40 percent of the Earth's surface is dryland, vulnerable to degradation.

Regarding forestry the panel concluded that the real issue is the rapid rate of change, which gives those involved in managing the very legitimate exploitation of forests no time to develop the knowledge that is necessary. We are moving and doing things faster than trees can grow, so to speak. The challenge for those involved in the profession, in the scientific dimension, is to come up with inventive and innovative modelling approaches so that the required knowledge can be developed and disseminated, and new approaches can be tried that are friendly to that resource.

On the desertification side the issue was that this is a very widespread problem, in the sense that of the 40 percent of the Earth's land area that falls under the dryland classification, about 69 percent is degraded in one form or another. This is a serious problem. One of the questions that the panel wrestled with is why desertification is not as high on the public opinion agenda as other problems discussed at the international level, such as climate change or the ozone layer.

One distinction that was suggested was that there are two categories of global issues. One set is widely seen as "systemic global issues," or those that interfere with cosmic systems control-

ling climate and energy. Ozone depletion and climate change due to greenhouse gases fall into this category. Other issues are global because of the vast geographic extent of their impact, and these include the two issues we were discussing, as well as loss of biodiversity and population pressures. But we are coming to understand that these latter issues also have an impact on systemic global problems and are linked, as both Ismail Serageldin and Robert Watson emphasized, to other global issues.

In addition to the problem itself, then, the panel expressed concern over the relative lack of visibility of desertification issues on the overall world agenda, resulting in reduced levels of funding for research and experimentation. This is a concern especially because, for example, the loss of biodiversity in drylands is economically much more important than in many other ecosystems, because drylands are the origin of many of the basic crop species used to feed the world.

Among the factors contributing to this relative lack of visibility are, first, that our experience in forestry and desertification provides more examples of misguided approaches—attempts that have not worked—than success stories. But we are beginning to develop more effective approaches. Reuben Oleombo cited some examples of very promising local approaches from China and Pakistan, from which others can learn.

Second, economic factors play a key role in explaining the problems of deforestation and desertification. They range from land-tenure

policies that encourage speculation rather than production to subsidies to the forestry industry that, by some accounts, amount to more than what is being spent by the world on armaments. The increasing importance of financial flows—James Wolfensohn talked about the dwarfing of overseas development assistance by private flows—was also noted. These private flows have an enormous impact when they are invested in mining or oil, or when concessions are granted to companies that do not always use the best practices in exploiting the forest. This is one of the challenges posed by the impact of globalization on forests and on drylands.

Another contributing factor is the role of illegal crops in certain regions of the world—Latin America in particular—that create an enormous incentive to destroy massive tracts of forest and replace them with such crops. Enforcement efforts often exacerbate the problem; producers simply move to another area and destroy still more forestland.

Political factors also play a role. It was suggested that the political will to stem desertification and deforestation is lacking. The panel discussed the importance of corruption as a partial explanation of how and why some permits that result in deforestation are conceded, for example. Social and political factors also explain the lack of influence on forest management policies and projects of people who live by and from the forests or in degraded dryland areas. Both tend to be marginalized people who are voiceless in their own societies. Consequently, the problems that they raise do not tend to percolate to the top of the political agenda.

The problems themselves, then, are magnified by the fact that these issues are not receiving pride of place on the international agenda. Our panel's discussion also highlighted the many ways that capacity issues continue to play a role in the developing nations—be it in terms of managing things in a different way, or having a more level playing field during negotiations between multinational and local firms.

What can be done about this, and what should be the role of an institution such as the World Bank? First, to recognize the importance of addressing these global issues with local solutions, and to try to build and provide access to knowledge. The panel debated whether we should still

talk in terms of technology transfer, or whether we should refer instead to "access to knowledge?" The consensus was that we need to talk about access to knowledge and the kind of knowledge that needs to be developed. Panelists expressed the hope that certain solutions can "leapfrog," so that some developing nations will be able to skip steps and do so in a way that challenges the scientific community.

Another ongoing discussion revolves around whether or not development is a right. The consensus of the panel was that reaffirming the right to development might be a very important role for the international community. The panel talked also of the importance of exploring the possibilities of joint implementation that were mentioned earlier to provide new avenues, and the importance of giving a concrete operational meaning to the concept of "differentiated but common responsibilities."

The World Bank Group has an important role to play in access to knowledge, helping to level the playing field, and more importantly, entering into many partnerships with a broad spectrum of people—from the scientific community to local people in marginalized lands that need help and from whom we can still learn.

There were also many questions about what can be done by the international community, in this era of multinational investment, to increase the social citizenship of companies that work in or with forests and begin to develop a different set of rules of engagement and behaviors. In that context the idea of creating a "Forest Watch" expressed by Ula Ullston, arising from his work with the World Commission on Forests and Sustainable Development, was discussed and endorsed by the panel. The importance of forests to a wide variety of issues—from biodiversity to livelihoods—warrants the formation of an independent, nonpartisan group representing the international public interest to analyze how forest management is taking place.

The bottom line is that desertification and forests are extremely important global issues that have somehow been relegated to the status of "poor relation" by other global issues. One major challenge, especially because of the connectedness that Robert Watson mentioned in his talk, is to raise these issues to their rightful place on the agenda of global ecosystems management.

International Water Regimes

Summary

The point of departure for this panel was the question: Should international water issues be viewed as a problem or an opportunity? We read a great deal about doom and gloom, about the next century's wars being fought over water, but the panel discussions and the examples given illustrated that there are very promising trends. We can find many examples in which water has been a powerful catalyst for cooperation, bringing countries and cultures together.

The panel had examples from the South Pacific; an example of World Bank collaboration with a host of partners in the Baltic and Red seas, and examples from Southern Africa, where the 12 countries of the Southern Africa Development Community have signed a protocol to share their waters. Stephen Lintner spoke about a long-term program to restore the ecological balance of the Baltic Sea, which is taking a very comprehensive approach and has garnered active cooperation and participation from all of the 12 or 13 countries involved—from regional organizations, governments, local nongovernmental organizations, and others, as well as support from a number of sources. Many of the 12 countries in Southern Africa share river basins, as well as severe water scarcity problems. Now they have joined together in an agreement to ensure equitable use, exchange of information, water quality protection, and binding dispute resolution.

Such initiatives show that cooperation is possible. But we have to be realistic, and it was also very clear that while water quality and management of international waters are problems that can often be solved with money or through conventions or other solutions, problems related to water *quantity* can be much more difficult to resolve.

Quantity questions are much closer to home, especially in water-scarce situations; we all know how long it took to get to where we now are with the Convention on Non-Navigational Uses of Water. Nonetheless, it was the clear sense of the panel that things are moving in the right direction.

One speaker stressed the importance of the "management continuum," in the sense that you cannot deal with freshwater, coastal, and marine individually. What happens along the coast and in the sea often begins in drainage areas; therefore, an approach that considers the water continuum—from the upper catchment through the coastal zone and into the sea—is called for. The Baltic Sea programs vividly illustrated the need for a continuum approach.

It was stressed in the discussions and the questions to the panel that the linkages between water and land use are very critical to consider, and it was also very clear from the discussion that one problem is that water has been managed in a fragmented way, by sectors, instead of as a vulnerable resource. The way forward is to overcome

this fragmentation and move toward comprehensive, holistic management.

This was demonstrated in the panel by a number of examples. Among the lessons learned from these strategic action programs were that:

- We have to move from the segmented to the comprehensive.
- We have to move increasingly from curative to preventive approaches. It is often very difficult to cure an environmental disaster, so we have to work harder to ensure that disasters do not occur.
- We have to think and act more strategically, rather than incrementally.

A very interesting discussion among the panel was sparked by the representative of the Pacific Islands regarding the role of traditional customs and cultures, and how we have to learn from the intrinsic knowledge of peoples and cultures.

Where we more or less converged was that the way forward is to get stakeholders to the table. All of the cases showed that it is public awareness that creates political commitment. Successes are demonstrated when you get public sector, private sector, nongovernmental organizations, and everybody together. This is what occurred in the Baltic, where the program was engaging prime ministers and citizens alike.

The way forward in international waters is to try to level the playing field so that equitable and reasonable utilization of international waters takes place between as equal partners as possible. Such an effort requires that we really strive to level the playing field. That point leads to the conclusion of the panel, which was, indeed, the theme of this week: the need for partnerships.

The successes and the hopes that we have seen in recent years have arisen from partnerships. As one speaker put it, strange bedfellows have been coming together lately, all recognizing that we cannot improve water management by ourselves; we have to do it in partnership with other disciplines, other sectors.

The Global Water Partnership (GWP) is just one example of that mindset. It is only one year old so it cannot boast success, but it seems to be the way forward. It was created with an eye to promoting integrated, cross-sector management of water as a resource. The GWP seeks to bring together a broad network of actors and, through mobilization of expertise, exchange of information and experience, and facilitating funding, to put into practice the principles agreed upon at the Rio Earth Summit.

The GWP seeks to help countries translate the principles of Agenda 21 into practical guidelines that can be used for action on the ground. At the same time the GWP will work at the global level, trying to pull together the various approaches taken by different agencies into an "integrated water resources management" approach. This involves policy development, institutional capacity building, and the creation of economic or regulatory instruments. The GWP seeks to bring people together, help to level the playing field among interested parties, and raise the level of awareness of all the stakeholders involved. It hopes to stimulate the creation of a series of regional partnerships dedicated to integrated water management, both to solve current problems and prevent future damage to global water resources.

REGIONAL ROUNDTABLES

Africa

Toward Environmentally and Socially Sustainable Development in Africa: Regional and Subregional Approaches

Robert Clement-Jones, Africa Environment Group

The purposes of this Africa regional Roundtable are to (a) present the key strategies guiding the World Bank's efforts to support environmentally sustainable development in Africa; (b) give examples of how environment can be mainstreamed, and describe environmental support programs and projects pertaining to local, national, subregional, regional, and global issues and, by inviting a broad audience; (c) discuss in an open forum the appropriateness and relevance of these strategies and their associated activities.

As a follow-up to the 1992 Rio Earth Summit the Environment Group of the World Bank's Africa Region has mobilized efforts to formulate

policies to achieve environmentally and socially sustainable development in its development co-operation with Africa. This entailed an holistic approach in which it was absolutely fundamental to address the complete environmental agenda of that meeting—from the local through the global level—and translate it, in continuous dialogue with local stakeholders, into action and implementation on the ground.

It is our aim with this open forum to take stock of what we in the World Bank have done, what should and can be done, and how the World Bank can best translate the conclusions of Rio into activities that improve the livelihoods of African people and contribute to a better environment.

Environmentally Sustainable Development in Sub-Saharan Africa

Townsend S. Swayze, Africa Environment Group

It is not easy to summarize briefly such a broad topic: environmentally and socially sustainable development in Sub-Saharan Africa. I will take the option of painting the subject in very broad brush strokes, to set the stage for the speakers who will follow.

In the most fundamental terms I suspect that our strategy for Sub-Saharan Africa is reflected throughout the Bank. The emphasis is on *mainstreaming*, which is what environmentally sustainable development is all about; and, very importantly, we are trying to do a much better job of *listening to and hearing* what our clients have to say and want.

We could outline our program objectives in the following four broad categories.

1. *Integrate the environment in all our strategic discussions with borrowers*, and equally important, within the Bank, with our colleagues. Our strategic windows are, of course, policy dialogues, public sector reviews, poverty assessments, and the various forms of our country assistance strategies (CASs) and sector analyses. Later this afternoon Anders Ekbom will specifically address the challenges of getting across the environmental message in the CAS.

2. *Use environmental assessments (EAs) to help select the best alternatives*. EAs are an opportunity to get our message across among our project colleagues. We see this intervention as a valuable learning tool for all of us, to try to better understand the complexities of our business.

3. *Invest in environmental training* and help disseminate information in our countries, as well as to train and inform Bank staff. We want to invest in strengthening organizations and institutions to help them do their work better, and to invest resources in networking with other international organizations, as well as to work more effectively with the broad spectrum of participants in African countries, ranging from ministers to tribal chiefs to nongovernmental organizations (NGOs).

4. *Support the development of Environmental Information Systems (EISs)*. Later, Francois Rantrua will discuss this aspect of our work.

How Have We Been Pursuing These Objectives?

During this past year we held a series of seminars with African decisionmakers to help develop a regional strategy. These seminars helped us find out what is on each country's agenda, how Africans perceive their problems, and to clarify what Africa's priorities are. These discussions reflected a number of common issues that ran throughout the Sub-Saharan Region: problems of institutional capacity and management; water resources; coastal zones; forest and biodiversity conservation; urban and industrial issues; and land degradation. These findings are summarized in a publication entitled, *Toward Environmentally Sustainable Development in Sub-Saharan Africa*.

During this last year we have upstreamed Environmental Assessment (EA) work and prepared an increasing number of sectoral EAs. We have also expanded and diversified field-based networks that interact with the Bank, such as the Network for Environmentally Sustainable Development in Africa. And we have promoted something that we call MELISSA, an acronym for Managing the Environment Locally in Sub-Saharan Africa. MELISSA takes national environmental action programs down to the local level. We have also taken our broad strategy outlook down to a more operational, regional level. This was an initiative to look at problems and priorities in West Central Africa.

With support from the Norwegian Trust Funds and the United Nations Development Programme (UNDP), representatives from each of the West Central African countries met to plan a workshop agenda and assign paper topics and authors. This was a planning group held and run by the African participants. As a contribution to the workshop the Bank prepared a discussion paper based on the analysis of the countries' national environmental action plan, country environment strategy paper, and other reports. The objective was to assess problems common to the region and to point to a series of operations and interventions that not only addressed particular issues within a country but, importantly, looked across the borders at transboundary issues. One example was the Volta watershed, where the question raised was how activities in Ouagadougou affect power output and irrigation in Ghana.

The Bank paper and many other inputs prepared by Africa country specialists provided background for a week-long series of meetings that took place in July 1996 at Yamoussoukro, the capital of Côte d'Ivoire.

The Yamoussoukro workshop discussions focused primarily on the following areas:

- Capacity building
- Integration of environmental issues in the planning and budget process
- Stakeholder participation
- Data management and information exchange
- Coastal zone management
- Transboundary issues, such as parks, range-lands, forests, and biodiversity conservation.

The meetings provided an opportunity for the head of Ghana's environmental protection agency to speak for the first time about coastal issues with his neighbors. Before the workshop he had said to me: "I know it sounds silly, but when we need to address an offshore problem, I don't know whom to call in Côte d'Ivoire, Benin, or Togo."

The Yamoussoukro workshop was about *regional networking*. Participants focused on specific operational issues shared in common, presented best practices, and highlighted problems. The workshop was also designed for networking and promoting understandings *within* the countries. The African planning committee invited a selected cross-section of participants, including representatives not only from government-led environmental organizations, but also from NGOs, academia, the media, government planning and budget departments, and commercial interests.

After the workshop people took home with them a "local agenda" for Monday morning, covering things that each country could do the next day that would advance their environmental objectives. Most important they left with a feeling that this was *their* program, their agenda—and they left with the makings of a core group composed of both a regional and an internal network that would continue with the spirit and directions of the workshop.

What Role Is the Bank Playing?

In support of these overall strategies, the Bank has been moving forward on a broad front. At the end of June 1997 some 32 environmental projects were in the Bank's portfolio for Sub-Saharan Africa, of which 45 percent were in natural resource management, 35 percent centered on institution building, and about 20 percent aimed at improving capacity to control pollution.

Bank projects represent a broad range of activities, including small-scale biodiversity conservation and local community development activities, national institutional development programs, and the regional environmental information program for the Congo Basin that François Rantrua will discuss later.

A few stories can exemplify these figures. For instance, in spite of difficult working conditions, *Nigeria*, with the support of a Bank project, has developed a comprehensive set of national environmental impact regulations, a multisector Geographic Information System, and an impressive information base on land use and land degradation. We have also supported the establishment of environmental protection agencies and state environmental action plans for each of Nigeria's 36 states. Under the project they have held environmental workshops for the leaders of 774 local government authorities. The Bank is supporting similar institution-building projects in *Ghana*.

In the *Sahel*, spearheaded by the teaching and extension work of local villagers, we are substantially scaling-up very successful natural resource management programs in *Burkina Faso* and *Mali*. In each country we have helped to support rural communities in their requests for the development of local roads, firebreaks, improved soil and water management, and the installation of village wells.

In northern *Benin* we are assisting local communities in park management, to control poaching and create and manage buffer zones. In *Burkina Faso* and northern *Côte d'Ivoire* we are assisting community-based wildlife management and agriculture intensification to reduce the pressure on woodlands.

We have also taken some important steps to help countries to address coastal zone management issues. We have worked with our counter-

parts in *Nigeria* and *Ghana* to identify issues and frame strategies for the *Niger Delta* and for *Ghana's* coastal communities, with a particular emphasis on local community participation. We are now developing proposals for how the Bank can help on a regional basis, taking a close look at coastal initiatives and problems in *East Africa*. These findings and recommendations will provide input for the coastal zone workshop planned for Maputo in the Fall of 1988.

With regard to Environmental Assessments, in addition to our normal project reviews we have completed four or five sector EAs in the roads and power sector for *Ethiopia*, *Kenya*, *Uganda*, and *Zambia*. The importance of the sector EAs is that they articulate standards to be applied for investments in the sectors, as well as for ranking projects according to their environmental preference; projects that will have the greatest benefit and least negative impact.

The results on the ground over the last few years with environmental impact assessments of projects might be best reflected by the five to 10 environmental units that have been established in sector ministries, and which will now undertake assessments for their sectors. We have also strengthened the linkages of our EAs to social factors. For example, in the *Lesotho Highlands Water Project* we have minimized involuntary resettlement by altering the dam design while keeping the same service level, and the project will provide improved and socially sustainable living conditions for those who have had to move.

Mainstreaming Environment in Country Assistance Strategies

Anders Ekbom, *Africa Environment Group*

The purpose of this presentation is basically to (a) *assess past and current work* in the area, by reflecting on a review of the Bank's track record of mainstreaming environmental concerns in Country Assistance Strategies (CASs), and (b) to *suggest some essential steps forward* that would better integrate environmental concerns in the Bank's development assistance.

Past and Current Work

To implement the task of mainstreaming environment in African CASs, as outlined in *Toward Environmentally Sustainable Development in Sub-Saharan Africa* (1996), we found it necessary to assess the Bank's past and current performance on the subject. We looked into 33 existing CASs, of which 20 are from Sub-Saharan Africa (SSA). We identified good examples upon which we could build and provided a literature review containing 40 short summaries of useful literature.

Before presenting the review results, it is necessary to define the meaning of "mainstreaming environment" in national development planning or in CASs. Essentially, it is to: (a) plan and implement measures that mitigate or prevent deterioration of the biophysical environment, and (b) optimize countries' use of natural resources, to reduce poverty and promote growth without reducing the quality or stock of natural resources. A general term such as mainstreaming environment must, however, be broken down into man-

ageable pieces. Hence we identified a "filter" of issues to assist in the assessment of the World Bank's CASs.

Filter of Issues

The filter of 13 issues is grouped under five headings: issues, driving force analysis, existing work, actions, and process (13).

Issues attempts to capture the extent to which environmental problems and opportunities are described in the CAS, the quality of the analysis, and how it relates environmental problems to human health. We also review the way in which cross-border issues, such as the management of shared ecosystems, transboundary pollution, subregional and global environmental problems and abatement strategies are addressed in the CAS.

Driving force analysis is a process of identifying whether and how well CASs elaborate on the underlying causes of environmental problems, and whether forces such as market and policy failures, poverty and inequity, poorly defined or enforced property rights (including land tenure), population growth, migration, and economic policies are addressed in relation to environmental impact. The subsection on economic policies includes specific assessments of the impact of sector policies on the environment, as well as the links between macroeconomic policies and the environment.

Existing work assesses the extent to which the CAS makes reference to and utilizes (when they exist) the National Environmental Action Plan (NEAP) and the Country Environment Strategy Paper (CESP). Naturally, other relevant country documentation (building blocks) addressing environmental issues might exist; for example, national biodiversity strategies, sector policy documents, or poverty assessments, but they have not been subject to review.

Actions review the extent to which donor support to environmental management is addressed; whether environmental concerns have been brought to the Board's agenda for discussion; and, based upon the document's prior analysis, whether a set of actions to improve the environment is suggested.

Process reviews the extent to which the CAS document explicitly describes the process by which the CAS was developed, and whether stakeholders and environmental experts were consulted in a transparent process.

Results of the CAS Review

The CAS review yielded six main results:

1. *The filter of thirteen issues is a useful tool to mainstream environment.* The filter assists in environmental review of existing CASs and provides a road map, or guide, for formulating new CASs; the filter of issues makes "mainstreaming environment" more tangible and operational; it is comprehensive and covers most important areas pertaining to environment in the CAS context. It is not too sophisticated to apply.

2. *Environmental issues have made some inroads into the CAS process.* This applies in particular to environmental problems assessment, making use of the NEAP, linking environment and some sector policies (agriculture, health), and proposing Bank actions in the area of environment.

3. Even recognizing the limited format of the CAS document, *there is considerable scope for improvement.* A rich array of good examples exist, and we have only presented a selection.

4. *The World Bank and national governments have been part of the problem of and the solution to environmental degradation.* Examples include local stakeholders who expressed, as part of a consultative process, disappointment over the Bank's performance; especially its (a) insufficient focus

on poverty and environment, (b) slow response time, and (c) inadequate tailoring of experiences from other countries to their own special circumstances. The participatory process enhanced Bank performance. In other cases it was stated that governments have contributed to environmental degradation through (a) lax regulation of natural resource extraction, (b) insufficient management of national parks, (c) low stumpage fees, (d) liberal provision of forestry concessions, and (e) improper land-use planning and tenure. By addressing these failures governments can become part of the solution.

5. *Many CASs treat environment as a sector* with separate funding, objectives, activities, target group/counterpart, as if it were separate and independent from other sectors.

6. CASs tend to elaborate well on environment in two situations: when countries are heavily dependent on a limited number of natural resources, or when a natural disaster occurs around the time of drafting the CAS.

Steps Forward

Many steps are needed to move forward in this field. Arguably, the most important step and challenge is to boost integration between macroeconomic policies and environment, in policy analysis as well as policy formulation. We know that growth-oriented policies can lead to environmental improvements; they can also lead to environmental degradation. Hence, the main challenge is to analyze and address the link between fiscal and monetary policies and the environment. A general conclusion from the review in this respect is that we need to pay more systematic attention to the role the environment plays in the economy and vice-versa.

Requirements to accomplish this work include (a) drawing from previous analytical, empirical work ("building blocks"),¹ (b) encouraging increased and sustained interest among macroeconomists to adopt these links in their analyses, and (c) generating useful environmental data for targeted analysis, including merging data in multidisciplinary analytical work. This is justified on the basis of the scanty information on changes in the quality and quantity of key natural resources available in many client countries.

Other steps forward include making the *process more participatory* and the CAS more open to public discussion; disseminating good country examples; increasing learning across regions, including more *cross-country sharing of experiences and analysis*; facilitating subregional, regional, and global analysis and approaches, since ecosystems and pollution are transboundary issues; addressing environment as a cross-cutting issue and a concern relevant to all sectors and aspects of society and integrating it into all sections of the CAS document. Environment is not a special interest or an independent sector.

It is also necessary to team up in *multidisciplinary working groups* integrating cross-cutting themes such as poverty, health, macroeconomics, forestry, transport, and environment, respectively. Further, subject to local adaptation there is a need to apply a *structured approach* when attempting to mainstream environment. A useful tool is the Policy Analysis Matrix (PAM). In cases where we have good information about the state of the environment, the extent of environmental degradation, and its causes we need to *be strategic and set cost-effective priorities*. In cases where we do not know, we need to suggest more studies to collect and analyze reliable data to support decisionmaking. In the meantime, we must follow the precautionary principle in environmental management.

There is also a need to be explicit about trade-offs, since we have budget constraints, and environmental management is often costly. Another important tool to mainstream environment is the *Environmental Assessment*. EAs are a very useful entry point for environmental management within sectors, and can be even more powerful if extended to regional EAs, sectoral EAs, or if they incorporate monetary figures of the environmental impact identified in the EA. At present there is a pressing need to build EA capacity within client countries.

Other important steps to take include training or retooling of macroeconomists on fundamentals of environmental management to facilitate *environmentally adjusted Systems of National Accounts* (SNAs) and Genuine Savings Analysis, in which depreciation of natural capital is deducted from SNA. This is a powerful tool to assess the sustainability of government poli-

cies. A first step would be to identify and monitor key environmental indicators to complement traditional measures of growth and economic performance.

The two final steps to take would be first, to recognize and *internalize environmental risks in national development assistance*, and specify management plans for extreme climatic events such as droughts, floods, cyclones, and earthquakes, which all impose huge economic costs; and second, to *work upstream in the national planning process*, and participate actively early-on, to get a foot in the door when the main development agenda is set.

The review also contains a literature review. Its purpose is to identify useful literature to support integration of environmental concerns in national development planning. The content is 40 short summaries of literature relevant to most filter criteria, indicating that relevant literature in the field does, indeed, exist. A considerable body of relevant literature that can support the mainstreaming of environment in national developing planning was found. Moreover, the literature we have presented is nontechnical, easily accessible, applied, and based on empirical examples.

Building Blocks for Enhanced Environmental Mainstreaming

- Strategic overview documents of environmental issues: NEAP, CESP
- Policy matrix: systematic review of impact of macro and sector policies on environment
- Expenditure review of environmental components of the current capital budget
- Detailed sector and financial analyses of sustainability issues (government revenues, foreign exchange, employment revenues)
- Country economic memorandum on macroeconomics and environment
- Poverty Assessments: poverty and environment-links
- Living Standards Surveys: poverty, inequity, and environment links
- Benefits valuation or mitigation-cost estimation: sectoral assessment of air pollution, water pollution, deforestation, soil degradation, fisheries, or other areas

- Genuine savings analysis subtraction of depreciation of natural capital in GDP and savings calculations (Indonesia, Mexico, Philippines)
- Macro modeling
- Regional/sectoral EAs and EA extended to environmental economic analysis
- Monitoring environmental indicators (pressure, state, response)

- Legal or institutional reviews

Note

1. A set of "building blocks," which potentially can be useful for environmental mainstreaming, is listed at the end of this section.

Environment in a Free Trade Agreement: The Case of Morocco and the European Union

*Yoko Eguchi, Middle East and North Africa Rural Development,
Water, and Environment Group*

In 1995 Morocco established its National Environmental Strategy. The report suggested that the economic and social costs associated with environmental degradation amounted to 8 percent of gross domestic product, based on 1992 data. The main environmental problems include water scarcity and deteriorating water quality, air pollution, insufficient solid waste management, and soil degradation. The strategy emphasized the need for (a) substantial strengthening of the institutional and legal framework for environmental management, (b) streamlining agency mandates to avoid duplication of efforts and increase intra-agency efficiency, and (c) empowering local institutions.

The strategy's recommended implementation policy includes economic and financial incentives, integrated environmental management, private-sector investment for pollution abatement, public-private partnerships in urban sanitation, and increased participation by local governments.

Morocco has negotiated a Free Trade Agreement (FTA) with the European Union (EU) covering the period from 1997 to 2009. The FTA sets out to achieve sustainable development in the Euro-Mediterranean region; it addresses explicit environmental concerns, creates pressures to implement stronger environmental policies in Morocco, and offers EU support for (a) institutional development and technical assistance, (b) training and capacity building for implementa-

tion, and (c) investment for environmental conservation.

The Morocco-EU FTA was preceded by an extensive consultative process, which has built on Capacity 21 facilitated through the United Nations Development Programme (UNDP). The process started out by making an initial assessment of environmental implications of economic growth (assuming 6 percent per year) and the realization of trade liberalization policy. Specific attention is paid to air pollution, and projections of pollution loads are made based on the Bank's Industrial Pollution Projection System. The projections are incorporated into a "computable general equilibrium" model, with a detailed social accounting matrix. In addition to income growth, the model predicts substantial structural economic changes, leading to increased demand for transportation services and increased energy demand, and thus to the expansion of pollution-intensive sectors. The conclusions of the exercise are that there are scopes for pollution reductions. They can be realized if foreign direct investment can be stimulated, significant technology transfers can be made, greater private sector efficiency achieved, and environmental standards and policies harmonized and enforced with all major trading partners.

In sum, the Morocco-EU FTA is an interesting example of how a new opportunity for enhanced environmental management can be created for African countries. The agreement was mainly

realized through the increased pressure posed by (European market) consumers, the introduction of cleaner technologies, and the formalized setting in which environmental issues between countries are addressed—in the negotiations as well as in the articles of the agreement. The case

also provides an example of how environmental effects can be studied, taking into account both the positive and negative impacts of increased growth and trade on the environment, as well as the possible role of the Bank in such agreements.

Climate Change in Sub-Saharan Africa and Its Operational Implications

Robert Clement-Jones, Africa Environment Group

The aim of this subsession was to present key climate issues for Africa, present measures that could prevent or mitigate the negative effects, and outline the Regional program to cope with climate change in Sub-Saharan Africa.

First and foremost, whatever economic and climate models may be used, the *human dimensions are central* to the problem. People understand climatic variability and the very distinctive seasons in much of Africa. Examples include Fulani in the Sahel, and the bush people of the Kalahari. The problems must be interpreted in terms also of human impact, and what can be done by the populations in Africa to curb the negative effects.

Complex adaptive mechanisms characterize much of Africa, but the ability to adapt has been eroded and is not being replaced. Climatic variability is hence another factor contributing to conflict, refugees, rural-urban migration, poverty, and general sociocultural misery.

Key Climate Issues for Africa

Africa is likely to be a major loser from the effects of global climate change. Short-term variability appears to be increasing in southern Africa. Survival and economic performance in Africa are already sensitive to current climatic conditions. Drought and extreme events are often key factors affecting macroeconomic performance, and

the cost of coping with extreme events is rising globally. Longer-term climate change is likely to lead to wider climatic fluctuations, with the effect of a drier southern Africa. The agricultural sector will have to design and implement adaptive strategies to maintain productivity.

Existing water shortages are likely to intensify, and there is a risk of increased transmission of water- and vector-borne diseases. Sea levels are likely to rise with devastating effects on coastal zones, in particular on island states such as Mauritius and the Seychelles. This situation highlights the need for integrated water-management schemes. Natural ecosystems and biodiversity will also be affected, calling for reinforced and coordinated efforts to sustain the region's production, environmental quality, and stock of natural capital.

What Can Be Done?

First, *incorporate climate risk in economic and sector planning*. This includes drought planning, particularly at the macroeconomic level, and "budgeting for crisis." Further, Africa needs drought-risk management and adaptation of agriculture; for example, through adaptive research in drought-resistant crops and water storage, and by dramatically improving the information base on weather in Africa, to enhance the reliability of global modeling and translation into local conditions.

Second, *develop institutions* capable of using the most modern technological advances in meteo-

rology to improve the accuracy of medium- and long-lead weather forecasting. Africa needs to apply climate risk factors more systematically to investment and decisionmaking (for example, through Environmental Assessments), and work on transborder conservation programs to help develop large enough conservation areas for species migration.

Outline of Regional Program

Steps to better address the risks of climate change of the region would include

- Enhancing the use of meteorological applications in southern and western Africa
- Initiating standing groups on drought and emergencies in Africa
- Initiating macroeconomic, sector, and project work on drought and climate
- Preparing a training program on climate change with appropriate World Bank and other training institutions, such as the Economic Development Institute (EDI)

- Collaborating with initiatives to reduce carbon emissions
- Maintaining contacts and linkages with the scientific, research, and applications communities.

In response to questions of how climate change and an increased occurrence of extreme climatic events impact poor farmers—the foundation of economic life in Africa—it was stressed that the link between farmers and climate change is very strong. The current El Niño event is likely to lead to very dry conditions in southern Africa. Hence it is particularly important to get information to, and to work with, farmers. Examples from Malawi were presented, where very sound advice was provided: plant early, keep short-rotation crops, and protect cassava from goats and sheep. In South Africa a stand-by crisis management group has been formed to cope with the effects of El Niño. Finally, the importance of relating these issues to people on the ground, rather than remaining strictly in the scientific world of modeling, was emphasized

Regional Environmental Information Management Project: Knowledge Nodes in Central Africa

François Rantrua, Africa Environment Group

The Congo Basin Rainforest is the second largest contiguous primary rainforest in the world and is one of the last three remaining major blocks of intact tropical rainforest. It covers 2.1 million square kilometers, representing 26 percent of the world's remaining rainforest and 70 percent of the remaining African rainforest. It is thus considered an environmental "hot spot," due to its biodiversity, forest, water, and coastal resources.

Threats to the Congo Basin Rainforest include logging, agriculture, oil and mining exploitation, and infrastructure development. It is shrinking at about 0.6 percent annually and is under increasing human pressure. The Congo Basin Rainforest spreads over the territory of six countries (Cameroon, Central African Republic (CAR), Congo, Gabon, Democratic Republic of Congo (DRC), and Equatorial Guinea), covering a total population of 62.6 million people.

Several donor agencies are involved in efforts to assist national authorities in developing strategies to implement the Convention on Biological Diversity, which was signed and ratified by all Congo Basin countries. This convention explicitly recognizes the links between the conservation of biodiversity and sustainable development. National Environmental Action Plans (NEAPs) and the Tropical Forest Action Plans (TFAPs) are examples of donor-financed activities in this area. Within these initiatives, as well

as other local activities and projects, the lack of (or lack of access to) accurate and comprehensive environmental information for effective natural-resources management has been identified as a critical problem.

With support from several donors national authorities of the six countries and major stakeholders have developed collaboratively the framework for a project to address the following four problems:

1. Existing environmental information and knowledge are poorly shared.
2. Not enough well-informed decisions are made in the forestry and environmental sectors.
3. Major gaps exist in basic and thematic information on natural resources.
4. National capacity to generate and manage this information is limited.

The Regional Environmental Information Project (REIMP) was designed to implement this framework. Its four key objectives are to: ensure that information and knowledge circulates, thus optimizing benefits from existing initiatives; foster the involvement of decisionmakers in the use of environmental information use and communication with local communities; provide users with environmental information; and strengthen national technical expertise through capacity-building. REIMP will address lack of transparency in the decisionmaking process by improving knowledge management, and will use a partner-

ship and networking approach, especially through the creation of a local association of stakeholders (NGOs, private sector, government).

The five-year project budget is around US\$20 million, allocated to network and service, decisionmakers, user-oriented production, capacity building, and regional fund for local initiatives. The project will be undertaken in all six Congo Basin countries; other countries may join later. The project is financed by multiple sources, including the six countries, the European Union, the International Fund for Agricultural Development, the Global Environment Facility, and multilateral and bilateral agencies from Belgium, France, and Germany. Local and international nongovernmental organizations and the private sector are expected to participate in support for the project, which will be presented to the World Bank Board in December, 1997. Implementation is scheduled to start in April 1998.

The main risks presented by the project are (a) political instability, (b) its complexity, and (c) sustainability. Mitigation of these risks, respectively, includes using a regional approach, flex-

ibility of design and adaptive lending, and development of specially designed self-financing mechanisms. Transparency and good governance are also vital, but the project builds on openness and stakeholder consensus.

Lessons learned during project preparation include

- The Bank and its clients can be innovative (especially regarding topic, legal aspects, financing mechanisms, and institutional design).
- Working at the subregional level is relevant and possible when dealing with environmental issues and possible.
- Knowledge management is key for environmental management.
- Partnerships are key for knowledge management.
- The project preparation was a good exercise, in and of itself (creation of network, priority management, identification of local expertise and motivation), and associations such as the local network secretariats might be a good platform from which to help define and implement natural resource and environmental policies.

Latin America and the Caribbean

Mesoamerican Biological Corridor: Environmental and Social Dimensions

The Mesoamerican Biological Corridor (MBC) is a joint conservation/development initiative being undertaken by the countries of Central America, from southern Mexico to Panama. The corridor is rooted in the biological reality of a north-south corridor of natural habitat that links the flora and fauna of North and South America and strongly reflects the need to balance conservation efforts with the development needs of its human inhabitants. Most of these people are indigenous and have a special interest in maintaining the ecological integrity of their traditional lands. At present some 450 MBC projects are underway, 75 of which receive support from the World Bank; the Bank is the largest single promoter of the MBC among multilateral and bilateral financiers and donors.

The MBC theme was introduced by Luis Constantino, of the World Bank, and Juan Carlos Godoy, codirector of Programa Frontera Agricola, a project of the European Union active throughout Central America. They traced the origins of the MBC concept and detailed the many ongoing activities forming part of this initiative in Central America and Mexico. They also highlighted the fact that all governments of the region, several bilateral and multilateral cooperation agencies, and a number of civil society groups are involved in the effort.

Poverty and Social Development

This panel was moderated by Ana Maria Arriagada of the World Bank, and included as speakers José Flores Rodas, executive director of the Isla de la Bahia Project in Honduras; David Kaimowitz, natural resources economist from the Center for International Forestry Research in Indonesia; and Jorge Uquillas, World Bank specialist on indigenous peoples. They presented some of the factors causing poverty and environmental degradation, particularly in ecosystems characterized by great biological diversity. Presentations described the geographic overlap between indigenous peoples and poverty, and between indigenous peoples and biodiversity. The speakers stressed the need for poverty alleviation within a context of ESSD, including measures to support indigenous peoples of the region in a "development with identity" process. Finally, the potential of sustainable forestry activities to generate income and alleviate poverty was discussed in the context of Honduras.

Science's Input to Conservation Development

This panel was moderated by Alejandro Grajal, of the Wildlife Conservation Society, and included as speakers Mark Rose of Flora and Fauna

International (who presented slides on the Nicaraguan Atlantic Biological Corridor); Gonzalo Castro of the World Bank; and Juan Bezuary, of Amigos de Sian Ka'an in Mexico. They discussed the scientific basis of the MBC, particularly the fact that Mesoamerica is one of the areas with the highest biodiversity on Earth, being located between the two large land-mass areas of the Americas. Panelists argued for the need to make the MBC a reality, linking protected areas with areas under human use, so that biological species are given sufficient options to survive and reproduce. The importance of (a) involving local human populations in conservation and sustainable development endeavors, and (b) taking advantage of all opportunities to advance the MBC concept were also mentioned.

Indigenous Peoples, Land, and Biodiversity

This panel was moderated by Armstrong Wiggins of the Indian Law Resource Center. The panel included Juan Martinez, of the World Bank and several indigenous leaders from Mexico and Central America, including: Aurelio Ramos of MASTA in Honduras, Fabian Gonon of Maya-Kiche in Guatemala, Nicanor Gonzales of Kuna in Panama, and Ned Archibold of the Asociación de Sindicos Indigenas of Nicaragua. They debated issues such as the regularization of indigenous lands as a precondition for the full participation of indigenous peoples in conservation activities, and the importance of community participation in forest management. They also

discussed the need for training and technical assistance to enable indigenous people to be effective partners in biodiversity conservation. The panelists stressed the need to involve indigenous peoples in planning from the beginning, rather than presenting them with an external vision to be implemented.

Partnerships with the Private Sector

This panel was moderated by Augusta Molnar of the World Bank, and included as speakers Cristina Figueres of Costa Rica, Alberto Salas of the World Conservation Union (IUCN) in Costa Rica, and Michael Rubino of the Environmental Division of the International Finance Corporation (IFC). Panelists reiterated the need to involve not only nongovernmental organizations, but civil society at large, including the private sector, in the MBC. The panelists presented a range of initiatives to attract private sector resources.

One case was Costa Rica, where the private sector has shown interest in biodiversity prospecting, potential carbon offset deals, and ecotourism opportunities. Other cases included IUCN-assisted investments in ecotourism and a small- and medium-enterprise fund initiated by the IFC to encourage innovative environmental investments, including biodiversity. Panelists and others agreed that much work remains to be done to encourage private sector investment in the MBC, but that with adequate information flows and the backing of international agreements, the opportunities are tremendous.

PART THREE

SELECTED SUMMARIES AND READINGS FROM AFFILIATED EVENTS

ASSOCIATED EVENTS

Mainstreaming Freshwater Biodiversity in Development Projects: The Agenda Matures

Summary

Held at the World Bank

October 10, 1997

Freshwater biodiversity is something of a Cinderella issue, because biodiversity conservation initiatives have tended to focus on tropical forests and the cuddly, charismatic mammals and birds of terrestrial ecosystems. Recently, however, national and international attention is finally beginning to be directed towards freshwater ecosystems such as rivers and lakes.

Behind this new level of concern is a recognition that many development projects, including those financed by the World Bank, impact freshwater biodiversity in major ways through flow regulation, pollution, siltation, eutrophication, and changes in vegetation cover. Yet many of the world's poorest people depend on freshwater biodiversity for their protein needs, and healthy freshwater ecosystems provide a wide range of other benefits.

Recent reviews of environmental assessments conducted for World Bank projects have found that even when impacts on freshwater biodiversity are investigated, the quality of available information is often poor, and there are few effective mitigation or management provisions incorporated into project designs. This is in part due to acute human resource shortages, a lack of importance given to the work, and inadequate dialogue among specialists. The World Bank's Water Resources Management Policy paper rec-

ognizes that in order to help governments develop strategies and cost-effective mechanisms for ecologically sustainable development that include the protection and restoration of water-dependent ecosystems, more rigorous attention should be paid to maintaining biodiversity and protecting ecosystems in both the design and implementation of water projects.

The World Bank has become a leader in promoting concern for the management of freshwater biodiversity, and the well-attended, all-day meeting held during the ESSD Conference provided an opportunity to get an up-to-date international perspective on the issues. Those participating came from nongovernmental organizations (NGOs), government agencies, consulting companies, and a wide range of Bank units.

Tony Whitten, biodiversity specialist from the World Bank's East Asia Region, set the scene and described the path to the present from the World Bank perspective. One of the earliest steps was a meeting, cosponsored by the Bank and the Gilman Foundation, in which Asian freshwater biodiversity issues were discussed by engineers, NGOs, academics, and Bank staff. A number of products were conceived at that meeting, including the newsletter "Mainstream," produced by the Bank. Gerry Galloway, dean of the Industrial

College of the Armed Forces of the U.S. National Defense University, described the major changes in mindset within the enormously influential U.S. Army Corps of Engineers—from a structural approach to water problems toward a far more nonstructural approach—and pointed to the biodiversity benefits that have accrued. Galloway also described his experience leading a team appointed by the U.S. President to respond to the devastating Mississippi floods of 1995.

Delmar Blasco, secretary-general of the Wetlands Convention, described how the Ramsar Convention, the oldest of the international environmental conventions, presaged those that have followed by advocating sustainable use of wetlands. While the Convention was at first primarily concerned with wetlands used by waterfowl, in recent years the parties have called for a broader definition of “wetlands of international importance” that would include other major components of freshwater biodiversity.

Rohan Pethiyagoda, of Sri Lanka’s Wildlife Heritage Trust, demonstrated to participants just how little is known about freshwater biodiversity in some developing countries, and how hard it is to identify specimens when local collections reside in foreign museums. He highlighted three key weaknesses in the environmental assessment process: the lack of baseline data, a perception that water projects have relatively low impact when compared to other pressures on biodiversity, and the lack of political awareness of freshwater biodiversity-related problems. Maria Isabel Braga, freshwater ecologist at the World Bank, described the importance of developing good protocols that would allow environmental assessments to use common and comparable methodologies for assessing the status of freshwater biodiversity in a specific location.

John Bizer, an independent consultant, discussed ideas for integrating concerns about freshwater biodiversity at the project level. He concluded that many opportunities exist for adopting measures to protect freshwater biodiversity when planning for water resources development, and stressed that the full and true integration of freshwater biodiversity issues requires a commitment from all involved (financial institutions, developers, engineers, planners, and especially environmental scientists) early in the planning process.

The program included three presentations on Latin America. Gonzalo Castro, formerly of the World Wildlife Fund (now at the World Bank), presented a critical expert review of the massive Hidrovia project being considered by the governments of Argentina, Bolivia, Brazil, and Paraguay to facilitate inland shipping and promote regional economic development. Jorgen Thomsen of Conservation International described the rapid aquatic biodiversity assessment (known as AQUARAP) conducted in the Pantanal, on the border between Brazil and Paraguay, by their team of local and foreign scientists to identify conservation priorities and sustainable management opportunities. Ian Davidson, of Wetlands International/Americas, concluded with a presentation on his organization’s initiative to map the wetlands of the Americas.

Finally, panelists Maritta Koch-Weser and Dennis Mahar of the Bank’s Latin America Region and Environmentally and Socially Sustainable Development Network, and David Hales of USAID, offered perspectives on how to “mainstream” freshwater biodiversity within the Bank’s program by ensuring a sound assessment of economic value and demonstrating social relevance.

The Role of Law in the Promotion of Sustainable Development

Summary

Held at Washington College of Law, American University
October 6, 1997

The purpose of this event was to explore the contribution that law can make to the achievement of sustainable development. The panel analyzed the intertwining of the international and domestic legal systems, as well as the relationships among the law of international organizations, environmental law, human rights, and economic development.

The event was chaired by Claudio Grossman, Dean of the Washington College of Law of American University (AU), who pointed out in his welcoming remarks that a large number of international students attend the College of Law, which offers some 50 courses in the field of international law. The College cosponsored this roundtable with the World Bank because of its interest in reflecting on the issues of sustainable development at the international level and the role of lawyers in this process.

Roundtable presentations were given by Barbara Bramble, director of the International Office of the National Wildlife Federation; Durwood Zaelke, president and founder of the Center for International Environmental Law and adjunct professor of law at AU; Judge Christopher G. Weeramantry, vice president of the International Court of Justice; and Daniel D. Bradlow, director and professor of the International Legal Studies Program at American University's College of Law.

Barbara Bramble referred to three main pillars that support the concept of sustainable development: environmental health, economic viability,

and social equity. In order to reach these goals, she said, legal and administrative systems must allow for three important inputs: public access to information, public participation in decisionmaking, and the right to complain if things are not done according to established procedures. Nongovernmental organizations (NGOs) in many countries are in different stages of attempting to ensure that these three principles are followed; they have also been encouraging the World Bank to incorporate these principles into its operations. In response the Bank has established an access to information policy and a public information center; it has begun to implement an inspection panel that would hear citizens' complaints, and it is creating mechanisms for public participation through a Participation Learning Group.

The Bank's example has influenced other multilateral institutions to increase access to information and open up decisionmaking processes, and has even extended to some nations. Japan, for example, has begun to adopt a more open process in regard to its internal development decisions. This, in turn, could have an important impact in Japan's development financing—if it begins to apply the same principles to the development projects it funds—all of which could considerably improve the prospects for sustainable development in Asia.

Durwood Zaelke addressed the question of how lawyers can contribute to sustainable devel-

opment. First, he said, lawyers should return to school to learn the fundamental rules of ecology and ecological economics; then they should put this knowledge to use by laying the foundation for the progressive development of international environmental law. Next, lawyers should use their knowledge to strengthen international agreements, starting with the climate change convention and the upcoming negotiations in Kyoto.

Zaelke stressed the important role lawyers can play in education and advocacy work in favor of sustainable development. AU, for example, offers ten courses on international environmental law. But education should also be taking place at other levels, from elementary school through college, and among the general public. Referring to the "disinformation campaign" being waged by the fossil-fuels industry, Zaelke pointed out that a public educated on environmental issues will resist self-serving arguments, allowing the debate to move to a serious discussion of what cuts must be made to achieve climatic stability.

Regarding advocacy Zaelke pointed to the need for legal groups to participate in international environmental claims and disputes; for example, through the Commission on Environmental Cooperation of the North American Free Trade Agreement. Lawyers and legal advocacy groups can file *amicus curiae* (friends of the court) briefs in disputes before the World Trade Organization, which has a sophisticated dispute-resolution mechanism. Lawyers should look carefully as well at international trade and investment, to make sure that adequate environmental standards are incorporated into global investment agreements.

Finally, Zaelke called for stronger pressure within the United States from lawyers, environmental advocacy groups, and civil society in general to develop a strategy to implement Agenda 21. Until now the U.S. has done very little and is not exercising leadership in this area. One particular issue that must be addressed in the U.S. is consumption. Sustainable development could never be achieved if the entire world consumed at the level of the U.S.; the U.S. must get its house in order—reduce consumption, and reduce advertising that encourages needless consumption—to play any sort of leadership role in promoting sustainable development.

Judge Weeramantry began by noting the contradiction between two fundamental principles of human rights: the right to development and the right to a safe, protected environment. Allowed to progress unchecked, the two would inevitably clash—unbridled development would ignore the needs of the environment, or total environmental protection would inhibit all development. The concept of sustainable development is the means to balance these competing human rights.

Sustainable development forces us to reexamine some the basic building blocks of our legal systems. For example, most laws are written to protect those who are alive. What about future generations? African customary law looks at three levels of rights; ancestors, the living, and future generations. As the concept evolves, sustainable development must take future generations into consideration. Another basis of current law is that it protects only human beings. Traditional legal systems from all over the globe are far more far-reaching, in that they often recognized the rights of other living beings on the planet, creating sanctuaries and ensuring that basic environmental needs were met. The concept that the living are but *trustees* of the land, not its owners, must be built into the laws governing sustainable development.

Modern law is also very individualistic, measuring remedies according to individual rights. But environmental law requires a more collective approach. Environmental damage knows no boundaries, and the rights of all people must be taken into consideration, not just those of a particular state or nation. We must move beyond a passive international law, where countries merely tolerate the existence of one another, to a more active international law, in which countries band together to protect the environment.

Finally, Judge Weeramantry noted that some developing nations feel that sustainable development is just another concept dreamed up by the developed world to inhibit their economic development. He pointed to numerous cultural practices and instances of traditional wisdom from all over the world that show that sustainable development is not a new idea, but rather an ancient concept. It was not evolved by one civilization, but is rather the common heritage

of humanity. The wisdom of ancient civilizations can and should be drawn upon to build a fruitful mass of international law today in the field of sustainable development.

The final speaker, Daniel D. Bradlow, addressed the question of how to promote environmentally and socially sustainable development within the academic world, particularly within law schools and the legal framework as a whole. His first three points were that ESSD is a process of universal application, that it requires human actors to internalize the costs of their actions, and that it requires an intergenerational approach. These three factors, in turn, imply the need for a major change in traditional approaches to the teaching and practice of law.

For example, since sustainable development has no boundaries or borders, the legal view of jurisdiction and sovereignty must be broadened to include all relevant lawmaking and enforcing actors and stakeholders in both the national and international spheres. Now, only states are party to international agreements, but laws based on ESSD must consider that communities, individuals, or civil society groups may have an important role to play. Similarly, if all costs of human actions are not internalized, unsustainable burdens may be placed on others in society, on the ecosystem, or on future generations. So if a firm wishes to produce a given product, it would have to take into consideration the environmental and social costs associated with production as well as with disposal of the waste created during both production and consumption. It would have to look at the impact of the project on prospective employees, on the community where it would be located, on consumers, and on the communities and consumers who will have to deal with the disposal of waste from both production and consumption.

Such a process challenges the law to extend its notion of causation, where causation refers to those results of an action for which the actor can be held legally responsible. Present conceptions of causation often do not expose producers to liability for the consequences of the disposal of products after sale and consumption. Internalization of costs may require changes in both national and international law, as products are no longer seen as independent of the context in

which they operate. ESSD also challenges the way lawyers operate in society. Traditionally they are expected to work in favor of their client; in an ESSD context, they would work in favor of a greater social good.

These and other requirements related to ESSD have serious implications for the current way that law is perceived and practiced. Many of the decisions that will have to be made to enforce ESSD are so broad and far-reaching that they will require multidisciplinary teams to determine social and environmental costs and benefits. The law may have to expand the way it resolves disputes. Some decisions will involve stakeholders whose interests cannot be reconciled, but whose needs must be incorporated into a sustainable solution. Ways will have to be found to adequately inform all stakeholders of issues being discussed and include them in the dispute-resolution process. Moreover, the law must develop mechanisms that allow for consideration of future needs and interests in today's disputes.

Implementing ESSD requires lawyers who are

- Capable of thinking and acting globally or holistically
- Flexible enough to function as part of a multidisciplinary team.

This in turn requires law schools to adapt their curricula. They should incorporate more international law and comparative legal analysis into basic legal education, including "domestic" law courses. This will involve increasing contacts with law schools in other countries, for exchanges of knowledge and information. Since lawyers must learn to work in teams, law schools should incorporate more joint class exercises and simulation exercises into classroom methodology and offer relevant multidisciplinary courses, to accustom students to interpreting the law in a broader context. Law schools should also begin to incorporate social and environmental responsibility into the teaching of technical skills; students must be taught about ethical and social responsibilities—including responsibility to future generations.

In conclusion, Bradlow said, law schools must adopt a more global perspective, be more innovative in their teaching, pay more attention to integrating technical expertise with education on social and environmental responsibilities, and more engaged with the broader community.

LEARNING SEMINARS

Seminar on Global Environment Treaties and World Bank Policies

Summary

Held at the World Bank
October 8, 1998

To supplement the fifth ESSD Conference the Environment and International Law Unit of the World Bank's Legal Department organized a staff seminar entitled "Global Environmental Treaties and World Bank Policies." Respect for the rule of law contributes to the translation of international commitments on the ground, in people's daily lives. This can be achieved through the establishment of environmental institutions or the adoption and implementation of legislative and regulatory measures. Respect for the rule of law is a means to strengthen the participation of all stakeholders and to shape processes whereby all important actors have a role to play. Without respect for the rule of law, there cannot be sustainable development. Financial and technical assistance measures are the predominant vehicles for achieving such an aim, and the Bank plays a leading role in this endeavor. The changes taking place within the Bank reinforce the importance given to protecting the global environment. Steps are being taken at all levels and in all Regions to carry out new responsibilities in the area.

The growth of international environmental law in the course of the last 30 years is impressive. Almost nonexistent in the early 1970s, it is now a major body of rules and principles. Many of these international concerns have been incorporated into the Bank's policies and procedures, which cover topics such as environmental impact assessments, natural habitats, forestry, and water resources management. Their mere existence

highlights that environmental protection is not an abstract consideration for the Bank. The real challenge however is to internalize their requirements at the global, regional, and local levels. A wide array of strategies and mechanisms have been devised, as is eloquently demonstrated in papers by professors Brown Weiss and Jacobsen and others, which appear as annexes to this introduction.

The Bank's contribution should be understood in this context. It helps borrowing countries to comply with requirements of international environmental law. Bank loans often require the adoption of new environmental legal and regulatory frameworks, strengthening them where they exist, and enhancing the implementation and supervisory capacity of national institutions. The Bank, of course, is not alone in meeting these objectives; they cannot be achieved without partnership. Other international institutions also have a crucial role to play in providing assistance in the design and implementation of environmental policies, particularly the secretariats of environmental conventions. Some of their representatives, such as Delmar Blasco from the Ramsar Secretariat and James Amstrany from the Convention on International Trade in Endangered Species (CITES) were guest speakers at the seminar. Their presence provided an opportunity for Bank staff to familiarize themselves with issues being addressed outside the Bank, and for people outside the Bank to learn more about what the Bank is doing in the environmental area.

Reading

Strengthening National Compliance with International Environmental Agreements

Edith Brown Weiss and Harold K. Jacobson

In 1972 when the United Nations Conference on the Human Environment was held in Stockholm, only about three dozen multilateral environmental agreements were in existence. Today more than 900 international legal instruments (mostly binding) either focus on the environment, or contain one or more important provisions concerned with the environment. These instruments are viewed as the primary means for affecting the behavior of states and many other actors: subnational governments, industries, nongovernmental organizations (NGOs), and individuals. They involve substantial costs to states and to the targeted and interested actors, whether in the negotiations for the agreements or their implementation.

Until recently, little attention has been paid to the extent to which states and other actors comply with these agreements. In this brief article, we argue that compliance is a complex process involving both the intent and the capacity of states; that the three alternative compliance strategies embodied in international agreements—"sunshine," incentives, and sanctions—and the institutional design of agreements affects intent

and capacity; and that the choice of strategies must be targeted to individual countries' intent and capacity. Moreover, the preferred strategy choices vary across different areas of international agreements: trade, labor, human rights, arms control, and environment. This article is based on research conducted with colleagues from ten countries as part of a nine-country study of five international environmental agreements.¹

Conceptual Framework

The traditional stylized model of compliance assumes that countries accept international agreements only when governments regard them as being in their interest. Thus countries generally comply with obligations they have assumed. If they do not, sanctions are used to punish offenders and deter violations.

But the reality is different. While countries join agreements that are in their self-interest, there are many different reasons *why* they find them to be in their self-interest. And these reasons affect willingness and capacity to comply. In the best of worlds countries may join to show leadership

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in addressing a problem. But they also may join because others are doing so, or because governments with leverage over them are pressing them to do so, or because of domestic pressures. Countries may join because the obligations require no change in their present behavior, or they may join with no intention of immediate compliance—and may even lack the capacity to comply.

The traditional framework for analyzing compliance is hierarchic, static, and focused on states. Governments negotiate international agreements, which are then usually put into force through implementing legislation or regulations at the national level. States ensure that other actors comply with the domestic measures. This approach is hierarchic because it moves from the international agreement and member states downward to the subgovernmental units, NGOs, and individual actors. It is static because it assumes that a snapshot at some point in time accurately captures compliance with the agreement.

A more realistic framework for understanding compliance would be nonhierarchic, include many actors other than states, and treat compliance as a process that changes over time. The agreements themselves evolve over time, both as to the obligations they contain and the implementing measures. In this framework states continue as central and essential actors, but other actors also become important. These include intergovernmental organizations, secretariats servicing the agreements, NGOs, private industrial and commercial enterprises, and individual actors. These nonstate actors interact dynamically in complex ways according to patterns that vary among agreements and within countries.

Based on empirical research, the international study of national compliance found that, in general, national compliance increases over time, and countries frequently devote more resources to compliance over time. But compliance also declines during certain periods for certain countries and particular agreements. Economic chaos, political instability, and sudden decentralization have caused compliance to decrease, especially in regard to agreements for which there is no strongly vested interest in securing compliance.²

Two critical factors explaining national compliance are a country's intent and capacity to comply, both of which may change over time. In

designing international agreements and implementing measures, states should consider the appropriate mix of strategies to encourage member countries to have both the intent and the capacity to comply with agreements.

Intent and Capacity

The study on national compliance revealed that when countries join agreements they are in quite different positions with regard to their intent and capacity to comply, and that both factors change over time.

Intent is difficult to determine, but can be generally discerned from an analysis of the behavior of countries. Intent is not to be confused with the formal votes or positions countries may take in international meetings. Some countries intend to comply with the obligations they assume at the time they join the agreement. Implementing legislation that fully satisfies the treaty obligations may be already in effect; the country's past practice may already be in compliance with at least the substantive obligations of the treaty. In other cases countries may join treaties without having carefully considered the obligations; they may even be unaware of them. Others may join with no intent to comply, as in the case of certain central and east European countries becoming parties to the Protocols on Sulphur Dioxide and on Nitrogen Oxide to the United Nations Economic Commission for Europe Long-Range Transboundary Air Pollution Convention. They may bend to international pressure, or respond to "bribes" by other states, or they may join to foster international cooperation in general, in anticipation of other returns. There may be conflicts in intent within a country that reflect internal divisions. "[A] government may be divided, the foreign ministry may intend to comply while other branches of government may have no intention of abandoning practices that contravene the accord."³ The national government may even intend to comply, while relevant provincial governments do not. In many cases countries may intend, in the abstract, to comply, but then find that the agreements have too low of a priority to receive the attention and resources needed for compliance.

Countries must also have the capacity to comply. Many assets are important: an effective and

honest bureaucracy, economic resources, public support, and technical expertise and know-how. These assets differ among states when they join an agreement, and the assets change over time in response to domestic and international events. International environmental agreements, in particular, have targeted financial and technical assistance to states to help them develop the capacity to comply. In many cases the most acute issue for member states is one of prioritization: how much resources to devote to compliance with particular obligations contained in the agreements. This dilemma becomes particularly difficult when it involves coordination among several ministries and provincial and local governments, which may be recalcitrant.

While the only effective strategy to increase the political intent and capacity to comply is to engage countries in the agreement, countries can facilitate this through the strategies they adopt in designing and implementing international agreements and the institutional structures that accompany them.

Compliance Strategies

International legal strategies to encourage compliance⁴ may be grouped into three categories: negative incentives in the form of penalties, sanctions, and withdrawal of privileges; sunshine methods, such as monitoring, reporting, transparency, and NGO participation; and positive incentives, such as special funds for financial or technical assistance, and access to technology or training programs. In addition there are traditional public international law remedies for breach of an agreement, as set forth in the Vienna Convention on Treaties and customary international law. The question is which methods work best under what set of circumstances. In part, this can only be answered through empirical research.

Sanctions

Under the traditional framework for compliance parties rely on sanctions, penalties, and such measures as withdrawal of privileges under the convention to enforce treaty commitments. In trade law, sanctions have been regarded as essential to achieving compliance. In international

environmental law, sanctions are rarely used. Imposing sanctions means that individual parties ban trade in certain products with violators of the agreement or deny certain status or privileges accorded under the agreement to the violating party.

Trade sanctions have been threatened to enforce the Convention on International Trade in Endangered Species (CITES). For example, the CITES Standing Committee recommended that parties ban trade in wildlife products with China [and Taiwan] for violating prohibitions on trade in rhinoceros horns and tiger parts. Not long before, the Standing Committee considered a trade ban on CITES products with Italy. Using trade sanctions to enforce multilateral environmental agreements raises problems of consistency with the 1994 General Agreement on Tariffs and Trade (1994 GATT), as incorporated in the World Trade Organization. The 1994 GATT prohibits import quotas, requires national treatment between imported and domestic products, and requires most-favored nation treatment among countries (so that the most favorable treatment offered to one exporting country must be granted to all), but provides relevant exceptions in Article XX (b) and (g).

Withdrawing the privileges of membership in a convention is another traditional enforcement measure. The World Heritage Convention provides for a variation of this. While the text of the convention provides only for countries to list sites on the World Heritage List, the guidelines provide for delisting a World Heritage site if the country is in violation of its obligation to conserve the site. The language is ambiguous as to whether the host country must consent to the delisting. The sanction has not been used; no site has been removed from the World Heritage List, although the integrity of several sites is severely threatened.

In some instances sanctions in the form of withdrawal of some of the privileges of membership in the convention apply. In the Montreal Protocol, for example, countries qualifying as Article V developing countries, qualified to receive assistance from the Montreal Protocol Fund, can lose that status if they do not provide baseline data on consumption levels of controlled substances within a certain time after joining the agreement.

Public international law provides remedies for breaches of treaty obligations and for rules of customary international law. The Vienna Convention on Treaties indicates under what circumstances parties may withdraw from an agreement because of a breach of an obligation by a member party. Rules of customary international law set forth the right to resort to countermeasures. These rights have generally not been invoked in relation to international environmental problems. Nonetheless, such remedies are always available to states, providing that the legal requirements have been satisfied. In international environmental law, sanctions are a "last resort," invoked only after other methods have failed. The extent to which sanctions are needed as a latent threat, to make other methods of achieving compliance effective, is not clear. This issue is discussed below.

"Sunshine" Approach

The most effective way to ensure compliance is through what we have labeled the "sunshine strategy." This approach relies on: monitoring behavior of various actors through regular reports, site visits, and international review procedures; transparency and access to information; media access and coverage to stimulate public awareness; NGO participation in monitoring compliance; and informal pressures by parties and secretariats to comply. It relies on what has been termed the "reputation" factor to induce compliance.

Monitoring is essential to any effective program to increase implementation and compliance with treaty obligations. Monitoring may take many forms: off-site monitoring through advanced technologies of scientific baselines or other criteria; reports by parties or NGOs; on-site monitoring by parties, secretariat officials; or consultants; and international review of materials submitted by parties or gathered from other sources.

Reporting has recently become a primary monitoring instrument. Nearly all of the most recent United Nations Environment Programme (UNEP) conventions require regular reports from parties on implementation of the agreements. Indeed there is almost a "bandwagon" effect among countries to include a provision on reporting in new agreements.

A reporting requirement is useful in that it engages countries in implementing the agreement. Some official(s) in the country must be responsible for filing the report. Moreover, reports are an important tool for educating countries about their commitments under the agreement, and also serve as a potential means to build local capacity for compliance.

But there are also problems with relying on reporting as the key monitoring tool. Officials required to file reports under the burgeoning number of international agreements may find that their time is mostly occupied by preparing, reports rather than by taking the actions called for under the convention or addressing other high priority environmental issues. Indeed, in countries with a scarcity of skilled labor, the government may need to devote much of its time to meeting reporting requirements. This problem has been referred to as "congestion in treaty reporting." Moreover, unless reporting requirements are standardized, the data may be difficult to compare and evaluate. Great variations in content in national reports for a given agreement may occur, or, in other cases, national reports may begin to look alike across different issue areas, as information technology makes for easy transfer of written material.

Reports are useful monitoring tools if they convey information that others can review and verify. This requires an international process of review and a means to draw violations to the attention of parties for action. However, both secretariats and parties may be reluctant to call particular countries to account for inaccurate reports.

Some studies have found generally low rates of compliance by parties with reporting requirements. Many countries do not report or do not do so on a timely basis. The reports may be incomplete or inaccurate—as in cases when the same data is reported for several years. It may be difficult to determine whether the data is reliable. However, the preoccupation with the relatively low rates of compliance with reporting obligations in international environmental agreements may be somewhat misplaced. It is arguably much less important that all countries comply with the obligation to file regular reports than that the countries that are major players in a particular agreement comply. Here the record of compliance with reporting obligations is much

stronger, as in the 1972 London Convention, which controls dumping of pollutants in the oceans.

Reporting is linked with transparency to states, nonstate actors, and individuals. NGOs rely upon this transparency to monitor and encourage compliance with the convention, although admittedly the information might, under some circumstances, also be used to circumvent the obligations. Providing other member states and nonstate actors with access to information generally makes it more likely that unreliable reports and inaccurate data will be detected.

The sunshine strategy relies on NGOs, expert communities, and corporate actors to make possible parties' compliance with international agreements. NGOs bring violations to the attention of governments and secretariats servicing the convention. International NGOs, such as Greenpeace International and Friends of the Earth, may work with local NGOs to pressure countries to comply, or may exert pressure directly on governments or corporate actors. Nonstate actors (and individuals) bring suspected violations to the attention of the secretariats servicing the agreements, the parties, and the media. While these organizations have been much more active in developed than developing countries, their numbers are growing worldwide.

NGOs are explicitly designated to monitor some agreements. For example, the World Conservation Monitoring Unit has tracked national country reports of imports and exports of listed species for CITES. Other NGOs systematically monitor state behavior on their own initiative, as in TRAFFIC's (Trade Records Analysis of Flaura and Fauna in Commerce) monitoring of trade in endangered species and tropical timber.

Sometimes the most effective monitoring of compliance takes place in the private sector. Corporations have a keen interest in maintaining a "level playing field." In the case of the Montreal Protocol, for example, a handful of large companies that produce chlorofluorocarbons and other controlled substances have an important financial stake in ensuring that competitors abide by the agreement. They also have the resources to monitor compliance, albeit quietly.

Finally, the sunshine strategy relies on consultation and informal pressures, such as "jawboning," to induce compliance. Secretariats consult

with governments, NGOs, industry, and individuals. Governments consult with secretariats, NGOs, and industry. Industries and other private actors seek advice from secretariats regarding compliance. Secretariats often play an important, but low-profile, role in bringing informal pressure to bear upon noncomplying actors.

The sunshine strategy builds upon the culture that surrounds the politics of environmental issues in many, but not all, countries. The public sees the environment as an issue about which it ought to have access to information and an opportunity to participate in decisions that affect society. Governments are becoming accustomed to nonstate actors as influential participants in the policy process, whether formally or informally. Thus, in contrast to areas such as trade and national security, the sunshine strategy finds fertile ground.

Incentives

International agreements increasingly rely on positive incentives to induce compliance. The incentive approach is based on the belief that many problems of compliance are, in fact, problems of the lack of capacity to comply. If countries have the intent to comply, but lack the capacity, incentives can be an effective strategy for securing compliance. They may also be effective in shaping the interest, and hence the intent, of the country to comply.

Incentives can take the form of training materials and seminars, special funds for financial or technical assistance, access to technology, or bilateral and multilateral assistance outside the framework of the convention.

Many international environmental agreements provide for the establishment of special funds to assist parties in complying with the convention. The 1972 World Heritage Convention established a special fund, which although small, has regularly assisted countries in conserving sites on the World Heritage List. Similarly, parties to the Montreal Protocol established the Montreal Protocol Fund in 1990 to assist Article V developing countries to comply with their Protocol obligations. The two Rio conventions, the Framework Convention on Climate Change and the Biological Diversity Convention, provide for funding to countries to meet the global incremental costs of

complying with the conventions, although they do not establish separate funds to do so.

The Global Environmental Facility (GEF), created in 1990 initially as a US\$1.2 billion, three-year fund, provides grants and loans to developing countries for specific environmental problems: ozone depletion, biological diversity, climate change, and marine pollution. It has been restructured and become permanent, and the scope now encompasses desertification. The GEF provides an important potential source of additional financial incentives to countries to build local capacity to comply with international commitments.

Developing countries have increasingly viewed the provision of financial and technical assistance as prerequisites for joining international environmental conventions. India, for example, insisted that the Montreal Protocol Fund be in place before joining the Protocol. During negotiations for the Desertification Convention, some countries insisted on having access to funds as a prerequisite to concluding the convention.

Financial incentives build local capacity to comply with treaty obligations. But access to funds can also be used as a "stick" to ensure compliance with treaty obligations. For example, in 1995, the GEF linked fulfillment of obligations under the Montreal Protocol to receipt of GEF funds.

Training is an important component of the incentive strategy. Generally the funds devoted to training, and the numbers of people trained annually, have increased for international environmental conventions. For example, funds devoted to training under CITES have increased sharply since 1994.

Training programs build local capacity to comply with treaty obligations and engage local actors in the agreement. However, care must be taken to ensure that the proper people are trained, and that at least some of those trained will continue working with the agreements beyond six months. Various strategies can be employed: moving training to the regions or within countries, or training slightly more people than needed, so that some may still be on the job in a year. Other techniques include training of "trainers," who can then conduct regular seminars; providing clear training manuals; and scrutinizing training applicants for quality.

Of the three compliance strategies, only two are in frequent use: the sunshine and the posi-

tive incentive strategies. Sanctions and other enforcement measures are rarely resorted to, and then only for items in international trade. Sanctions are a blunt instrument. In contrast the sunshine and positive incentive approaches are more flexible, and rather more subtle, instruments to encourage compliance.

Institutional Measures

The institutional structure of the regime surrounding each international agreement affects compliance. Features intended to promote compliance include establishing an implementation committee among parties and noncompliance procedures (which have been unusually effective for the Montreal Protocol), engaging an enforcement officer in the secretariat (as in CITES), publishing violations (as in CITES and Basel Convention), providing a formal role for NGOs (as in UNESCO's World Heritage Convention and CITES), developing a formal link with industry (as in the Montreal Protocol and OzonAction), and establishing scientific and technical assessment and advice bodies to ensure that the convention keeps pace with scientific advances (as in the Montreal Protocol).

The role of the institutional features in facilitating compliance often evolves over time. The implementation committee and noncompliance procedures of the Montreal Protocol were used initially to help noncomplying Article V countries come into compliance with reporting obligations. However, since 1995 parties have used the procedures to exert strong pressure upon several countries, such as the Russian Federation, to come into compliance with procedural and substantive obligations. In the case of the World Heritage Convention, the role of the IUCN and organizations concerned with cultural heritage has shifted from an almost exclusive emphasis on evaluating sites for suitability for nomination to the World Heritage List, to a substantial focus on monitoring member state conservation of the listed sites. Similar changes have taken place in the institutional functions performed in other international agreements. Thus in designing international agreements, it is important to consider whether the parties will be able to use the institutional features of the agreement to respond flexibly over time to new needs and demands.

Secretariats to international agreements play an important role in securing compliance by members countries and targeted nonstate actors. They have substantial influence, in part, because they may be the only body with comprehensive knowledge of the extent to which parties are complying. They are uniquely situated to respond to questions and to jawbone actors into compliance.

One of the most important measures for securing compliance is to ensure that secretariats for the agreements have secure funding and long-term personnel contracts. In light of the financial crisis in the United Nations system, some secretariats have moved largely to short-term contracts of one-to-three months, and funds provided by the parties to the agreement, even if in separate bank accounts, have become subject to general restrictions on use. Secretariats need to attract and retain high quality personnel and to be able to implement long-range planning for implementing the convention and ensuring compliance by member countries.

Linking Compliance Strategies with Intent and Capacity

With respect to each international agreement, it is possible to create a figure of four boxes joining intent and capacity: countries with high intent to comply and strong capacity; countries with low intent to comply but strong capacity; countries with high intent to comply but lacking in capacity; and countries with little intent to comply and low capacity. In each of these categories, member countries will always have varying degrees of intent and capacity to comply. Compliance strategies must be targeted to move countries toward both the strong intent and capacity to comply. Different strategies need to be emphasized for different categories of countries, although a mix of strategies should be available.

For countries with both intent and capacity, the sunshine strategy may be especially important, for it facilitates monitoring by both governments and nonstate actors. Sanctions are of secondary importance—primarily to ensure that countries are not tempted to change their intent. In certain cases incentives may be useful to ensure that a country continues to have the capacity and the intent to comply. When countries have

the intent to comply, but lack capacity, incentives are especially important to build capacity. Sunshine strategies may play an important secondary role in mobilizing nonstate actor support and in monitoring progress in building capacity. The latent threat of sanctions may help to ensure that the targeted incentives are appropriately used to build capacity. This category of states, which would like to comply but lack capacity, includes many developing countries. Those countries that lack the intent to comply but have the capacity may be particularly susceptible to some form of sanction; the sunshine approach may be important in reshaping their intent. In certain cases incentives may also help, particularly in redirecting priorities. For those countries lacking intent and capacity, all three strategies may be essential.

One of the complications of linking intent and capacity with compliance strategies is that both the intent and capacity of countries to comply may change over time. National compliance changes over time in response to many factors. This suggests that the suite of measures needed to promote or ensure compliance by member countries may also change over time.

Compliance Strategies Compared across Areas of International Law

In international environmental law countries have relied primarily upon the sunshine and incentive approaches to secure compliance; sanctions have been rarely used. Nor have formal dispute resolution mechanisms been employed.

Patterns of compliance strategies used, however, vary across the fields of international law. Compliance strategies generally focus heavily on elements of the sunshine approach in both the human rights and the labor areas. In contrast, trade agreements and arms control instruments have relied more on sanctions and other enforcement measures, although monitoring measures are also important. Formal dispute resolution is an integral part of international trade law and human rights law, but this is not the case in international environmental law.

Since international environmental issues have, from the beginning, been of public concern, and since all states share a common interest in a healthy global environment, the emphasis on

sunshine and incentive strategies for compliance seems understandable and appropriate. As we enter the new millennium, the growing recognition that the quality and integrity of the environment is a shared concern ought to push both state and nonstate actors toward developing effective compliance strategies that ensure that countries have both the intent and the capacity to comply.

Notes

1. Harold K. Jacobson and Edith Brown Weiss, *Strengthening Compliance with International Environmental Accords: Preliminary Observations from a Collaborative Project*, 2 *Global Governance* 1 (1995). The research is published in Jacobson and Weiss, eds., *Engaging Countries: Strengthening Compliance with International Environmental Accords* (MIT Press, 1998).

2. See same source.

3. Jacobson and Weiss, *Compliance with International Environmental Accords: Achievements and Strategies*, 1996.

4. For an earlier version of this analysis and the accompanying figures and tables see Edith Brown Weiss, *Strategies for Compliance*, United Nations Environment Programme/Georgetown University Law Center, International Workshop on Compliance, May 20-21, 1996.

Reading

Sustainable Development and the World Bank: Legal and Policy Instruments

Charles E. Di Leva

International environmental law has traditionally centered upon international and regional environmental treaties and agreements. More recently, the topic is often considered to include the policies, procedures, codes of conduct, and guidelines of multilateral financial institutions, such as the World Bank Group (Bank)¹ and other United Nations specialized agencies. Although these "non-treaty" instruments are not binding in the traditional sense, they have considerable practical impact, especially throughout the developing world. In part this impact occurs because the financial leverage of institutions such as the World Bank enables them to impose environment-related instruments, such as "green" loan conditions, and environment-related policies as part of their financing activities. Further, the application of these instruments by multilateral financial institutions helps support traditional treaty law, because many of these instruments explicitly or implicitly further the aims of international environmental agreements. Thus in a world where the efficacy of a legal instrument is based upon its capacity to generate compliance, the policies of the World Bank and similar institutions may be highly effective in promoting international environmen-

tal treaties—in some cases more effective than many traditional sources of international environmental law.

The focus on "non-binding" instruments does not mean that international treaties lack significance to multilateral financial institutions. Because governments are the owners of the institutions like the World Bank, and are bound to comply with the treaties they have ratified, multilateral financial institutions must be careful to ensure that if these treaties are implicated in their projects, the treaties are appropriately taken into account in project design and finance.² In fact, in some cases, multilateral institutions are considered the prime means for implementing these treaties for the vast majority of the world's population, in the so-called "developing" countries. One example of this view is that the World Bank serves as the main implementing agency for the Global Environment Facility (GEF),³ which is the interim financial mechanism for the United Nations Framework Convention on Climate Change, and the Convention on Biological Diversity.⁴ The GEF was established in the World Bank as a pilot program to "assist in the protection of the global environment,"⁵ and to do so in a way that is consistent with the promotion of

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"environmentally sound and sustainable economic development."⁶

While this article notes that the growth of international environmental law has many positive aspects, to many this increase represents a troubling dilution of national sovereignty. To these concerned critics, the impact of project finance by international organizations and their decision-making processes are often carried out without adequate citizen involvement. Further, they contend that international organizations often seek to make environmental practices or standards globally or regionally harmonized, with the result that the environmental standards used will represent the lowest common environmental denominator. Frequently criticized in this context are the "Bretton Woods Institutions"⁷—the International Monetary Fund and the World Bank—and the World Trade Organization. Also accused are regional organizations such as the European Union and the administrative bodies of the North American Free Trade Agreement.⁸

The Concept of International Environmental Law

At the same time there have been clear global and local environmental benefits emanating from a broad view of international environmental law and the actions of these international organizations. As this paper attempts to portray, the application of World Bank-type environment-related policies has paved the way for increased prospects for procedural and substantive environmental improvements by all multilateral financial organizations. These improvements are apparent in that during the past few years alone a vastly wider range of stakeholders are now part of the decisionmaking process for projects financed in whole or in part by multilateral financial institutions, and the goals of environmental treaties are much more often a part of project implementation. Perhaps more importantly, with the multilateral institutions in the forefront, these policies are likely to be increasingly utilized by the private sector in their activity in developing countries. Given that the private sector often works in developing countries with uncertain or weak environmental standards or lax enforcement, utilization of these international practices

could result in major improvements over the current situation.

Clearly, to some, the World Bank has fallen short as a model institution for the support of sustainable development.⁹ To the Bank's credit, however, there are few institutions capable of bringing such a broad array of factors to seek to reconcile the tension between environment and development. A recent project that typifies this tension, but in which the Bank did not participate, was addressed in the recent ruling of the International Court of Justice in the dispute between Hungary and Slovakia over the construction of a dam on a shared watercourse.¹⁰

The two sides agreed that the principle of sustainable development was applicable to the case, but could not agree how to apply it. In a separate opinion Justice Weeramantry stressed the need for states to look beyond their narrow interests. In this context, Weeramantry noted, the proposition should stand that the law of sustainable development and application of environmental assessment are part of customary law.¹¹

Thus given the difficulties of balancing these competing interests in the judicial arena, even the Bank's most strident critics should agree that the Bank represents one of the most important mechanisms to influence the development of international environmental law, given its significant financial and technical resources and its global links to both the public and private sectors. In fact, as set forth in Agenda 21 of the United Nations Conference on Environment and Development¹² and in numerous references since the 1992 Rio Conference,¹³ international development institutions such as the Bank play a key role in promoting international environmental treaties and agreements, as well as the development of national environmental law. Indeed, while addressing the United Nations, World Bank President James D. Wolfensohn made it clear that the Bank would help to promote the goals of the global environmental conventions.¹⁴ This outcome is a welcome and natural progression for an institution "generally viewed as an environment-insensitive organization."¹⁵ The progression can be seen as an outcome of the Bank's growing support for international environmental law.

The World Bank is the first and largest multilateral financial institution. It is owned by the governments of 180 countries.¹⁶ Created in 1945, the Bank's Charter (Articles of Agreement) proclaimed that its purpose is, in part, "to assist in the reconstruction and development of territories of members by facilitating the investment of capital for productive purposes ... and the encouragement of the development of productive facilities and resources in less developed countries."¹⁷ As such, the Bank was created under, and undertakes its operations to be in compliance with, applicable public international law principles and rules.¹⁸

Although the Bank's Articles do not refer to the terms "environment" or "sustainable development," the World Bank provides more human and financial resources for the environment than any other international development institution. With an active portfolio of 166 projects funded at close to US\$12 billion, and a staff of approximately 300 specializing in the environment, the Bank is the largest international financier of environmental projects, which the Bank considers to be both "global" and "targeted"—meaning that the funds are aimed specifically at addressing environmental concerns of the international community, not just the sovereign recipient of funds.¹⁹ Newer international development institutions are also taking these strides, increasingly in conjunction with the Bank. In fact, the Articles of Agreement of the European Bank for Reconstruction explicitly refer to the need for environmental considerations in its financing activities.²⁰

While the World Bank's Charter did not refer to the environment, important Bank policy documents have done so for over two decades. The most comprehensive was a 1984 statement entitled "Environmental Aspects of Bank Work,"²¹ which noted the Bank's findings about the impact on the environment as a result of development financing, and discussed the seriousness of these impacts. It also noted that the Bank had guidelines suggesting "acceptable ranges [of impact] to be followed in Bank operations, unless the borrowing country's standards are stricter."²²

The instructions for applying these guidelines set forth a series of principles, each of which finds support in international environmental legal instruments. For example, almost as a precursor to the phrase "sustainable development," the in-

struction indicates that Bank-financed projects "should not exceed the regenerative capacities of the environment."²³ The operational statement also sets forth principles pertaining to indigenous peoples, involuntary resettlement, transboundary harm, and cultural heritage sites protected as "World Heritage sites or Biosphere Reserves."²⁴ Serving as a key principle for the discussion here, the statement also provides that "the Bank will not finance projects that contravene any international environmental agreements to which the member country concerned is a party."²⁵

While the 1984 statement specifically referred to binding "international environmental agreements," its more general discussion of the need to consult with nongovernmental organizations (NGOs) and provide information to the public, as well as its concern for broader environmental goals, reflect concerns embodied in nonbinding instruments.²⁶ To this extent the 1984 Bank statement can also be seen as supporting the many "soft law" instruments throughout the international community. A number of these instruments are also particularly relevant to the work of the Bank, including the Rio Declaration on Environment and Development, the statements of policy set forth in Agenda 21, and a series of principles and guidelines issued by other United Nations agencies and programs, such as the codes relating to pesticides from the Food and Agriculture and World Health Organizations.²⁷

This article contends that the Bank promotes international environmental law in a number of ways. The next section of this article points out that the Bank supports international environmental law through its lending strategy and selection of projects, as well as through its roles in relation to the Global Environment Facility and the Montreal Protocol. The last section of the article discusses the Bank's operational policies and procedures regarding the environment, and demonstrates how they support many goals of international environmental law.

The World Bank and Project Finance for International Environmental Law

The principle of "common but differentiated responsibilities"²⁸ dictates that developed coun-

tries should undertake the major burden of meeting the goals set forth in international environmental treaties. It is important to note that, notwithstanding this principle, developing countries still have responsibilities under international agreements,²⁹ such as the recently adopted Kyoto Protocol.³⁰ The resources of the GEF can provide up to US\$2 to US\$3 billion dollars triennially in grants to developing countries to fulfill their responsibilities, as set forth in international environmental treaties. But GEF resources are scarce, and it is important for the multilateral financial institutions to assist with those efforts.³¹ For example, as administrator of the Ozone Trust Fund,³² the Bank supports activities in developing countries that are necessary to carry out the goals of the Montreal Protocol.³³

World Bank Support for Developing Country Obligations under International Environmental Law

In addition to projects that directly serve identified environmental treaties, during the last several years the Bank has also financed a number of projects supporting general environmental goals that focus on human capital, such as environmental institution capacity-building, education, and awareness. These “environmental management” projects help develop environmental capacity and public participation at the national and local levels, and thereby provide indirect, but important, foundations for international environmental law.

Indeed, these environmental education projects portend well for international environmental law by introducing education on the subject to broad venues of the world’s less advantaged. One example is the World Bank’s India Environmental Management Project, designed to ensure that environmental law is taught at law schools in Bangalore and New Delhi.³⁴ This project was prepared following discussions with government officials and scholars, as well as interviews with leading environmental lawyers such as M.C. Mehta, the internationally acclaimed lawyer who achieved notable rulings by the Indian Supreme Court against polluting industries.³⁵ Thus while not falling expressly under the rubric of an environmental treaty, this project can help train the next generation of environmental lawyers in the

world’s largest democracy. A similar project is being prepared by the World Bank in Bangladesh.

Another example of promoting international environmental law through national planning occurred during the preparation of the Thailand Forestry Project.³⁶ This project was designed to help develop sustainable forestry and use GEF resources to support the goals of the biodiversity treaty. Because receipt of the GEF-funded portion of the project was dependent upon ratification by Thailand of the Convention on Biological Diversity (CBD), the project sparked a national debate on the issue of ratification, including discussion during a Bank-sponsored workshop in Bangkok at which dozens of Thai NGOs attended and debated the topic.³⁷ Eventually, the Thai government ratified the Convention. Thus in some cases the objectives of these projects do not necessarily come under the rubric of an international environmental treaty, yet they indirectly provide significant support for its goals.

In addition to natural resource projects supporting the goals of the CBD, the Bank is revising its energy lending to respond to the goals of the Climate Convention. The Bank’s draft Energy and Environment Strategy Paper³⁸ discusses the link between global and local environmental objectives. Under the strategy the Bank will assist clients in meeting their obligations under the Climate Convention and the Kyoto Protocol, while also serving the Bank’s primary development objective—poverty reduction.

Consistent with the Strategy Paper, the Bank is poised to begin preparations for a Carbon Investment Fund (“CIF”) following the negotiations of the Kyoto Protocol. The CIF would invest in projects that result in carbon offsets.³⁹ Funds would come from governments or private sector entities seeking to comply with emission limitations obligations. These projects could be part of the pipeline of projects already in the World Bank, International Finance Corporation (IFC), and other multilateral financial institutions. The CIF would operate with the goal of supporting carbon emission reduction projects, as authorized by the Kyoto Protocol. The Protocol authorizes these projects between countries listed in the Protocol Annex B.⁴⁰ This list includes so-called “developed countries” and the countries with economies in transition.⁴¹ At some point in the

future, perhaps by year 2000, it could include all developing countries. This possibility is envisioned under the Kyoto Protocol through the Protocol's proposed Clean Development Mechanism (CDM).⁴²

Linked to the combined goal of pollution and poverty reduction, the funds collected for the CIF could be disbursed through host country governments, or through the IFC; the ultimate recipients would be in the host country. The CIF could have its carbon offsets verified by the CDM or by CDM-approved third parties. By making these projects more energy efficient, and thereby reducing carbon emissions, the investors could receive carbon offset certificates,⁴³ which could be used as evidence of their efforts to comply with the emission reduction limitations. To the extent that these actions could take place before Kyoto Protocol rules on emission reductions, crediting, and verification are in place, there is a need to discuss the possible grandfathering of these credits under the Kyoto Regime.

Any grandfathering effort could be aided by the knowledge gained by some projects already undertaken by the Bank during the "pilot phase" of activities implemented jointly (AIJ), as authorized through the Climate Convention.⁴⁴ Consistent with that authority, the Bank established AIJ pilot-phase activities in Poland, Mexico, Burkina Faso, and India using GEF and other resources. In these projects financial resources from developed countries were used to reduce carbon emissions below the amount of carbon that would have been emitted as of the project's original design; that is, the "baseline" for the project. Through the World Bank the results of those AIJ projects have been reported to the Convention Secretariat and then to the Parties to the Convention. These projects, and projects under the future CIF, will provide important lessons for future broad-scale reduction activities.

As noted above the global problem of greenhouse gases is also a local health problem, because many of the greenhouse gases emitted from fossil fuel-burning sources also contain particulate matter and sulfur dioxides linked to respiratory illness.⁴⁵ Thus by addressing local pollution, the Bank and others can also help alleviate the global problem. As a result, the Bank has noted that "polluters—whether large power plants, fac-

tories, households burning coal or firewood, or the owner of a stroke motorcycle—continue to pollute without paying the full social and environmental cost of doing so or of switching to cleaner fuels."⁴⁶ A key step toward reducing these emissions is to find ways to demonstrate the global and local externalities arising from air pollution. The Bank, the Asian Development Bank, and others have helped develop an environmental assessment tool, "RAINS-ASIA," which, through satellite imagery and other tools, can depict acid rain "hot spots" to local regulators throughout Asia.⁴⁷ In this way regulators and investors can devise alternative energy-development strategies.⁴⁸

The Bank also helps developing countries to reduce their consumption of ozone-depleting substances (ODSs). To do so the Bank plays a key role under the Montreal Protocol on Substances that Deplete the Ozone Layer, acting as one of four implementing agencies of the Multilateral Fund for the Implementation of the Montreal Protocol (Multilateral Fund).⁴⁹ The Multilateral Fund was established to provide the funds necessary for developing countries to phase out the use of ODSs. The World Bank holds a portfolio, which now stands at close to US\$250 million, that will go largely to private-sector enterprises in developing countries to enable them to find substitutes for, or shut down their production of, chlorofluorocarbons, the principal chemicals destroying the ozone layer. This portfolio represents almost 25 percent of the consumption of ozone-depleting substances by developing countries.

Key to the legal component of work under the Multilateral Fund is to ensure that the recipients of the fund also contractually obligate themselves not to restart operations with ozone-depleting substances in the future. Such obligations are inserted in the World Bank's legal agreements with the fund recipients. The Bank and relevant environmental ministries undertake follow-up supervision and monitoring activities to ensure compliance with these obligations. For example, as proposed under an upcoming grant to Mexico, Bank staff and staff from the National Institute of Ecology (INE) will make supervisory visits to factories. As is standard with the Bank and its ozone project clients, the Bank and the INE will

also review Mexico's overall progress in implementing national phase-out of ODSs.⁵⁰

Support for International Environmental Law in the Bank's Overall Lending Program

The World Bank "proactively supports the objectives of the global environmental Conventions."⁵¹ Consistent with this message, World Bank President James Wolfensohn has noted that the Bank is in the process of mainstreaming GEF resources with the Bank's portfolio. This mainstreaming strategy makes clear that the Bank is going to proactively support the global environmental agenda by, among other things, ensuring that Bank funds will be combined with GEF resources to support global environmental conventions. Indeed, as a recent independent study of the GEF Portfolio indicated, while the Bank has made progress mobilizing different sources of funds for global environmental projects financed by the GEF, as well as accelerating the time required to prepare GEF projects, there is still considerable progress that should be achieved.⁵² Therefore, as the Bank has indicated and the GEF Study supports, for the Bank to be more effective, it "must 'mainstream' global environmental concerns into its regular lending and non-lending services and take on a major intellectual and policy leadership role."⁵³ The GEF Study concluded that to achieve these goals the Bank must find ways to provide incentives to staff, so that they will put the same or greater emphasis on global concerns as they place on traditional Bank business.⁵⁴

To date, however, the Bank's "environmental" portfolio is limited by virtue of the need for Bank resources to reach into the wide range of types of development projects through which the Bank supports developing countries. In the 1996 fiscal year the World Bank committed US\$21.520 billion for projects in 94 countries. These projects consisted of 129 International Bank for Reconstruction and Development (IBRD) loans in 45 countries, and 127 International Development Association (IDA) "credits" in 49 countries.⁵⁵ At the same time the Bank committed to finance 20 projects solely for environmental purposes, in the amount of US\$1.63 billion. This brought the Bank's overall environmental portfolio to US\$11.6 billion. These environmental projects are geared

specifically to water and air pollution control, energy-efficiency related issues, environmental institution building, and on the "green" side, to natural resource management.⁵⁶

To help develop the effectiveness of the overall environmental project portfolio, the Bank is implementing measures to integrate global and national environmental goals into individual Country Assistance Strategies (CAS).⁵⁷ The CAS is key to the Bank's overall lending program, as it is the national lending strategy document developed by the Bank and each of its borrowers.⁵⁸ All projects financed by the Bank should be consistent with the CAS; which thus serves as an important national economic planning tool. Concern has been expressed that because the CAS is dominated by economic considerations, environmental needs were being ignored. That perspective has undergone change; beginning in 1995 Bank policy specified that environmental concerns should be taken into account in the development of the CAS.⁵⁹ The procedure for implementing this policy, however, is not yet fully developed.

Overall lending in the energy sector is also changing, to coordinate with environmental needs. The recent draft Strategy Paper put forward by the Bank's Environment and Industry and Energy Departments indicates that reforming the CAS is crucial in order to assist countries in meeting their commitments under the Climate Convention.⁶⁰ This commitment is especially important for those countries with economies in transition (EITs), as they are obligated by the Convention to abide by emissions limitations similar to those of Organisation for Economic Co-Operation and Development (OECD) countries.

While a measure of progress promoting environmental mainstreaming at the local level has occurred, the Bank recognizes that "except for the phase-out of ozone depleting substances ... at the global level we are not achieving our objectives."⁶¹ This disappointing result can be traced by environmental indicators that reveal a continued increase in global atmospheric pollution, loss of natural habitat and biodiversity, marine pollution, and soil degradation.⁶² Indeed, a certain irony is apparent by the now-tarnished trumpeting of the "East Asian Miracle's" economic growth. Even when Bank indicators noted that the Asian economy was booming, the availabil-

ity of clean air and water continued to decline in the region. Recent economic difficulties do not bode well for this scenario.

From a legal perspective, improving environmental indicators requires that the Bank's lending strategy continue to take into account relevant international and national legal instruments, as well as Bank environment-related policy. Thus Bank staff should redouble their efforts to apply accepted international treaty principles that seek to protect the environment, and to continue to improve environmental assessment, which promotes the application of these principles. In this sense a key role Bank lawyers help to fulfill in project finance is to offer project-related advice that could be less tied to country lending goals, and more tied to other long-term objectives. These objectives include the need to build legal frameworks and institutional capacity as part of overall and project-specific lending.⁶³ There is an urgent need to forge stronger links between economically successful projects and improved efforts toward legal and institutional capacity building.

Bank Support for the Global Environment Facility

The Bank also promotes the goals of international environmental law through its role as one of the implementing agencies of the GEF.⁶⁴ Both the Climate Change and Biodiversity conventions recognized the need to establish a financial mechanism to function under the guidance of, and be accountable to, the Conference of the Parties.⁶⁵ Thus with somewhat parallel approaches the conventions note that the GEF should serve as the international entity entrusted to operate the financial mechanism referred to in the conventions, and that the mechanism will operate, at least initially, on an interim basis.

In carrying out these functions, the convention bodies noted that the financial mechanism should include modalities to ensure that GEF-funded projects to address climate change and biodiversity are in conformity with the policies, programme priorities, and eligibility criteria established by the Conference of the Parties.⁶⁷ The Bank, as the main implementing agency of the GEF, must ensure that the projects it implements under the climate change and

biodiversity focal areas of GEF operate in a manner consistent with the conventions. These GEF-financed actions represent direct and immediate support for the development of these treaties.

The GEF operates in four focal areas: climate change, biological diversity, international waters, and ozone-layer depletion. The GEF directs funds toward projects in each of these areas to "enhance and protect the global environment."⁶⁸ In addition the GEF addresses land degradation issues, primarily desertification and deforestation, as they relate to the four focal areas mentioned above.⁶⁹

The GEF operates under an Operational Strategy that incorporates guidance from the Climate Change and Biodiversity conventions.⁷⁰ The Strategy recognizes that "all GEF-funded activities in climate change will be in full conformity with the guidelines provided by the Conference of the Parties to the UNFCCC."⁷¹ Further, it notes that "all GEF-funded activities in biodiversity will be in full conformity with the guidance provided by the COP [Conference of the Parties] to the CBD."⁷²

GEF resources are available to GEF-eligible recipients (which can include governments and nongovernmental entities) as grants and as concessional (noninterest-bearing) loans. Since 1991, when the GEF was established, it has provided more than US \$1.8 billion to recipient countries. To maximize the effect of these resources, the Bank and the GEF seek to leverage Bank and other donor funds with GEF-funded projects. To date close to US\$5 billion has been leveraged from cofinancing of funds from other agencies, such as the World Bank, for projects in more than 110 countries.

Because GEF resources can only be used in conformity with the GEF-relevant Conventions and the underlying focal areas, GEF-financed and Bank-implemented projects clearly support the development of the international environmental law regime pertaining to climate, the ozone layer, international waters,⁷³ and biodiversity. As part of the Bank's goal to mainstream the consideration of global environmental issues into Bank lending, an increasing number of these projects will include funds from the Bank. To take advantage of leveraging, Bank borrowers must be willing to accept the importance of these envi-

ronmental goals, since unlike GEF "stand-alone" financed projects, GEF/Bank projects require return payment to the Bank for the loans and credits provided by IBRD and IDA.

For climate, biodiversity, and the ozone layer GEF support is closely aligned to the relevant international treaties mentioned above, each of which specifically refers to its financial mechanism. The GEF provides protection for the ozone layer by funding non-ODS projects in economies in transition not covered by the Multilateral Fund for the Montreal Protocol. GEF support for the international waters focal area also conforms with relevant international environmental law, but the GEF Operational Strategy for international waters helps to promote numerous international conventions, treaties, and agreements. The reach of the topic is expanded by the large number of multilateral and bilateral agreements covering transboundary freshwater basins.⁷⁴ Project selection criteria for this GEF focal area specify that projects will attain "consistency with national environmental planning documents and international legal obligations."⁷⁵

Bank and GEF Financing for Technical Assistance

Under the international waters focal area the GEF-financed Wider Caribbean Initiative on Ship-Generated Waste is a US\$5.5 million technical assistance project undertaken at the request of 22 countries in the wider Caribbean region.⁷⁶ The goal is to support the implementation of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)⁷⁷ and the Special Area designation of MARPOL Convention Annex V (plastic waste).⁷⁸ Key to this project has been the development of model legislation under the auspices of the International Maritime Organization (IMO). The IMO has provided model laws to the countries of the Wider Caribbean and offered technical assistance to enable legislatures in the region to prepare the necessary implementing legislation, so that the countries have the option to ratify and implement the MARPOL Convention.

The Wider Caribbean Initiative is an ambitious effort using limited means to try to harmonize broad-reaching marine legislation. Despite grant

funding for this project, finding the time and commitment to introduce potentially complicated legislation into already overburdened parliaments poses a challenging task. Even if the legislation is enacted, it will be difficult to find the capacity to implement enforcement action.⁷⁹ Still, the participating countries recognize the urgency of developing the enforcement tools to protect the fragile Caribbean.

One example of an effort by the Bank to harmonize legislation involves the introduction of cost-recovery legislation into the countries of the Eastern Caribbean as part of the Organization of Eastern Caribbean States (OECS) Solid Waste Management Project.⁸⁰ The relatively small countries of the eastern Caribbean depend to a great extent on tourism revenue from cruise lines. The World Bank Project team and the OECS established as a condition of project effectiveness that the OECS-member countries develop cost-recovery legislation creating a per passenger charge on all cruise ships entering their ports. The revenue will go toward maintaining solid waste facilities capable of managing ship-generated waste, and thereby support the implementation of the OECS country MARPOL obligations. OECS countries were concerned that if they did not act jointly, the first country to impose the charge could lose tourist business if its colleagues did not follow through with charges of their own, or if they instituted lesser fees. It was a courageous act for the countries to put forward these measures in the face of possible cruise line industry reprisals; hopefully they will continue to consider cooperation to be in their best interest.

Another Bank project which seeks to enhance transboundary legal and political cooperation is the Lake Victoria Environmental Management Project.⁸¹ This project will supply both Bank (IDA) and GEF funds to protect the world's second largest body of fresh water.⁸² The lake is suffering from agricultural and industrial run-off, from deoxygenation due to water hyacinth clogging and matting on the lake surface, and the disappearance of many species of fish. With support from the Bank and other international organizations a tripartite agreement was signed among the riparian countries (Kenya, Tanzania, and Uganda) pledging collaboration in the process of project preparation and implementation. Key to

the project will be funding to develop the harmonization of laws and regulations among the three countries.⁸³

A series of other regional projects is also underway with Bank and GEF financing. The three riparian countries of Lake Malawi (Malawi, Mozambique, and Tanzania) have agreed to jointly undertake studies of the lake and take the steps required to enhance cooperative monitoring and regulation.⁸⁴ More recently, the six countries of the Congo Basin rainforest have agreed to form a Regional Environmental Information Management Project that will share environmental information and build up environmental institutional capacity. The Bank (including the Bank's Environmental Law Unit) and the Food and Agriculture Organization will help implement the Congo Basin project, along with financial support from the GEF and the European Union.

The World Bank is also implementing GEF- and Bank-financed regional transboundary water projects in a number of regional seas and international lakes. These include projects in the Aral Sea, the Black Sea, Lake Baikal, the Caspian Sea, Lake Ohrid, and the Red Sea.

GEF Financing for Setting up Environmental Trust Funds

Environmental trust funds have emerged as an innovative legal instrument to protect biodiversity. These funds can be structured in a variety of ways, but typically are designed to ensure a source of stable income to be used to pay for the ongoing costs of particular conservation efforts.⁸⁵ The World Bank has worked extensively with donors and stakeholders in designing such funds, particularly in the area of biodiversity protection. One of the first and most successful of these is the "Bhutan Trust Fund."⁸⁶ The Bhutan Fund was started with financial assistance from the United Nations Development Programme (UNDP) and the World Wildlife Fund-US, and then received a US\$10 million grant through the GEF, as well as additional donations in the range of US\$10 million through several foreign governments. The Charter of the Trust Fund,⁸⁷ which governs disbursement, states that its purpose is to promote social welfare through preservation of biodiver-

sity. In addition the terms of the 1996 Charter require the government to maintain its forest cover at 60 percent of the country's area and set aside as protected areas the same percentage of the country's protected area as existed on the date of the signature of the Charter.⁸⁸ The Fund is governed by a Board of Directors, of which five members are Bhutanese. The sixth member is a WWF representative, who will serve for five years and then be replaced by a Bhutanese citizen.

Currently, all of the Bhutan Trust Funds are invested outside Bhutan; program activities are funded by a portion of the investment income. If the interest on the investment income is insufficient to meet project requirements, the fund's capital can be invaded, but only up to a specified amount and with unanimous vote of the Board. Given the Fund's success to date, invasion of capital is not a high probability.

The Uganda Trust Fund for the Conservation of the Bwindi Impenetrable and Mgahinga Gorilla National Parks⁸⁹ is also financed by the GEF. This fund follows an investment strategy similar to that in Bhutan and was devised so that a number of local stakeholders have key decision-making roles. The fund's goal is to protect some of the only remaining native gorilla habitat in eastern Africa.⁹⁰ In Mexico negotiations have recently concluded for the establishment of a GEF-financed trust that will enable a Mexican private foundation to manage the funds.⁹¹ The funds will be used to finance biodiversity conservation in a number of rural areas, for which Bank staff have worked with the government to prepare indigenous peoples development plans. These plans apply to areas within the government's network of protected areas, and were developed pursuant to the Bank's Indigenous Peoples policy.⁹² Other trust funds are also underway, mostly with funds provided by the GEF.⁹³ The projects include the Eastern Carpathian Trust Fund (for the countries of the Ukraine, Slovakia, and Poland—administered under Swiss law) and the Peru Trust Fund, as well as recent discussions about establishing a new biodiversity trust fund in Nepal.

While mobilizing financial resources is vital to protect the global environment, these valuable sums will be wasted if they are not expended in an environmentally and socially sound manner. Thus Bank project preparation and implementa-

tion must follow policies and procedures, which are discussed in the next section.

World Bank Environment-Related Policies and Procedures

World Bank management has issued a series of operational policies and procedures for staff.⁹⁴ These policies instruct staff on the means by which projects are financed and the steps required to protect environmental and social interests in preparing and carrying out projects.⁹⁵ The instructions, therefore, act as a form of internal management structure which, because of the Bank's global reach, could well be argued to also mean that the impact and control they exert on development finance transform them into a veritable "soft" international environmental law.

Adding to the rigor of these instructions, and to the contention that they serve as a form of "soft law," in 1993 the Bank established an Inspection Panel to address alleged noncompliance of Bank staff with these policies and procedures,⁹⁶ especially pertaining to the policies discussed below.⁹⁷ The stated purpose of the Panel includes:

Providing people directly and adversely affected by a Bank-financed project with an independent forum through which they can request the Bank to act in accordance with its own policies and procedures.⁹⁸

To date the Panel has handled numerous inquiries involving projects with environmental-and social-related issues. By mid-1997 it had processed eight formal requests and acted upon five in fiscal 1997 alone.⁹⁹ The discussion below provides a brief survey of the policies and their relation to international environmental law.

Development of Environment-Related Policies

Since its beginning, the Bank has been applying policies linked to environmental protection. In 1949 the Bank decided to avoid making loans for projects that involved disputed waters of the Indus River system, as the riparian countries had not been able to agree on an approach for use of the waters. The Bank's concern was to avoid contributing to water disputes between riparians.¹⁰⁰

Similarly, during the early 1950s the Bank was requested by the Government of Egypt to provide financing for the construction of the Aswan Dam. The Bank set conditions for its financing, including that Egypt and Sudan reach agreement on how to share the water resources and make arrangements for the compensation and relocation of people to be resettled due to flooding. When Egypt did not enter into discussions with Sudan, the Bank did not finance the dam; financing was ultimately provided by the former Soviet Union. For similar reasons in the same time period, the Bank did not fund other major water projects on the Euphrates river.

Thus despite the absence of pertinent international watercourse treaties, by 1956 the Bank had set out procedures for Bank staff to follow in financing projects on international waterways.¹⁰¹ These procedures ensured that staff would investigate and notify Bank management if Bank projects could involve the use of an international inland waterway. A chief objective of these procedures was to ensure that riparians did not undertake projects with Bank financing to the detriment of other riparians, especially in the absence of adequate notice and opportunity for consultation. Thus Bank policy was largely consistent with today's international treaties many years before their development.

By the 1970s the Bank had begun to take the environment into consideration in a more formal way, through the hiring of its first environmental specialists.¹⁰² Then, in 1984, the Bank published an Operational Manual Statement¹⁰³ which recognized that the Bank's environmental practices were still evolving, but that there was a body of international environmental law that the Bank would help to promote. Moreover it helped pave the way for the Bank's publication in 1989 of its cornerstone environmental policy—"environmental assessment;" other policies followed.

By 1992 the Bank had decided to convert its operational policies into a new format from what were termed "operational manual statements," "operational policy notes," and "operational directives."¹⁰⁴ These documents serve as guidance to Bank staff.¹⁰⁵ The Board decided that these policy formulations would be converted into "Operational Policies,"¹⁰⁶ "Bank Procedures,"¹⁰⁷

both of which would be binding upon staff, and nonbinding "Good Practices"¹⁰⁸ (collectively referred to as OP/BP/GP).

This conversion process is still underway, and some of the policies and procedures discussed herein may change. For the most part the conversion meant that the substance of the policies would not change when put into the new format. However, some policies may be revised, as in the case of indigenous peoples, involuntary resettlement, and, possibly, forestry.¹⁰⁹ The Operational Directive for environmental assessment has not yet been converted, although this should occur in the very near future.¹¹⁰ The conversion has been closely monitored in and outside the Bank, given the critical relation between environmentally sound project finance and thorough, high-quality environmental assessment.

Environmental Assessment

Any project financed or implemented by the Bank in which the potential exists for adverse environmental impact requires application of the Bank's environmental assessment (EA) policy.¹¹¹ In many cases the application of other important policies—such as those regarding involuntary resettlement, indigenous peoples, natural habitat, forestry, water resources, cultural heritage, agricultural pest management, cultural heritage, and international waterways—occurs in concert with the Bank's EA policy. This contemporaneous consideration often occurs during the preparation of, or as part of, the EA report required of the borrower by the Bank. The EA report is the property of the borrower, not the Bank. Thus the EA policy can help facilitate coordinated assessment by the borrower and the Bank of various economic, social, and environmental concerns (although there are many cases in which limited or no environmental impact means that economic or social assessment occur without an EA). Still, given the diversity of issues to be addressed in the quest for sustainable development, the successful application of the Bank's EA policy is tied, in part, to the Bank's post-Rio record as a modern "sustainable" development institution.

In considering this record, a recent internal Bank study of environmental assessment prepared for Bank-financed projects indicates that

while the Bank and its borrowers made significant progress with environmental assessment (in comparison to results from a study conducted several years earlier), there is still ample room for improvement in carrying out EAs.¹¹² The implication that environmental impact and public participation has been assessed in a less than satisfactory manner for some projects suggests that continued EA progress is vital to the Bank's success as a sustainable development institution. This progress represents an indirect, but significant, form of Bank support for international environmental law. Among other matters, high quality environmental assessment means that affected people are consulted in a meaningful way, that projects do not take place unless they are part of a valid development scheme, and that analysis of all relevant legal issues takes place.

To formalize the EA process, in 1989 the Bank became the first multilateral financial institution to establish a binding policy pertaining to environmental assessment. In putting the policy into practice, the Bank helped make the requirement for EAs a custom of all other multilateral financial institutions. These efforts have also helped put in place institutional capacity in many Bank borrower countries. Perhaps more importantly, these efforts provide the underpinnings for increased public participation in environment-related decisionmaking.

By taking these actions in support of environmental impact assessment and public participation, the Bank and other multilateral financial institutions are acting in a manner consistent with the Rio Declaration.¹¹³ For example, Rio Declaration Principle 17 states that "environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority."¹¹⁴ Further, Principle 10 states, in pertinent part, that:

Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous

materials and activities in their communities, and the opportunity to participate in decisionmaking processes by making information widely available.¹¹⁵

While these two principles relate to national practices, the Rio Principles also support the need for transboundary environmental impact assessment, or, if not "assessment" per se, at least for cooperation between states when activities of one state could cause environmental impact in another.¹¹⁶

Notwithstanding the occasional academic debate over whether the Stockholm and Rio Declarations are "hard" or "soft" law, the principles requiring environmental impact assessment and public participation may be approaching acceptance as custom.¹¹⁷ Further, the combination of these Rio principles with other international instruments, such as the Convention on Environmental Impact Assessment in a Transboundary Context,¹¹⁸ and various regional instruments requiring cooperation on transboundary environmental impact assessment, such as between Canada, the United States, and Mexico,¹¹⁹ may also augur well for the consideration of transboundary environmental impact assessment as customary international law.

The Bank's EA policy requires that an environmental assessment consider relevant international and national environmental law. In addition to requiring consideration of relevant legislation, where applicable, the Bank's loan documents frequently include covenants to protect environmental and social interests. The review of relevant laws and the development of protective covenants require the attention of environmental specialists.

Environment-Related Requirements Pertaining to Legal Instruments and the Development of Project Legal Documentation¹²⁰

The Bank requires that the EA process consider all relevant international environmental treaties or agreements relevant to project-related impacts.¹²¹ In practice this means that Bank staff should seek to ensure that the EA has noted and discussed relevant treaty obligations pertaining to the borrower/member and whether those ob-

ligations have an impact on the design of the proposed project. The Bank has also taken the position that it will not finance project activities that would contravene such country obligations, as identified during the EA.¹²²

This position helps to clarify that the EA report must include discussion about any relevant international environmental treaty obligations, and that they should be met by the project design. Where appropriate in the view of the Bank's Legal Department and the Borrower, these obligations can then be included in relevant legal conditions included in loan documents. This action is consistent with the requirement that the EA include the requisite legal, policy, and administrative framework within which the EA report is prepared.¹²³

Indeed, the Bank's recent review of its environmental assessment practices noted clearly that legal conditions included in loan documents need to be enhanced in relation to the EA applicable to the project.¹²⁴ The report stated as follows:

The strength of environmental language in project legal documents appears to be a critical factor in how much attention the environment receives during supervision. The types of environmental issues focused on are also largely determined by the nature of these conditions and covenants. This is only to be expected, as compliance with legal clauses is one of the principal ways project performance is assessed. Projects with specific environmental clauses in the legal documents are also more likely to have environmental specialist participation in the supervision, thus further intensifying the focus on environmental aspects.¹²⁵

The report thus supports the Bank's Legal Department and Bank staff who have worked with borrowers to draft and include conditions in the legal documents spelling out the need to carry out environmental mitigation plans mandated by the EA. For example, in carrying out a solid waste management project negotiated over the last two years, a borrower was required to "carry out an environmental assessment in connection with each disposal site to be used under

the Project," and to "ensure that all environmental mitigation and monitoring measures, recommended under each report furnished to the Bank in connection with an EA, ... shall have been carried out."¹²⁶

Clearly, the Bank is seeking to ensure that environmental conditions and covenants are set forth in a more uniform manner. The Bank has available on-line access to all environmental covenants set forth in its loan agreements. Further, while the Bank now routinely works to incorporate in the legal documents both the environmental mitigation measures and any environmental management plan arising from the EA, further clarification of this process has been proposed in the draft environmental assessment policy now under consideration, which will ensure added uniformity in the effort to ensure that environmental plans are carried out.

The draft environmental assessment policy will also clarify another long-standing policy pertaining to project development. Since the late 1980s the Bank has used its environmental guidelines during project preparation and environmental assessment. These guidelines are considered to be especially essential when projects take place in developing countries lacking modern environmental laws and regulations. The *Pollution Prevention and Abatement Handbook*¹²⁷ (a revision of the 1988 World Bank Environmental Guidelines, prepared in 1988) sets forth the pollution prevention abatement measures and emission levels that "are normally acceptable to the Bank."¹²⁸

The Handbook was prepared based upon the standards and consultations with the Bank's borrowers, U.N. specialized agencies, national regulatory agencies, NGOs, and the private sector. The Bank's draft EA policy makes clear that these pollution measures should be taken into account in the environmental assessment. It is also clear that they will be taken into account in legal documentation, as referred to above. At the same time where local law is adequate or local conditions indicate that the guidelines are not suitable, the EA can recommend alternative emission levels to those in the Handbook, provided that the "EA report must provide full and detailed justification for the levels and approaches chosen for the particular project or site."¹²⁹

Ensuring Public Participation

To the extent that the Rio Conference underscored the fundamental need for broad-based public participation in environmental and social issues, the Bank's EA policy serves to implement these same principles. Perhaps here the Bank can have the most impact by allowing the poorest citizens an opportunity for involvement in development projects that affect their lives.

Under the Bank's EA policy, information pertaining to environmental assessment must be made public.¹³⁰ The EA policy requires "meaningful consultations" among the borrower, affected people, and local NGOs for all Bank projects for which an EA report is necessary.¹³¹ The Bank's EA consultation policy is supported by its procedures for disclosure of Bank documentation¹³² and the its practices for involving NGOs.¹³³ In addition public participation is a key aspect to almost all of the Bank's policies. For example, policies on involuntary resettlement and indigenous peoples depend upon the availability of meaningful consultation with affected people.¹³⁴ Some of the key steps for ensuring public participation are set forth below.¹³⁵

Preliminary steps: screening and terms of reference. The Bank screens all potential Bank investment projects to determine their potential environmental impact.¹³⁶ When the Bank's screening process determines that a project needs an EA, the Bank discusses with the borrower the scope of the EA and assigns a category to the project.

Category A projects may have "diverse and significant environmental impacts" and therefore require a "full-scale environmental assessment," normally referred to as an EA report.¹³⁷ Category B projects consist of projects which may have specific environmental impacts, but only require an environmental analysis.¹³⁸ Category B projects may have a separate EA report where the environmental issues warrant such treatment. Alternatively, the Category B environmental analysis may be contained within routine project documentation. Category C projects do not have any environmental impact, and do not require an EA or environmental analysis.¹³⁹

At the time of screening the Bank also completes the preparation of draft terms of reference (TORs) for the EA, as necessary.¹⁴⁰ The TORs out-

line the potential conditions of the loan, and the Bank should ensure that the TORs require adequate interagency coordination and consultation with affected groups and local nongovernmental organizations.¹⁴¹

Consultation during design and preparation of the EA report. The Bank expects the borrower to take the views of affected groups and NGOs fully into account in project design and implementation, and in particular in the preparation of EAs.¹⁴² Such consultations should occur at least at two stages: shortly after the EA category has been assigned; and once a draft EA has been prepared.¹⁴³ Further consultations are encouraged at other points during EA preparation, after EA completion, and throughout project implementation. Experience has shown that updates and information feedback between meetings are best utilized when they are systematic and routine. An effective approach in many countries has been to follow the first interagency meeting with an initial consultation session with affected groups and local NGOs.¹⁴⁴

The Bank has noted that for consultations to be effective, the borrower first has to provide the public, in a timely manner, with relevant information presented in a form that is meaningful and accessible to the groups being consulted.¹⁴⁵ Such information normally includes: (a) a summary of the project description and objectives, and potential adverse effects of the proposed project for the initial consultation; and (b) a summary of its conclusions in a form and language meaningful to the group being consulted, once the EA report has been prepared. Consultations should pay particular attention to those issues most likely to affect the people being consulted.¹⁴⁶

Dissemination of the EA report. Once the EA report has been prepared, in keeping with the Bank's requirement that meaningful consultation take place with affected people, the Bank's policy states that the borrower should make the EA report available at some public place accessible to affected groups and local NGOs, for their review and comment.¹⁴⁷

To meet the disclosure requirement, the report should be placed at a location(s) convenient to affected groups and local NGOs, at or near the project site, and in a language understood by the same local population, in addition to the required English-language submission to the Bank. Of

course, in some types of regional projects, such as a transboundary pipeline, this requirement could mean that the report would have to be made available at various locations along the intended route in a manner convenient to each of the affected communities. During the development of the proposed Chad-Cameroon oil pipeline, the Bank was requested to provide project guarantee financing, as well as development assistance to the local governments. Bank participation in project development led to application of the Bank's policies, including the EA's public participation aspects. As part of the public participation requirements, project developer Esso stated that it conducted consultation sessions with over 125 villages, cantons, and major towns along the proposed pipeline route and in the oil field area.¹⁴⁸

Once the EA has been released and made available locally in the relevant languages and officially received by the Bank, the pertinent Bank Country Director or the Project Task Manager is supposed to send a copy of the EA to the World Bank's Infoshop, through which interested parties may obtain the report.¹⁴⁹ In practice, efforts are made for all of this dissemination to occur at the same time. The Infoshop provides to the field offices only the documents specific to their country, plus policy papers. At field offices, documents on the country where the field office is located are provided free of charge to users in that country.

Release of EA report by the borrower. Bank policy is to request the borrower's advance permission to release the EA report to the Bank's Board; that is, its executive directors. When the need for an EA and the TORs for the EA are discussed with the borrower, the Task Manager should seek the borrower's permission, in principle, for the release of the report to the executive directors.

Once the Bank has received a copy of the EA report from the borrower, with the necessary permission for release, the Country Director should transmit the borrower's English-language summary of the EA to the World Bank Secretary's Department for distribution to the executive directors. This action takes place before the departure of the appraisal mission. If the borrower indicates at any time that it is not in a position to release such a report to the executive directors, the Bank should not proceed with further work

on the project, unless the Senior Vice President of Operations decides otherwise on the recommendation of the Regional Vice President concerned, and for objective reasons unrelated to the environmental soundness of the project.¹⁵⁰

Some key aspects of the EA report. For the EA report to be acceptable to the Bank, it has to be prepared in English, Spanish, or French and include an executive summary in English.¹⁵¹ Of course, the EA process must be consistent with the requirements of pertinent national legislation; if the latter include additional disclosure or consultation requirements, these would also have to be taken into account.¹⁵²

The EA report must list the names of the individuals involved in the preparation of the EA, the references used in preparing the report, and contain a record of the consultation meetings, including lists of both invitees and attendees.¹⁵³ The record can include additional documentation, such as videotapes of meetings. The record of consultations for obtaining the informed views of the affected people and local NGOs should also be included. The record should specify means other than consultations that were used to obtain the views of affected groups and local NGOs.¹⁵⁴

As noted above the EA report should be received by the Bank prior to the departure of the appraisal mission, and an English language summary should be circulated to the Board prior to that time.¹⁵⁵ In practice, circulation has usually been several months before the departure of the appraisal mission. The full EA report, along with a copy of the English language summary, are placed in the project file as soon as they are available.¹⁵⁶

Bank experience shows that poorly prepared and/or underfunded EAs results in the implementation of less than optimal projects. Measures are underway to improve compliance and funding of the Bank's EA process. In addition the consistent inclusion of the EA's environmental mitigation plan in the Bank's legal documents will help to improve project implementation and thereby the promotion of international environmental law. Moreover, such steps may assist with what was identified as one of the weak points of environmental assessment—public consultation and the analysis of project alternatives.¹⁵⁷

While the EA policy requires borrowers to take into account various issues of relevance to the

environment and sets out the procedures for doing so, the Bank has developed other, more specific, policies that provide added detail, instructions, or guidance on topics that the Bank has determined affect project development. Many of these policies build upon principles of international environmental law. They cover a diverse array of issues. One of the first such policies sought to address the controversies that can arise between riparian countries as a result of projects on international waterways.

International Waterways Projects

Projects on international waterways frequently require extensive environmental assessment, as many of them involve engineering activity, such as irrigation and hydroelectric schemes. Thus, when financed in whole or in part by the Bank, they must comply with the Bank's environmental assessment policy. Beyond this compliance, such projects need to be viewed in terms of long-standing principles about riparian use of shared water bodies, especially in regard to the process by which countries notify each other of their proposed use. The Bank has sought to take these principles into account through Bank policy.¹⁵⁸

The Bank's policy on "International Waterways" defines the term to be, with one potentially significant exception, consistent with the "international watercourses," addressed by the Convention on the Law of the Non-Navigational Uses of International Watercourses.¹⁵⁹ Unlike the Convention, the Bank's policy does not refer to groundwater. Under the Convention "watercourse" means "a system of surface waters and groundwater constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus."¹⁶⁰ Further, "international watercourse" is "a watercourse, parts of which are situated in effluent states."¹⁶¹

Although the Bank's definition of "international waterways" does not refer to groundwater, its definition—based upon a series of specifically identified types of water areas and waterbodies—is potentially broader than those of the Convention. Besides the distinctions in definitional coverage, another interesting contrast between the Bank's policy and the Convention is that Bank policy is phrased to ensure that

a project does not cause "appreciable harm."¹⁶² The Convention makes more prominent note of the concerns for "equitable utilization."¹⁶³ In practice these distinctions are not likely to present barriers to a consistent approach to project finance, as both instruments stress the need to ensure that all parties receive early and adequate notice of potential issues.¹⁶⁴ The Bank encourages early notice from the riparian party undertaking a project to other riparians users.¹⁶⁵ Such notice may be required, even when the riparian party undertaking the project is not in a position to cause harm to other riparian parties, to ensure that the project "will not be appreciably harmed by the other riparians' possible water use."¹⁶⁶ Thus notice may be required even if the project would not cause appreciable harm.¹⁶⁷ Before presenting the loan to the Bank's Board, Bank staff must ensure that the project is either covered by an agreement between the relevant riparian states, has received a positive consent or no objection from the other riparians, or "will not cause appreciable harm to the other riparians."¹⁶⁸

By using the "appreciable harm" and "adverse effect" formulation, the Bank was not rejecting the "equitable utilization" formulation. In fact, it has been noted that the "equitable use" formulation is considered to be the "cornerstone" of the law in this field.¹⁶⁹ In the Bank's view, however, the equitable use analysis could require the Bank to act more in the nature of a tribunal, adjudicating issues of equity and distribution between the parties, whereas the "appreciable harm" or "adverse effect" formulation is more of a purely scientific determination, akin to the environmental assessment/economic analysis required of Bank investments.¹⁷⁰

At the same time if riparian states wish to enter into negotiations on the equitable utilization of international waterways, the Bank has always stood ready to facilitate and assist countries or regional organizations with those issues to be negotiated.¹⁷¹

From Waterways to Global Externalities

While the policy on international waterways represents one of the Bank's first formal policies to address transboundary issues of the hydrosphere, increasing attention is focused on the global is-

sues pertaining to other natural resources, especially the atmosphere. Addressing the global externalities of Bank project financing is a relatively new phenomenon, but will require increasing devotion of resources, especially when undertaking environmental assessments. The Bank's first policy on this issue is set forth in a policy on economic analysis of Bank investments.¹⁷² This policy addresses, in part, project externalities that are domestic, cross-border, or global. Cross-border externalities could include the effects from a project that impact on more than one riparian state.¹⁷³ Global externalities affect the global commons, and include emissions of greenhouse gases or ozone-depleting substances, pollution of international waters, or impacts on biodiversity.¹⁷⁴

The Bank's policy points out that these externalities and their impacts need to be taken into account during EAs when Bank-financed "payments related to the project are made under an international agreement," or "projects or project components are financed by the Global Environment Facility."¹⁷⁵ If these two conditions do not exist, "global externalities are fully assessed (to the extent tools are available) as part of the environmental assessment process and taken into account in project design and selection."¹⁷⁶

The "tools" to carry out the global externality analysis are still evolving. Often the externality can be assessed in economic terms, by forecasting the monetary value an investor might be willing to pay to lower the environmental impact from the planned investment operation. An example could be the cost to undertake an environmentally friendly fuel switch at an industrial plant in order to lower atmospheric emissions. In some cases this "willingness to pay" is more easily determined in projects where there will be cofinancing. Cofinancing, especially linked to air emissions, is likely to arise from an investor or country who perceives a regulatory need to support an emission-reduction project, and is willing to "cofinance" a project to achieve the reductions.

If the willingness to pay is not clear, how does one assess the externality? Precisely what is the environmental cost of an added ton of greenhouse gas to the atmosphere, and how should that cost be internalized in project finance? In the context of the United Nations Framework Con-

vention on Climate Change,¹⁷⁷ if a country has binding obligations under the Convention the cost of a less polluting gas might be more easily calculated by determining the cost of compliance with a regulation. Following that determination, the less polluting option might then be added to the cost of financing the project. If no binding obligations are imposed on the project financier, and the willingness to pay is not clear, determining the externality is a challenge.

Protection of Natural Habitats and Endangered Species

Recent discoveries about the value of wetland plant and animal species have demonstrated that certain natural habitats and species are of global value. The Bank's environmental portfolio will hopefully contribute to the environmental treaties for the preservation of natural habitats and endangered species, the success of which depends upon transfer of resources to developing countries. The Ramsar Convention on the Protection of Internationally Important Wetlands¹⁷⁸ and the Convention on the Conservation of Migratory Species¹⁷⁹ are among many treaties that seek to support our natural heritage. While Bank policy pertaining to natural habitats does not cite international conventions that seek to protect natural habitat,¹⁸⁰ the policy is protective of the types of natural habitats whose survival is the objectives of these treaties. Bank policy states:

The Bank does not support projects involving the significant conversion of natural habitats, unless there are no feasible alternatives for the project.... If the environmental assessment indicates that a project would significantly convert or degrade natural habitats, the project includes mitigation measures acceptable to the Bank. [Further]...the Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development... The Bank does not support projects that, in the Bank's opinion, involve the significant conversion or degradation of critical natural habitats.¹⁸¹

"Critical natural habitats" are defined as follows:

Existing protected areas and areas officially proposed by government as protected areas (such as reserves that meet the criteria of the World Conservation Union classifications), areas initially recognized as protected by traditional local communities (such as sacred groves), and sites that maintain conditions vital for the viability of these protected areas (as determined by the environmental assessment process).¹⁸²

Coverage of natural habitats that are not "critical" is less stringent, given the less sensitive nature of the habitat. In these cases

The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project...If the environmental assessment indicates that a project would significantly convert or degrade natural habitats, the project includes mitigation measure acceptable to the Bank.¹⁸³

The policy on natural habitats also contains another interesting reference to internationally known principles. It states at the outset that the Bank supports and expects borrowers to apply a precautionary approach to natural resource management, to ensure opportunities for environmentally sustainable development. However, the Bank has not yet had extensive discussion about this provision or determined how it will be implemented.¹⁸⁴

In 1984 the Bank stated that it would "not finance projects which would significantly modify natural areas designated by international conventions as World Heritage sites ..."¹⁸⁵ Later the Bank expanded upon this principle, stating that it would seek to help countries conserve, maintain, enhance, and restore their cultural heritage.¹⁸⁶ This policy enables the Bank to address cultural property and cultural resources. The Bank has also issued recent guidance on addressing cultural heritage issues during Bank project finance.¹⁸⁷

Sustainable Forestry

International treaty negotiations are still under development for a treaty on sustainable forestry.¹⁸⁸ The Bank's forestry policy makes no explicit reference to potentially relevant international forestry agreements.¹⁸⁹ Yet comparison of the Bank's policy with prominent international instruments indicates some consistency of approach, and represents a step toward the development of accepted international best practice in this field. Such policies may go a long way toward helping develop an international frame of reference for generally accepted forestry principles. Of course, key areas of consensus do not yet exist in the international regime, and efforts to conclude a forestry treaty last year were unsuccessful.

The Bank is considering revising its forestry policy, and at the same time, has efforts underway to help the international dialogue toward an approach to sustainable forestry.¹⁹⁰ As it proceeds, the Bank needs to take into consideration any legal developments pertaining to the draft Forestry treaty, as well as current timber agreements.

The Bank states that its "lending operations in the forest sector are conditional on government commitment to undertake sustainable management and conservation-oriented forestry."¹⁹¹ This means that the Bank can require borrowers to "adopt policies and a legal and institutional framework" to support sustainable practices, while also promoting the "active participation of local people and the private sector."¹⁹² The Bank's policies toward local peoples includes its recognition of their rights, through the Bank's indigenous peoples policy.¹⁹³ Thus, for example, as a requirement for going forward with an IDA credit to Laos for the Lao Forestry Project, the Bank required development, to its satisfaction, of a forestry law and underlying legislation supporting the customary rights of indigenous peoples, with the participation of affected local and indigenous peoples.¹⁹⁴

These and other provisions set forth in the Bank's policy are consistent with certain provisions in the Forestry Principles adopted at the Rio Earth Summit.¹⁹⁵ Both emphasize the need to promote participation of interested parties in the development, implementation, and planning of national forest policies, while also supporting

the culture and rights of indigenous peoples. Potential differences exist, however, in that the Forestry Principles apply to all types of forests, while the Bank policy does not refer explicitly to temperate forests. Further, the Forestry Principles also address the issue of regulating trade in forest products, but the Bank does not address this topic in its forestry policy, although it is recognized as an important and challenging issue.¹⁹⁶

The Bank's policy also states that the Bank will "not finance commercial logging operations or the purchase of logging equipment for use in primary tropical moist forest."¹⁹⁷ The Rio Principles, on the other hand, speak to the need to "aim" to protect "primaryold growth."¹⁹⁸ In this context the Bank is embarking upon the support of projects that focus on sustainable forestry, including in the private sector. Recently, the International Finance Corporation agreed to support a project in Papua New Guinea under which concessions will be granted to local villagers, provided their activities are carried out in a sustainable manner.

Rights of Indigenous Peoples

It has been estimated that there are over 250 million "indigenous peoples" in over 70 countries.¹⁹⁹ Principle 22 of the Rio Declaration states:

Indigenous people and their communities and other local communities have a vital role to play in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development.²⁰⁰

International instruments supporting the rights of indigenous peoples were summarized recently by the United Nations Commission on Human Rights.²⁰¹ In these discussions recognized the difficulty of developing a uniformly accepted definition of indigenous people. Many World Bank projects are in regions inhabited by indigenous peoples, and since 1982 the Bank has had an explicit policy to address these peoples, beginning with the "Tribal Peoples" policy.²⁰² This policy was revised in 1991, and is now referred

to as the "Indigenous Peoples" Policy.²⁰³ Further revisions are under consideration. The policy was broadened to extend the definition to a wider range of social groups that maintain social and cultural identities distinct from the majority and who, as a result, are vulnerable to social and political pressure. In addition the policy stresses the importance of ensuring that in cases when they are affected, indigenous peoples participate in and benefit from Bank-financed projects. It also spells out the requirements for Indigenous Peoples Development Plans, as a means to incorporate the needs of indigenous people as part of the project loan documentation.

Today it is difficult to define the types of people that fit into prescribed categories. For some the difference between indigenous peoples and tribal peoples relates essentially to the principle of self-determination. Some in the field contend that a people may be "tribal either by their own choice, or without their consent, whereas indigenous peoples are classified as such only if they choose to perpetuate their own distinctive identity and institutions."²⁰⁴ Further, as the U.N. Commission points out: "The United Nations system should be mindful of the conclusion of the managers of the World Bank that 'no single definition can capture the diversity of indigenous peoples worldwide.'"²⁰⁵

Even if indigenous peoples could be clearly defined and identified, there is an inherent tension between, on the one hand, seeking to support indigenous rights by recognizing a group of people as a distinct entity and, on the other, seeking to integrate their participation in environmental management. Yet no more than ten countries have ratified relevant international legal instruments that seek to spell out indigenous peoples rights, such as the International Labor Organization's Convention No. 169 on the Rights of Indigenous Peoples.²⁰⁶ Thus a lack of clarity remains in regard to the legal rights of indigenous peoples. This places added responsibility upon lawyers and project staff involved in the process of preparing projects that affect indigenous peoples to ensure the fulsome research into the rights of indigenous peoples and, where such rights are not adequately defined, to enter into dialogue with relevant government and local officials to undertake the development of an appropriate legal regime. This task is difficult

because it requires clarifying uncertain and/or unrecorded legal principles, finding additional project preparation funds, and forging a difficult political dialogue among actors who may have a history of conflict.

Despite these difficulties, rather than form a strict legalistic interpretation of the people covered under relevant terms, the Bank has taken a more regional and country-specific way of identifying groups that should be considered under its operational policy. Most important in this context, the Bank has sent a message that the processing of projects in areas that could impact on indigenous people requires engaging qualified lawyers, sociologists, and anthropologists. The Bank's policy seeks to ensure that Bank projects that impact indigenous peoples have a plan to ensure that their rights and interests are taken into account, so as to maintain their cultures, while giving them the opportunity to improve their lifestyles. The World Bank Working Group on Indigenous Peoples Policy strives to improve upon these processes.²⁰⁷

Some evidence of the success of this policy and its application were detailed in a Nicaraguan civil action, in which indigenous groups filed suit to require action on their behalf by government officials. As part of their claim, and as evidence of international norms supporting their rights to their native lands, they argued:

It stands out that the World Bank has established a normative policy in favor of the territorial rights of indigenous peoples. In its Operational Directive 4.20 of 1991, the Bank establishes the objective of assuring that indigenous peoples do not suffer the adverse effects of development. As a result, the Directive sets forth legal acknowledgement of land tenure schemes agreeing to the rights of indigenous traditions, and to the informed participation of the same communities in the setting out and execution of any development project that could affect them.²⁰⁸

While this case has not yet been decided, it suggests that the policies of multilateral development banks can form the basis of international norms, thereby contributing to the development of international environmental jurisprudence.

Involuntary Resettlement

Projects with major environmental impact may lead to displacement of people, in some cases involuntarily. Such human impact is difficult to separate from environmental concerns, and many cases result in an impact on the legal rights of those who are forced to move from their homes. Among the Rio Principles are articles setting forth the need for informed public participation and right to judicial review. The need for the thorough, just application of an involuntary resettlement policy that takes these principles into account is paramount. The Bank estimates that over the last decade close to 80 or 90 million people have been resettled as a result of infrastructure projects. World Bank activity in this period has accounted for a "small, but significant share" of this amount.²⁰⁹ In 1996 it was estimated that the Bank's portfolio at that time would involve the resettlement of 2 million people over an eight-year period.

The Bank's policy on involuntary resettlement, like that on indigenous peoples and environmental assessment, carries forward the theme of meaningful consultation and the right to independent/judicial review when resettlement is inevitable.²¹⁰ This policy requires screening for potential resettlement requirements in cases of projects that involve land acquisition, or in which a Category A or B environmental assessment is required.²¹¹ Further, it requires that the project design seek to avoid involuntary resettlement or, if it is unavoidable, that resettlement be minimized to the extent possible. When resettlement must occur, a plan must be in place before the Bank can finance the project.²¹² This plan must be developed in consultation with the affected people, Bank staff (including social scientists), and the national government and must ensure that the people to be displaced receive benefits from their relocation. People displaced must be given the means to improve, or at least restore, their former living standards.

Principle 10 of the Rio Declaration states in part that "effective access to judicial and administrative proceedings, including redress and remedy, shall be provided."²¹³ The Bank's policy requires that design of the resettlement plan encompass a thorough understanding of the legal framework, and in case of disputes, such as land acquisition

disputes, there must be legal procedures available, including an appeals process with an applicable time-frame for such an appeal.²¹⁴

In addition the resettlement policy incorporates the Bank's protection of cultural heritage, also reflected in other policies. The policy notes that the potential for acceptance of a resettlement plan can be increased by ensuring that people retain access to cultural property, such as temples and pilgrimage centers.²¹⁵

Policies to Protect against the Adverse Impact of Chemicals, Pesticides, and Hazardous Wastes

In a number of instances international organizations have developed or applied legal instruments to seek to protect the public from exposure to toxic chemicals and other harmful products. As an example of the application of these laws or policies, the Bank has developed and implemented policies pertaining to the use of pesticides, the handling of hazardous wastes and other hazardous materials, and the regulation of tobacco. The policy receiving the most attention applies to pesticides and their use in agriculture pest management.

Pesticides

The Bank's policies dealing with agricultural pest management take note of applicable international instruments and their effort to prevent hazardous application and exposure to dangerous pesticides.²¹⁶ For example, the Bank's policy on "Pest Management" states:

In assisting borrowers to manage pests that affect either agriculture or public health, the Bank supports a strategy that promotes the use of biological or environmental control methods. The Bank uses various means to assess pest management in the country and support integrated pest management (IPM) and safe agricultural use.²¹⁷

Having stated the goal of minimizing the use of chemical pesticides, the policy then lays out certain requirements pertaining to procurement of pesticides. Noting that the procurement "of any pesticide in a Bank-financed project is contingent

on an assessment of the nature and degree of associated risks," the policy goes on to note: "With respect to the classification of pesticides and their specific formulations, the Bank refers to the World Health Organizations recommended Classification of Pesticides by Hazard and Guidelines to Classification (Geneva: WHO, 1994-1995)."²¹⁸

Any pesticides financed by the Bank must be manufactured, packaged, labeled, handled, stored, disposed of, and applied according to standards acceptable to the Bank.²¹⁹ The FAO's Guidelines for Packaging and Storage of Pesticides (Rome, 1985), Guidelines on Good Labeling Practice for Pesticides (Rome, 1985), and Guidelines for the Disposal of Waste Pesticide and Pesticide Containers on the Farm (Rome, 1985) are to be used as minimum standards.²²⁰

The policy further states that:

The Bank does not finance any formulated products that fall in WHO classes IA and IB, or formulations of products in Class II, if (i) the country lacks restrictions on their distribution and use; or (ii) they are likely to be used by, or be accessible to, lay personnel, farmers, or others without training, equipment, and facilities to handle, apply, and store these products properly.²²¹

Thus, in practice, Bank policy seeks to ensure that pesticides are only used when necessary. If they are used, however, it must be in accordance with accepted international best practice and appropriate technology financed by the Bank.

Hazardous Wastes

The Bank has also developed a policy to address the transboundary shipments of hazardous waste. Prior to the adoption and entry into force of the Basel Convention on the Control of the Transboundary Movements of Hazardous Wastes and their Disposal,²²² World Bank President Barber Conable stated that the Bank "will not finance any projects that involves the disposal of hazardous wastes from another country, nor will it finance the shipment of such wastes for disposal in any developing countries."²²³ Following this approach, the Bank has undertaken projects to develop waste management facilities that support the Basel Convention's goals for the

environmentally sound management of their hazardous wastes.

When Bank staff prepare such projects they refer to definitions and requirements under the Basel Convention, or to practices required by the waste management industry. As an example, in an industrial pollution control project in India, legal conditions require that the Bank consider requests for subproject financing. Following receipt of a request for funding, the Bank notified the government's executing agency that it would have to clarify to the Bank the temperature at which an incinerator would be operated and the identity of the substances to be burned. The Bank's task manager informed the borrower that the Bank would not finance an incinerator that would burn halogens or mercury.²²⁴

Hazardous Materials. In addition to the use of operational policies as a means to control use of environmentally dangerous chemicals through the Bank's applicable procurement policies, the Bank seeks to ensure that environmentally dangerous products are not purchased with Bank loans. Bank policy on "Procurement Arrangements for Adjustment Operations," in pertinent part, states:

Consistent with the Bank's policies that loan proceeds are used for development purposes, such items as military hardware, luxury goods, and environmentally hazardous goods are excluded by using a negative list ... Funds may be disbursed for any imports except those excluded by the negative list.²²⁵

While this policy is not often referred to in the context of the environment, the relation between public-sector procurement and "green" behavior is likely to grow over time. This is especially true given increased attention to product certification and eco-labelling.²²⁶

Tobacco

While there are few treaty instruments addressing tobacco, the Bank's tobacco policy is included here. Similar to other health-threatening substances, tobacco is a substance likely to be regulated; it has already been the subject of an interesting trade- versus-environment dispute between the United States and Thailand, concern-

ing restrictions by Thailand on cigarette imports.²²⁷ International organizations have also expressed concern about the manufacture of tobacco-related products, as reflected by the work of the World Health Organization, which, in turn, is reflected in a 1991 World Bank report and set forth in a policy on tobacco.²²⁸ The Bank's tobacco policy states:

The Bank does not lend directly for, invest in, or guarantee investments or loans for tobacco production, processing or marketing. To the extent practicable, the Bank does not lend indirectly for tobacco production activities....Unmanufactured and manufactured tobacco, tobacco processing machinery and equipment, and related services are included in the negative list of imports in Loan Agreements.²²⁹

Perhaps just as the tribe in Nicaragua referred to the Bank's policy to support their actions, future disputes on this issue will take into account the World Bank's policy on tobacco as evidence of international norms.

Conclusion and Next Steps

As an economic institution, the Bank has extensive experience in measuring the economic performance of its borrowers and the financial return on its projects. Economic data remains proficient in providing quantitative data on project performance. Yet it is increasingly agreed that measurements of qualitative indicators are lacking. The opening statement of the Bank's report on "Monitoring Environmental Indicators" notes that "Most knowledgeable people working on environmentally sustainable development know that the empirical base for decisionmaking is weak."²³⁰ Thus "green accounting" is still inexact, despite efforts to improve the use of environmental indicators.

Given this unfinished state of affairs, in which many economists have difficulty measuring the relative merit of environmental mitigation measures, there is a call for greater multidisciplinary planning in economic investment decisions, and greater adherence to the environmental and social policy measures that are drafted to ensure long-term social and environmental benefits.

Moreover, this state of affairs must embrace all actors, not just the multilateral development banks who no longer provide the bulk of finance in developing countries, but the private sector as well. The Bank is well equipped to serve as a mechanism for bringing these actors together. This is clearly a goal of the Bank under its current leadership.

The Bank can take on leadership in this regard through commitment to thorough portfolio assessment that mainstreams global environmental concerns, as well as environmental assessment that analyzes global and local impacts—even if it means the "no-project" alternative is preferred, or that extra caution means delays in project finance. This effort is especially important because such efforts are not likely to be achieved by perennially underfunded environmental regulatory agencies.

To a great extent it seems that borrowers and project sponsors are more willing today to work within these natural and human resource limits. Perhaps the Kyoto Protocol signifies, finally, an understanding that there are limits to growth. Still, the unfortunate irony is that as resources become more scarce and fragile, the pressure is growing to maximize profit from these same resources as a means to help poorer countries improve their living standards. The World Bank is at the crossroads of this unsettling challenge.

Notes

[Having been written in legal format, these notes have not been copyedited to be consistent with the other notes in this proceedings, which have been edited in *The Chicago Manual of Style* format.—ED.]

1. The World Bank Group consists of the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), the International Finance Corporation (IFC), and the Multilateral Insurance Guarantee Agency (MIGA), and the International Centre for Settlement of Investment Disputes (ICSID). As used here, "World Bank" refers to the IBRD and IDA. The IFC lends funds to the private sector. While the author does not intend to refer to the IFC when using the terms World Bank or Bank, the World Bank and the IFC have are increasingly trying to harmonize their operational policies, as discussed below.

2. Taking international environmental treaties into account in project finance can be a challenge, given that there are hundreds of multilateral treaties and

agreements relevant to the environment. See Edith Brown Weiss, "International Environmental Law: Contemporary Issues and the Emergence of the New World Order," 81 GEO. L.J. 675 (1993); A. Kiss, *Selected Multilateral Treaties in the Field of the Environment* (1983); Seth Osafo and I. Rummel-Bulksa, 2 *Selected Multilateral Treaties in the Field of the Environment* (1991).

3. The Global Environment Facility (GEF) is the principal international mechanism available to provide grant financing for global environmental needs. The Bank, the United Nations Development Programme, and the United Nations Environment Programme are the three implementing agencies of the GEF. The GEF was created in March 1991 (see World Bank, *Documents Concerning the Establishment of the Global Environmental Facility*, November 1991, 30 I.L.M. 1739, and has been restructured pursuant to the Instrument for the Establishment of the Restructured Global Environment Facility. The Global Environmental Facility: Instrument Establishing, Mar. 16, 1995, 33 I.L.M. 1273, 1283 [hereinafter Instrument Establishing the GEF].

4. United Nations Conference on Environment and Development: Framework Convention on Climate Change, May 9, 1992, 31 I.L.M. 849 (1992), arts. 11 & 21(3) [hereinafter Framework Convention on Climate Change-FCCC]; and United Nations Conference on Environment and Development: Convention on Biological Diversity, June 5, 1992, 31 I.L.M. 818 (1992), arts. 21 & 39 [hereinafter Convention on Biological Diversity-CBD].

5. Instrument Establishing the GEF, *supra* note 3, pmb. (a), at 1284.

6. In 1994 the GEF was restructured to make it more transparent and democratic in nature. The GEF has close to 160 member countries. To be eligible to receive GEF grants, countries must fit the criteria established by the "Conference of the Parties of each convention [FCCC and CBD] and must be eligible to borrow from the World Bank or an eligible recipient of UNDP technical assistance." *Id.*, §§1(6) & (9), at 1284-86. For further discussion on the GEF, see Stephen Silard, *The Global Environment Facility: A New Development in International Law and Organization*, George Washington Journal of International Law 28 (607) (1995).

7. The Bretton Woods Institutions were designed by the Allied governments at the Bretton Woods Conference in 1944 as part of an effort to develop a multilateral system that could help address the many tasks linked to economic reconstruction and international trade liberalization. The International Monetary Fund (IMF) and the International Bank for Reconstruction and Development (IBRD) emerged from the Conference. Plans for the creation of the International Trade Organization were not immediately fulfilled, because the U.S. Congress never approved the Charter. Later, in 1947, the General Agreement on Tariffs and Trade (GATT) was established and

in December 1993, the World Trade Organization was formed as the successor to GATT. Together, these three organizations form the basis of the Bretton Woods system. Bretton Woods Commission, *Bretton Woods: Looking to the Future*, at B1-3 (July 1994) [hereinafter Bretton Woods Commission Report].

8. See Richard Falk, *Environmental Protection in an Era of Globalization*, 1995 Y.B. Int'l Envt L. 1, 3-25.

9. See Bruce Rich, *Mortgaging the Earth: The World Bank, Environmental Impoverishment, and the Crisis of Development* (1994); see also Catherine Caulfield, *Masters of Illusion: The World Bank and the Poverty of Nations* (1996).

10. Case Concerning the Gabčíkoco-Nagymoros Project (Hung. v. Slovk.), 1997 I.C.J. 92 (Sept. 25).

11. For the separate opinion of the ICJ Vice-President Weeramantry, see <<http://www.law.cornell.edu/ijc/ijc6/ihjudweerman.htm>>. For discussion on customary environmental law, see Daniel Bodansky, *Customary (and not so Customary) International Environmental Law*, 3 IND. J. GLOBAL L. STUD. 105 (1995).

12. See United Nations Conference on Environment and Development, Agenda 21: Programme of Action for Sustainable Development, U.N. Doc. A/CONF. 151/26 (vol. 1) (August 12, 1992). See generally *Financial resources and Mechanisms*, *supra*, ch. 33; *National Mechanisms and International Cooperation for Capacity Building in Developing Countries*, *supra*, ch. 37; *International Institutional Arrangements*, *supra*, para. 9, ch. 38 (noting that "all specialized agencies of the United Nations, [including the World Bank] . . . have an important role to play in the implementation of relevant parts of Agenda 21 and other decisions of the Conference." *Id.*, para. 38.28; also noting that "[t]he success of the follow-up to the Conference is dependent upon an effective link between substantive action and financial support, and this requires close and effective co-operation between United Nations bodies and the multilateral financial organizations." *Id.*, para. 38.41). See also *International Legal Instruments and Mechanisms*, *supra*, ch. 39 (discussing that "[e]ffective participation in international lawmaking" notes that the effective participation of developing countries "should be assured through appropriate provision of technical assistance and/or financial assistance").

13. Rio Declaration on Environment and Development, 47th Sess., U.N. Doc. A/CONF.151/5/REV. 1 (1992), reprinted in 31 I.L.M. 874 (1992) [hereinafter Rio Declaration].

14. Speech by World Bank President James Wolfensohn, Special Session of the United Nations General Assembly (New York, June 7, 1997).

15. See Bretton Woods Commission, *supra* note 7, at C-307.

16. The World Bank, 1997 Annual Report 76 (1997) [hereinafter 1997 Annual Report]. It is anticipated that

Palau will soon become the 181st member of the Bank.
See id.

17. International Bank for Reconstruction and Development (IBRD), Articles of Agreement, Dec. 27, 1949, 2 U.N.T.S. 134, *amended by T.I.A.S. No. 5929 (Dec. 16, 1965)*, [hereinafter World Bank Articles of Agreement]; *see also* International Development Association (IDA), Articles of Agreement, Jan. 26, 1960, 439 U.N.T.S. 249.

18. For the most comprehensive treatment on the Bank's responsibilities and practices as related to international law, *inter alia*, see Ibrahim F.I. Shihata, *The World Bank in a Changing World: Selected Essays I* 53-180 (1991).

19. *See The World Bank, Environment Matters* (Fall 1997).

20. Agreement Establishing the European Bank for Reconstruction and Development, art. 2.1, para. vii (May 29, 1990) <<http://www.ebrd.org/public/lists/basic1.htm>>. This Article directs the Bank to "promote in the full range of its activities environmentally sound and sustainable development."

21. World Bank, *Environmental Aspects of Bank Work*, in Operational Manual Statement, § 2.36 (May 1984) [hereinafter O.M.S. § 2.36].

22. *Id.* ¶8.

23. *Id.* ¶ 9(a).

24. *Id.* ¶ 9(a), (d), (f) & (g).

25. *Id.* ¶ 9(e). For a related discussion see Ibrahim F.I. Shihata, *Implementation, Enforcement and Compliance With International Environmental Agreement-Practical Suggestions in Light of the World Bank's Experience*, 9 Geo. Int'l. Envtl. L. Rev. 37, 47-51 (1997).

26. O.M.S. § 2.36, *supra* note 21, ¶ 11.

27. *See discussion infra Part III.I.i.*

28. *See Rio Declaration, supra* note 13, princ. 7; Framework Convention on Climate Change, *supra* note 4, para. 1.

29. For discussion concerning the actions by developing countries under the Climate Change Convention, see W.V. Reid and J. Goldemberg, *Are Developing Countries Already Doing as Much as Industrialized Countries to Slow Climate Change* (World Resources Institute: Climate Notes, July 1997). The authors conclude by asking "whether industrialized countries are the leaders or laggards in mitigating climate change." *Id.* at 6.

30. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997 (FCCC/CP/1997/L.7/Add.1) <<http://unfccc.de/homep.htm>> [hereinafter Kyoto Protocol].

31. *See Environment Matters, supra* note 19.

32. Third Ozone Depleting Substances Phase-out Project, Ozone Project Trust Fund Grant Agreement, United Mexican States & Nacional Financiera, S.N.C. -

I.B.R.D., Grant No. 22018 (not yet signed by parties) [hereinafter Ozone Trust Fund].

33. *See discussion infra* notes 49-50 and accompanying text.

34. Discussions held by the author and his colleague, Dr. Mohan G. Gopal, Principal Counsel, World Bank Legal Department, Task Manager of the Project at the offices of Mr. Mehta, New Delhi, April 16, 1996. For a discussion concerning, *inter alia*, the series of cases brought by M.C. Mehta, *see Bharat Desai, Enforcement of the Right to Environment Protection Through Public Interest Litigation in India*, 3 Indian J. Int'l. L. 27 (1993).

35. Case concerning M.C. Mehta v. Union of India, AIR 1988 P.C. 1037, *reprinted in Compendium of Summaries of Judicial Decisions in Environment Related Cases*, 3 SACEP/UNEP/NORAD Publication Series on Env'tl. L. & Pol'y 48 (1997).

36. Thailand Conservation Area Protection and Management Project, Global Environment Trust Fund Grant Agreement, *letter of agreement only signed Dec. 30, 1994, GEF-Thail. (No. GET-PPA TF 28669)*. This project seeks to carry out goals described in the Bank's policy paper on how it intends to support the goals of the Convention on Biological Diversity. The World Bank, *Mainstreaming Biodiversity in Development: A World Bank Assistance Strategy for Implementing the Convention on Biological Diversity* (Nov. 1995).

37. Ploenpoch Vorapien, *NGOs Disagree with World Bank*, Bangkok Post, June 25, 1995, at 1.

38. World Bank, *An Environmental Strategy for the Energy Sector*, (Working Draft, Oct. 6, 1997) [hereinafter Strategy Paper].

39. *See World Bank, The Global Carbon Initiative* (May 1997) (visited Feb. 6, 1998) <<http://www.worldbank.org/html/extdr/climchng/overview.htm>>.

40. *See Kyoto Protocol, supra* note 30, arts. 3 & 6, annex B.

41. *See id.*

42. *See id.*, art.12.

43. *See World Bank (Global Climate Change Unit, Global Environment Division), The Carbon Offset Investment Business and the Role of the World Bank Group 8* (July 1997).

44. Consistent with art. 4.2(d) of the Climate Change Convention, the Conference of the Parties decided the first meeting of the Parties in Berlin to approve criteria for a pilot phase for "activities implemented jointly" (AIJ). *See Report of the Conference of the Parties on its First Session*, held at Berlin from Mar. 28 to Apr. 7 1995, Dec. 5/CP.1, 1st Sess., U.N. Doc. FCC/CP.1995/7/Add.1 (1995).

45. Arnold W. Reitze, *Health Effects of Air Pollution, in Air Pollution Law* 47 (Michie 1995).

46. *See Strategy Paper, supra* note 38.

47. *Environment Matters, supra* note 19, at 14.

48. An interesting project in this area, the Indonesia Solar Homes Systems Project, provides GEF grant and Bank lending to Indonesia to make solar energy affordable to 35 million rural dwellers. The World Bank, Indonesian Solar Home Systems Project: Global Environment Facility Trust Fund Grant, No. 28488 (Mar. 11, 1997) [hereinafter Indonesian Solar Homes System Project].

49. Montreal Protocol on Substances that Deplete the Ozone Layer, Sept. 16, 1987, 26 I.L.M. 1550 [hereinafter Montreal Protocol]; Adjustment to the Montreal Protocol on Substances that Deplete the Ozone Layer, June 29, 1990, 30 I.L.M. 539, art. 10.

50. See Ozone Trust Fund, *supra* note 32.

51. Environment Matters, *supra* note 19, at 6.

52. Global Environment Facility, *Study of GEF's Overall Performance Executive Summary*, at 4 (visited Dec. 1997) <www.gefweb.com>[hereinafter GEF Performance Summary].

53. *Id.* See also Environment Matters, *supra* note 19, at 6.

54. See GEF Performance Summary, *supra* note 52, at 4.

55. See the World Bank, 1996 Annual Report 35 (1996) [hereinafter 1996 Annual Report]. Overall lending declined in fiscal year 1997. See 1997 Annual Report, *supra* note 16, at 8. IDA terms are softer than those provided to countries borrowing from the IBRD. IDA credits go to the poorest countries on concessional terms; these funds can be minimal requirements for repayment of interest. See also Bretton Woods Commission Report, *supra* note 7, at B-3.

56. See 1996 Annual Report, *supra* note 55, at 57.

57. See Environment Matters, *supra* note 19, at 6.

58. See World Bank, *Country Assistance Strategies*, in Operational Manual: Bank Procedures (January 1995), § 2.11 [hereinafter B.P. § 2.11].

59. See *id.*, ¶ 7.

60. See World Bank, Environment and Industry and Energy Departments, *Energy and Environment Strategy* (visited Oct. 1997) <<http://www.geei.org/wbstrat.html>>. The GEF Portfolio Study, *supra*, also noted that the Bank had not systematically developed means to incorporate global concerns in the CAS. See *id.* at 4, 8.

61. See Robert T. Watson, *Overview: Our Global Environment*, in Environment Matters, *supra* note 19, at 4-5.

62. See *id.* See also World Bank, Monitoring Environmental Progress (1995). For a discussion on declining availability to clean water and air, see chapters 3 & 6.

63. The efforts to include institutional capacity building as part of overall lending is challenging, as institutional capacity is difficult to borrow for, and the rate of return is difficult to gauge. Yet, increasingly, through the work of lawyers and institutional specialists, the Bank has made headway in this area. For these

reasons, the particular skills of lawyers in legal and institutional framework-setting can serve the long term interests of the parties involved. By the end of 1997 fiscal year the Bank was helping 70 countries to strengthen their environmental management capacity. See 1997 Annual Report, *supra* note 16, at 25.

64. See Instrument Establishing the GEF, *supra* note 3, at 1.

65. See Framework Convention on Climate Change, *supra* note 4, art. 11.

66. See *id.*, art. 21(3).

67. See *id.*, art. 11(3)(a).

68. The Global Environment Facility, 1997 Annual Report, at (i) (1997). More than 155 countries participate in the GEF, which was restructured in March 1994. It operates with a three-year financing budget close to \$2 billion. Currently the GEF is in the process of being replenished in an amount estimated in the range of \$2.75 billion. See *id.*

69. See World Bank, *Policy Framework*, in The Operational Strategy of the Global Environment Facility, at (i) (Feb. 1996) <<http://www.worldbank.org/html/gef/complete.htm>> [hereinafter GEF Operational Strategy]. United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, June 17, 1994, U.N. Doc A/AC.241/15/Rev.7.

70. See also World Bank, GEF Operational Programs (Apr. 1997) (serving as a series of reference documents pertaining to the Operational Strategy, see GEF Operational Strategy, *supra* note 69, and to guide strategic planning and assist task managers in the preparation of GEF-financed projects) <<http://www.worldbank.org/html/gef/operprog/outline.htm>>.

71. GEF Operational Strategy, *supra* note 69, at 14.

72. *Id.* (noting that “[t]he COP designated the GEF to serve as the institutional structure to operate the financial mechanism of the CBD on an interim basis”). See also *Financial Resource and Mechanism*, Report of the Conference of the Parties on its First Session, Dec. 1/2, 1st Sess., U.N. Doc. UNEP/CBD/COP/1/17 (1995); annex 1, at 33-34.

73. See GEF Operational Strategy, *supra* note 69, at 48 (defining “international waters”).

74. See *id.*

75. *Id.*, at 54.

76. See World Bank, Wider Caribbean Initiative on Ship Generated Waste Project: Global Environmental Facility Trust Fund Grant Agreement, Aug. 1, 1994, I.M.O.-I.B.R.D., Grant No. TFO28653 [hereinafter Wider Caribbean Initiative].

77. See London International Convention for the Prevention of Pollution from Ships, Nov. 2, 1973, U.K.T.S. 27, 12 I.L.M. 1319 (1973), as modified by the Protocol of 1978 relating thereto, Feb. 17, 1978, 34 U.S.T.

3407, reprinted in 17 I.L.M. 546 (1978) [hereinafter MARPOL].

78. See Wider Caribbean Initiative, *supra* note 76.

79. For example, many of the countries engaged in the Wider Caribbean Initiative have very few attorneys available to work on the model legislation proposed as the basis upon which to enforce MARPOL. In some cases, the attorneys must work on many non-environment-related topics at the same time, or may even have part-time positions in thinly-staffed government offices.

80. See OECS Ship Generated Waste Management Project, Global Environment Trust Fund Grant Agreement, May 11, 1995, O.E.C.S.-I.B.R.D., Grant No. TF028594-TF028600 [hereinafter OESC Waste Management Project].

81. See World Bank (Eastern Africa Department), *Staff Appraisal Report for the Lake Victoria Environmental Management Project*, June 18, 1996 (Report No. 15429-AFR).

82. See *id.*

83. See *id.* at 20.

84. See SADC Lake Malawi/Nyasa Biodiversity Conservation Project: Global Environment Trust Fund Grant Agreement, June 8, 1995, Malawi Rep. -I.B.R.D., Grant No. 28671 MAI [hereinafter Lake Malawi Project].

85. World Bank (Environment Department), *Issues and Options in the Design of GEF Supported Trust Funds for Biodiversity Conservation* 14 (1995) [hereinafter Design of GEF Supported Trust Funds]. See also generally Peter Sand, *Trusts for the Earth: New Financial Mechanism for International Environmental Protection* (1994).

86. Royal Charter of the Trust Fund for Environmental Conservation (Thimpu, Bhutan, 1996).

87. *Id.*

88. See *id.* art. 2.3.

89. Bwindi Impenetrable National Park and Mgahinga Gorilla National Park Conservation Project, Global Environment Trust Fund Grant Agreement, Mar. 7, 1995, Uganda-I.B.R.D., Grant No. 28670 UG.

90. See Design of GEF Supported Trust Funds, *supra* note 85, at 70.

91. See Environmental Project, Global Environment Facility Trust Fund Grant Agreement, June 1997, *Fondo Mexicano Para La Conservacion de la Naturaleza*, A.C.-United Mexico States- I.B.R.D., Grant No. TF028678.

92. See *infra* notes 202-15 and accompanying text.

93. For further information, see Design of GEF Supported Trust Funds, *supra* note 85.

94. See *infra* notes 106-08, 110 and accompanying text.

95. See *id.*

96. See I.B.R.D. Resolution No. 93-10 and IDA Resolution No. 93-6, *Resolution Establishing the World Bank*

Inspection Panel, September 22, 1993, in The World Bank in a Changing World: Selected Essays II 647, app. III(A) (1994) [hereinafter The World Bank in a Changing World II]. See also Inspection Panel for the IBRD, Operating Procedures 5, adopted Aug. 19, 1994 [hereinafter Operating Procedures].

97. See Ibrahim F.I. Shihata, *The World Bank Inspection Panel* 1, 5-35 (1994).

98. See Operating Procedures, *supra* note 96, at 4.

99. See 1997 Annual Report, *supra* note 16, at 42-45.

100. See Raj Krishna, *World Bank Operational Policy Relating to International Waterways: Its Genesis and Evolution*, Paper presented to World Bank Seminar on International Watercourses, Washington D.C., Nov. 3-4, 1997. Mr. Krishna served until 1995 as Legal Advisor to the World Bank on issues of international trade and international waters.

101. See *id.* (referring to World Bank Operational Memorandum No. 8 of Mar., 1956).

102. See *The World Bank in a Changing World* II, *supra* note 96.

103. See O.M.S. § 2.36, *supra* note 21.

104. Operating Procedures, *supra* note 96, at 45-46.

105. *Id.* at 46.

106. World Bank, *World Bank Operational Manual: Operational Policies* [hereinafter Operational Policies].

107. World Bank, *World Bank Operational Manual: Bank Procedures* [hereinafter Bank Procedures].

108. World Bank, *World Bank Operational Manual: Good Practices* [hereinafter Good Practices].

109. Thus, for example, the draft Operational Policy on environmental assessment refers to the obligation to refer during project preparation and EA work to the recent draft of the World Bank's "Pollution Prevention and Abatement Handbook." WORLD BANK, *Environmental Assessment*, in *World Bank Operational Manual: Operation Policy (Draft)*, at § 4.01, para. 6 (Nov. 1997) [hereinafter Draft O.P. § 4.01]. See also The World Bank, Pollution and Prevention Abatement Handbook (annual meeting, ed. Sept. 1997) [hereinafter World Bank Handbook]. It is expected that both the policy and the Handbook will soon become final. The full Handbook, as it currently stands, is available on the World Bank website at <<http://www-esd.worldbank.org/pph/>>.

110. World Bank, *World Bank Operational Manual: Operational Directive* [hereinafter Operational Directive].

111. See *Environmental Assessment*, in *Operational Directive*, *supra* note 110, §4.01 (Oct. 1991) [hereinafter O.D. §4.01].

112. See World Bank, *The Impact of Environmental Assessment: A Review of World Bank Experience*, World Bank Technical Paper 363 (1997) [hereinafter Impact of Environmental Assessment].

113. Rio Declaration, *supra* note 13.

114. *Id.* princ. 17.

115. *Id.* princ. 10.

116. *See id.* princs. 14 & 19.

117. *See* Opinion of Mr. Justice Weeramantry, *supra* note 11; D. Hunter, et al., *Concepts and Principles of International Environmental Law: An Introduction*, in Environment and Trade 1, 22-27 (U.N. Environment Program Series on Trade and Environment, Geneva 1994).

118. *See* Convention on Environmental Impact Assessment in a Transboundary Context, Feb. 21, 1991, 30 I.L.M. 800; *see also* Council Directive 97/11/EC of 3 March 1997 on Environmental Impact Assessment Amendment L. 71, amending Council Directive 85/337/EEC of 5 July 1985 on Environment Impact Assessment, L. 175.

119. North American Agreement on Environmental Cooperation, Sept. 8, 1993, 32 I.L.M. 289, art. 10(7).

120. Environmental Assessment policy has evolved along with Bank practice. Bank practice has long included use of an Environmental Assessment Sourcebook, which contains many examples of best practice in the field. World Bank, Environmental Assessment Sourcebook Update, vols. I-III (1991) [hereinafter Environmental Assessment Sourcebook]. This Sourcebook should be looked at in conjunction with Bank policy.

121. O.D. § 4.01, *supra* note 111, annex A & A(j). *See also*, Charles Di Leva & O. Kjorven, *International Agreements on Environment and Natural Resources: Relevance and Application in Environmental Assessment*, in Environmental Assessment Sourcebook, *supra* note 120, at no. 10 (Mar. 1996).

122. O.M.S. § 2.36, *supra* note 21.

123. *Id.* annex B, ¶ 2(b).

124. Environmental Assessment Sourcebook, *supra* note 120, at 68-75.

125. *Id.*

126. World Bank, Lebanon Solid Waste/Environmental Management Project, Loan No. 3899 (1997).

127. World Bank Handbook, *supra* note 109.

128. Draft O.P. § 4.01, *supra* note 109, ¶ 6. This draft policy helps clarify prior Bank practice pursuant to which the Bank's EA process took into account the 1988 Environmental Guidelines.

129. *Id.*

130. O.D. § 4.01, *supra* note 111, ¶ 19-22. *See also* The World Bank, World Bank Policy on Disclosure of Information (1994).

131. O.D. § 4.01, *supra* note 111, ¶ 19-22; World Bank Policy on Disclosure, *supra* note 130.

132. *See Disclosure of Operational Information*, in Bank Practices, *supra* note 107, §17.50 (Sept. 1993) [hereinafter B.P. § 17.50].

133. *See Involving Nongovernmental Organizations in Bank-Supported Activities*, in Good Practices, *supra* note 108, § 14.70 (Mar. 1997), setting forth that the Bank

encourages borrowers and staff to involve nongovernmental organizations (NGOs) at all stages of the Bank project cycle. *See also* Ibrahim F.I. Shihata, *The World Bank and Non-Governmental Organizations*, 25 Cornell Int'l. L.J. 623 (1994).

134. *See Indigenous Peoples*, in Operational Directive, *supra* note 110, § 4.20 (Sept. 1991) [hereinafter O.D. § 4.20]; *Involuntary Resettlement*, in Operational Directive, *supra* note 110, § 4.30 (June 1990) [hereinafter O.D. § 4.30].

135. *See* World Bank Policy on Disclosure, *supra* note 125; *see also* B.P. § 17.50, *supra* note 130.

136. This screening includes for GEF projects even if they do not include Bank financing. *See* The World Bank, *Global Environment Facility: Procedures for Investment Operations under the Global Environment Facility*, in Operational Directive, *supra* note 110, § 9.01 (May 1992) [hereinafter O.D. § 9.01]. *See also* O.D. § 4.01, *supra* note 111, n.1.

137. O.D. § 4.01, *supra* note 111, ¶ 17.

138. *Id.*

139. There has been discussion about the merits of categorization within the Bank and in technical working groups of the multilateral financial institutions in which the author participates. Some have noted that the expenses of Category A projects are much greater than Category B in terms of time and document preparation and disclosure. As a result, there is concern that there could be a temptation to seek to categorize certain projects as Category B. The Inter-American Development Bank has done away with categorizations, with each project's environmental assessment prepared as extensively as required by the project's impact.

140. O.D. § 4.01, *supra* note 111, ¶ 17.

141. *Id.* annex D, ¶ 3.

142. *Id.* ¶ 19.

143. *See id.*, ¶20. During the preparation of the OECS Solid Waste Management Project, *supra* note 79, local release of the EA provided an opportunity for the local bird club to point out to the Bank and the EA preparers that the EA has not included mention of habitat for the endangered Grenada dove at the site of a proposed landfill. With this information, the Bank stopped further action on that component of the project until a new study was done of other potential locations throughout the island, and further work completed on how to best protect the bird habitat. *See Impact of Environmental Assessment*, *supra* note 112, at 38.

144. O.D. § 4.01, *supra* note 111, n.15.

145. *Id.* ¶ 21.

146. *Id.*

147. *Id.* ¶ 21. *See also* B.P. § 17.50, *supra* note 132, ¶ 12.

148. *See Esso Exploration and Production Chad, Inc., Chad/Cameroon Development Project: Fact Sheet* (Nov. 1997).

149. B.P. § 17.50, *supra* note 132, ¶ 12.

150. O.D. § 4.01, *supra* note 111, ¶ 22. The author is not aware of any project since 1992 in which a borrower has refused to release the EA.

151. *Id.* annex B, ¶ 1.

152. *Id.* annex B.

153. *Id.* annex B, ¶ 2(j)(iii).

154. *Id.* annex B, ¶ 1(j).

155. *Id.* annex D, ¶ 6.

156. *Id.* annex D, ¶ 10.

157. See *Impact of Environmental Assessment*, *supra* note 112, at xvi. In fact, one of the clarifications to be included in the draft Environmental Assessment policy is that the Bank's policy is to provide analysis of the "without project" alternative. While this has been Bank policy, it has not been explicitly set out in O.D. § 4.01, *supra* note 111. It does appear in the Environmental Assessment Sourcebook, *supra* note 120, at 138, ¶ 8.

158. See *Projects on International Waterways*, in Operational Policy, *supra* note 106, § 7.50 (1994) [hereinafter O.P. § 7.50].

159. Convention on the Law of the Non-Navigational Uses of International Watercourses, *Report of the Sixth Committee Convening as the Working Groups of the Whole*, U.N. GAOR, 6th Comm., 51st Sess., Agenda Item 144, U.N. Doc. A/51/869 (1997) [hereinafter Convention]. The U.N. General Assembly, on May 21, 1997, under G.A. Res. 51/229, adopted the Convention with 103 votes for, three against, and 27 abstentions. The development of the Bank's policy also took into account the Report of the Fifty-Second Conference in The Helsinki Rules on the Uses of the Waters of International Rivers, Int'l L. Ass'n, at 477-531 (Helsinki 1966).

160. Convention, *supra* note 159, art. 2(a).

161. *Id.* art. 2(b).

162. As noted by one of the Bank's former legal advisors, the Bank seeks to ensure that "a state is entitled to use the flow of the river or its territory but only in such a way that it does not cause appreciable harm to another riparian." See R. Krishna, *supra* note 100, at 15. This principle follows the reasoning from the well-known duty of one nation not to use its property to the harm of another nation. See *In re Trail Smelter Arbitral Tribunal*, 3 R. Int'l. Arb. Awards (1941).

163. Convention, *supra* note 159, arts. 5 & 6.

164. Both documents follow similar pre-project notification provisions. See O. P. § 7.50, *supra* note 158, ¶ 4-6; Convention, *supra* note 159, ¶ 12-18.

165. O.P. § 7.50, *supra* note 158, ¶ 4.

166. *Id.* ¶ 8(c). Presumably, this requirement also protects the financial investment in the project by ensuring that adequate water flows have been recognized by upstream riparians. This provision is not explicit in the Convention.

167. *Id.* ¶ 7.

168. *Id.* ¶ 8.

169. S. McCaffrey and M. Sinjela, *The 1997 Convention on International Watercourses*, AM. J. INT'L L. (forthcoming).

170. O.P. § 7.50, *supra* note 158 (paragraph 6 provides that if, following notification, one riparian objects to the proposed project, the Bank may appoint independent expert[s] to examine the issues of harm and legality).

171. *Id.* ¶ 3.

172. See *Economic Analysis of Investment*, in Operational Policies, *supra* note 106, § 10.04, ¶ 8 (Sept. 1994) [hereinafter O.P. § 10.04].

173. *Id.* ¶ 5.

174. *Id.*

175. *Id.* ¶ 8.

176. *Id.*

177. O.M.S. § 2.36, *supra* note 21, ¶ 8.

178. A GEF project which protects wetland sites officially designated under the Ramsar Convention is the Ghana Coastal Wetlands Management Project, GEF Trust Fund Grant No. 28619 (1992).

179. Convention on the Conservation of Migratory Species of Wild Animals, June 23, 1979, 19 I.L.M. 15 (1980).

180. See *Natural Habitats*, in Operational Policies, *supra* note 106, § 4.04, ¶ 1 (Sept. 1995) [hereinafter O.P. § 4.04].

181. *Id.* annex B.

182. *Id.* annex A, ¶ 1(b).

183. *Id.* annex A, ¶ 1(a).

184. For extensive discussion about the precautionary principle, see *The Precautionary Principle and International Law: The Challenge of Implementation* (David Freestone & Ellen Hey eds. 1996).

185. O.M.S. § 2.36, *supra* note 21.

186. See *Cultural Property*, in Operational Policies, *supra* note 106, § 11.03 (Sept. 1986). [hereinafter O.P. § 11.03].

187. See World Bank, *Cultural Heritage in Environmental Assessment*, in Environmental Assessment Sourcebook Update: World Bank No. 8 (Sept. 1994).

188. Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all Types of Forests, June 13, 1992, 31 I.L.M. 881 [hereinafter Statement of Forest Principles]. See also *International Tropical Timber Agreement*, Jan. 26, 1994, 33 I.L.M. 1014 (1994) [hereinafter ITTA]. The ITTA is intended to be a commodity agreement between producer and consumer countries, and established the International Tropical Timber Organization [hereinafter ITTO]. The ITTO agreed to a non-binding goal of sustainable management by the year 2000 and has issued some guidelines to that effect.

189. See *Forestry*, in Operational Policies, *supra* note 106, § 4.36 (Sept. 1993) [hereinafter O.P. § 4.36].

190. These efforts by the Bank include trying to bring together various stakeholders in the forestry industry

and environmental groups to address the issues of sustainable forestry practices, as well as forming an alliance with the World Wildlife Fund-US to try to preserve 10 percent of each of the world's forest types by the year 2000. *See Environment Matters, supra* note 19, at 57.

191. O.P. § 4.36, *supra* note 189, ¶ 1.

192. *Id.* ¶ 1(d)(i).

193. O.D. § 4.20, *supra* note 134. Section 4.20 is currently under revision.

194. *See Lao People's Democratic Republic, Forestry Project Credit No. 25860* (1994).

195. Statement of Forestry Principles, *supra* note 188.

196. On this and many other trade-related issues, the Bank has established a broad consultative approach with the World Trade Organization [hereinafter WTO]. For example, the Bank's Environmental Law Unit and Environment Department routinely discuss issues of mutual interest with the WTO's Environment and Trade Division.

197. O.P. § 4.36, *supra* note 189, ¶ 1(a).

198. Statement of Forestry Principles, *supra* note 188.

199. *See Julian Burger, The Gaia Atlas of First People 18* (1990).

200. Rio Declaration, *supra* note 13, princ. 22.

201. United Nations Economic and Social Council, Commission on Human Rights, Sub-Commission on Discrimination and the Protection of Minorities, Working Group on Indigenous Populations, 14th Sess., U.N. Doc. E/CN.4/Sub.2/AC.41996/2 (1996) [hereinafter ECOSOC Report].

202. World Bank, *Tribal People in Bank-financed Projects, in Operational Manual Statement*, § 2.34 (1982) [hereinafter O.M.S. § 2.34].

203. O.D. § 4.20, *supra* note 134.

204. *See ECOSOC Report, supra* note 201, ¶ 29.

205. O.D. § 4.20, *supra* note 134, ¶ 5(a) (Sept. 1991).

206. International Labor Organization, Convention Concerning Indigenous and Tribal Peoples in Independent Countries, June 27, 1989, 28 I.L.M. 1382 (entered into force Sept. 5, 1991).

207. Discussions with Shelton H. Davis, Principal Social Scientist, World Bank Environment Department, Social Policy Division.

208. *La comunidad Mayagna (Sumo) de Awas Tingni, et al. v. Ing. Milton Cardenal, et al, Recurso De Amparo dirigido al Honorable Sala de lo Civil del Tribunal de Apelaciones de Matagalpa*, Case No. 11.557 (Oct. 2, 1995) (Constitutional action brought to the Appellate Civil Tribunal of Matagalpa).

209. World Bank (Environment Department), Resettlement and Development 1 (Mar. 1996).

210. O.D. § 4.30, *supra* note 134.

211. *Id.* ¶ 1.

212. *Id.* ¶ 3(b).

213. Rio Declaration, *supra* note 13, princ. 10.

214. O.D. § 4.30, *supra* note 134, ¶ 12 & 17.

215. *Id.* ¶ 7.

216. *See Pest Management, in Operational Policies, supra* note 106, § 4.09 (July 1996) [hereinafter O.P. § 4.09].

217. *Id.* ¶ 1 & 3.

218. *Id.* ¶ 6.

219. *Id.* ¶ 7.

220. *Id.*

221. *Id.*

222. *Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal*, Mar. 22, 1989, UNEP/IG.80/3, *reprinted in* 28 I.L.M. 657 (1989).

223. *Speech of former World Bank President Barber Conable, Oslo Conference on Sustainable Development* (July 10, 1988).

224. *See World Bank, India Industrial Pollution Control Project, Loan No. 3334-IN, Credit No. 2252-IN* (1991).

225. *See Procurement Arrangements for Adjustment Operations, in Operational Directives, supra* note 110, § 11.03, ¶ 6 (Dec. 1991) [hereinafter O.D. § 11.03].

226. *See Barbara Verhoeve & Graham Bennett, Products and the Environment: An International Overview of Recent Developments*, 3 Eur. Envtl. L. Rev. 74 (1994); Donald Reid & Morton Fraser, *The Packaging and Waste Directive*, 4 Eur. Envtl. L. Rev. 239 (1995); Manuela Palomares-Soler & Peter M. Thimme, *Environmental Standards: EMAS and ISO 14001 Compared*, 5 Eur. Envtl. L. Rev. 247 (1996).

227. *See Sand, supra* note 85, at 5-7.

228. *See World Bank, World Bank Report: Policy on Tobacco* (R91-225) (Oct. 9, 1991); Chairman's summary of the World Bank Executive Director's discussion of the paper on November 26, 1991 (SecM91-1565). *See also* Peter Sand, *International Economic Instruments For Sustainable Development: Sticks, Carrots and Games*, 36 Ind. J. Int'l L. 1, 7 (1997) (discussing, *inter alia*, the Bank's tobacco policy, and the government of Thailand's tobacco regulations, which were successfully challenged before the General Agreement on Tariffs and Trade, and noting that such public policies should not be ignored by the multilateral trading system as falling outside their mandate).

229. *Tobacco, in Operational Policies, supra* note 106, § 4.76, ¶ 1 & 3 (Mar. 1994) [hereinafter O.P. § 4.76].

230. *Monitoring Environmental Progress*, *supra* note 62, at vii.

Reading

Environmental Law: Concepts and Issues

David Freestone and Laurence Boisson de Chazournes

Law refers to a body of rules accepted as binding on the members of a given society. Sophisticated legal systems have existed since early times, and include the Code of Hammurabi in Babylonia in the eighteenth century B.C. and the laws of Manu in India (200 B.C.). In modern societies law is the primary instrument through which policies are implemented; it can express minimum standards of morality or reflect the aspirations and goals of a society. Law reflects a society's values and adapts as they change, while at the same time serving as an important instrument that allows such changes to occur in an orderly fashion.

A diversity of legal traditions coexist in the world today. The common law tradition evolved from judge-made law in medieval England, and is now used by most of the former British possessions, including the United States. Another tradition, based on civil law, is characterized by the enactment of "codes" that integrate and organize systematically all legal rules pertaining to a particular subject. This tradition has its roots in Roman law, was revitalized by the enactment in France of the Napoleonic Code in 1804, and is now used in most countries in Western Europe and Latin America, as well as in some Asian countries, such as Japan. Other legal traditions are

based on religious beliefs, such as Jewish, Hindu, Muslim, and Canon law.

Sources of law vary among different legal traditions. Usually, however, they include judicial decisions rendered by courts and tribunals. Another important source is the body of statutes or acts that are adopted by the state; or in democracies, by an elected legislature. These statutes and acts are, in turn, implemented by detailed regulations promulgated by the national administration. Additional sources of law include custom, general principles of law, and legal writing by scholars. The science of law is divided into different branches. The basic branches are contract, tort, property, criminal, administrative, and constitutional law. Others include admiralty, corporate, intellectual property, and environmental law.

Domestic Environmental Law

Domestic, or national, law refers to the legal system applicable to a defined territory over which a sovereign power has jurisdiction. International law, on the other hand, regulates the conduct of states and other international actors. Over the years domestic and international systems of law have evolved in parallel. In certain fields and re-

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gions of the world, international law has shaped and significantly contributed to the development of domestic environmental law. Yet international environmental law also reflects domestic experiences considered successful by the community of nations. The result is a complex relationship in which the two levels of environmental law mutually contribute to and reinforce each other. This section deals with domestic environmental law; the next section addresses international environmental law.

Early Developments

Environmental law is a relatively new field; other branches of law have historically been used to remedy environmental problems. In the common law system, tort law—which provides remedies for harm caused by one individual to another—provided the necessary legal foundation in early cases. Nuisance actions were the most popular, because they allow a successful claimant not only to receive compensation, but also a court order to abate the nuisance, such as a smell or smoke. In the civil law system claimants invoked tort and property law in much the same way. Historically, however, tort law, based as it is on the protection of individual rights and the need to prove specific injury, has not been a significant means of preventing environmental degradation.

The inadequacy of tort and property law convinced governments, including local authorities, to adopt measures to tackle the most pressing environmental problems. There is some debate regarding the true nature of the first local ordinances regulating odors, smoke, and wastewater. Some scholars argue that they are early environmental statutes, while others see them simply as health-based policies having the effect of regulating environmental problems. Most of these early measures were, in fact, enacted after sporadic crises that endangered public health.

Modern Environmental Law

Since the 1970s environmental law has experienced an unprecedented growth in many countries. This was made possible through the enactment of new statutes and regulations that provide for higher standards of environmental protection. The level of government that has en-

acted these instruments varies from one country to another. In federal states such as Canada, jurisdiction over the environment is shared between the provincial and federal governments. In the United States the federal government has adopted most of the important environmental statutes, but their implementation is delegated to the states through a complex system of incentives and responsibilities. The European Union (EU) has a developed system of environmental law, the legal basis for which is now to be found in the 1992 Maastricht Treaty on European Union. Although implementation is the responsibility of individual EU member states, European law permits individuals, as well as other member states and the European Commission, to pursue actions for breach of these rules before the European Court of Justice in Luxembourg.

Most countries have created institutions to handle environmental matters and given them varying degrees of independence, power, and jurisdiction. The primary function of such institutions is to coordinate domestic efforts aimed at protecting the environment. This normally involves statute and regulation development, environmental law enforcement, integration of environmental concerns in governmental decisionmaking, and general environmental education. The nature of the institutions also differs greatly from one country to another; there is no ideal arrangement. Many countries have created an independent environment ministry or have established a specialized Agency, such as the U.S. Environmental Protection Agency, which was created by an executive order and reports directly to the President. Some countries, such as the U.K., have both. Another approach, adopted widely in Latin America, is the creation of an environmental commission that groups together representatives of many other ministries and departments.

Organization of Environmental Statutes

Environmental statutes have traditionally been drafted and organized around important themes such as nature conservation and protection of the principal natural media: air, water, and soil. This allows the elaboration of rules of limited application that are easier to manage and enforce, but may fail to acknowledge the importance of an holistic approach and to deal with important

natural relationships, such as the effects of air pollution on water quality. Other countries have adopted different approaches. New Zealand has a seminal 1991 Resource Management Act, which integrates all sectors and relevant activities, while Canada has consolidated five of its main environmental statutes into one single act of general application. A similar technique is also used in other countries, such as Chile, that have adopted environmental framework laws, under which sectoral laws can be promulgated in an integrated way.

Legislative Techniques

Despite the particular organization of a country's environmental laws, a law-making body can resort to a number of legislative techniques to attain its policy objectives.

Prior authorization. A general prior authorization requirement prohibits any person from engaging in any activity that could harm the environment without prior permission. This essentially establishes a permit or license system, whereby any activity constituting a potential source of pollution requires the permission of a central authority. This technique can be adapted to serve different policy goals. The scope of the permitting system can be broad, to cover almost any component of the biosphere, or limited, to regulate only certain types of activities.

Environmental standards. Environmental standards are mostly "command and control" measures by which a central authority mandates specific requirements to be followed by the regulated community. As such, commentators distinguish them from "economic instruments," which rely on market-based approaches and will be examined below.

The objective of standards is to prescribe specific quantitative and qualitative limits to be followed by the regulated community. They may take at least five different forms. First, health standards are normally based on risk assessment analysis that identifies safe tolerance levels. These are used to control pesticides and other similar substances, and may be enacted without taking into account the compliance costs for the regulated community. Second, ambient environmental standards are used widely in the control of water and air pollution. These standards pre-

scribe specific limits on the concentration of certain designated pollutants that will be tolerated, for example, in the ambient air or water. They may be used for the control of non-point or diffuse pollution sources, such as the nitrate content of run-off from agricultural land. Compliance with such standards may require major changes of agricultural or commercial practices. Third, emission and discharge standards are also used to combat air and water pollution. Instead of specifying limits applicable to the ecosystem, such standards place limits on the composition of the actual emissions or discharge by a specific source.

Two further forms of standards relate to technology. The most commonly used standard is technology-based. A statute may prescribe the use of the "best available technology." Through cost-benefit analysis the environmental agency will then specify for each class of industry the specific technology that it considers to be the "best available," and which is therefore mandated. Such standards can be upgraded relatively easily. More progressive are "technology forcing" standards, which cannot be met by the regulated community under the current state of technology. The intention, however, is that the obligation to meet this type of standard will stimulate and "force" technological innovation. This technique has been used in the United States to regulate motor vehicle emissions.

Liability. Liability refers to the condition of being actually or potentially subject to a legal obligation. Under civil liability, individual liability may be due to negligence, that is, if the individual's conduct fell below the objective standard of a reasonable person. Criminal liability is more serious, and requires proof beyond reasonable doubt of an unlawful act and specific intent. Strict liability is an intermediary concept that is commonly used in environmental laws. It relieves the state of the obligation to prove that the unlawful act resulted from negligence (civil liability) or that the defendant's conduct was intentional (criminal liability). In other words, the state need only prove that the particular defendant committed an unlawful act; for example, discharging wastewater. Another important liability concept consists of joint and several liability, according to which violators will be held liable together and individually. In this case

governments can sue both violators together or either of them individually to recover, for example, the cost of clean-up. This technique is very useful when it can be proven that each defendant contributed to an unlawful activity, but the exact contribution of each is difficult to demonstrate, and sometimes the injury is simply indivisible.

Retroactive liability is the hallmark of modern soil statutes and constitutes an exception to general principles of law. Under these principles no one should be held liable for the acts of another or for actions that were lawful when they were taken. Many governments have invoked this exception as a solution to the contamination of land by hazardous wastes. In urban areas land contamination often results from decades of intensive industrialization that has occurred without any meaningful pre-existing environmental standards. Under some soil statutes current and past owners of contaminated land may be held liable for clean-up costs, even if they have not personally contributed to the contamination. Under certain circumstances operators, transporters, and, to a limited extent, lenders can also be held liable. Retroactive liability is still controversial and has raised some problems. It has important economic consequences, as the value of such land may drop precipitously in cases where clean-up costs exceed the property's value. In the long run, retroactive liability can also result in new investments going only to pristine "greenfield" sites, to avoid contaminated areas that are often situated in disadvantaged communities. Despite these difficulties the harshness of the liability provision has, in some countries, coerced industries into better environmental behavior and substantially minimized major health risks.

Environmental impact assessment. Among modern environmental statutes environmental impact assessment (EIA) laws crystallize a preventive approach to environmental protection, because they integrate environmental considerations in decisionmaking processes. Generally, EIA laws require the preparation of an environmental impact assessment for any proposed development activity, to review and assess its environmental impacts. The requirement can be applicable to a broad array of actions, and may include issuance of a permit or prior authorization, the funding

of a project, and the adoption of a new statute or policy. The first step under EIA laws (known as screening) is to determine whether or not the proposed activity is likely to cause environmental impacts beyond a certain threshold. If such a determination is positive, the proposor must proceed with the preparation of a formal assessment. Depending on the nature of the probable impacts, the general public may be notified and public consultations held. The environmental assessment may be required to identify appropriate mitigation measures, or alternatives to the proposed action, that minimize environmental impacts. The key issue is whether EIA statutes oblige the proposor to implement the mitigation measures and alternatives previously identified. Without such a mitigation requirement, EIA laws may render decisionmaking more transparent, but they do not provide effective safeguards to protect the environment.

Enforcement of Environmental Law

Enforcing environmental law is critical to ensuring that the regulated community complies with the policies embodied in a statute. The goals of a good enforcement program are that a government: (a) achieve general environmental compliance through deterrence, (b) identify environmental violators efficiently, and (c) prosecute them diligently. Compliance can be achieved through general education and outreach to the regulated community, backed by effective prosecution procedures. In addition government bodies may conduct inspection activities periodically or on the basis of probable cause. In some countries a regulated industry is obliged to make its monitoring data publicly available. This information allows nongovernmental organizations (NGOs) to play an important role in identifying violators.

Governments, through their administrative agencies, are normally responsible for prosecuting violations of environmental law. In some countries individuals or NGOs can also sue violators and recover a share of the awarded penalty as a reward for their initiative, through procedures known as citizen suits or public interest actions. In addition national constitutions or environmental statutes may protect the right of an individual to a clean environment. In In-

dia, for example, such provisions have allowed the courts to take a highly proactive role in environmental protection.

New Trends in Environmental Law

Two new trends are currently shaping environmental legislation. The first is integrated pollution control (IPC), which allows for the regulation of an ecosystem as a whole, instead of approaching it on a sector-by-sector basis. This mechanism specifically seeks to avoid the transfer of pollution from one medium (such as water) to another (such as air), and helps in controlling pollution from non-point or diffuse sources. This approach was pioneered in the U.K., and is now being used in the E.U.

The second trend is the use of economic instruments that complement command and control measures. Under this approach, the government sets out targets and allows members of the regulated community to allocate among themselves the burden of compliance. Theoretically, if the price of noncompliance is set at an appropriate level, the desired abatement of pollution will be achieved. The advantage is that sources with lower compliance costs will over-comply and receive economic benefits from those with higher compliance costs. The result is the attainment of pollution abatement at a lower net cost to society, compared to strict command and control measures. Other economic instruments include the use of taxes, environmental auditing, eco-labelling (to reassure consumers that a product meets certain environmental standards), and the reduction of subsidies that allow the regulated community to play a role in shaping new practices.

International Law

Modern international law has its roots in the public law of Europe in the 16th and 17th centuries—law that was created to govern the diplomatic, commercial, military, and other relations of the society of Christian States. With the growing penetration of Europe into Asia in the late 18th and early 19th centuries, other subjects were included in the community of states, but it was only with the formation of the League of Nations in 1920, in which any state could be a member, that the

international system began to aspire to be truly global.

Doctrinal Foundations of International Law

International law rests on the doctrine of sovereignty and equality of states. This doctrine enshrines the principle that national states are sovereign and have equal rights and duties as members of the international community, notwithstanding differences of an economic, social, or political nature. This fundamental feature of international law has created systemic limitations—the absence of an established central legislative authority, comparable to a nation system and of a compulsory, or even widely used, judicial system, often coupled with the absence of effective enforcement machinery for breaches of international law. It is not surprising, then, that even after a few centuries of the existence of international law, many still ask what has been described as “the standard sherry party question:¹ is international law really law? Despite its systemic limitations, international law does exist. States make it and they follow it, and like most other laws, on occasion, they break it. Certain breaches are spectacular, overshadowing the general, everyday pattern of compliance.

Sources of International Law

The international community, in the face of the rudimentary character of international law-making institutions, has developed its own system of creating norms and making international laws. These are basically twofold: treaties and customary international law. Treaties can only be binding on those that consent to them; they are solemn binding agreements between subjects of the international legal order, principally states. They originate in a framework of international negotiation over matters of common interest, and result in an agreement, in the form of a text, that usually reflects mutual advantage. Once the text is agreed upon (and at that stage often signed) the process of ratification commences. This is the process by which the parties ensure, by their various constitutional means, that when the treaty comes into force, the legal, financial, and administrative mechanisms by which the parties will be able to honor their new obligations, are in

place. Only after these national measures have been put in place will the state be in a position to notify the Depository (the state or institution formally holding the list of parties) that it wishes to be bound by the treaty. This is the act of ratification.² Once a treaty has received the agreed upon number of ratifications, it will then come into force. This is not an easy process. Pressures of government time, changing priorities, or simple second thoughts, can cause dramatic delays. The larger the enterprise, the more apparently intractable the problems often are. For example, on November 16, 1994, the Law of the Sea Convention signed in Montego Bay, Jamaica, in December 1982 finally came into force. It had taken 12 years and considerable legal ingenuity in the negotiation of an amending Agreement, for this major international legislative act to receive the 60 ratifications it required to enter into force.

International customary law is defined by the Statute of the International Court of Justice as "general practice accepted as law" by States. In simple terms it is something that states do because they regard themselves as legally obliged to do it.

Treaties and custom constitute *hard law*, law that nation states are obliged to follow under pain of sanction from the international legal system and community. Another category of law, in contrast, is termed *soft law*, and is comprised of non-binding instruments that lay down guidelines for future action, or through which states commit themselves politically to meeting certain objectives. Soft law is largely based on international diplomacy and customs, dependent on moral suasion or fear of diplomatic retribution. The 1972 Stockholm Declaration and the 1992 Rio Declaration, which embody a series of widely revered environmental principles, constitute good examples of soft law, although a number of those principles may be said to have crystallized into "harder" obligations representing customary law.³ Subsidiary sources of international law also exist, such as doctrine, judicial decisions, general assembly resolutions, and opinions of international jurists.

Development of International Environmental Law

International environmental law refers to the body of international law relevant to environ-

mental issues.⁴ While the status of international environmental law as a discipline, in and of itself, is disputed by a few international scholars who believe that no autonomous "international law" exists apart from the general international law,⁵ it appears well established that environmental perspectives and concerns have stimulated and catalyzed international legal development. The growth of international environmental law is premised on the globalization of environmental problems and concerns, attributable to two crucially interrelated factors: ecological and economic interdependence.

Huge conceptual leaps have been made in international environmental law in the latter quarter of the twentieth century. Environmental problems have progressed from being tackled within a bilateral, coexistence framework to a multilateral, cooperation framework. Further, international environmental law has traversed the path from being merely *reactive*, such as in the negotiation of treaties to address the known threats of marine oil pollution, to being *proactive*, such as in the case of the U.N. Framework Convention on Climate Change (UNFCCC), which is an anticipatory response to the possibility of future anthropogenic global climate change.

The development of international environmental law can be traced through two main phases: from 1972–1992, which was the period of burgeoning international environmental consciousness surrounding and following the U.N. Conference on the Human Environment in Stockholm in 1972, and from 1992 onwards. This latter period, initiated by the negotiations leading up to the 1992 U.N. Conference on Environment and Development (UNCED) in Rio de Janeiro, is distinguished by concerns for sustainable development and includes the current phase of experimentation with economic, market-based instruments to achieve environmental compliance.

From Stockholm to Rio (1972–1992). The 1972 Stockholm Conference served as a catalyst for several environmental initiatives. It resulted in a Declaration containing a series of normative environmental principles,⁶ a 109-point Environmental Action Plan, and a Resolution recommending institutional and financial implementation by the United Nations. The result of these recommendations was the cre-

ation of the United Nations Environment Programme (UNEP), established by U.N. General Assembly Resolution and based in Nairobi. UNEP plays an active role in convening and organizing meetings to negotiate global environmental treaties. The Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, signed in Basel, Switzerland March 22, 1989, is a case in point. The Basel Convention is built around two basic principles: proper waste management and prior informed consent.⁷ UNEP was also directly responsible for the development of the important Regional Seas Program, which has resulted in a network of regional framework conventions protecting the marine environment, each with protocols developed to meet the special requirements of the region.

This era also witnessed the birth of several other international environmental treaties. Of particular significance is the 1985 Vienna Convention for the Protection of the Ozone Layer. The very real and apparently imminent threat of depletion of the ozone layer by commercially produced chemicals, principally chlorofluorocarbons (CFCs), prompted the convening of a conference in 1985 to negotiate the Vienna Convention. The format chosen was a framework convention: general obligations and institutional framework were laid down by the Treaty, to be made more specific in the future by the negotiation of detailed protocols (or subtreaties open to the parties to the main Convention). The discovery of the ozone hole over Antarctica led to intense intergovernmental negotiations and resulted in the Montreal Protocol on substances that deplete the Ozone Layer in 1987. The Protocol called for a freeze on the production and consumption of CFCs and halons at 1986 levels, followed by a 50 percent reduction in CFC use by industrialized countries over a ten-year period. Developing countries were allowed to increase their CFC consumption for a period of ten years. The Protocol was deliberately designed as a flexible and dynamic instrument—countries were allowed to select the most economic mix of reductions, with incentives to reduce the most harmful chemicals.

A follow-up to the Stockholm Conference was held in 1982 in Nairobi, which spurred the U.N. to set up the World Commission on Environment

and Development, chaired by Gro Harlem Brundtland, then Prime Minister of Norway. Its 1987 Report "Our Common Future" placed the concept of *sustainable development* into the realm of international environmental law. At the suggestion of the Commission, preparations began for the Rio Summit, officially the Conference on Environment and Development, thus marking the end of the era of emphasis on the "human environment" and the beginning of the era of emphasis on "environment and development."

Rio and Beyond. The UNCED conference, held 20 years after the Stockholm Conference, was popularly perceived as an attempt at environmental planning on a grand scale. In addition to a tremendous surge in environmental consciousness, the Rio Summit resulted in:

- Agenda 21, an action plan for the next ten years and into the 21st Century
- The Rio Declaration on the Environment and Development
- The 1992 United Nations Framework Convention on Climate Change, which was to provide a framework for the negotiation of detailed protocols on further issues, such as controls on the emissions of greenhouse gases, particularly carbon dioxide and deforestation
- The 1992 Convention on Biological Diversity, aimed at arresting the alarming rate at which species were disappearing through pollution and habitat destruction
- The Non-Legally Binding Authoritative Statement on Forests.⁸

Despite the obvious significance of these environmental initiatives, perhaps the most enduring legacy of the Rio Summit lies in its contribution to the development of a framework of international environmental law principles. If indeed the maturity of international environmental law is to be assessed by the development of "discrete, discipline-specific" principles,⁹ then the Rio Declaration heralded the coming of age of international environmental law.

Principles of International Environmental Law

Several principles of international environmental policy, some first enunciated in the Stockholm Declaration, were crystallized through the Rio process. Among them, were the principles of *precaution, polluter-pays, sustainable development*,

common but differentiated responsibility, and *environmental-impact assessment*. Some of these concepts, such as the *polluter-pays* and *environmental-impact assessment*, have their roots in domestic environmental law. Environmental-impact assessment (EIA), for instance, was first established in the domestic law of the United States under the 1972 National Environment Protection Act. Other principles, such as that of *common but differentiated responsibility*, are products of international thought and action. International lawyers still dispute whether any or all of these concepts remain policy principles or have hardened into binding principles of customary international law.

Precautionary principle. Enshrined in Principle 15 of the Rio Declaration, the precautionary principle postulates that in cases when serious harm is threatened, positive action to protect the environment should not be delayed until irrefutable scientific proof of harm is available. It represents an important tool for decisionmaking in uncertainty, which a significant body of opinion argues is now a legal principle. In its strongest formulations this principle can be seen to require a reversal of the normal burden of proof, so that a potential actor would need to prove that a proposed activity will not cause harm before it can be sanctioned. It has been endorsed by virtually all recent environmental treaties, including regional treaties such as the 1992 Maastricht Treaty on European Union, the 1992 Paris Convention on the North East Atlantic, the Helsinki Convention on the Baltic, and global environmental treaties such as the UNFCCC, the Convention on Biological Diversity, and the 1995 United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks.

Environmental-impact assessment, public participation, and access to information. Related to the precautionary principle is the concept of "environmental-impact assessment," which is based on the premise that rational planning constitutes an essential tool for reconciling development and environment. EIA provides an important modality for the implementation of the precautionary principle. Though first debated at Stockholm, the concept of EIA found a place only in the Rio Declaration. Agenda 21 calls on countries to assess the suitability of infrastructure in human settlements, ensure that relevant decisions are pre-

ceded by EIAs, take into account the costs of any ecological consequences and integrate environmental considerations in decisionmaking at all levels and all ministries. The EIA requirement is also embodied in several international instruments, notably the 1991 U.N. Economic Commission for Europe (ECE) Convention on Environmental Impact Assessment in a Transboundary Context, the 1992 Biodiversity Convention, and the 1991 World Bank Operational Directive 4.01.¹⁰

The value and legitimacy of the EIA process has, in recent times, been strengthened by the evolution of the right of access to information on the environment and the right of public participation. The Rio Declaration recognizes in Principle 10 that environmental issues are best handled with the participation of all concerned citizens. This notion has recently been validated in the U.N. ECE Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, signed on June 25, 1998, by 37 countries. The Convention recognizes that "every person has the right to live in an environment adequate to his or her health and well-being, and the duty, ...to protect and improve the environment" and that "citizens must have access to information, be entitled to participate in decisionmaking and have access to justice in environmental matters." So that people can fulfill these rights and responsibilities, the Convention obligates signatory states to, among other provisions: (a) make environmental information available "as soon as possible," and "without an interest having to be stated" by the requester; (b) take specific measures to ensure complete public participation in decisions of specific activities, plans, programs, policies, and other regulations related to the environment; and (c) ensure that any person who feels that the state has not met specific environmental commitments has access to a review procedure before a court. The value of such participation is enhanced by the right of access to information, a right that has found its way into various international instruments. European Directive 90/313 on Access to Environmental Information assures the public free access to and dissemination of all environmental information held by public authorities throughout the European Union.

Common but differentiated responsibility. Articulated as Principle 7 of the Rio Declaration, this principle requires states to cooperate in a spirit of global partnership to protect the environment. Yet, because states have contributed differently to global environmental problems, the principle recognizes that they should have common, but differentiated, responsibilities. A good example is Article 4 of the 1992 UNFCCC, which places an obligation on developed countries to take the lead in meeting the required reductions in greenhouse gas emissions. Developing country parties, however, are only obliged to implement these commitments to the extent that developed countries have met their commitments to provide financial resources and to transfer technology.

As a general principle, sure to govern further negotiations on the UNFCCC, the principle of common but differentiated responsibility is highly significant.¹¹ The structure of the 1997 UNFCCC Kyoto Protocol mirrors the philosophy of common but differentiated responsibility. Developed countries are committed to reducing their overall emissions of greenhouse gases by at least 5 percent below 1990 levels between 2008 and 2012. Developing nations have no such commitments. Although every nation state has the responsibility to reduce global greenhouse gas emissions, only Organisation for Economic Co-Operation and Development (OECD) and economies-in-transition countries are required to make specific, quantified emission limitations. The limitations, even among these countries, vary to take into account differing domestic circumstances. Developing countries are provided with an opportunity to participate through the Clean Development Mechanism, which allows countries to cooperate on specific projects to reduce greenhouse gas emissions.

Polluter-Pays. This requires that the costs of pollution be borne by the party responsible. The practical implications of this principle lie in its allocation of economic obligations in environmentally damaging activities. This seemingly intuitive principle has not received the kind of broad support that the precautionary principle has in recent times. Principle 16 of the Rio Declaration, for instance, supports the "internalization of environmental costs" taking into account the polluter-pays principle, but only "with due regard to the public interest and without distort-

ing international trade and investment." An example of an international instrument that refers expressly to the polluter-pays principle is the 1972 OECD Council recommendation on Guiding Principles Concerning the International Economic Aspects of Environmental Policies, which endorses the polluter-pays principle to allocate costs of pollution prevention and control measures, so as to encourage rational use of environmental resources.

Sustainable development. Defined by the 1987 Brundtland Committee Report as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs," this principle is at the heart of many environmental initiatives. It recognizes the need for intergenerational equity, sustainable and equitable use of resources held in common by the current generation, and the integration of environmental considerations into economic and other development initiatives. This principle is also reflected in the Framework Convention on Climate Change in Article 3(4), among others. Although specifically recognized as a legal principle in the separate opinion of Judge Weeramantry in the 1997 *Gabcikovo-Nagymaros* Case of the International Court of Justice (ICJ), the very breadth of the concept means that considerable controversy still surrounds this argument.

Compliance with International Environmental Law and Its Enforcement

The term "enforcement" in the context of international environmental law refers to the measures taken to ensure the fulfillment of international legal obligations, or to obtain a ruling by an appropriate international body that obligations are not being fulfilled.

Initially, only the general principles of state responsibility and dispute settlement guided efforts at enforcement of international environmental law. As the principal subjects of international law, states assume the obligation to enforce international environmental law. Enforcement by states arises primarily in situations of trans-boundary environmental harm and involves a determination by an international body, such as the ICJ in The Hague. The ICJ, the principal judicial organ of the United Nations, rules on questions of international law,

including—potentially—issues of international environmental law. In fact, however, its contribution to the development of international environmental law principles has been very slight.

A range of techniques and a panoply of international actors are today involved in the enforcement of international law.¹² Enforcement includes a wide array of forms including diffusion of information, monitoring, verification, and inspection. For example, it is increasingly common for international law agreements to mandate their Conferences of Parties, the permanent plenary body of environmental agreements, to conduct *implementation reviews*. This review mechanism monitors national compliance with the obligations undertaken under the environmental agreement. Such a review is based primarily on national self-reporting, although some conventions provide for independent means of gathering information.

Other conventions may use incentives or disincentives; that is, adopt the "carrot and stick" approach, to obtain participation and ensure compliance. For example, under the Montreal Protocol trade restrictions can be imposed on imports to and exports from non-parties to the Protocol, and a fund has been created to assist countries in complying with their obligations under the Protocol, thereby encouraging participation. Recently negotiated conventions utilize creative, dynamic, and flexible means to obtain environmental compliance. The UNFCCC Kyoto Protocol provides a number of "flexibility mechanisms" (including cooperative implementation, emissions trading, and technology transfer) to assist parties to meet their commitments.

Among the concerned actors are also international organizations and NGOs. International organizations have a small, but useful, role to play in the enforcement of international environmental obligations. States have traditionally been reluctant to endow international organizations with enforcement powers, but some recent instruments do provide certain bodies with limited enforcement authorities. For instance the 1982 United Nations Convention on the Law of the Sea provides the International Sea Bed Authority with the power to supervise implementation of parts of the Convention, call attention of the Assembly to cases of noncompliance, and institute proceedings for noncompliance. NGOs often play

the role of self-appointed "watchdogs" over national governments, and can thus help in the enforcement of international law through political means or public-interest litigation, to ensure that governments maintain their international environmental commitments. The individual as an actor in the international arena also deserves mention. With the increasing emphasis on public participation and provision of access to environmental information in international discourse, the individual's role in ensuring international environmental compliance is becoming increasingly relevant.

Notes

[These notes have been left in legal format. See editor's note, p. 174—ED.]

1. D.J Harris, *Cases and Materials on International Law*, London, Sweet & Maxwell, 4th ed, 1991, 5.

2. If the parties wish, it is possible for treaties to come into force immediately upon signature. Similarly, states that have not participated in the negotiation process or have not signed the treaty may accede.

3. David Freestone, "The Road from Rio: International Environmental Law after the Earth Summit," 6 *Journal of Environmental Law* 193 (1994).

4. Patricia W. Birnie and Alan E. Boyle, *International Law and the Environment*, Oxford, Oxford University Press, 1992, 1.

5. Ian Brownlie, "International Law and the Fiftieth Anniversary of the United Nations," 255 *Recueil des Cours* 181 (1995).

6. Even while recognizing the sovereign right of all nations to exploit their resources pursuant to their own developmental needs, it provides that states have a responsibility to ensure that the activities under their jurisdiction and control do not cause damage to the environment of other states or of areas beyond their national jurisdiction. Principle 21, Stockholm Declaration.

7. See Katharina Kummer, *International Management of Hazardous Wastes: The Basel Convention and Related Legal Rules* (Oxford, Clarendon Press, Oxford Monographs in International Law, 1995).

8. In addition a number of other instruments were negotiated as indirect outcomes of Rio, including the 1994 U.N. Convention to Combat Desertification, the 1995 Washington Declaration on Protection of the Marine Environment from Land-based Activities, the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, and the 1995 U.N. Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks.

9. David Freestone, *supra* note 3 at 210.
10. As part of an internal conversion process, this was reissued, in substantially the same form, as World Bank Operation Policy 4.01, in September 1998.
11. See also Article 20(2) of the Convention on Biological Diversity, under which developed countries are required to provide the funds for developing countries to meet the obligations of the Convention.
12. Laurence Boisson de Chazournes, "La mise en oeuvre du droit international dans le domaine de la protection de l'environnement: enjeux et défis," 99 *Revue générale de droit international public* 37 (1995).

PART FOUR

APPENDIXES

Appendix A

Program and Other Events

**PARTNERSHIPS FOR GLOBAL ECOSYSTEM MANAGEMENT:
SCIENCE, ECONOMICS AND LAW
FIFTH ANNUAL WORLD BANK CONFERENCE
ON ENVIRONMENTALLY AND SOCIALLY SUSTAINABLE DEVELOPMENT**
Held at the World Bank and George Washington University, Washington, D.C.
October 6-7, 1997

PROGRAM

October 6

Opening Plenary

Welcoming Remarks

Stephen J. Trachtenberg, President, George Washington University
Ismail Serageldin, World Bank

Memorial Dedication to Jacques-Yves Cousteau

Global Challenges for Managing Ecosystems

James D. Wolfensohn, World Bank

The Sovereignty and Systems of Nature and Nations: Challenges and Opportunities

Chair: Maurice F. Strong, United Nations and World Bank
Presenters: Peter Doherty, Nobel Laureate, Immunology
Joseph E. Stiglitz, World Bank
Christopher G. Weeramantry, International Court of Justice

The Requirements of Leadership for National Solutions

Robert T. Watson, World Bank

The Big Picture: Linking Environmental Issues and Human Needs

Caio K. Koch-Weser, World Bank

The Global Treaties: Making Connections for Efficiencies, Effectiveness, and Equity

Chair: Mostafa K. Tolba, International Center for Environment and Development
Presenters: Yolanda Kakabadse, World Conservation Union Council
Carolyn McAskie, Canadian International Development Agency
José I. Vargas, Ministry of Science and Technology, Brazil

Reflections for the Future

Mohamed T. El-Ashry, Global Environment Facility

Summing up

Ismail Serageldin

Closing Plenary

Global Ecosystem Management: Innovations and Opportunities in Public/Private Partnerships

Alassane D. Ouattara, International Monetary Fund

George Olah, Nobel Laureate, Chemistry; Loker Hydrocarbon Research Institute

Public-Private Partnerships: Applications and Best Practices

Chair: Sven Sandstrom, World Bank

Presenters: Henry J. Hatch, World Engineering Council for Sustainable Development

K. Madhava Sarma, Secretariat for the Vienna Convention

and the Montreal Protocol

Jemal-ud-din Kassum, International Finance Corporation

Aggregating Knowledge for Policy: Global Information Systems

Kass Green, Pacific Meridian Resources

Closing Commentary

Ismail Serageldin

October 7

Thematic Roundtables

Ground-Truthing Global Ecosystem Management in National Sustainable Development

Climate Change

Chair: Johannes F. Linn, World Bank

Presenters: Robert T. Watson, World Bank

Rajendra Pachauri, Tata Research Institute

Rudolf Dolzer, Institute for International Law

David Malin Roodman, Worldwatch Institute

Eileen Claussen, Alcalde & Fay

Rapporteur: Helmut Schreiber

Biodiversity

Chair: Jean-Michel Severino, World Bank

Presenters: Delmar Alberto Blasco, Ramsar Convention

Peter Schei, Ministry of the Environment, Norway

Nicolás Mateo, National Biodiversity Institute

Peter H. Raven, Missouri Botanical Garden

Charles Perrings, University of York

Bernd von Droste zu Hülshoff, United Nations Educational, Scientific
and Cultural Organization

Rapporteur: Anthony J. Whitten

Desertification and Forests

Chair: Jean-Louis Sarbib, World Bank
 Presenters: Mohamed Kassas, University of Cairo
 Reuben Olembo, United Nations Environment Programme
 Ola Ullsten, former Prime Minister, Sweden
 Manuel Rodriguez-Becerra, Andes University
 Steven P. Hamburg, Brown University
 Rapporteur: Jean-Roger Mercier

International Water Regimes

Chair: Callisto Madavo, World Bank
 Presenters: Torkil Jonch-Clausen, Global Water Partnership
 Tamarii Tutangata, South Pacific Environment Programme
 Stephen F. Lintner, World Bank
 Rapporteur: David C. Gray

Regional Roundtables***Africa******Toward Environmentally and Socially Sustainable Development in Africa: Regional and Subregional Approaches***

Chair: Robert Clement-Jones, World Bank
 Presenters: Townsend Swayze, World Bank
 Anders Ekbom, World Bank
 Yoko Eguchi, World Bank
 Robert Clement-Jones, World Bank
 François Rantrua, World Bank

Latin America and the Caribbean***The Mesoamerican Biological Corridor***

Chair: William Partridge, World Bank
 Presenters: Luis Constantino, World Bank
 Jorge Cabrera, Central American Commission on Environment
 and Development
 Juan Carlos Godoy, Programa Frontera Agricola

Science's Input to Conservation Development: Too Much or Too Little?

Chair: Alejandro Grajal, Wildlife Conservation Society
 Presenters: Gonzalo Castro, World Bank
 Mark Rose, Fauna & Flora International
 Juan Bezaury, Amigos de Sian Ka'an

Poverty and Social Development

Chair: Ana Maria Arriagada, World Bank
 Presenters: David Kaimowitz, Center for International Forestry Research
 Jose Flores Rodas, Isla de la Bahia Project
 Jorge Uquillas, World Bank

Indigenous Peoples, Land, and Biodiversity

Chair: Armstrong Wiggins, Indian Law Resource Center

Presenters: Aurelio Ramos, MASTA
Fabián Gonon, Maya-Kiche
Nicanor Gonzalez, Kuna
Ned Archibald, Asociación de Síndicos Indígenas
Juan Martínez, World Bank

Partnerships with the Private Sector

Chair: Augusta Molnar, World Bank
Presenters: Cristina Figueres, First Lady of Costa Rica
Alberto Salas, World Conservation Union
Michael Rubino, International Finance Corporation

OTHER EVENTS

Held at the World Bank and Other Locations, October 6-11, 1997

Associated Events

Biotechnology and Biosafety
Conference on Coral Reefs
Ethics and Values: A Global Perspective
Forum on Human Settlements, Human Solidarity, and Global Ecosystems
Indicators for Natural Resource Management: A Workshop
Mainstreaming Freshwater Biodiversity in Development Projects
The Role of Law in the Promotion of Sustainable Development
Washington College of Law, American University
Chair: Claudio Grossman, American University
Presenters: Daniel D. Bradlow, Washington College of Law
Barbara Bramble, National Wildlife Federation
Christopher G. Weeramantry, International Court of Justice
Durwood J. Zaleke, Center for International Environmental Law

Concurrent Meetings

Global Ecosystems: Innovative Strategies for the 21st Century
Organizing Knowledge for Environmentally and Socially Sustainable Development
Water Diplomacy for the 21st Century

Learning Seminars

Desertification: The Phenomenon, Contributing and Mitigating Factors
El Niño: An Impetus for Strategic Management of Droughts
Geographic Information Systems for Coastal Management

Workshop and Seminar

Information and the Environment: Geographic Information Systems
and Remote Sensing for Decisionmaking

Bank Staff Learning Seminars

Country Case Studies
Global Treaties and Bank Policy and Operating Directives

Exhibits

Geographic Information Systems
Coral Reefs

Appendix B

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Appendix C

Biographies

Mahmood Yousef Abdulraheem

Mahmood Yousef Abdulraheem is Technical and Administrative Coordinator of the Regional Organization for the Protection of the Marine Environment (ROPME) in Kuwait. His main areas of interest are environmental monitoring and impact assessment, water quality analysis, and waste management.

As a government official Dr. Abdulraheem has represented Kuwait at international and regional meetings, including the United Nation Environment Programme's (UNEP) Governing Council, the 1992 UN Conference on Environment and Development (UNCED), and the Arab League. He has also attended conferences of environmental conventions, including the Basel Convention on Hazardous Wastes, the Biological Diversity, and the Climate Change Conventions. Dr. Abdulraheem is the former Director and Secretary of the Environment Protection Council in Kuwait, a position to which he acceded after serving as Deputy Director. He was also seconded as the Director of the Shuaiba Industrial Authority Environment Protection Laboratory. He began his career as a chemist at the Kuwait Ministry of Health, Occupational Health Section.

Dr. Abdulraheem has a BA degree from the University of Miami in Ohio and a PhD from the University of Liverpool.

Delmar Alberto Blasco

Delmar Blasco is the Secretary General for the Ramsar Convention. Among his responsibilities are providing leadership in the creation of global strategies for the conservation and wise use of wetlands and water resources, as well as liaising with other environmental conventions, and governmental and nongovernmental organizations. Previously, Mr. Blasco was Executive Director of the International Council of Voluntary Agencies, an international association of more than 100 NGOs. Earlier, he headed the Council, Membership and External Relations Division of the World Conservation Union (IUCN) and its Membership Services Unit. In earlier positions he was Executive Director of the Environment Liaison Centre International in Nairobi, Kenya.

Mr. Blasco studied Social Anthropology at the National University of Rosario, Argentina.

Eileen Claussen

Eileen Claussen, a partner in the public affairs firm of Alcalde & Fay, is the former U.S. Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs. She was responsible for developing and implementing U.S. policy on major international issues, including climate change, ozone depletion, chemicals, forests, biodiversity, oceans, fisheries and wildlife conservation, and sustainable development.

Prior to joining the Department of State, Ms. Claussen served for three years as a Special Assistant to the President and Senior Director for Global Environmental Affairs at the National Security Council. During this time she also served as Chairman of the United Nations Multilateral Montreal Protocol Fund. From 1987 to 1993 she was Director of Atmospheric Programs at the U.S. Environmental Protection Agency.

Ms. Claussen received an MA degree from the University of Virginia, and a BA from The George Washington University.

Peter Doherty

Peter Doherty is Chairman of the Department of Immunology at St. Jude Children's Research Hospital in Tennessee, United States. He received the Nobel Prize for Physiology or Medicine in 1996. Dr. Doherty's research interests include cell-mediated immunity, T cell recognition and repertoire, immunological tolerance, viral immunology, immunopathology, and immune memory.

Before his current position, he was Professor and Head, Department of Experimental Pathology, at the Australian University, Canberra. Before that he was Associate Professor/Professor at the Wistar Institute in Philadelphia, Pennsylvania, United States. He was also a Research Fellow at the Australian University, Canberra, a Senior Scientific Officer at the Moredun Research Institute in Edinburgh, and a Veterinary Officer in Brisbane, Australia. Dr. Doherty has also been involved in many consultant activities.

Dr. Doherty received BVSc and MVSc degrees from the University of Queensland, Australia, and a PhD from the University of Edinburgh, the United Kingdom. He has published more than 200 scientific articles, as well as numerous book articles and review articles.

Rudolf Dolzer

Rudolf Dolzer is Director and Professor at the Institute for International Law at the University of Bonn. His fields of interest include international economic law and politics and environmental law and politics. He has focused on issues of sustainable development, environmental conventions; the effort to stem climate change, biodiversity, international waters, ozone depletion, the role of international institutions; environment, trade and investment; and North/South cooperation.

Dr. Dolzer served as a member of the German Parliamentary Commission on Protection of the Atmosphere from 1990 to 1994 and of the Scientific and Technical Advisory Panel of the Global Environment Facility from 1991 to 1994, and as the Director General of the Office of the Federal Chancellor from 1992 to 1996.

Dr. Dolzer received a BS in sociology, political sciences and law at Tübingen University in Germany, and a Doctorate in Law at Heidelberg University. He also received a Doctorate in Law at Harvard University in the United States. He has published widely.

Mohamed T. El-Ashry

Mohamed El-Ashry is Chief Executive Officer and Chairman of the Global Environment Facility.

Previously, Dr. El-Ashry was the Chief Environmental Advisor to the President and Director of the Environment Department at the World Bank. Before joining the World Bank, he served as Senior Vice President at the World Resources Institute and as Director of Environmental Quality at the Tennessee Valley Authority. He has held teaching and research positions at Cairo University, Pan-American-U.A.R. Oil Company, Illinois Geological Survey, Wilkes University, and the Environmental Defense Fund. He served as Senior Environmental Advisor to the United Nations Development Program, and as Special Advisor to the Secretary General of the 1992 UN Conference on Environment and Development.

Dr. El-Ashry received his BS degree from Cairo University and his PhD in geology from the University of Illinois. He has published widely.

Kass Green

Kass Green is President and a cofounder of Pacific Meridian Resources, a natural resources consulting firm that operates from offices in California, Georgia, Oregon, and Utah. Ms. Green's background includes over twenty years' experience in natural resource policy, economics, Geographic Information Systems (GIS) analysis, and remote sensing. She is author of numerous articles on GIS and remote sensing and is co-authoring a book on the practical aspects of accuracy assessment.

Steven P. Hamburg

Steven Hamburg is Ittleson Associate Professor in Environmental Studies and Ecology and Evolutionary Biology at Brown University, United States. His research focuses on terrestrial ecosystems in North and Central America and in Taiwan.

Formerly, Dr. Hamburg was Senior Ecologist at the Environmental Defense Fund, where he remains a consultant. Before taking his position at Brown, he served as the Director of the Environmental Studies Program and, prior to that, as an Assistant/Associate Professor in the Environmental Studies Program and Department of Systematics and Biology at the University of Kansas. Dr. Hamburg has consulted to the Intergovernmental Panel on Climate Change, and is a contributor to the "Interlinkages" Assessment Report being cosponsored by the United Nations Environment Programme (UNEP), the U.S. National Aeronautics and Space Administration (NASA), and the World Bank.

Dr. Hamburg completed his undergraduate education at Vassar College in the United States and earned a PhD from Yale University.

Henry J. Hatch

Henry J. (Hank) Hatch serves as Chair of the World Engineering Partnership for Sustainable Development. Concurrently, Mr. Hatch is President and Chief Executive of Fluor Daniel Hanford, Inc., in Washington State, United States. In 1996 the company was awarded a \$4.8 billion contract to clean up the U.S. Department of Energy's Hanford Site, where material was produced during World War II and the Cold War to support the U.S. nuclear weapons programs. Before joining Fluor Daniel, Mr. Hatch was Chairman of the Law Companies Group, an international engineering and environmental services company.

Mr. Hatch served for thirty-five years in the United States Army, retiring as a Lieutenant General in the position of Chief of Engineers and Commander of the U.S. Army Corps of Engineers. In this position he commanded over 40,000 members of the Corps, supervising programs in excess of \$13 billion annually. While at the Corps, Mr. Hatch also sought a broader environmental engineering mission for the organization.

Mr. Hatch is a graduate of the West Point Military Academy. He received a MS degree in geodetic science from Ohio State University.

Torkil Jonch-Clausen

Torkil Jonch-Clausen is Chairman of the Technical Advisory Committee of the Global Water Partnership in Stockholm. He is also Director of the Institute for the Water Environment in Denmark, an independent research and development and consulting organization affiliated with the Danish Academy of Technical Sciences. There he is responsible for collaboration with the World Health Organization and the United Nations Environment Programme on water issues.

Previously, Dr. Clausen worked at the Ministry of Foreign Affairs for DANIDA, the Danish development agency. From 1987 to 1989 he worked as the Counselor for Development Cooperation at the Danish Embassy in Bangladesh. From 1984 to 1987 he served as Technical Advisor, with responsibilities for appraising and monitoring water supply and sanitation projects in Africa and Asia. Previously, at the Danish Hydraulic Institute he was responsible for water projects in Africa and Asia as well as in Denmark. Early in his career, he worked for the UN Food and Agriculture Organization in Somalia.

Dr. Clausen has a MS degree in civil engineering from the University of Denmark and a PhD from Colorado State University in the United States.

Yolanda Kakabadse

Yolanda Kakabadse is President of the World Conservation Union (IUCN) Council as well as Executive Vice President of the Fundación Futuro Latinoamericano. The purpose of the Fundación, located in Ecuador, is to establish policy dialogues among decisionmakers in Latin America to reach negotiated agreements among different sectors in conflict. The Fundación also trains facilitators and conflict managers in sustainable development.

Yolanda Kakabadse is also a member of the Board of Directors of the World Resources Institute and the Board of Directors of the Ford Foundation and serves on the advisory council to the Environmentally and Socially Sustainable Development vice presidency at the World Bank. She is a senior advisor to the United Nations Development Programme's Administrator and a Counselor to the President of the Global Environment Facility. Previously, Ms. Kakabadse was the Nongovernmental Organization (NGO) Liaison Officer for the 1992 Rio de Janeiro UNCED Conference and the Executive Director of Fundación Natura in Ecuador.

Mohamed Kassas

Mohamed Kassas is Professor Emeritus of Botany at the University of Cairo. He was President of the International Union for Conservation of Nature and Natural Resources (IUCN) from 1978 to 1984. He was awarded the UN Prize for the Environment.

His principal research interests during the last fifty years have been in plant ecology, especially in arid lands. He was among those who warned the world against the hazards of desertification and

contributed to the UNESCO Arid Lands Research Programme, including the ecological maps of the Mediterranean Basin, from 1950 to 1960 and to the scientific preparation for the United Nations Conference on Desertification in 1977. Dr. Kassas was on the panel of Senior Advisors to the United Nations Environment Programme (UNEP) between 1973 and 1992 and was one of the scientific editors for the UNEP study, The World Environment 1972-82. He serves on the editorial boards of several international ecology and environmental sciences journals. He is a member of many organizations, including the Club of Rome.

Dr. Kassas earned BS and MS degrees from Cairo University. He earned a PhD from the University of Cambridge in England.

Jemal-ud-din Kassum

Mr. Jemal-ud-din Kassum is Vice President, Investment Operations, at the International Finance Corporation (IFC) of the World Bank Group. He has global responsibility for all new investments undertaken by the Regional and Specialist Investment Departments of the Corporation.

He joined the World Bank Group in the Young Professional Program in 1974 and transferred to the IFC in 1975. After six years' work in the Africa Region and two years as Special Assistant to the Executive Vice President, he was appointed to various management positions in the Asia Region including Division Manager, Department of Investments (1983) and Chief of IFC's Regional Mission in New Delhi (1987). Mr. Kassum was promoted as Director, Department of Investments, Asia II, in 1988.

Mr. Kassum, a Tanzanian national, studied at Harrow School, England, and holds an engineering with economics degree from Oxford University (1970) and an MBA from Harvard Business School (1974).

Caio K. Koch-Weser

Caio Koch-Weser is a Managing Director at the World Bank, with responsibility for with responsibility for the IBRD's operations, operational policies, and supervision of the vice presidencies for Europe and Central Asia, Middle East and North Africa, Latin America and the Caribbean, Human Development, and Environmentally and Socially Sustainable Development. Previously, he served as Vice President of the Middle East and North Africa Region in the Bank.

Mr. Koch-Weser's prior responsibilities at the World Bank included serving as Deputy Treasurer and Director of Treasury Operations in the Finance Complex, Director of the Western Africa Department, and Division Chief for China. Joining the Bank in 1973 in the Young Professionals Program, he first served as an economist with the Human Resources Division of the Development Policy Staff, then as a Health Projects Officer with the Central Projects Staff.

A German and Brazilian national, Caio Koch-Weser attended the Universities of Münster, Berlin, and Bonn in Germany, where he studied economics, sociology, and history. He obtained his Master's degree in economics and participated in the PhD program conducting his thesis research in Brazil. During that period he also represented the Friedrich-Ebert Foundation in Brazil, supporting labor unions, social research institutes, and nongovernmental organization projects. He was a trainee at Siemens, Inc., in Munich, São Paulo, and New York.

Johannes F. Linn

Johannes F. Linn is Regional Vice President for Eastern Europe and Central Asia at the World Bank. Formerly, he was Vice President for Financial Policy and Resource Mobilization, in charge of overall financial policies and prudential management of the World Bank (IBRD and IDA) and in charge of mobilizing capital resources for IBRD and donor resources for IDA and the Global Environment Facility (GEF). He has worked with the Bank since 1973 as Country Economist and Economic Advisor for the East Asia Regional Staff, and as Senior Economic Advisor of the Development Economics Staff. He has served as Director in two departments: International Economics and Country Economics. He was Staff Director of the World Development Report 1988, which dealt principally with issues of public finance in development. Dr. Linn spent six months as a visiting researcher at the University of Münster in Germany.

Dr. Linn studied law at the Free University, Berlin. He received his training as an economist at Oxford University and holds a PhD from Cornell University.

Callisto Madavo

Callisto Madavo is Co-Vice President of the World Bank's Africa Region, directing Bank operations in twenty-five of Sub-Saharan Africa's forty-eight countries. He is also the Bank's ranking representative in such Africa-wide initiatives as the Special Program for Africa, which mobilizes targeted funding for countries in particular need, and the UN/World Bank-sponsored Initiative for Africa, which coordinates external assistance to the continent. He also works closely with key development institutions such as the UN Economic Commission for Africa, the African Development Bank, and the Organization for African Unity.

Previously, Dr. Madavo served as Director of the East Asia and Pacific Country Department in the World Bank. Before that he served as Director of the Eastern Africa Department, Assistant Director of the East and Southern Africa Projects Department, Division Chief for the Pakistan Programs Division of the South Asia Country Programs Department, and Division Chief for the Urban Projects Department for both East and West Africa. Callisto Madavo, who joined the World Bank in 1969 in the Young Professionals Program, began his tenure as an economist with the Bank's Urbanization and Regional Projects Division, from which he was promoted to Senior Economist.

He received his early education in Zimbabwe. He received his BA, MA, and PhD in economics from Notre Dame University.

Nicolás Mateo

Nicolas Mateo is General Coordinator, Biodiversity Prospecting Division, at the National Biodiversity Institute (INBio) in Costa Rica. Previously, he served as Director of the International Network for the Improvement of Banana and Plantain (INIBAP) in France, and as Associate Director at the International Development Research Centre (IDRC) in India and Singapore. In 1987 and 1988 Dr. Mateo was a visiting scientist at the International Rice Research Institute (IRRI) in the Philippines. Prior to that, he served as a senior program officer at the IDRC in Colombia, and as an agronomist for the Centro Agricultura Tropical de Investigación y Enseñanza (CATIE) in Honduras and in his native Costa Rica. He began his professional career in the Ministry of Agriculture in Costa Rica.

Dr. Mateo received his undergraduate education at the University of Costa Rica, where he also earned a MSc in crops and cropping systems. He received his PhD in agronomy and soils from the University of Florida, Gainesville, in the United States.

Carolyn McAskie

Since 1993, Carolyn McAskie has been Vice President of the Canadian International Development Agency's (CIDA) Africa and Middle East branch; in July 1996 she was nominated as Vice President of the Multilateral Programmes Branch. Ms. McAskie began working at CIDA in 1968. In 1971 she was posted to Nairobi as First Secretary, Development, to the Canadian High Commission. She later served as Assistant Director of Finance and Personnel Services of the Commonwealth Secretariat in London. From 1980 to 1986 Ms. McAskie managed a number of CIDA multilateral programs with U.N. agencies and Commonwealth and Francophone institutions.

George A. Olah

George Olah is the Director of the Loker Hydrocarbon Research Institute at the University of Southern California, United States. He was awarded the Nobel Prize in Chemistry in 1994.

In previous positions at USC he was the Loker Distinguished Professor of Organic Chemistry and the Scientific Director of the Hydrocarbon Research Institute. Earlier, he was the CF Mabery Distinguished Professor of Research in Chemistry at Case-Western Reserve University and Professor and Chairman of the Department of Chemistry at Western Reserve University, both in the United States. Preceding that, he was Senior Research Scientist for Dow Chemical.

Born in Hungary, Dr. Olah received his undergraduate education and PhD at the Technical University of Budapest, where he subsequently taught for seven years, becoming head of the Organic Chemistry Department and Associate Director of the Central Research Institute of the Hungarian Academy of Sciences.

Dr. Olah has published more than 1,000 scientific papers and several university texts. He has also obtained 100 patents. Dr. Olah has received awards from many international academies, societies, and foundations, as well as many honorary degrees.

Reuben Olembo

Reuben Olembo is an Assistant Secretary General of the United Nations and Deputy Executive Director of the United Nations Environment Programme in Nairobi, Kenya, where he has been since 1975. He was Founder Director and Coordinator of the Division of Environmental Management from 1981 to 1987. He became Assistant Director for Programmes in 1987, heading all processes for the Convention for Biological Diversity and contributions for the 1992 UNCED process.

Prior to coming to the United Nations, Dr. Olembo taught at Makerere and Nairobi University, where he was the first Kenyan Professor and Head of the Department of Botany. Nationally, he served as Chairman of the Boards of Kenya National Parks, the Kenya Wildlife Fund Trustees, Kenya Marine and Research Institute, and Scientific Advisor to the Ministry of Natural Resources. He was also a Trustee of the International Institute of Tropical Agriculture (Ibadan, Nigeria), the International Board of Plant Genetic Resources (Rome, Italy), and the World Conservation Monitoring Centre (Cambridge, United Kingdom).

Dr. Olembo obtained the BSc, MSc, and PhD degrees from Purdue University, Indiana, United States. In 1994 the university conferred on him the Distinguished Agricultural Alumnus status. Professor Olembo's publications are in the disciplines of genetics, ecology, and environmental policy.

Alassane D. Ouattara

Alassane Ouattara assumed office as Deputy Managing Director of the International Monetary Fund in 1994. Mr. Ouattara was Prime Minister of the Republic of Côte d'Ivoire from November 1990 to December 1993.

Following his appointment as an economist at the IMF from 1968 to 1973, he served as Chargé de Mission at the Central Bank of West African States (BCEAO) in Paris from 1973 to 1975, when he became Special Advisor to the Governor and Director of Research. He was appointed Vice Governor of the BCEAO in 1983. He returned to the IMF as Director of the African Department in 1984 and simultaneously, from 1987, as Counsellor to the Managing Director. In 1988 Mr. Ouattara was named Governor of the BCEAO. Beginning in 1990, he served concurrently as Chairman of the Interministerial Committee for Coordination of the Stabilization and Economic Recovery Programme of Côte d'Ivoire in Abidjan.

Mr. Ouattara earned his BSc degree in business administration from Drexel Institute of Technology in Philadelphia and his MA and PhD degrees in economics from the University of Pennsylvania. He has published widely in the political, economic, and social fields.

Mr. Ouattara was awarded the Commander of the Ordre du Lion from Sénégal, Commander of the Ordre du Mono from Togo; Grand Officier of the National Order of Côte d'Ivoire, and Honorary Governor, BCEAO.

Rajendra K. Pachauri

Rajendra Pachauri is Director of the Tata Research Institute in New Dehli, a position he has held since 1981. He is also President of the Asian Energy Institute and an Advisor to the Administrator of the UN Development Programme on Energy and Sustainable Management of Natural Resources. His fields of interest include energy, development, environment, and climate change.

Dr. Pachauri sits on the Climate Institute Advisory Board as well as on the Board of the International Solar Energy Society. In 1988 he was President of the International Association for Energy Economics and served as Chairman of that organization in 1989 and 1990. In India he serves on a number of committees in the areas of power and energy, and petroleum and natural gas.

Rajendra Pachauri earned a PhD in industrial engineering, as well as a PhD in economics, from North Carolina State University. He is a graduate of the Institution of Mechanical Engineers and the Institution of Production Engineers in London. He has written or edited twenty books and published numerous papers and articles. He writes regularly for a number of newspapers in India and is affiliated with many professional journals.

Charles Perrings

Charles Perrings is the Head of the Department of Environmental Economics and Environmental Management at the University of York in the United Kingdom. Previously, he was Director of the Biodiversity Programme at the Beijer Institute in Stockholm, Sweden; Professor of Economics at the University of California at Riverside in the United States; Head of the Economics Department at the University of Botswana; Lecturer and Professor at the University of Auckland in New Zealand; and Lecturer at the National University of Lesotho. He has also consulted with many international government and nongovernmental organizations.

Dr. Perrings earned his undergraduate degree and his PhD from the University of London. He has written a number of studies ranging from the economics of ecological resources to sustainable development, poverty alleviation, biological diversity, biodiversity conservation, and the interdependence of economics and the environment.

Peter H. Raven

Peter Raven is Director of the Missouri Botanical Garden and Engelmann Professor of Botany at Washington University in St. Louis, Missouri. His professional emphases are sustainable agriculture and forestry in the tropics and the preservation of plants and animals throughout the world.

In the United States Dr. Raven is Home Secretary of the National Academy of Sciences, Chairman of the Report Review Committee of the National Research Council, and a member of the President's Committee of Advisors on Science and Technology. He is a member of the Committee on Research and Exploration of the National Geographic Society, Co-chair of the Editorial Committee of the Flora of China Project, and Chairman of the U.S. Civilian Research and Development Foundation for the Independent States of the Former Soviet Union.

Before coming to St. Louis in 1971, Dr. Raven was a member of the Department of Biological Sciences at Stanford University. He is past president or past chairman of a number of scientific groups or institutes.

Dr. Raven received his PhD at the University of California at Los Angeles. He did his undergraduate work at the University of California at Berkeley. He is the author of more than 450 scientific papers and eighteen books, including textbooks in biology and botany. He is also the recipient of many international awards.

Manuel Rodriguez-Becerra

Manuel Rodriguez-Becerra is Professor of Environmental Policy at the Andes University in Bogotá and a private consultant on environmental affairs to both national and international organizations.

Mr. Rodriguez-Becerra served as an advisor to the Colombian Ministry of the Environment (1995-97) for the Intergovernmental Panel on Forests. He also contributed to the Sustainable Forests Management Action Plan for the Risaralda West Region, a 90,000-hectare forest inhabited by indigenous and mestizo peoples. He was Co-chair of the Intergovernmental Panel on Forests of the United Nations Commission on Sustainable Development, and he is a contributor to the "Interlinkages" Assessment Report being cosponsored by the United Nations Environment Programme (UNEP), the U.S. National Aeronautics and Space Administration (NASA), and the World Bank.

Mr. Rodriguez-Becerra received his undergraduate training in industrial engineering at Andes University and a Master of Philosophy degree in management from Oxford. He is the author of numerous articles and books on environmental management.

David Malin Roodman

David Roodman is Senior Researcher at the Worldwatch Institute. He specializes in economics and the political economy of environmental problems, in particular, energy policy, the human and ecological impact of construction, and the effects that taxes and subsidy policies have on the environment. He writes regularly for Worldwatch and for selected newspapers.

Before joining the Worldwatch Institute, Mr. Roodman worked at the Institute for Human Development in Philadelphia and the Energy Study Institute in Washington, D.C. Mr. Roodman received a BA in pure mathematics from Harvard University. He also studied at the University of Cambridge, where his interests shifted to the relationship between the economy and the environment.

Sven Sandstrom

Sven Sandström is Managing Director for Corporate Planning and Resource Management at the World Bank. In this position he is also responsible for resource mobilization for the International Development Association (IDA) and the Bank's participation in the debt initiative for the highly indebted poor countries (HIPC). Sven Sanström is also a member of the Executive Committee, which guides the Bank Group's strategic direction. Before his current appointment Sven Sandström served as Director of the Office of the President. Earlier, he was Director of the Bank's Southern Africa Department and had held a series of management positions with increasing responsibility, particularly in Africa and Asia. He began his career in the Bank in the early 1970s as a project analyst in the transport, water, and sanitation, and urban development sectors.

Dr. Sandström graduated from the Royal Institute of Technology in Stockholm (DrSc in civil engineering), the Stockholm School of Economics (MBA) and University of Stockholm (BA). He worked as a consultant in Sweden from 1966 to 1968 and as a research associate at the Massachusetts Institute of Technology and Harvard Business School in the United States from 1969 to 1972, when he joined the World Bank.

Jean-Louis Sarbib

Jean-Louis Sarbib has been Co-Vice President for the Africa Region of the World Bank since April 1996. Previously, he served as Director for the Western Africa Department, Division Chief for Country Operations in the Sahelian Department, and Deputy Division Chief in the Industry Department's Mining and Non-Ferrous Metals Division. Before that, he served as Senior Loan Officer in the East and South Africa Country programs Department II. Earlier, he was Senior Planning Advisory Officer. Mr. Sarbib began his career at the Bank in 1980 as a Planning Advisory Officer assigned to the East Africa Region.

Prior to joining the Bank, Mr. Sarbib worked in the French government and taught at the University of Pennsylvania and at the University of North Carolina at Chapel Hill.

Mr. Sarbib holds an Engineering degree from the Ecole Nationale Supérieure des Mines de Paris in France. He did his post-graduate studies in city and regional planning at the University of Pennsylvania.

K. Madhava Sarma

K. Madhava Sarma is Executive Secretary of the Secretariat for the Vienna Convention and the Montreal Protocol, a position he has held in the United Nations Environment Programme for six years.

Madhava Sarma is also a member of the Indian Administrative Service. He has held senior positions at the state level as a general administrator with responsibilities for water supply, irrigation, and power. He served in the national government for five years in the Ministry of Environment and Forests. As an Additional Secretary at the Ministry of the Environment and Forests, he participated in international meetings on global environmental issues and helped clarify the role of developing countries in the preservation of the global environment.

Peter Schei

Peter Schei is the Special Advisor to the Minister of Environment in Norway. He has extensive experience in nature conservation and the sustainable use of biodiversity, as well as in the integration of biodiversity into national and sector plans. Mr. Schei also has extensive experience in the negotiation of environmental treaties and their implementation, both on a national and international level.

Most recently, Mr. Schei served as the Chairman of the Subsidiary Body on Scientific, Technical, and Technological Advice for the Convention on Biological Diversity. In 1993 he was the Co-Chair of UNEP Panel 1 on the scientific and technical basis for implementing the Convention. In Norway for many years he has been the head of the national delegation to the Convention on International Trade in Endangered Species. More recently, he has held the same position with respect to the Convention on Biological Diversity.

Mr. Schei's areas of interest include the study of terrestrial ecosystems, bird ecology, and protected areas. He has gained field experience in many regions of the world including Africa, Central and South America, parts of South and South East Asia, Eastern Australia, and Western and Eastern Europe.

Mr. Schei earned a MSc in zoology at the University of Oslo. He has received many national awards for his work in biological conservation.

Ismail Serageldin

In 1998 Ismail Serageldin was appointed vice president for Special Programs, including cultural heritage. At the time of the fifth ESSD Conference he was vice president for Environmentally and Socially Sustainable Development (ESSD) at the World Bank, Chairman of the Consultative Group on International Agricultural Research (CGIAR), Chairman of the Consultative Group to Assist the Poorest (CGAP), and Chairman of the Global Water Partnership (GWP). He has published widely on economic development, human resource issues, and the environment. He has been awarded three honorary doctorates: from the University of Bucharest in sociology, and from the University of Melbourne and the Indian agricultural research Institute in Agricultural Science. His most recent books are *Sustainability and the Wealth of Nations: First Steps in an Ongoing Journey* (1996) and *Nurturing Development: Aid and Cooperation in Today's Changing World* (1995).

Ismail Serageldin earned his BSc degree at Cairo University and his Master's and PhD degrees at Harvard University.

Jean-Michel Severino

Jean-Michel Severino is Vice President of the East Asia and Pacific Region at the World Bank. He joined the Bank in 1996 as Director of Country Department II in the Europe and Central Asia Region, responsible for Bosnia.

Before joining the Bank, Mr. Severino served as Director of Development in the French Ministry of Cooperation and Development, reporting directly to the Minister. Career posts included Economic and Financial Advisor to the Cabinet, Chief of Finance Studies and Foreign Relations at the Ministry of Development and Cooperation, and Financial Auditor at the Ministry of Economy and Finance.

Born in Abidjan, Côte d'Ivoire, Mr. Severino graduated from the Ecole Supérieure de Commerce and Institut d'études politiques in Paris. He completed his Master's degrees in law and economics at the University of Paris and graduated from the National School of Administration (ENA).

Joseph E. Stiglitz

Joseph Stiglitz is Senior Vice President, Development Economics, and the Chief Economist at the World Bank. Previously, he was Expert Economist at the U.S. Council of Economic Advisors, which advises the President on economic issues. Preceding that, he was Professor of Economics at Stanford University and Senior Fellow at the Hoover Institution at Stanford. Joseph Stiglitz has taught at Princeton University; Oxford University; Yale University; University College, Nairobi, Kenya; the University of Canterbury, Christchurch, New Zealand; and the Massachusetts Institute of Technology (MIT). Dr. Stiglitz has consulted to many organizations, including the Ford Foundation (Energy Policy Study), the U.S. Department of the Interior (Offshore Oil Leasing Programs), the Federal Energy Administration (Intertemporal Biases in Market Allocations of Natural Resources), the Electrical Power Research Institute, and the Inter-American Development Bank.

He completed his undergraduate training at Amherst College in Massachusetts and his PhD at MIT.

Maurice F. Strong

Maurice Strong, P.C., is Under Secretary General and Executive Coordinator for United Nations Reform at the UN and Senior Advisor to the President of the World Bank. He holds numerous other positions in both the private and public sectors, including Chairman and founder of the Earth Council, Chairman of the World Resources Institute, and Co-Chair with Mikhail Gorbachev of the Earth Charter Commission.

In 1992 Mr. Strong served as the Secretary General of the United Nations Conference on Environment and Development (UNCED, or the Rio Earth Summit), and was Under Secretary General of the United Nations for two years previously. Earlier, he served as Executive Coordinator of the United Nations Office for Emergency Operations in Africa, as the first Executive Director of the United Nations Environment Programme (UNEP) in Nairobi, and as Secretary of the United Nations Conference on the Human Environment. Mr. Strong has held numerous prominent positions in Canada, including Chairman and Chief Executive Officer of Ontario Hydro; and President, Chairman, and CEO of Petro Canada. He was the first President of the Canadian International Development Agency (CIDA).

Maurice Strong's global leadership on environment and social policy has been acknowledged by the award of many personal and professional honors. He is a member of the Queen's Privy Council of Canada and has received honorary doctorates from forty universities.

Mostafa K. Tolba

Mostafa Tolba is a former Under Secretary General to the United Nations, where he was Executive Director of the United Nations Environment Programme (UNEP) from 1973 to 1992, elected to four terms.

Currently, Dr. Tolba is President of the International Center for Environment and Development and of the Environmental, Engineering and Geological Consulting Office at Cairo University. Before becoming Director of UNEP, Dr. Tolba served for two years as Deputy Director. Previously, he was Alternate Member of the Executive Board for UNESCO. In Egypt Dr. Tolba was Minister of Youth for the Egyptian Academy of Scientific Research and Technology and served in the Egyptian Government as Under Secretary of State in the Ministry of Education. He also served as Cultural Counselor and Director at the Egyptian Education Bureau in the Egyptian Embassy in the United States. Before that he was Assistant Secretary and Secretary General at the Supreme Science Council. Dr. Tolba began his career as a professor at Cairo University. He also taught at Baghdad University.

Dr. Tolba received his undergraduate education in botany from the University of Cairo. He earned his PhD in microbiology from Imperial College in London. He has published nearly 100 scientific papers, and hundreds of articles as well as seven books on international environmental issues. He is the recipient of numerous awards and honors.

Tamarii Tutangata

Tamarii Tutangata is Director of the South Pacific Regional Environment Program. Previously, he served for ten years in a variety of positions with the Government of the Cook Islands, including senior consultant to the Prime Minister and the Ministry of Planning and Economic Development, Chief Executive Officer to the Prime Minister, and Secretary of the Prime Minister's Department. He also served as Secretary to the Ministry of Cultural Development and Chairman of the National Conservation Advisory Council.

Previous to these positions, he worked at the South Pacific Commission in New Caledonia, where he was promoted to Director of Programmes.

Tamarii Tutangata received his college and university education in New Zealand.

Ola Ullsten

Ola Ullsten is Co-Chair of the World Commission on Forests and Sustainable Development. Since 1983 he has been a member of the InterAction Council of former Heads of State and Government (IAC).

Ola Ullsten is a former Prime Minister of Sweden. Other positions he has held in Swedish government and politics include Deputy Prime Minister, Minister of Foreign Affairs, Ambassador to Italy, Ambassador to Canada, Leader of the Liberal Party, Minister for International Development Cooperation, and Member of Parliament.

In the international arena Ola Ullsten is a past member of the "Eminent Advisor Group" to the Secretary General of UNCED, Chairman of the UN Food and Agriculture Organization Independent Review Team of Tropical Forestry Action Plan, Co-Chair of the European Forum for Forest Protection, and Chairman of the IAC High Level Group of Experts on Transfer of Resources to Developing Countries (1984) and on "Global Deforestation Trends."

José I. Vargas

José Israel Vargas is Minister of Science and Technology in Brazil. His fields of specialization include the chemical consequences of nuclear transformation, solid state chemistry and hyperfine interactions in solids as well as high temperature superconductors, and modeling techniques of science and technology diffusion.

Among the many international organizations for which Dr. Vargas has worked are the International Atomic Energy Agency (IAEA), UNESCO, and the UN Committee on Science and Technology for Development. He also worked for the Commissariat à l'Energie Atomique in France. In Brazil he has worked for the National Research Council and the Presidential National Energy Commission. He has also been State Secretary for Science and Technology, Minas Gerais, and the Secretary for Industrial Technology, Ministry of Industry and Trade. Dr. Vargas has been a professor at several universities and institutes.

He obtained his undergraduate degree in chemistry from the University of Minas Gerais in Brazil and his PhD from Cambridge University in England.

Bernd von Droste zu Hülshoff

Bernd von Droste is the Director of the UNESCO World Heritage Centre and Secretary of the World Heritage Convention. Previously at UNESCO, he was Director of the Division of Ecological Sciences, Executive Secretary of the Man and the Biosphere Programme, and Publishing Director of the quarterly journal, *Nature and Resources*. Dr. von Droste began his career at UNESCO as a Programme Specialist in various fields of ecology.

Before working for UNESCO, Dr. Droste had been a forester, subsequently returning to school to earn a PhD in forest ecology studies from the University of Munich, where was appointed Associate Professor. Dr. von Droste is the author of over 170 scientific papers and several books, primarily in the fields of heritage conservation, ecology, forestry, hydrology, and cultural landscapes.

Robert T. Watson

Robert Watson is Chair of the International Panel on Climate Change, and Director of the Environment Department and Head of the Environment Sector Board at the World Bank. He joined the Bank in 1996 as the institution's Senior Scientific Advisor, sitting in the Environment Department. Previously, he served as Associate Director for Environment in the Office of Science and Technology Policy in the Executive Office of the U.S. President. Prior to joining the Clinton White House, Dr. Watson was Director of the Science Division and Chief Scientist for the Office of Mission to Planet Earth at the National Aeronautics and Space Administration (NASA).

Dr. Watson has played a key role in the negotiation of global environment conventions and the evolution of the Global Environment Facility (GEF). From 1991 to 1994 he served as Chairman of the GEF's Scientific and Technical Advisory Panel. He is Chair or Co-Chair of a number of international scientific assessments, including Working Group II of the Intergovernmental Panel on Climate Change (IPCC), the United Nations Environment Programme/World Meteorological Organization (UNEP-WMO), International Scientific Assessment of Ozone, and UNEP's Global Biodiversity Assessment.

Dr. Watson received his PhD in chemistry from London University in 1973. He has received numerous awards and prizes.

Christopher G. Weeramantry

Christopher Weeramantry is Vice President of the International Court of Justice in The Hague. He has been a member of the Court since 1991.

Prior to joining the Court, Judge Weeramantry participated in a number of international initiatives concerning human rights. He was the editor of a two-volume United Nations study on science, technology and human rights. He was a Panelist on the Scientists Committee on Problems of the Environment/Environmental Consequences of Nuclear War. He also served as Vice Chairman of the United Nations Centre against Apartheid. Judge Weeramantry began his career in Sri Lanka, where he served as Justice of the Supreme Court. Before that, he was Commissioner of Assize, Supreme Court, and before that Advocate, Supreme Court.

Judge Weeramantry has taught at numerous universities throughout the world, including Monash University, Melbourne, Australia; University of Hong Kong; University of Tokyo; University of Papua New Guinea; and University of Florida.

Judge Weeramantry received his undergraduate and legal graduate training at the University of London. He has published widely, including a long report on environmental damage to the island state of Nauru.

James D. Wolfensohn

James Wolfensohn is the ninth President of the World Bank Group. In addition to his career as an investment banker he has a long record of parallel involvement in development issues and the global environment. Since he assumed the Bank presidency, he has traveled widely to Africa, the Caribbean, Central Asia, East Asia, Eastern Europe, Latin America, and the Middle East. He has taken the initiative to form new strategic partnerships between the Bank Group and the governments it serves, the private sector, civil society, regional development banks, and the United Nations. To improve the Bank's effectiveness in fighting poverty and to meet the needs of a rapidly changing global economy Mr. Wolfensohn has launched a major reform program in the Bank, the Strategic Compact. Among the many other initiatives he has pursued at the Bank are efforts to mainstream environmental issues in all aspects of Bank activity.

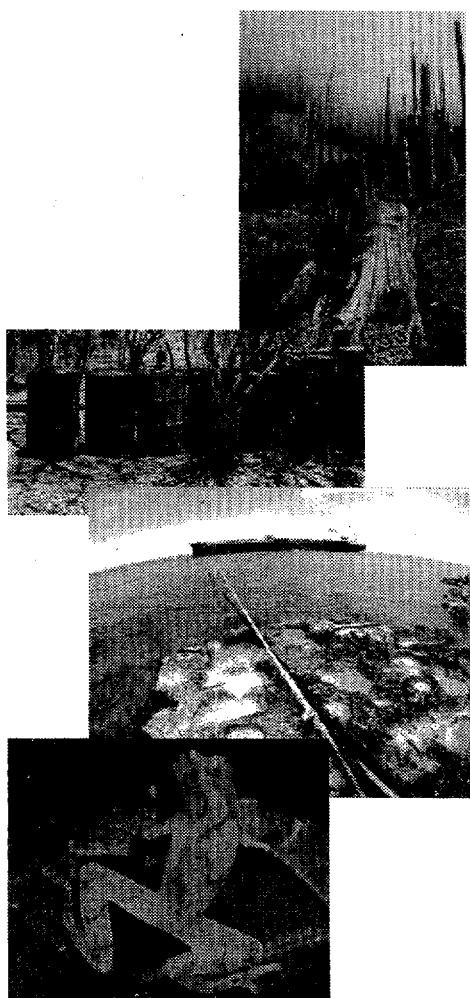
Before joining the Bank, Mr. Wolfensohn was President and Chief Executive Officer of James Wolfensohn, Inc. (in which he relinquished all interests). Prior to that, he was head of the investment banking department for Salomon Brothers. He was also Chairman of the Board of Trustees of the John F. Kennedy Center for the Performing Arts, Chairman of Carnegie Hall, President of the International Federation of Multiple Sclerosis Societies, Director of the Business Council for Sustainable Development, both Chairman and board member of the Finance Committee of the Rockefeller Foundation, and a member of the Middle East Economic Strategy Group.

Mr. Wolfensohn holds a BA and LLB from the University of Sydney and an MBA from the Harvard Graduate School of Business. He has received numerous awards and honors, including Honorary Knighthood by Queen Elizabeth II for his contribution to the arts, and in particular for artistic exchange between the United States and Great Britain.

Mr. Wolfensohn is Chairman of the Institute for Advanced Study at Princeton University, an Honorary Trustee of the Brookings Institution, and a member of the Council on Foreign Relations. He is also a Fellow of the American Academy of Arts and Sciences and a Fellow of the American Philosophical Society.

Appendix D

Summaries of Global Environmental Treaties



CLIMATE CHANGE

OZONE DEPLETION

BIOLOGICAL DIVERSITY

FORESTS

DESERTIFICATION/DRYLANDS

ENDANGERED SPECIES

WETLANDS

INTERNATIONAL WATERCOURSES

SEAS AND OCEANS

HAZARDOUS WASTES

WORLD HERITAGE



Since the 1970s, when scientists began to express concern that greenhouse gases produced by human activity would cause climate change, knowledge of this subject has grown significantly. Scientists still disagree about the extent of change, and all predictions are contingent on assumptions about future events, but a broad consensus has been established that the Earth will be affected by climate change in the coming decades and beyond. Moreover, it is recognized that without remedial measures, the economic and social consequences of these changes could be severe.

Among the projected consequences of climate change are increases in certain diseases, notably malaria, in areas that become warmer and more humid, a rise in sea levels that could displace millions of people, and large shifts in ecosystems. A near-term dieback in forests is possible as climate boundaries move towards the poles (a shift estimated to be between 150 and 650 kilometers), while rising sea temperatures could damage or kill many coral reefs. From an economic perspective, the costs associated with climate change have been estimated between 1.5 and 2 percent in developed countries, and as high as 9 percent in developing nations.

The principal greenhouse gases that trap heat and therefore affect global temperature are carbon dioxide, methane, chlorofluorocarbons (CFCs), nitrous oxide, ozone, and water vapor. With the exception of CFCs, all of these

Climate Change

gases occur naturally in the atmosphere. For this reason, "anthropogenic" is used to identify emissions that disturb the atmosphere's natural equilibrium.

By producing carbon dioxide as well as nitrous oxide, fossil fuel combustion is the most important factor in the increase in greenhouse gases. Deforestation adds to the level of greenhouse gases, because forests serve as an important "sink" for carbon, transforming it from gaseous carbon dioxide into biomass. Cattle also create greenhouse gases by expelling methane as a result of digestion. Rice paddies are another source of methane as are coal mines and leakages from natural gas lines. The release of CFCs adds another greenhouse gas to the atmosphere, but the overall impact on global warming is attenuated by the fact that CFCs destroy ozone, which itself is a greenhouse gas.

International Legal Regime

The international effort to respond to climate change is governed by the United Nations Framework Convention on Climate Change (FCCC), which was opened for signature at the Rio Earth Summit in June 1992 and entered into force in March 1994. There are 166 Signatories and 167 Parties to the Convention.

In comparison with other international agreements on the environment, the Climate Convention has certain distinctive characteristics. While

many of these agreements have been negotiated in response to obvious evidence of environmental damage, such as species extinction, the Climate Convention was negotiated largely in response to anticipated environmental damage, based on extrapolations from observed changes and predictions about future emission patterns. The willingness of so many countries to acknowledge the need for international action indicates a heightened sensitivity to the environment. At the same time, however, the Convention has fewer binding commitments than some other agreements, and thus remains a work-in-progress.

Differences among Countries

While stating that "change in the Earth's climate and its adverse effects are a common concern of human-kind," the opening text of the Climate Convention also acknowledges that countries have different interests in the effort to mitigate climate change. In this regard, the Convention states that countries should participate in "an effective and appropriate international response in accordance with their common but differentiated and respective capabilities and their social and economic conditions."

The opening text of the Convention also acknowledges that the impact of climate change will not affect all countries equally. It states that "low-lying and other small island countries, countries with low-lying coastal, arid and semi-arid areas or areas liable to floods, drought and desertification, and developing countries with fragile mountainous ecosystems are particularly vulnerable to the adverse effects of climate change." It also refers to "the special difficulties of those countries, especially developing countries, whose economies are particularly dependent on fossil fuel production, use and exportation, as a consequence of action taken on limiting greenhouse gas emissions."

Lastly, the opening text contains several formulations to ensure that developing countries will not be prevented from increasing their use of energy resources. It affirms, for example, the "principle of sovereignty of States in international cooperation to address climate change." Explicitly, it states that "the share of global emis-

sions originating in developing countries will grow to meet their social and development needs" and that "for developing countries to progress towards [the goal of sustainable development] their energy consumption will need to grow."

Commitments and Goals

In the context of differentiated responsibilities, the Convention distinguishes among developing countries, former Eastern Bloc countries, and members of the Organisation for Economic Co-operation and Development (OECD). It calls on those in the latter two groups, designated as Annex I countries, to take "the lead in modifying longer-term trends in anthropogenic emissions." Specifically, these more developed countries committed themselves to the "aim" of holding anthropogenic emissions in the year 2000 (other than CFCs controlled by the Montreal Protocol) at the same levels as in 1990. At this juncture, the evidence is that these goals will not be met, except in unusual circumstances, as in former Eastern bloc countries, where reductions in emissions are more closely tied to economic difficulties than to technological change.

To assist developing countries in their effort to catalog and control greenhouse gas emissions, the Convention also commits the OECD countries, designated as Annex II countries, to "provide new and additional resources" and calls for technology transfer and "enhancement of endogenous capacities." The Global Environment Facility (GEF) serves as the financing mechanism for the Convention.

Science

Having made the case that climate change requires concerted international action, science must now refine its models to better predict both the timing and magnitude of global warming as well as determine more precisely how particular regions will be affected. Little is known at this stage, for example, about where floods and storms are most likely to occur. For nations concerned about investments in irrigation projects or dams, this kind of information

is more important than generalized predictions about temperature changes.

Further progress must also be made in the area of renewable energy, which holds significant promise of directing energy use and production onto more sustainable pathways, especially in developing countries. The Convention establishes a Subsidiary Body for Scientific and Technological Advice to "identify innovative, efficient, and state-of-the-art technologies and know-how and advise on the ways and means of promoting development and/or transferring such technologies." Solar cells, wind power, and biomass are all promising sources of energy in regions in which access to electric grids is not economically feasible. Along with renewable energy, developing countries will also need access to higher efficiency conventional technologies, in particular those that shift energy use and production to fuels that burn more cleanly.

Economics

The most promising means of achieving the goals of the Convention involve the use of economic tools, including macroeconomic policy changes. Significant progress has been made in recent years in the reduction in subsidies of fossil fuels. In many developing and former socialist countries, these subsidies were substantial; reducing them, therefore, is a classic win-win situation for the economy and for the environment. Such reductions stimulate energy efficiency, and they also create a level playing field for newer, climate friendly technologies. Macro-economic policies that encourage the evolution to higher value-added industries, whether in the developed or developing world, are another means of reducing greenhouse gas emissions.

Other economic tools that can help achieve the goals of the Convention are studies that measure the costs of inaction versus the costs of action. In this way, comparisons can be established that create the necessary impetus to redesign incentive systems. Environmental taxes also can help reduce greenhouse gas emissions. Some countries have experimented with carbon taxes, but until now, various impediments have limited their broader application. These include

general opposition to taxes, a tendency for such taxes to be regressive, and concern that national industries would suffer.

The process of Joint Implementation (JI) is an additional means of encouraging more efficient energy use and consumption. Under JI, which was approved on a pilot basis at the Berlin Conference of the Parties (COP) in 1995, reductions in carbon emissions are calculated for specific projects. Ultimately, when Parties commit to binding emission targets as they have pledged to do, these reductions could be used as credits to offset against the agreed targets. A system based on carbon offsets could take different forms. Under a conservative scenario, offsets could be granted for investments within Annex I countries. A more ambitious approach could grant offsets for investments in a larger group of countries, including developing countries. Because the marginal cost of carbon abatement is lower in economies in transition and developing countries, a system of carbon offsets would maximize the efficiency gains of new investments, while encouraging resource flows into these countries. The effectiveness of the system could be enhanced by establishing a carbon investment fund that pools different projects, thus reducing risk and lowering transaction costs. Ultimately, such a fund could lead to a full-fledged system of tradable emission permits.

Law

Because the issue of climate change involves all nations in the world, but in many different ways, it poses special difficulties in the area of international law. Traditionally, atmospheric pollution has been viewed through the lens of sovereignty. As stated in the influential 1941 Trail Smelter case between the United States and Canada, "no State has the right to use or permit the use of territory in such a manner as to cause injury by fumes in or to the territory of another." In the case of climate change, however, where action is based on precaution and the issues of proof are still problematic, the use of traditional international law may not be helpful. The obvious solution is treaty law, but as the text of the Convention makes clear, dif-

ferent nations have different interests. For this reason, the negotiations at the COP in Kyoto in December 1997 are expected to be particu-

larly strenuous, as countries focus on the need for compliance measures to achieve reduction targets.

For further information

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Signatories and Parties to the Convention (as of July 1997)

Afghanistan (np)	Dominican Rep. (np)	Libya (np)	St. Vincent and the Grenadines
Albania	Ecuador	Liechtenstein	Samoa
Algeria	Egypt, Arab Rep. of	Lithuania	San Marino
Angola (np)	El Salvador	Luxembourg	São Tomé and Príncipe (np)
Antigua and Barbuda	Eritrea	Madagascar (np)	Saudi Arabia
Argentina	Estonia	Malawi	Senegal
Armenia	Ethiopia	Malaysia	Seychelles
Australia	European Community (w)	Maldives	Sierra Leone
Austria	Fiji (w)	Mali	Singapore
Azerbaijan	Finland	Malta	Slovak Rep.
Bahamas	France	Marshall Islands	Slovenia
Bahrain	Gabon (np)	Mauritania	Solomon Islands (w)
Bangladesh	Gambia	Mauritius	South Africa (np)
Barbados	Georgia	Mexico	Spain
Belarus (np)	Germany	Micronesia	Sri Lanka
Belgium	Ghana	Moldova	Sudan
Belize	Greece	Monaco (w)	Suriname (np)
Benin	Grenada	Mongolia	Swaziland
Bhutan	Guatemala	Morocco	Sweden
Bolivia	Guinea	Mozambique	Switzerland
Botswana	Guinea-Bissau	Myanmar	Syrian Arab Rep.
Brazil	Guyana	Namibia	Tanzania
Bulgaria (w)	Haiti	Nauru (w)	Thailand
Burkina Faso	Honduras	Nepal	Togo
Burundi	Hungary (w)	Netherlands	Trinidad and Tobago
Cambodia	Iceland	New Zealand	Tunisia
Cameroon	India	Nicaragua	Turkmenistan
Canada	Indonesia	Niger	Tuvalu (w)
Cape Verde	Iran, Islamic Rep. of	Nigeria	Uganda
Cent. Afr. Rep.	Ireland	Niue	Ukraine
Chad	Israel	Norway	United Arab Emirates
Chile	Italy	Oman	United Kingdom
China	Jamaica	Pakistan	United States
Colombia	Japan	Panama	Uruguay
Comoros	Jordan	Papua New Guinea (w)	Uzbekistan
Congo, Dem. Rep. of	Kazakhstan	Paraguay	Vanuatu
Congo, Rep. of	Kenya	Peru	Venezuela
Cook Islands	Kiribati (w)	Philippines	Vietnam
Costa Rica	Korea, Dem. People's Rep. of	Poland	Yemen, Rep. of
Côte d'Ivoire	Korea, Rep. of	Portugal	Yugoslavia, Fed. Rep. of (Serbia/ Montenegro) (np)
Croatia (w)	Kuwait	Qatar	Zambia
Cuba (w)	Lao People's Dem. Rep.	Romania	Zimbabwe
Cyprus (np)	Latvia	Russian Federation	
Czech	Lebanon	Rwanda (np)	
Denmark	Lesotho	St. Kitts and Nevis	
Djibouti	Liberia (np)	St. Lucia	
Dominica			

Note: no abbreviation = ratification; np = not currently a Party; w = with declaration or understanding.



In the mid-1970s it was first perceived that certain human-made chemicals being released into the atmosphere might deplete stratospheric ozone. The initial hypothesis was put forward on the basis of calculations indicating that significant amounts of atomic chlorine were accumulating in the stratosphere, where the ozone layer exists. Based on the chemical properties of atomic chlorine and ozone, it was realized that a chemical reaction between the two would quickly ensue, and as a result, ozone molecules, which comprise three atoms of oxygen, would be destroyed.

The original calculations were made for two common chemicals known as chlorofluorocarbons (CFCs), which were being used as refrigerants, solvents, and foam-blown agents. These chemicals are also referred to as halogenated compounds, because they contain one or more halogens, a class of elements with similar chemical properties. Other halogenated compounds that are significant sources of ozone depletion are halons, which are very effective fire-extinguishing agents, and methyl bromide, an effective fumigant used in agriculture.

The chemical stability that often makes halogenated compounds useful is also what makes them dangerous to the ozone layer. Most chemicals that escape into the atmosphere with the potential to deplete ozone never reach into the stratosphere. Rather, they return quickly to the Earth's surface, usually dissolved in rainwater. In contrast, halogenated compounds remain in-

Ozone Depletion

tact for longer than a century while they are circulated through the atmosphere. At levels above fifteen kilometers, the sun's ultraviolet radiation is strong enough to break apart these otherwise inert compounds, thereby releasing chlorine and bromine atoms. When conditions are right, these atoms spark a catalytic chain reaction in which each atom is continually set free to react with and break up new ozone molecules.

What began as an academic hypothesis was confirmed in 1984, when the ozone hole above Antarctica was discovered. Since then, less dramatic ozone depletion has been detected above much of the Earth's surface, except at tropical and subtropical latitudes. Ozone absorbs a portion of ultraviolet radiation known as UVB, which poses a danger to human beings in the form of increased skin cancer and cataracts and can alter biological processes. Thus, ozone depletion has been recognized from the beginning as a global threat requiring a global response.

International Legal Regime

The Vienna Convention for the Protection of the Ozone Layer set in motion the international regulatory process to protect the ozone layer. Negotiated under the auspices of the United Nations Environment Programme (UNEP), it was opened for signature in 1985 and entered into force in 1988. The Montreal Protocol, which along with subsequent amendments imple-

ments the goals of the Vienna Convention, was signed in 1987 and entered into force in 1989. There are 28 Signatories and 165 Parties to the Vienna Convention. There are 46 Signatories and 162 Parties to the Montreal Protocol.

Scientific Assessment

As the initial international effort to protect the ozone layer, the Vienna Convention did not set targets or timetables to reduce emissions of ozone-depleting substances. Rather, it emphasized the need for countries to work together. It stated that countries should "co-operate by means of systematic observations, research and information exchange in order to better understand and assess the effects of human activities on the ozone layer and the effects on human health and the environment." The Convention called for assessments of alternative substances and technologies, and it outlined the kind of information that countries should exchange, including production of ozone-depleting substances and information on imports and exports.

Recognizing that the Vienna Convention was a work-in-progress, the text called on the UNEP executive director "to convene a working group to continue work on a protocol that addresses both short and long term strategies to control equitably global production and use of CFCs." It also authorized the executive director "to convene a Diplomatic Conference, if possible in 1987, for the purpose of adopting such a protocol."

Controlling Use and Production

On schedule, the Parties to the Vienna Convention met and adopted the Montreal Protocol, which establishes legal obligations to limit the use and production of specific chemicals based on calculations of their ozone-depleting potential. A landmark agreement in the area of environmental law, it is widely credited with limiting the amount of ozone-depleting substances released into the atmosphere and spurring the production of alternative nondepleting substances. Under the Protocol, countries agreed to meet a series of emission targets by specific dates. During the initial phase, they agreed to

limit production and consumption of ozone-depleting substances to the same level that had prevailed in 1986. Subsequent phases stipulated actual reductions, leading ultimately to complete phase-out. In the years since the Protocol was negotiated, the Conference of the Parties has met annually to review the Convention. Three times—in London in 1990, in Copenhagen in 1992, and in Vienna in 1995—it added amendments and adjustments. These expanded the number of controlled substances to include additional CFCs as well as carbon tetrachloride, methyl-chloroform, methyl bromide, hydrobromofluorocarbons (HBFCs) and hydrochlorofluorocarbons (HCFCs), a class of chemicals used to replace CFCs. These amendments and adjustments also accelerated the phase-out of substances for which substitutes have become available.

Assisting Developing Countries

In its original and amended forms, the Montreal Protocol includes several provisions designed to alleviate the concerns of developing (or Article 5) countries. The 1987 Protocol allowed developing countries whose consumption of ozone-depleting substances was less than 0.3 kilograms per capita (since reduced to 0.2 kilograms) to delay compliance for ten years. Furthermore, any Party whose production of controlled substances was less than 25 kilotons could "transfer to or receive from any other Party, production in excess of the limits" as defined in the Protocol. Because these original exceptions were not sufficiently attractive, the 1990 amendment added a Multilateral Fund to the Protocol. It stated that the capacity of developing countries to meet their obligations would depend on "the effective implementation of the financial co-operation [as provided by the amendment] and transfer of technology." In the wake of these changes, most developing countries have become members of the Convention and of the Protocol.

Science

Whereas a number of environmental issues are driven primarily by socioeconomic forces, such

as desertification or deforestation, the issue of ozone depletion has in many respects been science-driven. After scientists first realized that certain chemicals pose a threat to the ozone layer, extensive efforts were undertaken to measure the seriousness of the problem. Subsequently, scientists tackled the underlying causes by finding alternative chemicals that could replace ozone-depleting substances. Acknowledging the dominant role of science is key in assessing how the international community has responded to the threat of ozone depletion and in drawing lessons that might be applicable to other environmental issues.

The most obvious lesson of the Montreal Protocol and its amendments is that the stringent limits they imposed have largely been successful. As a result, the threat to human health and the environment from ozone depletion now appears contained. Assuming continued compliance (and success in stamping out the illegal black market that arises from production in Russia), the level of ozone-depleting halogens in the stratosphere is expected to peak in several years and then slowly subside. According to current estimates, the natural process of ozone production will restore the ozone layer in perhaps fifty years, as the levels of chlorine and bromine decrease.

The rapid international response to the problem of ozone depletion is strong evidence of what countries can do when faced with an immediate environmental threat. In particular, it demonstrates the importance of thorough scientific assessment based on global research and analysis, including effective coordination. Furthermore, it demonstrates the importance of bringing all the relevant stakeholders together to ensure that scientific knowledge is properly disseminated and integrated in national action plans. Nonetheless, it is worth noting that global action did not occur as quickly as it might have. Bans on the use of CFCs for certain purposes, for example, were initiated in several countries, notably the U.S. in the 1970s, when damage to the ozone layer was still considered hypothetical. The global response to ozone depletion can be considered a successful model for multilateral action, but a model that must be

adjusted and expanded as attention shifts to other technologically complex matters, such as global climate change.

Economics

Although the Montreal Protocol relies heavily on command and control targets to achieve its purposes, it nonetheless holds an historic place in the history of environmentalism because of a key economic innovation. The 1990 amendment that established the Multilateral Fund to help developing countries was the first example of its kind among international environmental treaties. It set an important precedent that helped pave the way for the 1992 Rio Earth Summit (UNCED) and the negotiation of the Framework Convention on Climate Change (FCCC) and the Convention on Biological Diversity (CBD). Henceforth, it was possible to view the international effort to preserve the environment not simply as a set of negotiated legal norms but also as a comprehensive global project implying broader obligations on the part of all countries.

Law

An interesting legal issue that relates to the regime to control ozone-depleting substances concerns international trade. The Montreal Protocol is the only international agreement regulating the global commons that makes use of trade measures as an enforcement tool. Although it does not restrict trade between Parties, the Protocol does impose trade restrictions on imports and exports with non-Parties. It also states that Parties should "refrain from providing new subsidies, aid, credits, guarantees or insurance programs for the export to States not Party to this Protocol of products, equipment, plants or technology that would facilitate the production of [ozone-depleting substances]." Subsequent amendments also banned the import from non-Parties of certain products that contain controlled substances. Certain legal commentators have questioned whether these enforcement measures would be considered a violation of the General Agreement on Tariffs

and Trade (GATT), although others point out strongly that Article XX of GATT allows for exceptions "necessary to protect human, animal

or plant life or health." The multilateral trade provisions have never been the subject of a legal challenge.

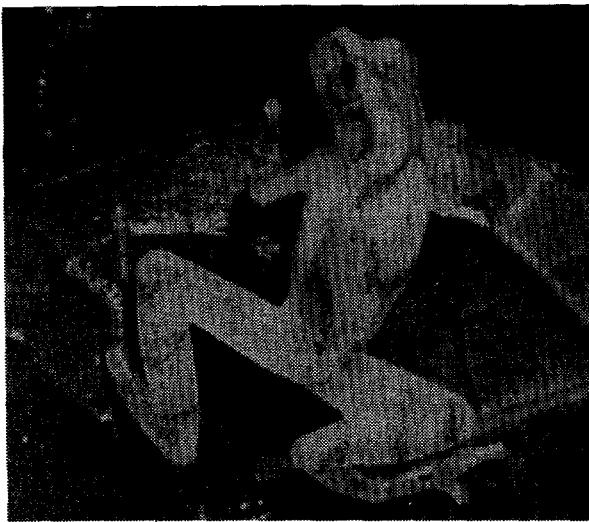
For further information

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Signatories and Parties to the Convention and Protocol (as of July 1997)

Algeria	El Salvador	Liechtenstein	St. Vincent and the Grenadines
Antigua and Barbuda	Equatorial Guinea (np/m)	Lithuania	Samoa
Argentina	Estonia	Luxembourg	Saudi Arabia
Australia	Ethiopia	Macedonia, former Yugoslav Rep. of	Senegal
Austria	European Community (w)	Madagascar	Seychelles
Azerbaijan	Fiji	Malawi	Singapore
Bahamas	Finland (w)	Malaysia	Slovakia
Bahrain (w)	France	Maldives	Slovenia
Bangladesh	Gabon	Mali	Solomon Islands
Barbados	Gambia	Malta	South Africa
Belarus	Georgia	Marshall Islands	Spain
Belgium	Germany	Mauritania	Sri Lanka
Belize (np/m)	Ghana	Mauritius	Sudan
Benin	Greece	Mexico	Swaziland
Bolivia	Grenada	Micronesia, Federated States of	Sweden (w)
Bosnia and Herzegovina	Guatemala	Moldova	Switzerland
Botswana	Guinea	Monaco	Syrian Arab Rep.
Brazil	Guyana	Mongolia	Tajikistan (np/m)
Brunei Darusalam	Honduras	Morocco	Tanzania
Bulgaria	Hungary	Mozambique	Thailand
Burkina Faso	Iceland	Myanmar	Togo
Burundi	India	Namibia	Trinidad and Tobago
Cameroon	Indonesia	Nepal	Tunisia
Canada	Iran, Islamic Rep. of	Netherlands (w)	Turkey
Cent. Afr. Rep.	Ireland	New Zealand	Turkmenistan
Chad	Israel	Nicaragua	Tuvalu
Chile	Italy	Niger	Uganda
China	Jamaica	Nigeria	Ukraine
Colombia	Japan	Norway (w)	United Arab Emirates
Comoros	Jordan	Pakistan	United Kingdom
Congo, Dem. Rep. of	Kenya	Panama	United States
Congo, Rep. of	Kiribati	Papua New Guinea	Uruguay
Costa Rica	Korea, Dem. People's Rep. of	Paraguay	Uzbekistan
Côte d'Ivoire	Korea, Rep. of	Peru	Vanuatu
Croatia	Kuwait	Philippines	Venezuela
Cuba	Latvia	Poland	Vietnam
Cyprus	Lebanon	Portugal	Yemen, Rep. of
Czech	Lesotho	Qatar	Yugoslavia, Fed. Rep. of (Serbia / Montenegro)
Denmark	Liberia	Romania	Zambia
Dominica	Libya	Russian Federation	Zimbabwe
Dominican Rep.		St. Kitts and Nevis	
Ecuador		St. Lucia	
Egypt, Arab Rep. of			

Note: no abbreviation = ratification; np/m = is a Party to the Vienna Convention but not to the Montreal Protocol;
w = with declaration or understanding.



The Earth's biological resources, and the life support systems they sustain, are vital to the physical, social, and economic survival of humankind. At the same time that there is growing recognition of the tremendous importance of biological diversity to present and future generations, biodiversity is coming under increasing pressure in many parts of the world.

"Biodiversity" is an umbrella term that describes both the number and variability of living organisms. It can be defined as genetic diversity, species diversity, and ecosystem diversity. Genetic diversity refers to the variability within a species, such as corn, rice, or tigers, and to the sum of genetic information contained in the genes of individual plants, animals, and micro-organisms. Species diversity refers to the variety and distinctiveness among species, with emphasis on species that are unique or endemic to certain ecosystems or countries. The number of species on Earth has been variously estimated to be between 10 and 100 million, although to date, only 1.7 million species have been described. Ecosystem diversity refers to the variety of habitats, biotic communities, and ecological processes in the biosphere. Biodiversity can be maintained *in situ*, whereby species are conserved within natural habitats, including protected areas, or *ex situ*, whereby they are preserved in zoos, arboreta, or botanical gardens, or in the form of germplasm in genebanks.

The main threats to species are habitat loss and fragmentation, overhunting and overhar-

Biological Diversity

vesting, secondary extinctions due to abundance or absence of other species, pollution, and the introduction of alien species. Climate change may become a major threat in the next century and has already been suggested as a cause of the decline in certain amphibian populations. Species losses are occurring globally, from tropical forests, which include 50 percent of all identified terrestrial species, to rivers and lakes, mountains, and islands. According to recent estimates based on current rates of deforestation, between 2 percent and 8 percent of the Earth's species will disappear over the next twenty-five years.

International Legal Regime

Because the distribution of biological resources transcends political boundaries, the preservation of biodiversity requires global cooperation. Concern over species loss and growing global commitment to sustainable development led to preparation of the international Convention on Biological Diversity (CBD) under the auspices of the United Nations Environment Programme (UNEP). The Convention was signed at the Earth Summit in Rio de Janeiro in June 1992 and entered into force in 1993. There are 184 Signatories and 169 Parties to the Convention.

The Convention promotes a renewed partnership among nations through scientific and technical cooperation, access to financial and genetic resources, and transfer of ecologically sound technologies. Its main objectives are the conser-

vation of biological diversity, the sustainable use of its components, and the equitable sharing of the benefits of the use of genetic resources. Although several other international agreements and protocols address biodiversity issues (see Endangered Species and Wetlands), the CBD is the first to address all aspects of biological diversity: genetic resources, species, and ecosystems. The CBD recognizes for the first time that the conservation of biological diversity is a common concern for humankind and an integral part of development.

The preamble establishes baseline premises and concerns. Notably, it states that "where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat." This is known as the Precautionary Principle.

Many of the regions of highest biodiversity lie in tropical developing countries, which have been the least studied and often lack adequate scientific capacity and resources to protect these precious resources. The Convention articulates the "urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures."

Balancing Rights and Obligations

The Convention calls for the "fair and equitable sharing of the benefits arising out of the utilization of genetic resources." At the same time, it affirms the "sovereign right" of nations to "exploit their own resources pursuant to their own environmental policies." The Convention tries to mediate the conflicting implications of these statements through a variety of measures. It calls on all nations to identify and monitor components of biodiversity and to integrate "consideration of the conservation and sustainable use of biological resources into national decision-making." The Convention also calls on the Parties to take into account the special needs of developing countries.

The CBD is the first international legal instrument to spell out the rights and obligations of its Parties concerning scientific, technical, and

technological cooperation. To this end, it provides for a financial mechanism and a Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA).

Financing the Convention

While the CBD acknowledges that new and additional resources will be needed to meet global biodiversity objectives, it clarifies that, for developing countries, "economic and social development and eradication of poverty are the first and overriding priorities." It also states that "the extent to which developing country Parties will effectively implement their commitments" will depend on how the developed countries meet their commitments "related to financial resources and transfer of technology."

The Convention also lays out criteria for selecting a financing mechanism. The Global Environment Facility (GEF) is the interim financing mechanism. The GEF has an Operational Strategy for Biodiversity, providing funding for biodiversity projects in four ecosystems: semi-arid and arid; coastal, marine, and freshwater; forest; and mountain. Land degradation issues, preparation of national action plans, and short-term emergency actions for threatened species also can be funded through GEF.

Science

Science contributes to knowledge of biodiversity at all three levels—ecosystem, species, and genes—and to understanding the complex interlinkages between species and ecosystem health. It also provides the knowledge and tools for biodiversity management, conservation, and sustainable use. Specific articles of the CBD relate to the need for biological assessment, inventory, and monitoring (Article 7); research and training (Article 12); impact assessment (Article 14); and technical and scientific cooperation (Article 18).

Unlike other environmental treaties such as the Convention on Climate Change, no formal scientific assessment was carried out prior to negotiation of the CBD. Subsequently, UNEP, with

GEF resources, prepared the Global Biodiversity Assessment (GBA), an expert review involving 1,500 scientists worldwide. This assessment of relevant biological, economic, and social issues provides a useful baseline review of current biodiversity knowledge, issues, and theories. It also identifies key needs for further research, training, and information management to develop tools for conservation and sustainable use that will address human needs while maintaining a healthy environment.

In addition to the GBA, scientists are collaborating internationally on biodiversity research, expertise, and information exchange in sectors as diverse as agriculture, forestry, fisheries, marine science, and health, all of which depend on natural ecosystems and the environmental functions they protect. In addition, global initiatives are being established to monitor terrestrial habitat degradation and loss and coral reefs.

The emergence of biotechnology and better techniques for preservation and handling of biological materials and germplasm is enabling science to make a major contribution to new products and processes with significant medical and agricultural potential. Scientific investigations and understanding of key ecological processes are also enabling the development of tools for biological control of pests and waste.

Economics

Biological resources provide many kinds of goods and services. The resources that are consumed to meet human needs, such as timber, fish, or medicinal plants, have the most obvious kind of economic value. Those not consumed may also possess value. Examples include nature preserves that promote recreation, tourism, or education. Biological resources can also possess indirect economic value. Examples include watersheds that provide clean water, wetlands that promote fisheries and prevent floods, forests that conserve soil and enrich its productivity through nutrient cycling, habitats that support pollinators, and predators of pests that destroy agricultural crops. Another type, quasi-option value, refers to value that may be realized in the future, such as a scientific discovery made with germplasm.

Biological resources also have what might be called passive economic value. One form is the amount of money that people are willing to pay (or forego) so that others may have access to biological resources such as clean water. A second form includes what people wish to leave to future generations, while a third is what economists call existence value: the value that people attach to knowing that a species, such as polar bears, exists even if they never actually see one.

Economists are concerned about biodiversity precisely because market prices are unreliable indicators of social and environmental costs. For instance, watershed services and supply of a regular supply of clean water are often perceived as free goods. Recent estimates to put a value on global ecological services have proposed a figure in the region of US\$33 trillion per year, well above the value of total global economic output. Even though these figures are highly speculative, they demonstrate the valuable role that biodiversity plays in providing the ecological services that underpin human existence and livelihoods.

In recognition of the importance of integrating economic tools in the effort to preserve biodiversity, Article 11 of the CBD states that Parties should adopt "incentives for the conservation and sustainable use of components of biological diversity." One of the better known incentives to preserve biodiversity is the debt-for-nature swap. Under such swaps, part of the international debt of developing countries is forgiven or purchased in exchange for an agreement to reserve land for a conservation area. The use of easements or tax breaks for not developing land is another economic tool for achieving biodiversity conservation goals, as are conservation trust funds.

Reform of economic policies and removal of subsidies and other incentives to unsustainable land use and unsustainable management of agriculture, forests, and natural resources can also be useful tools to promote biodiversity conservation. In Bangladesh, for instance, reduced subsidies on pesticides and fertilizers led to lower chemical use in rice fields, adoption of integrated pest management, maintenance of greater natural biodiversity in the production

landscape, cleaner water, and reduced impact on fisheries in neighboring wetlands.

Law

The CBD emphasizes action at the national level to conserve biodiversity and use it sustainably. Legal measures are critical tools for countries seeking to maintain biodiversity. Such measures can include customary and traditional legal measures, national legislation for protected areas, regulatory actions to control land and species use, and laws for regulating processes and activities detrimental to biodiversity. Legislation is essential to confer jurisdiction and powers on public bodies and communities for conservation; establish and enforce procedures (such as environmental impact assessments); provide for public participation; establish a legal basis for conservation

contracts, easements, and management agreements; and implement obligations under international agreements.

A key biodiversity issue concerns the equitable sharing of benefits arising from the use of genetic resources and the acknowledgment of intellectual property rights for local and traditional knowledge and discoveries. Where possible, the Convention says that nations that possess specific genetic resources should be able to participate in research projects that involve those resources. To further protect the interests of developing countries, the Convention calls for "access to and transfer of technology" but states that such a process must be subject to patent law and intellectual property rights. These issues need to be resolved both at the national and international level and will be debated further at the Fourth Conference of the Parties in Bratislava in 1998.

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Albania	Egypt, Arab Rep. of	Libya (np)	
Algeria	El Salvador	Liechtenstein (np)	Samoa
Angola (np)	Equatorial Guinea	Lithuania	San Marino
Antigua and Barbuda	Eritrea	Luxembourg	Saõ Tomé and Príncipe (np)
Argentina (w)	Estonia	Madagascar	Senegal
Armenia	Ethiopia	Malawi	Seychelles
Australia	European Community (w)	Malaysia	Sierra Leone
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Azerbaijan (np)	Finland	Mali	Slovak Rep.
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Bangladesh	Gambia	Mauritania	South Africa
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Botswana	Guinea-Bissau	Mozambique	Syrian Arab Rep. (w)
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Burundi	Hungary	Nepal	Trinidad and Tobago
Cambodia	Iceland	Netherlands	Tunisia
Cameroon	India	New Zealand	Turkey
Canada	Indonesia	Nicaragua	Turkmenistan
Cape Verde	Iran, Islamic Rep. of	Niue	Tuvalu (np)
Cent. Afr. Rep.	Ireland (w)	Niger	Uganda
Chad	Israel	Nigeria	Ukraine
Chile (w)	Italy (w)	Norway	United Arab Emirates (np)
China	Jamaica	Oman	United Kingdom (w)
Colombia	Japan	Pakistan	United States (np)
Comoros	Jordan	Panama	Uruguay
Congo, Rep. of	Kazakhstan	Papua New Guinea (w)	Uzbekistan
Congo, Dem. Rep. of	Kenya	Paraguay	Vanuatu
Cook Islands	Kiribati	Peru	Venezuela
Costa Rica	Korea, Dem. People's Rep. of	Philippines	Vietnam
Côte d'Ivoire	Korea, Rep. of	Poland	Yemen, Rep. of
Croatia	Kuwait (np)	Portugal	Yugoslavia, Federal Rep. of (Serbia/Montenegro) (np)
Cuba (w)	Kyrgyz Rep.	Qatar	Zambia
Cyprus	Lao People's Dem. Rep.	Romania	Zimbabwe
Czech	Latvia (w)	Russian Federation	
Denmark	Lebanon	Rwanda	
Djibouti	Lesotho	St. Kitts and Nevis	
Dominica		St. Lucia	
Dominican Rep.			

Note: no abbreviation = ratification; np = not currently a Party; w = with declaration or understanding.



Of the major environmental issues that confront the world community, the size and condition of forests has the greatest impact on all the others. Forests contain the largest share of the Earth's biodiversity, and they are also the most important terrestrial sink for carbon, thus making them important in the effort to stem climate change. Forests also play a key role in dryland regions, where they help prevent soil and wind erosion as well as store moisture. Finally, because they regulate most of the Earth's watersheds, forests help ensure the availability of fresh water for sanitation and agriculture.

In many parts of the world, forests have been cut down or altered in ways that endanger global ecosystems. Historically, the greatest transformation of the forest environment has occurred in temperate, developed countries. More recently, this process has been occurring in tropical, developing countries in which logging interests are aggressively harvesting the hardwoods that typically grow in hot and humid climates and forests are being converted for agricultural use.

International Legal Regime

In recognition of the importance of forests to global ecosystems, extensive preparatory efforts were undertaken before the 1992 Rio Earth Summit to negotiate an international convention on

Forests

forests. However, because many outstanding issues could not be resolved, there is no binding international agreement on forests. In lieu of an agreement, negotiators included in Agenda 21 a chapter entitled "Combating Deforestation." They also agreed to a more wide-ranging document entitled "Forest Principles" or the "Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests." The Forest Principles were annexed to Agenda 21.

Forest Principles

Acknowledging that international forest law is evolving, the preamble to the Principles speaks of a "first global consensus on forests" and states that countries have "decided to keep [the Principles] under assessment for their adequacy with regard to further international cooperation on forest issues." Because certain countries were concerned that their forest policies were being singled out for implicit criticism, the preamble also states that "these [P]rinciples should apply to all types of forests, both natural and planted, in all geographic regions and climatic zones, including austral, boreal, subtemperate, temperate, subtropical and tropical."

In recognition of the varied, often conflicting values that forests possess, the Principles make several references to cost-benefit analysis. The

document states that "decisions taken on management, conservation, and sustainable development of forest resources should benefit, to the extent practicable, from a comprehensive assessment of economic and noneconomic values of forest goods and services and of the environmental costs and benefits. The development and improvement of methodologies for such evaluations should be promoted."

Because forests have important links with international trade and macroeconomic conditions, the Principles also make reference to the role of the international community in forest management. The document states that "the efforts of developing countries to strengthen the management, conservation and sustainable development of their forest resources should be supported by the international community, taking into account the importance of redressing external indebtedness, particularly where aggravated by the net transfer of resources to developed countries, as well as the problem of achieving at least the replacement value of forests through improved market access for forest products, especially processed products." The Principles also state that "new and additional financial resources should be provided to developing countries."

International Tropical Timber Agreement

Almost a decade before the Rio Earth Summit, the International Tropical Timber Organization (ITTO), comprising producers and consumers of tropical timber, signed the International Tropical Timber Agreement (ITTA). First negotiated in 1983, the Agreement was renegotiated and extended for five years in 1994. Its central objective is to promote the sustainable production of tropical timber. The organization's goal is to ensure that by the year 2000 all tropical timber that entering world markets will be harvested from sustainable sources.

Under the Agreement, Parties have committed themselves to support a Special Account and

the Bali Partnership Fund, whose purpose is to finance projects that promote sustainable production. In allocating resources for the Bali Fund, the Agreement states that members should "take into account ... the special needs of members whose forestry sectors' contribution to their economies is adversely affected by the implementation of the strategy for achieving the exports of tropical timber and timber products from sustainability managed sources by the year 2000."

Another purpose of the ITTO is to improve information relating to the tropical timber industry. It has established a variety of guidelines and criteria on tropical forests. These include guidelines for the sustainable management of natural and planted tropical forests, criteria for the measurement of sustainable tropical forest management, and guidelines on the conservation of biological diversity in tropical production forests.

Intergovernmental Panel on Forests

Another international initiative aimed at improving forestry management was the "Open-ended Ad Hoc Intergovernmental Panel on Forests (IPF)."^{*} In contrast with the Forest Principles and their emphasis on global similarities, this initiative acknowledged the differences among countries and regions. According to the report on the Third Session of the IPF, the process was designed "to encourage national implementation of criteria and indicators for sustainable forest management." The IPF report states that international efforts to establish such criteria and indicators should take into account "the specific regional and subregional conditions of forests and the diversity of economic, social and cultural environments."

To implement the goals of the IPF, a number of regional efforts were initiated. These were the Helsinki Process (European countries), the Montreal Process (other countries with temper-

* This panel, initiated by the UN Commission on Sustainable Development (CSD), ended earlier in 1997. A proposal to extend and reformulate the panel as the Intergovernmental Forum on Forests was under discussion at the time of printing.

ate or boreal forests), the Tarapoto Proposal (tropical South American countries), the Lepaterique Process in Central America, the Dry-Zone Africa Process, and the Near East Process. All of these efforts are intended to increase the sustainable forestry knowledge base. Ultimately, the knowledge gained could provide the basis for an international convention on forests, or, at the least, improved international coordination in sustainable forest management.

Science

Among the many scientific issues surrounding forests, one that stands out is the need to better understand the natural ecology of tropical forests. Unlike many temperate or particularly boreal forests, where the number of different tree species may be relatively limited, tropical forests usually contain a great number of species. This variety poses particular challenges for sustainable forestry. By its very nature, agriculture represents a conscious decision to limit biodiversity, with the expectation that economies of scale can thereby be achieved. If, however, the vitality of a forested area depends on the diverse interaction of many species, sustainable logging techniques will be harder to design. In recognition of these concerns, the ITTO has stated that it may take years to determine the logging capacity of tropical forests. The ITTO bases its caution on the need to wait until several tree rotations have been harvested, so that the secondary effects of such harvesting can be properly understood.

Economics

Consensus is widespread that forests are undervalued. Much attention has been paid to techniques that correct for these distortions. By themselves, efforts to calculate more accurate values are not a panacea and must be viewed within the context of political realities, but they are a crucial first step on the path to sustainable forest management. In particular, they establish

the economic justification for more efficient tax and incentive policies, international investment programs, and forest preservation.

Many techniques can be used to arrive at more accurate valuation of forests. One technique looks at nontimber forest products that could be harvested if local communities were made aware of potential markets. Some studies have shown that the value of these products could be substantial. Another technique looks at the economic value of the ecological functions of forests. For example, a wooded area that stems soil erosion could be valued at the level of monetary damage that siltation would cause in an irrigation system. Because of the costs that climate change would impose, forests can also be valued as a function of how much carbon they sequester and thus keep out of the atmosphere. Another technique uses the costs that people are willing to travel to obtain a certain good. The price that people pay for ecotourism, for example, can be used to estimate the value of a particular recreation site. Opportunity costs can also be used to value forest goods, such as firewood, when extensive labor is involved in collecting the wood. Another technique to value forests might look at the relocation expenses of moving indigenous peoples displaced by encroaching pastureland. Substitute goods are another means of valuing forest products. The value of market-traded fruit, for example, can be used to measure the value of nontraded fruit.

Law

To encourage sustainable forest management, broad interest has been expressed in establishing a system of timber certification or ecolabeling. Certification is typically undertaken by third-party organizations that have no self-interest in a specific forest activity, are not stakeholders in the forests being certified, and can assure the public of professional judgment. Ecolabeling criteria can include analyses of forest inventory, management planning, silvicultural

ture, harvesting, and road construction. Other criteria can include determinations of whether the rights of workers, local communities, and

indigenous peoples are protected. Currently, the best example of certification is the Forest Stewardship Council (FSC).

For further information

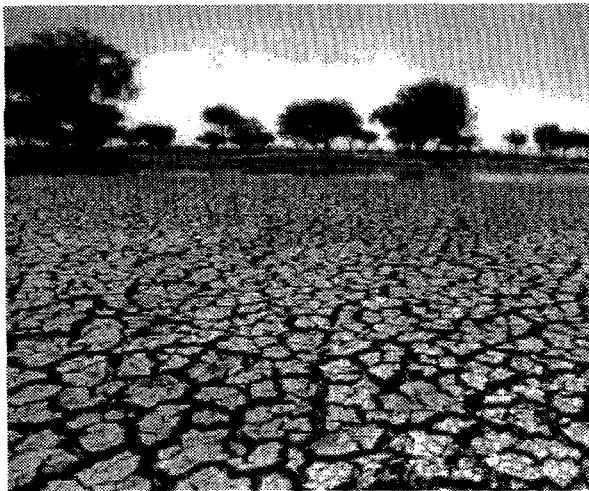
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Brazil	Malaysia	Algeria	Japan
Cameroon	Mexico	Australia	Korea, Rep. of
Colombia	Myanmar	Austria	Luxembourg
Congo, Dem. Rep. of	Panama	Bahrain	Nepal
Congo, Rep. of	Papua New Guinea	Belgium	Netherlands
Costa Rica	Paraguay	Bulgaria	New Zealand
Côte d'Ivoire	Peru	Canada	Norway
Dominican Rep.	Philippines	Chile	Portugal
Ecuador	Tanzania	China	Russian Federation
El Salvador	Thailand	Denmark	Slovakia
Equatorial Guinea	Togo	Egypt, Arab Rep. of	Spain
Gabon	Trinidad and Tobago	European Community	Sweden
Ghana	Venezuela	Finland	Switzerland
Guyana		France	United Kingdom
Honduras		Germany	United States
India		Greece	

Intergovernmental Panel on Forests

Helsinki Process	Russian Federation	Lepaterique Process	Mauritius
Albania	Slovak Rep.	Belize	Mozambique
Austria	Slovenia	Costa Rica	Namibia
Belarus	Spain	El Salvador	South Africa
Belgium	Sweden	Guatemala	Swaziland
Bosnia and Herzegovina	Switzerland	Honduras	Tanzania
Bulgaria	Turkey	Nicaragua	Zambia
Croatia	Ukraine	Panama	Zimbabwe
Czech	United Kingdom	Dry-Zone Africa Process	Near East Process
Denmark	Montreal Process	(by region)	Afghanistan
Estonia	Argentina	Burkina Faso	Cyprus
European Community	Australia	Cape Verde	Egypt
Finland	Canada	Chad	Ethiopia
France	Chile	Gambia	Iran, Islamic Rep. of
Germany	China	Guinea Bissau	Iraq
Greece	Japan	Mali	Jordan
Hungary	Korea, Rep. of	Mauritania	Kuwait
Iceland	Mexico	Niger	Lebanon
Ireland	New Zealand	Senegal	Libya
Italy	Russia	Djibouti	Pakistan
Latvia	Uruguay	Eritrea	Qatar
Liechtenstein	United States	Ehtiopia	Saudi Arabia
Lithuania	Tarapoto Proposal	Kenya	Somalia
Luxembourg	Bolivia	Somalia	Sudan
Malta	Brazil	Sudan	Syria
Moldova	Colombia	Uganda	Tunisia
Monaco	Ecuador	Angola	Turkey
Netherlands	Guyana	Botswana	United Arab Emirates
Norway	Peru	Lesotho	Yemen, Rep. of
Poland	Suriname	Malawi	
Portugal	Venezuela		
Romania			



Numerous factors including unsustainable agriculture, deforestation, and changes in settlement patterns are endangering drylands throughout the world. Unchecked, these factors cause desertification (a term often used interchangeably with land degradation) in the form of soil erosion, compaction, and salinization. Loss of vegetative cover is often widespread. For people in drylands, the consequences are likely to be poverty and famine, while for ecosystems, desertification can contribute to biodiversity loss and climate change.

Drylands cover 40 percent of the Earth's terrestrial surface and may be defined as regions in which the average amount of water that falls as precipitation is significantly less than what evaporates from the land or plants. There are four categories of drylands: hyperarid, arid, semiarid, and dry subhumid. Hyperarid regions include the true deserts, such as the Sahara in Africa or the Atacama in Chile. The productive capacity of these lands is extremely limited, except where rivers flow or underground water is available. Arid regions can support grazing, while semiarid regions, although primarily pastoral, can also support rainfed agriculture in wetter sections. Dry subhumid zones will support woodlands and are used for intensive agriculture along with livestock production.

What constitutes desertification has been a subject of discussion over the years. In the past, it was defined as "the diminution or destruction of the biological potential of the land, lead-

Desertification/Drylands

ing ultimately to desert-like conditions." More recently, a definition has been adopted that acknowledges greater variability in the condition of drylands. Under this definition, desertification is considered "land degradation in arid, semi-arid and dry subhumid areas resulting from various factors, including climatic variations and human activities."

Currently, many of the drylands in the world are degraded. Although there is debate about the reliability of the data, it has been estimated that three-fourths of the arid land used for grazing in the world is degraded to a moderate or greater degree, primarily through the loss of vegetative cover. It has also been estimated that one-half of the cropland located in semiarid or dry subhumid regions is degraded, primarily through soil and wind erosion. Lastly, one-third of all irrigated land is estimated to be degraded through salinization.

International Legal Regime

Efforts to respond to drought and desertification lend themselves to a multilateral approach, because rarely are the consequences confined to one country. Dry spells frequently lead to transboundary migration, and in many instances, international emergency relief is necessary to help those afflicted. The United Nations Convention to Combat Desertification (CCD), which carries the subtitle, "In those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa," is the

most comprehensive approach designed to reduce desertification. The CCD was opened for signature in October 1994 and entered into force in December 1996, replacing an earlier UN effort launched in 1977. There are 106 Parties and 115 Signatories to the Convention.

Unlike certain environmental issues for which the need for concerted global action has only recently been recognized, the need to respond to the threat of desertification has long been acknowledged. The earlier UN effort, for example, came in response to the drought in the African Sahel in the 1970s. Long before that, the famous 1930s dust bowl in the United States demonstrated the need to adapt agricultural methods to local climate and soil conditions. For these reasons, the CCD puts less emphasis on the need for action, which is understood, and instead establishes guidelines on how countries can pursue their efforts with the maximum likelihood of success.

Participation and Cooperation

Article 3 of the Convention, entitled "Principles," emphasizes the importance that negotiators placed on creating an integrated and democratic framework for combating desertification. It first states that the "Parties should ensure that decisions on the design and implementation of programmes ... are taken with the participation of populations and local communities." It also states that "Parties should ... improve cooperation and coordination at sub-regional, regional and international levels." Finally, "the Parties should develop, in a spirit of partnership, cooperation among all levels of government, communities, nongovernmental organizations and landholders."

The themes of participation and cooperation are meant to build on lessons learned from the earlier regime designed to combat desertification. Negotiators believed that in too many cases, competing approaches and interests had prevented donors and beneficiaries from creating effective partnerships. Moreover, they believed that the people who live on drylands and are often the most knowledgeable about them

were not adequately consulted in relation to programs and policies. Under the CCD, national action programs will be drawn up that commit nations to agreed approaches and that rely on community participation in planning and implementation.

The CCD is unusual among recent environmental agreements in that it does not create a new financial mechanism to support its activities. Rather, the Convention establishes a "Global Mechanism," whose mandate is "to increase the effectiveness of existing financial mechanisms." However, as with many other international agreements, the Convention does call for "new and additional funding."

Focusing Concern

Although drylands and deserts exist on all continents except Antarctica, including much of the western United States, the Convention focuses on the impoverished regions of the world. Its subtitle highlights desertification in Africa, while the text refers to "the particularly tragic consequences of these phenomena in Africa." The CCD also expresses "concern over the impact of desertification and drought on affected countries in Central Asia and the Transcaucasus." Regional annexes to the Convention outline the need to also combat desertification in Latin America and the Caribbean and in the Northern Mediterranean. Lastly, the Convention states that "desertification and drought affect sustainable development through their interrelationships with important social problems such as poverty, poor health, and nutrition, [and] lack of food security."

Biodiversity and Climate Change

Because desertification is likely to cause the loss of biodiversity and because the destruction of vegetation and woodlands increases carbon dioxide, a greenhouse gas, the CCD also calls on nations to coordinate activities as they relate to the Convention on Biological Diversity (see Biological Diversity) and the Framework Convention on Climate Change (see Climate Change).

Science

Desertification has generated significant scientific debate. One issue has been whether desert-like areas, notably in Africa, are advancing inexorably or whether observed changes are better explained by normal variations in climate. More generally, there is debate as to the nature of less severe forms of land degradation. In both cases, it will be important to expand the data base to pinpoint the areas most affected while determining where intervention can be most effective.

Biotechnology will play a key role in the effort to combat desertification. In response to harsh conditions, plants and animals in drylands typically exhibit unusual genetic traits. Scientists already have been able to use such traits to develop crops that are more resistant to drought. At the same time, harsh conditions have generally limited the range of biodiversity in drylands, making them particularly vulnerable to biodiversity loss and extinction. The result is a scientific race against time to map biodiversity in dryland regions. The sooner science unlocks the value of genetic resources in drylands, the greater will be the incentive to preserve those resources. This will help forestall biodiversity loss, while also encouraging efforts to combat desertification.

Economics

Economic tools, particularly cost-benefit analysis, play a critical role in combating desertification by enabling communities to make more efficient use of limited resources in dryland regions. These tools are especially helpful in measuring external costs, which are often beyond the capacity of local populations to discern. For example, soil erosion in the form of river sediment can cause damage hundreds of miles away, and the ill effects of salinization may not show up for many years. Unfortunately, measuring these costs can pose special challenges in regions in which desertification is most acute, such as Africa and Western Asia. In particular, the analysis is made more difficult by prices that have been heavily distorted by taxes and subsidies.

To promote sustainable development in drylands regions, resources and services must be valued more accurately. Necessary reforms include wider imposition of grazing fees for communally held land, cost-recovery for the use of water and animal health services, and elimination of subsidies for fuels and fertilizer. Reductions in price supports for livestock and the abolition of incentives to convert forests into pasture are other needed reforms.

Even as economists emphasize the importance of market signals in promoting sustainable economic activity in drylands, attention has been focused on how policies to promote free trade can have unintended consequences. In certain regions, farmers have engaged in monoculture to respond to high world prices, not recognizing its risks. Far from disproving the importance of market signals, inappropriate use of monoculture demonstrates the need to improve the quality of information in dryland regions, where the margin for error is much less than elsewhere.

Regarding development assistance, further research is necessary to measure the return on investment for projects that are designed to help pastoralists become more productive. Absent such analysis, investment may bypass drylands, and many of the factors causing desertification will not be addressed.

Law

A key legal issue in the effort to combat desertification concerns land tenure in pastoral regions. In the case of farming, consensus is strong that a system of private ownership or secure leases is preferable. However, in the case of pastoralism in arid and semi-arid regions, the issue is more complicated. Pastoralists in these regions need considerable flexibility of movement to deal with climatic stress. This does not imply complete freedom of access, however, and under traditional communal systems, complex rules and regulations evolved to ensure that resources were managed efficiently and sustainably. Unfortunately, many of these systems have been undermined-sometimes delib-

erately. A key reform aimed at rectifying past errors, while permitting pastoralists to respond to changing social and economic conditions, is the restoration of local authority and responsibility

in the management of common resources. The encouragement of such efforts, in combination with proper incentives, can lead to more sustainable resource use in dryland regions.

For further information

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Angola	Djibouti	Kuwait (w)	Rwanda (np)
Antigua and Barbuda	Ecuador	Lao People's Democratic Rep.	St. Kitts and Nevis
Argentina	Egypt, Arab Rep. of	Lebanon	St. Lucia
Armenia	El Salvador	Lesotho	St. Vincent and the Grenadines
Australia (np)	Equatorial Guinea	Libya	(np)
Austria (w)	Eritrea	Luxembourg	São Tomé and Príncipe (np)
Bahrain	Ethiopia	Malaysia	Saudi Arabia
Bangladesh	European Community (np)	Madagascar	Senegal
Barbados	Finland	Malawi	Seychelles
Belgium	France	Mali	Sierra Leone (np)
Benin	Gabon	Malta (np)	South Africa (np)
Bolivia	Gambia	Mauritania	Spain
Botswana	Georgia (np)	Mauritius	Sudan
Brazil	Germany	Mexico	Swaziland
Burkina Faso	Ghana	Micronesia, Federated States of	Sweden
Burundi	Greece	Mongolia	Switzerland
Cambodia (np)	Grenada	Morocco	Syrian Arab Rep.
Cameroon	Guinea	Mozambique	Tajikistan
Canada	Guinea-Bissau	Myanmar	Tanzania
Cape Verde	Guyana	Namibia	Togo
Cent. Afr. Rep.	Haiti	Nepal	Tunisia
Chad	Honduras	Netherlands (w)	Turkey (np)
Chile (np)	Iceland	Nicaragua (np)	Turkmenistan
China	India	Niger	Uganda
Colombia (np)	Indonesia (np)	Nigeria	United Kingdom
Comoros (np)	Iran, Islamic Rep. of	Norway	United States (np)
Congo, Dem. Rep. of (np)	Ireland (np)	Israel	Uzbekistan
Congo, Rep. of (np)	Italy	Oman	Vanuatu (np)
Costa Rica (np)	Japan (np)	Pakistan	Yemen, Rep. of
Côte d'Ivoire	Jordan	Panama	Zambia
Croatia (np)	Kazakstan	Paraguay	Zimbabwe (np)
Cuba		Peru	

Note: no abbreviation = ratification; np = not currently a Party; w = with declaration or understanding.



Before scientists and environmentalists began to sound the alarm about the loss of biodiversity, their attention was focused on endangered species. Their earlier efforts were responding to mounting evidence that many of the world's magnificent forms of wildlife were threatened with extinction. Contributing factors included habitat loss, wider availability of powerful weapons, and improvements in transportation that connected formerly remote areas with world markets. In many instances, the wildlife that most caught the public eye was being hunted for use as luxury goods, such as alligator handbags or leopard skin coats.

International Legal Regime

To protect global wildlife, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was opened for signature in 1973 and entered into force in 1975. CITES has 56 Signatories and 139 Parties. These countries act by banning commercial international trade in an agreed list of endangered species and by regulating and monitoring trade in others that might become endangered.

CITES' most obvious characteristic is that it seeks to prevent species' extinction primarily through international trade regulation, not just through domestic measures. Although species' destruction has often occurred for reasons quite apart from international trade and the Convention recognizes "that peoples and States are and

Endangered Species

should be the best protectors of their own wild fauna and flora," there are practical reasons to emphasize trade in the Convention. In particular, many animals threatened with extinction were being hunted or (in the case of tropical birds) captured for sale abroad. Furthermore, at this early stage in environmental law, it was easier to amend an existing customs regime than to achieve consensus on changes in domestic law.

Another noteworthy characteristic is that CITES largely invokes qualitative reasons for taking action. The first paragraph of the Convention states that "wild fauna and flora in their many beautiful and varied forms are an irreplaceable part of the natural systems of the earth which must be protected for this and the generations to come." The second paragraph includes the words "aesthetic" and "recreational" to describe the value of wild fauna and flora. This emphasis stands in contrast to some environmental agreements that focus on the threat to public health from chemical pollution, or the social and economic costs of unsustainable resource use.

Listing Endangered Species

The Convention lists all species that are endangered or could become endangered in three separate appendices, according to the severity of the extinction threat:

Appendix I. Includes all species threatened with extinction that are or may be affected by

trade. Currently, Appendix I lists 830 species, most of which are birds, mammals, and plants.

Appendix II. Includes all species that may become threatened with extinction unless trade is strictly regulated. It also covers species that are similar in appearance to endangered species and must therefore be regulated to ensure that efforts to protect endangered species are effective. Currently, Appendix II lists close to 30,000 species, most of which are plants.

Appendix III. Includes all species that any Party identifies as being subject to regulation within its jurisdiction for the purpose of preventing or restricting exploitation. The cooperation of other Parties is, therefore, needed. Currently, Appendix III lists 229 species.

CITES recognizes that amendments need to be made to the appendices on a regular basis. For Appendices I and II, amendments to add or subtract a listing require a two-thirds majority of Parties participating at a meeting of the Conference of the Parties. For Appendix III, a Party may make an amendment adding or subtracting a listing whenever it chooses. A Party may also enter an exception, or reservation, with respect to any of the species listed in Appendix III whenever it chooses.

Regulation and Enforcement

To control trade in endangered species, the Convention establishes a system of permits. Any specimen that is listed in the first two appendices must be accompanied by an export and import permit when it enters the importing country. For marine species, the responsibility to enforce the law rests with the State of introduction. Specimens listed on Appendix III must be accompanied by an export permit alone. Without the correct permits, the specimen is considered illegal and must be returned to the exporting country.

The criteria for granting permits vary according to the appendix. Under Appendix I, a Scientific Authority and a Management Authority of the State of Export (as so designated) must advise that export will not be "detrimental to the survival of that species" and that the species was not taken illegally. An import permit shall only be granted when the Management Author-

ity of the State of Import is satisfied that the specimen is not to be used for "primarily commercial purposes."

Appendix II states that permits should not be granted in cases in which the designated scientific authority determines that trade should be controlled to maintain the species "well above the level at which that species might become eligible for inclusion in Appendix I." Under Appendix III, permits are granted on a relatively routine basis.

To facilitate enforcement, the Convention states that countries should "penalize trade in, or possession of, such specimens, or both; and to provide for the confiscation or return to the State of export of such specimens." The return of specimens shall be done at the expense of the State of Export.

Nongovernmental Organizations

CITES makes special provision for the participation by interested parties, including non-governmental organizations, in meetings of the Conference. These groups shall be admitted unless at least one-third of the Parties present object.

Science

As concern has intensified in recent years about the threat of species extinction, much discussion has focused on the number of species that exist. Among higher taxa of species, scientists catalogue more than 13,000 species of mammals and birds; more than 30,000 species of reptiles, amphibians, and fish; and approximately 25,000 species of flowering plants. For all forms of life, including those not catalogued, the figures are much less certain, with one widely quoted estimate ranging between 10 million and 100 million species.

Given the uncertainty that surrounds issues of species extinction, along with the complex interaction among species, conservation efforts are increasingly looking at the broader forces that determine ecological well-being. One conservation approach that holds particular promise in the effort to promote sustainable development is ecosystem management, which makes use of

concepts such as minimal viable population, community ecology, and demography to improve understanding of how ecosystems function. Where appropriate, and given adequate information, such efforts may allow for the conservation of ecosystems and the species that live there while allowing for controlled economic activity.

Science is also improving understanding about the importance of genetic variation within populations as a basic evolutionary force. In fact, maintaining intraspecific genetic variation, and thus evolutionary "potential," is a critical objective of conservation and sustainable development.

Economics

Whereas the Convention on Biological Diversity (see Biological Diversity) pays special attention to the economics of preserving biodiversity, CITES makes scarce reference to these concerns. Yet, clearly, economics is a driving force behind the growing threat of species extinction. The wildlife trade, for example, is a highly lucrative, multi-billion dollar-a-year business that thrives in the face of extensive efforts, including CITES, to stamp it out. Millions of live animals and plants are traded each year to supply the demand for pets and ornamental plants, while products from endangered species, including furs, leather, and timber, continue to cross borders in large quantities.

The reason that CITES does not discuss economic issues, such as the cost of regulation or the use of economic instruments to encourage preservation, may be traceable to the economic theory of species extinction that prevailed in the 1970s at the time of negotiation. According to that theory, species became endangered when their natural growth rate was not adequate to accommodate the economic rents that could be gained by exploiting them. The purpose of CITES was to reduce the price in the marketplace by means of moral suasion and to increase the cost of harvesting by making trade (and per-

haps poaching) illegal. As an explanation for species destruction, this theory accounted for certain key relationships. In particular, endangered species products that fetch a high price in the marketplace clearly encourage exploitation. At the same time, however, it was not clear that outlawing trade in endangered species would necessarily lower prices. Where moral suasion did not work, greater risk might actually cause the price to rise. Moreover, to the degree that species are threatened by habitat conversion, CITES creates no countervailing incentives to promote preservation.

An instructive example of the economic implications of CITES is the case of the vicuña in the Andean mountains. Because CITES banned trade in vicuña wool products, the population of the vicuña has recovered from fewer than 1,000 at its low point to nearly 100,000 today. Lifting the ban on the vicuña trade could create an important source of income for poor Andean communities, especially if the income were used to manage this resource sustainably. Nonetheless, the fear persists that delisting the vicuña would open the way to renewed exploitation and the possibility of future extinction. In such situations, close monitoring and regulation as well as appropriate property regimes are necessary to ensure that these formerly endangered species are harvested sustainably.

Law

An interesting legal case that addresses the issue of endangered species in an international context is currently being argued before the WTO. The case was brought by several shrimp-exporting nations against the United States for imposing an embargo on shrimp caught with nets that do not have special devices to protect sea turtles. The U.S. action, which was only taken in response to a federal court order, involves the United States Endangered Species Act, although sea turtles endangered by shrimp fishing are also protected under CITES. The issue in the case is whether the U.S. embargo violates GATT. In a

potentially analogous situation, the 1991/1994 Tuna/Dolphin decisions that involved the U.S. and Mexico, free trade principles prevailed. The ruling in this case, which is expected in Decem-

ber, will provide an indicator of whether environmental considerations may be incorporated to a greater degree than previously in issues surrounding international trade.

For further information

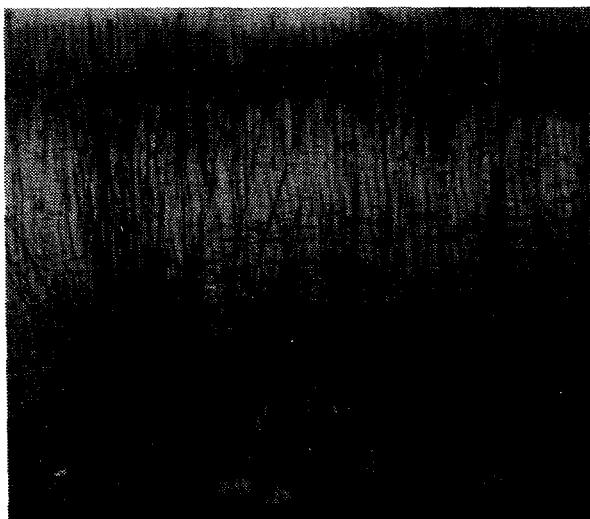
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C.P. 456

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Signatories and Parties to the Convention (as of July 1997)

Afghanistan	Denmark	Latvia	St. Lucia
Algeria	Djibouti	Lesotho (np)	St. Vincent and the Grenadines
Antigua and Barbuda	Dominica	Liberia	Saudi Arabia
Argentina	Dominican Rep.	Liechtenstein	Senegal
Australia	Ecuador	Luxembourg	Seychelles
Austria	Egypt, Arab Rep. of	Madagascar	Sierra Leone
Bahamas	El Salvador	Malawi	Singapore
Bangladesh	Equatorial Guinea	Malaysia	Slovakia
Barbados	Eritrea	Mali	Somalia
Belarus	Estonia	Malta	South Africa
Belgium	Ethiopia	Mauritius	Spain
Belize	Finland	Mexico	Sri Lanka
Benin	France	Monaco	Sudan
Bolivia	Gabon	Mongolia	Suriname
Botswana	Gambia	Morocco	Swaziland
Brazil	Georgia	Mozambique	Sweden
Brunei Darussalam	Germany	Myanmar	Switzerland
Bulgaria	Ghana	Namibia	Tanzania
Burkina Faso	Greece	Nepal	Thailand
Burundi	Guatemala	Netherlands	Togo
Cambodia	Guinea	New Zealand	Trinidad and Tobago
Cameroon	Guinea-Bissau	Nicaragua	Tunisia
Canada	Guyana	Niger	Turkey
Cent. African Rep.	Honduras	Nigeria	Uganda
Chad	Hungary	Norway	United Arab Emirates
Chile	India	Pakistan	United Kingdom
China	Indonesia	Panama	United States
Colombia	Iran, Islamic Rep. of	Papua New Guinea	Uruguay
Comoros	Ireland (np)	Paraguay	Uzbekistan
Congo, Rep. of	Israel	Peru	Vanuatu
Congo, Dem. Rep. of	Italy	Philippines	Venezuela
Costa Rica	Jamaica	Poland	Vietnam
Côte d'Ivoire	Japan	Portugal	Zambia
Cuba	Jordan	Romania	Zimbabwe
Cyprus	Kenya	Russian Federation	
Czech	Korea, Rep. of	Rwanda	
	Kuwait (np)	St. Kitts and Nevis	

Note: no abbreviation = ratification; np = not currently a Party.



It has become widely recognized that wetlands provide multiple economic and environmental benefits and that they are essential for the health, welfare and safety of people who live in or close to them. Throughout much of history, however, wetlands were viewed quite differently, usually considered unproductive and often disease-producing areas that should be avoided, if they could not be drained. As a result, conversion of wetlands often was associated with social and economic progress, and governments played a key role by subsidizing civil engineering projects that channeled or otherwise diverted water from these sensitive ecosystems. The unfortunate consequence is that today many of the world's wetlands have disappeared. It is estimated, for example, that over two-thirds of the wetlands in Europe and approximately half of those in the United States and in Asia have been destroyed. In India and Malaysia, more than half of the mangroves have been cleared, while in Africa and Central and South America, wetlands are also under siege.

Wetlands are the transitional zone between permanently wet and generally dry environments. They exhibit enormous diversity according to their genesis, geographical location, water regime and chemistry, soil or sediment characteristics, and biota. There may be considerable variation within a single wetland, and many different types of wetlands may be found in proximity, forming not just different ecosystems but wholly different landscapes. Classification of wetlands is difficult, partly because of the enor-

Wetlands

mous variety of wetland types and their highly dynamic character and partly because of difficulties in defining precise boundaries. Generally, five major wetland systems are recognized:

1. Marine. Coastal wetlands, including rocky shores and coral reefs
2. Estuarine. Including deltas, tidal marshes, and mangrove swamps
3. Lacustrine. Wetlands associated with lakes
4. Riverine. Wetlands along rivers and streams
5. Palustrine. Meaning "marshy" and including marshes, swamps, and bogs.

International Legal Regime

The Convention on Wetlands of International Importance Especially as Waterfowl Habitat provides the framework for international cooperation for the conservation and wise use of wetlands and their resources. Also known as the Ramsar Convention on Wetlands, it was opened for signature in 1971 and entered into force in 1975. The Convention has 98 Signatories and 101 Parties. Currently, 872 wetland sites, totaling more than 62 million hectares, are designated for inclusion in the Ramsar List of Wetlands of International Importance.

Designating Wetlands

The Convention states that "each contracting party shall designate suitable wetlands within its territory for inclusion in a List of Wetlands

of International Importance." Under the Convention, "the boundaries of each wetland shall be precisely described and also delimited on a map that may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands." These wetlands should be chosen "on account of their international significance in terms of ecology, botany, zoology, limnology, or hydrology. In the first instance, wetlands of international importance to waterfowl at any season should be included."

The Convention also states that "each contracting party shall designate at least one wetland" either when it signs the Convention or when it deposits its instrument of ratification or accession. A country is permitted to delete or restrict the boundaries of a designated wetland on the basis of "urgent national interests."

Planning and Implementation

Once countries have designated wetlands, the Convention states that "the Contracting Parties shall formulate and implement their planning so as to promote the conservation of the wetlands...and as far as possible the wise use of wetlands in their territory." They are also required to inform the bureau in charge of the Convention "if the ecological character of any wetland in its territory and included in the List has changed, is changing or is likely to change as a result of technological developments, pollution or other human interference."

As part of a broader effort to preserve wetlands, the Parties agreed to "promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening." Should a country decide to alter the boundaries of a wetland as part of the 'urgent national interest' exception, the Convention states that it "should as far as possible compensate for any

loss of wetland resources, and in particular it should create additional nature reserves." The Convention also calls on Parties to "encourage research and the exchange of data and publications regarding wetlands and their flora and fauna," and to "promote the training of personnel competent in the fields of wetland research, management and wardening." Parties should also "consult with each other...in the case of a wetland extending over the territories of more than one Contracting Party or where a water system is shared by Contracting Parties."

In 1990 the Parties made an important addition to the Convention when they agreed to establish a financing mechanism, the "Wetlands Conservation Fund," to help developing countries meet their obligations. The fund provides small grants to improve management of designated sites, add new sites, promote wise use, and support regional activities.

To strengthen coordination of the key global treaties on species and habitat preservation, in 1996 the secretariats of the Ramsar Convention, CITES (see Endangered Species), and the Bonn Convention on Migratory Species* signed a Memorandum of Cooperation with the executive secretary of the Convention on Biological Diversity.

Science

Our understanding of the importance of wetlands has improved over the years. Today, it is clear that wetlands are "keystone" ecosystems, which provide crucial economic and ecological benefits. Science has advanced understanding of the important inter-relationships between wetlands and other ecosystems and highlighted the importance of wetlands in global energy and nutrient cycling. Wetlands are among the most productive ecosystems on earth and are critical during different stages of the life-cycles of numerous species.

Science is also helping countries manage and protect wetlands. A key scientific challenge is

* The Convention on Migratory Species has several noteworthy characteristics. For example, it covers many kinds of threats to species, and its requirements vis à vis contracting Parties are notably rigorous. However, it has not attracted a large number of Parties.

the need to establish accurate maps and inventories of them. Satellite imagery and geographic information systems (GIS) promise to speed up the mapping process. Where wetlands have already been degraded, science can help determine the most effective ways of restoring them.

Economics

Wetland benefits can be classified as functions, values, and attributes:

Functions. The interactions of physical, biological, and chemical components of a wetland, such as soils, water, plants and animals, enable the wetland to perform important functions. A few of these functions include water storage; storm protection and flood mitigation; shoreline stabilization and erosion control; groundwater recharge (the movement of water from the wetland down into the underground aquifer); groundwater discharge (the movement of water upward to become surface water in a wetland); water purification; retention of nutrients, sediments, and pollutants; and stabilization of local climate conditions, particularly rainfall and temperature.

Values. Wetlands provide very important economic benefits, including water supply (maintenance of both quantity and quality), support of fisheries, support of agriculture through the maintenance of water tables and irrigation, grazing, timber production, energy resources such as peat and plant matter, wildlife resources, transport, and recreation and tourism opportunities.

Attributes. Wetlands have special attributes, including their importance for biological diversity, since wetlands support very large concentrations of birds (especially waterfowl), mammals, reptiles, amphibians, fish and invertebrate species, as well as countless plant species including rice, the staple diet of more than half of the world's people. Wetlands are also important to cultural heritage preservation, supporting open landscapes, indigenous wildlife, and local traditions.

These functions, values and attributes can be maintained only if the ecological processes of wetlands are allowed to function. Unfortunately,

wetlands are among the world's most threatened places as a result of ongoing drainage, land reclamation, pollution, and unsustainable use. This ongoing destruction is occurring largely because the benefits provided by wetlands cannot be bought and sold directly in the marketplace. A critical issue for policymakers, therefore, is to ensure that these benefits are assigned economic value when decisions about alternative economic uses of wetlands are being made.

In addition, many earlier economic incentives that were designed to encourage conversion of wetlands still exist, even as the importance of preserving wetlands has become more widely recognized. These incentives can take many forms. They can include tax incentives for development, irrespective of whether the development harms wetlands, and many kinds of public insurance. Government-sponsored flood insurance, for example, which may once have been considered a socially conscious public policy, often encourages development in regions that would be more appropriately left as wetlands.

Agricultural subsidies are also a major cause of damage to wetlands. These include price supports for surplus crops, thereby encouraging over-production, as well as inappropriate subsidies for irrigation, which may drain water from wetlands. Incentives for aquaculture and many subsidized infrastructure projects can also cause harm to wetland areas.

Law

The Ramsar Convention is arguably the pre-eminent example of how international environmental law can grow and develop as scientific knowledge increases and new needs are identified. When first negotiated, the Convention was directed primarily at the preservation of waterfowl. However, as the importance of wetlands has become more widely acknowledged, the Convention has expanded its emphasis to deal with broader issues of habitat conservation and sustainable use. The number of countries that are Parties to the Convention and the number of wetlands that are designated under its provisions have grown significantly over the years. With the addition of a financing mechanism, al-

though modest at present, the Convention also serves as a vehicle to allow for technology transfer and financial support to developing countries. Finally, the existence of the Convention

gives shape and direction to the international effort to preserve wetlands in ways that would not occur if preservation were limited to national or regional efforts.

For further information

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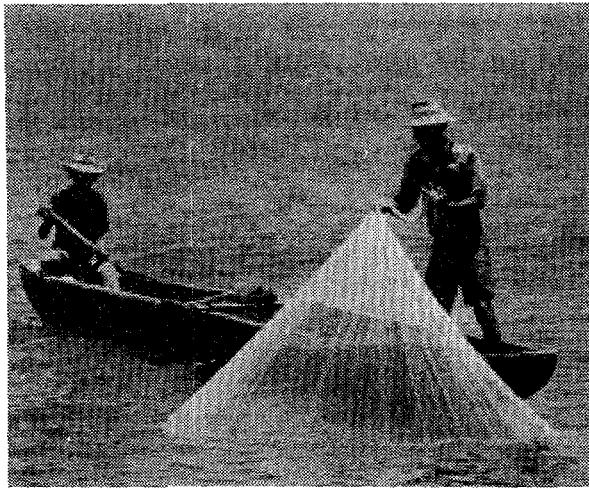
Fax: 41-22/999-0169

Website: <http://www.iucn.org/themes/ramsar/>

Signatories and Parties to the Convention (as of July 1997)

Albania (1)	Estonia (10)	Lithuania (5)	Senegal (4)
Algeria (2)	Finland (11)	Luxembourg (np)	Slovak Rep. (7)
Argentina (6)	France (17)	Macedonia, former	Slovenia (1)
Armenia (2)	Gabon (3)	Yugoslav Rep. of	South Africa (15)
Australia (49)	Gambia (1)	(1)	Spain (36)
Austria (9)	Georgia (2)	Malawi (1)	Sri Lanka (1)
Bahamas (1)	Germany (31)	Malaysia (1)	Suriname (1)
Bangladesh (1)	Ghana (6)	Mali (3)	Sweden (30)
Belgium (6)	Greece (10)	Malta (2)	Switzerland (8)
Bolivia (1)	Guatemala (3)	Mauritania (2)	Tajikistan (np)
Botswana (1)	Guinea (6)	Mexico (6)	Togo (2)
Brazil (5)	Guinea-Bissau (1)	Morocco (4)	Trinidad and
Bulgaria (5)	Honduras (3)	Namibia (4)	Tobago (1)
Burkina Faso (3)	Hungary (13)	Nepal (1)	Tunisia (1)
Canada (35)	Iceland (3)	Netherlands (24)	Turkey (5)
Chad (1)	India (6)	New Zealand (5)	Uganda (1)
Chile (7)	Indonesia (2)	Niger (1)	Ukraine (4)
China (7)	Iran, Islamic Rep. of (18)	Norway (23)	United Kingdom (106)
Comoros (1)	Ireland (45)	Pakistan (8)	United States (15)
Congo, Dem. Rep. of (2)	Israel (2)	Panama (3)	Uruguay (1)
Costa Rica (6)	Italy (46)	Papua New Guinea (1)	Uzbekistan (np)
Côte d'Ivoire (1)	Japan (10)	Paraguay (4)	Venezuela (5)
Croatia (4)	Jordan (1)	Peru (7)	Vietnam (1)
Czech (9)	Kenya (2)	Philippines (1)	Yugoslavia, Federal
Denmark (38)	Korea, Rep. of (1)	Poland (8)	Rep. of (Serbia/ Montenegro) (4)
Ecuador (2)	Latvia (3)	Portugal (10)	Zambia (2)
Egypt, Arab Rep. of (2)	Liechtenstein (1)	Romania (1)	
		Russian Federation (35)	

Note: no abbreviation = ratification; np = not currently a Party; numbers in parentheses = sites listed under the Convention.



The rationale for regulating international watercourses in the form of trans-boundary rivers, lakes, and reservoirs is particularly strong. Nearly half of all the world's river basins are international, draining two or more countries, and no natural resource is more critical to public health and social and economic development than freshwater. Moreover, international watercourses create an intrinsic opportunity for nations or private interests to externalize costs, either through pollution or through unsustainable use. The need for effective regulation has become particularly acute in recent years, as the combined impact of agricultural demand, industrial development, and population growth is stretching water supplies to the limit. In regions where rainfall is sparse and river basins are shared, many commentators believe that disputes over water have the potential to cause armed conflict.

International Legal Regime

Although the need to regulate international watercourses has long been recognized and there is a large body of law on the subject, the quest to create universal legal principles has proven difficult. One general statement of principles can be found in Chapter 18 of Agenda 21, which sets out a series of program areas aimed at protecting the quality and supply of all freshwater resources. An explicit effort to establish a universal legal regime for shared freshwater is the Con-

International Watercourses

vention on the Law of the Non-navigational Uses of International Watercourses. It was approved in May 1997 by the UN General Assembly with 103 votes in favor and opened for signature. This Convention draws on a similar treaty, the United Nations/Economic Commission for Europe (UN/ECE) Convention on the Protection and Use of Transboundary Watercourses and International Lakes, which was negotiated among European countries and entered into force in 1996. Lastly, there are numerous separate agreements for specific lakes or river basins. In terms of financing, the Global Environment Facility (GEF) provides assistance for transboundary water projects and programs as part of its mandate to protect international waters.

Agenda 21 – Freshwater Resources

Chapter 18 of Agenda 21 is entitled "Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approaches to the Development, Management and Use of Water Resources." A general statement of principles that applies to all freshwater, it sets out seven program areas for action. These are (1) integrated water resources development; (2) water resources assessment; (3) protection of water resources, water quality, and aquatic ecosystems; (4) drinking water supply and sanitation; (5) water and sustainable urban development; (6) water for sustainable food production and

rural development; and (7) impacts of climate change on water resources. In the case of international watercourses, the chapter calls on "riparian States to formulate water resources strategies, prepare water resources action programs and consider, where appropriate, the harmonization of those strategies and action programs."

Convention on International Watercourses

The Convention on the Law of the Non-navigational Uses of International Watercourses remains open for signature until the year 2000 and requires ratification from 35 countries to enter into force. The Convention was negotiated "with the conviction that a framework convention will ensure the promotion of the optimal and sustainable utilization" of international watercourses. It also states that countries along international watercourses "shall in their respective territories utilize an international watercourse in an equitable and reasonable manner."

To define the concept of "equitable and reasonable," the Convention states that "all relevant factors and circumstances" should be taken into account. These include "geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character," and "the social and economic needs of the watercourse States concerned." They also include "the effects of the use or uses of the watercourses in one watercourse State on other watercourse States" as well as "conservation, protection, development and economy of use of the water resources of the watercourse and the costs of measures taken to that effect." Finally, they include "the availability of alternatives, of comparable value, to a particular planned or existing use."

The Convention also states that countries "shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States." In the event such harm occurs, "the States whose use causes such harm shall ... take all appropriate measures ... to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation."

A key part of the Convention concerns notification of "planned measures" that are expected to alter the watercourse. It states, for example, that "before a watercourse State implements or permits the implementation of planned measures which have may have a significant adverse effect upon other watercourse States, it shall provide those States with timely notification. Such notification shall be accompanied by available technical data and information, including the results of any environmental impact assessment." The Convention stipulates that the notifying State must allow the notified State six months to study the information, (plus an additional six months if asked). During this period, the notifying State "shall not implement or permit the implementation of the planned measures without the consent of the notified States. In the event that Parties cannot resolve disagreements over planned measures, the Convention includes rules for an arbitration process.

The Convention also addresses the importance of reducing and preventing environmental abuses. It calls on Parties to take measures such as "setting joint water quality objectives and criteria and establishing techniques and practices to address pollution from point and nonpoint sources."

Agreements Based on Geography

In lieu of an international governing regime and because the characteristics of different river basins and lakes vary widely, as many as 2000 agreements have been negotiated to govern how countries manage specific freshwater resources. Some of the more prominent regional regimes for international watercourses govern the Danube, Indus, Niger, Plate, Rio Grande, and Zambezi Rivers, Lake Victoria, the North American Great Lakes, and the Aral Sea.

Science

Among the different program areas set out in Agenda 21, most involve the need for improved scientific understanding and research. In the case of "Water resources assessment," recent

studies by UN agencies have found that many countries, especially in the developing world, do not have adequate programs in place in terms of meteorology, hydrology, and other sciences related to freshwater. Much also needs to be learned about "the impact of climate change on water resources." In the cases of "Protection of water resources, water quality and aquatic ecosystems" and "Drinking water supply and sanitation," some progress has been made. A clear success story is the improvement in the quality of drinking water, based on the development and implementation of drinking water guidelines and the use of chemical treatments and filters to fight water-borne diseases. Many countries have benefited from upgraded water quality standards, while water-quality monitoring programs have also made significant progress. Nonetheless, much remains to be done, particularly to improve sanitation.

Economics

As with most environmental issues, effective management of freshwater resources requires the use of economic tools and market mechanisms. In particular, countries must recognize that water is an economic good, which can be valued in the marketplace as a function of the demand that exists for competing uses. In this regard, Agenda 21 states that "water users should be charged appropriately" and the Convention on International Watercourses states that "in absence of agreement or custom to the contrary, no use of an international watercourse enjoys inherent priority over other uses." The application of market principles to the use of water has proven quite successful in Chile, where water must be transported long distances from rainy southern regions to the progressively drier regions in the north. Meanwhile, efforts to create water markets in the Middle East hold great promise of reallocating water in that region from countries with a water surplus to those with a water deficit, while reducing the potential for conflict. What works on a national level also works on the community level, where numerous projects have demonstrated that demand-driven measures to allocate and supply

water do a better job of meeting people's needs than traditional, large-scale government projects. This is true in the case of projects to provide water that is used for consumption and sanitation as well as water that is used for irrigation.

Law

Despite the clear advantages of market-driven approaches to water allocation, reform has not come as quickly as it might, in either the developing or the developed world. In part, this slowness to reform may be explained by the legal theories that historically governed water use and in many cases still apply. According to an early theory of water use, countries exercised absolute sovereignty over the use of freshwater resources within their boundaries, regardless of what impact this might have on neighboring countries. This is known as the theory of absolute sovereignty. It is sometimes referred to as the Harmon Doctrine, named after a U.S. attorney general who asserted in 1895 that the United States had full legal right to pollute the Rio Grande on the border with Mexico. Another theory establishes water rights as a function of prior appropriation. Users of waters are guaranteed continued use in what might be called a first-come first-served system. Another theory, the opposite of the Harmon doctrine, asserts that downstream riparian countries have the right to full-flow of water of natural quality. None of these theoretical doctrines has drawn wide support as a generally applicable approach to water issues. Nonetheless, they have shaped how individual countries often view water issues. The fact that countries may once have viewed rivers through the lens of absolute sovereignty or of prior appropriation is likely to affect current practice, because countries are reluctant to renounce rights or practices that provide tangible economic benefits.

In recognition of the need to balance the interests of riparian States, customary and case law have established certain principles, which also underlie agreements such as the Convention on International Watercourses. The doctrine of *sic utere* is a common law

maxim that states that one should not use one's property to injure others and is the basis of the influential 1957 Lac Lanoux decision between Spain and France. In that case, which involved the use of a transboundary

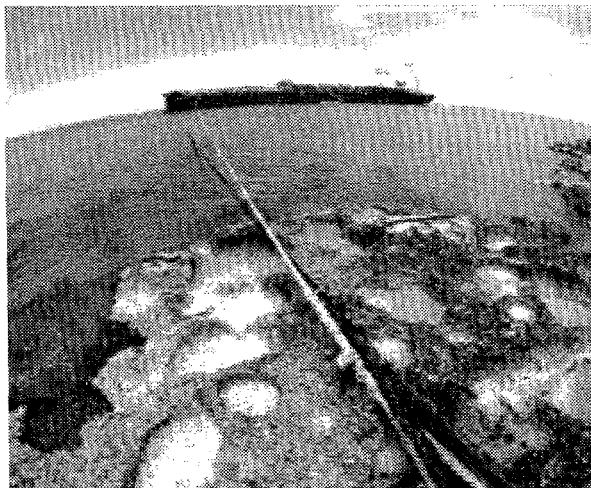
river for a hydroelectric project, the court ruled that waters should be used equitably. The Court stated that "France is entitled to exercise her rights; she cannot ignore Spanish interests."

For further information

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**Countries That Voted in the UN General Assembly to Adopt the Convention on the Law
on Non-navigational Uses of International Watercourses**

Albania	Gabon	Lithuania	Samoa
Algeria	Georgia	Luxembourg	San Marino
Angola	Germany	Madagascar	Saudi Arabia
Antigua and Barbuda	Greece	Malawi	Sierra Leone
Armenia	Guyana	Malaysia	Singapore
Australia	Haiti	Maldives	Slovakia
Austria	Honduras	Malta	Slovenia
Bahrain	Hungary	Marshall Islands	South Africa
Bangladesh	Iceland	Mauritius	Sudan
Belarus	Indonesia	Mexico	Suriname
Botswana	Iran, Islamic Rep. of	Micronesia, Federated States of	Sweden
Brazil	Ireland	Morocco	Syria
Brunei Darussalam	Italy	Mozambique	Thailand
Burkina Faso	Jamaica	Namibia	Trinidad and Tobago
Cambodia	Japan	Nepal	Tunisia
Cameroon	Jordan	Netherlands	Ukraine
Canada	Kazakhstan	New Zealand	United Arab Emirates
Chile	Kenya	Norway	United Kingdom
Costa Rica	Korea, Rep. of	Oman	United States
Côte d'Ivoire	Kuwait	Papua New Guinea	Uruguay
Croatia	Lao People's Dem. Rep.	Philippines	Venezuela
Cyprus	Latvia	Poland	Vietnam
Czech	Lesotho	Portugal	Yemen, Rep. of
Denmark	Liberia	Qatar	Zambia
Djibouti	Libya	Romania	
Estonia	Liechtenstein	Russian Federation	



Ever since the publication in 1609 of *Mare Liberum*, the classic treatise by Hugo Grotius on maritime law, most countries at most times have acknowledged the principle of open access to the seas and oceans. Not surprisingly, a system based on this principle has created special problems, and much effort has gone into defining the limits of open access. Some of the earliest international treaties on the environment, dating back to the nineteenth century, regulate access to marine resources, and in the modern era, a high proportion of environmental treaties concern the use of seas and oceans. Nonetheless, marine pollution and other forms of marine degradation continue to worsen in many regions of the world, especially along coastal areas in both developed and developing countries, where population pressures are high. The importance of preserving and restoring the ecology of marine areas is one of the major environmental challenges facing the world community.

The most significant sources of marine pollution are land-based, including sewage, agricultural effluents, and fertilizer, which cause biological imbalances leading to such phenomena as algal blooms and red tides. These rob the water of necessary oxygen, thereby killing fish and other forms of marine life. Contamination from hazardous wastes and other chemicals, including pesticides and herbicides, is another form of land-based pollution that harms the ma-

Seas and Oceans

rine environment. Ocean dumping, petroleum discharges from oil tankers and offshore rigs, and non-biodegradable plastics, including fishing nets, are other sources of marine pollution. Seas and oceans are also polluted from atmospheric sources, including incineration at sea. Unsustainable fishing and aquaculture pose further threats to the marine environment. Large drift nets and other techniques have endangered the viability of many marine species, while overfishing has resulted in dramatic declines in particular stocks of fish. The use of dynamite and cyanide for fishing, along with other forms of environmental degradation, has also contributed to the destruction of ecologically sensitive coral reefs.

International Legal Regime

The most comprehensive international agreement on the marine environment is the United Nations Convention on the Law of the Sea (UNCLOS), which was adopted in 1982 and entered into force in 1994. The Convention, which took nine years to negotiate, brings together many separate sources of law, including customary law and other existing agreements, and establishes important new rules. UNCLOS makes an important contribution to the progressive development of international environmental law. There are 158 Signatories and 118 Parties to the Convention.

Regulating the Marine Environment

As part of a general obligation to preserve and protect the marine environment, UNCLOS articulates the role that countries are expected to play to prevent, reduce, and control pollution. It also mandates that "states shall take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other States and their environment, and that pollution...does not spread beyond the areas where they exercise sovereign rights."

In recognition of the multiple sources of marine pollution, the Convention emphasizes that the measures enacted by countries "shall deal with all sources of pollution." These sources include "the release of toxic, harmful or noxious substances, especially those which are persistent, from land-based sources, from or through the atmosphere or by dumping," as well as "pollution from vessels," including "intentional and unintentional discharges." Other sources include "pollution from installations and devices used in exploration or exploitation of the natural resources of the sea-bed and subsoil" and "pollution from other installations and devices operating in the marine environment."

International Rules and Minimum Standards

A key characteristic of UNCLOS is that rather than stipulating specific rules and regulations on different kinds of marine pollution, it makes reference to international law outside the Convention. In the case of pollution from ship vessels, for example, the Convention states that countries shall adopt laws and regulations that "at least have the same effect as that of generally accepted international rules and standards established through the competent international organization or general diplomatic conference." Because these standards were established by the International Maritime Organization and were adopted in the 1973/1978 International Convention for the Prevention of Pollution from Ships (MARPOL) Convention, UNCLOS had the effect, most commentators believe, of imposing

these standards on all Parties to UNCLOS, whether or not they are Parties to MARPOL. Similar logic applies in the case of dumping, for which UNCLOS states that "national laws, regulations and measures shall be no less effective in preventing, reducing and controlling such pollution than the global rules and standards." In this case, UNCLOS would appear to invoke the 1972 London Convention on Dumping.

However, the progressive nature of UNCLOS in the area of pollution from ship vessels or from dumping (as well as sea-bed activities) does not carry over to pollution from land-based sources, which comprises the most significant danger to the marine environment. The Convention says that "States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from land-based sources ... taking into account [italics added] internationally agreed rules, standards and recommended practices and procedures." The Convention uses similar language in the section on atmospheric pollution.

Conservation of Living Resources

Along with the goal of controlling pollution, the Convention seeks to promote the conservation of living resources. It states that countries should "protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life." It also calls on countries to cooperate "with a view to the conservation of marine mammals." Furthermore, the Convention states that coastal states "shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation." As part of the effort to preserve fishing stocks, a supplemental agreement has also been negotiated. It is entitled "Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks."

Regional Seas Programme

An important precursor of UNCLOS was the Regional Seas Programme, created in 1974 under the auspices of the United Nations Environment Programme (UNEP). The significance of the Regional Seas Programme has been twofold: it has promoted the creation of international environmental law at the regional level, and it has implemented numerous Action Plans which have helped mitigate or eliminate degradation of the marine environment. The Regional Seas Programme encompasses 13 regions around the world. More than 140 countries and territories participate. The 13 Action Plans cover the Mediterranean, Kuwait (the Arabian Gulf), West and Central African, Caribbean, East Asian Seas, Red Sea and Gulf of Aden, South Pacific, Eastern African, South Asian Seas, Northwest Pacific, and Black Sea.

Science

As with all environmental concerns, myriad scientific issues pertain to the seas and oceans. One area with obvious significance is the biology of fisheries, which have come under severe stress from pollution and from mismanagement. Attempts to restore depleted fish populations require greater understanding of the many factors that affect fish populations, including spawning and migratory patterns. Decisions about fish quotas and the concept of maximal sustainable yield must be based on sound scientific knowledge.

Another area for which scientific assessment will be important concerns coral reefs crucial habitats for many marine species. Coral reefs have been severely damaged in many regions, and they face the possibility of more severe damage in the future, both from continued pollution and from warmer sea temperatures, which could be brought about by climate change. In particular, the process of coral bleaching is not fully understood.

Economics

A leading cause of over-fishing is the availability of subsidies to the fishing industry. Often

these support long-range fishing fleets from developed countries and those with rapidly emerging economies, which pay for the right to exploit the fisheries within the 200-mile Exclusive Economic Zones (EEZs) of developing countries. The situation is exacerbated as fisheries are pushed beyond their limits, and the industry becomes less profitable, often switching from higher-valued species to those with limited commercial value except as fish meal or fertilizer. Reductions in fishing subsidies would, therefore, be a win-win for both the economy and the environment.

Another issue that affects the marine environment and has economic implications is the debate over best practices and cost-benefit analysis. Proponents of best practices argue that the public is better served when regulation establishes specific criteria on what technology to use, whereas proponents of cost-benefit analysis argue that their approach promotes greater efficiency. All sides agree, however, that cost-benefit analysis is less useful when information is not adequate, which is often the case with the marine environment. For its part, UNCLOS states that Parties should use the "best practicable means at their disposal."

Law

The key challenge that faced the UNCLOS negotiators was that maritime regions possess characteristics that are both global and national. For example, although people do not "settle" on the seas or oceans, coastal areas have many linkages to coastal states in the form of economic activities or through geography, most notably rivers. The singular achievement of UNCLOS was to fashion a regime that reflects the hybrid nature of seas and oceans. UNCLOS granted countries significantly greater sovereignty over their coastal waters, notably the 200-mile EEZ, thus establishing more effective incentives for sound environmental management. For the high seas, it guarantees freedom of access for both navigation and fisheries, while for sea-beds, it establishes a global authority whose responsibilities include environmental protection. Port-state jurisdiction,

an important innovation of UNCLOS, combines national and global jurisdiction by allowing port states to enforce rules against environmental

damage to the oceans, no matter where it occurs, when a ship voluntarily enters a country's port.

For further information

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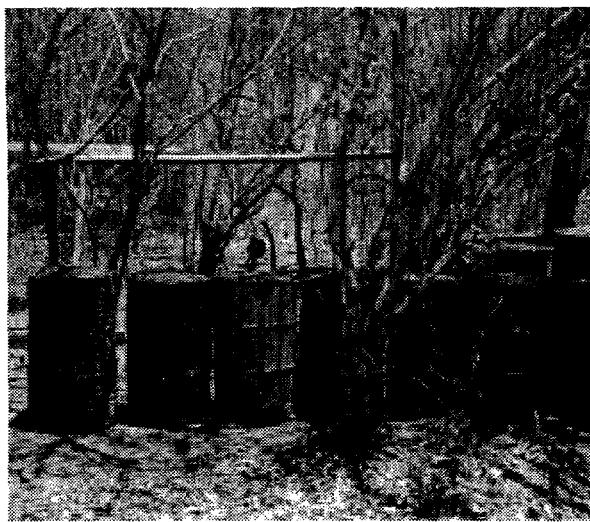
Fax: 212/963-5847

Website: <http://www.un.org/depts/los>

**Signatories and Parties to the Convention (not including subsequent Agreements)
(as of July 1997)**

Afghanistan (np)	Dominica	Liberia (np)	St. Kitts and Nevis
Algeria (w)	Dominican Rep. (np)	Libya (np)	St. Lucia
Angola (w)	Egypt, Arab Rep. of (w)	Liechtenstein (np)	St. Vincent and the Grenadines
Antigua and Barbuda	El Salvador (np)	Luxembourg (np) (w)	
Argentina (w)	Equatorial Guinea	Macedonia, former Yugoslav Rep. of	Samoa
Australia	Ethiopia (np)	Madagascar (np)	São Tomé and Príncipe (w)
Austria (w)	European Community (np)	Malawi (np)	Saudi Arabia (w)
Bahamas	(w)	Malaysia (w)	Senegal
Bahrain	Fiji	Maldives (np)	Seychelles
Bangladesh (np)	Finland (w)	Mali (w)	Sierra Leone
Barbados	France (w)	Malta (w)	Singapore
Belarus (np)(w)	Gabon (np)	Marshall Islands	Slovak Rep.
Belgium (np)(w)	Gambia	Mauritania	Slovenia (w)
Belize	Georgia	Mauritius	Solomon Islands
Benin (np)	Germany (w)	Mexico	Somalia
Bhutan (np)	Ghana	Micronesia, Federated States of	South Africa (np) (w)
Bolivia (w)	Greece (w)	Monaco	Spain (w)
Bosnia and Herzegovina	Grenada	Mongolia	Sri Lanka
Botswana	Guatemala (w)	Morocco (np)	Sudan (w)
Brazil (w)	Guinea (w)	Mozambique	Suriname (np)
Brunei Darussalam	Guinea-Bissau (w)	Myanmar	Swaziland (np)
Bulgaria	Guyana	Namibia	Sweden (w)
Burkina Faso (np)	Haiti	Nauru	Switzerland (np)
Burundi (np)	Honduras	Nepal (np)	Tanzania (w)
Cambodia (np)	Hungary (np)	Netherlands (w)	Thailand (np)
Cameroon	Iceland (w)	New Zealand	Togo
Canada (np)	India (w)	Nicaragua (np) (w)	Tonga
Cape Verde (w)	Indonesia	Niger (np)	Trinidad and Tobago (np)
Cent. African Rep. (np)	Iran, Islamic Rep. of (w) (np)	Nigeria	Tunisia (w)
Chad (np)	Iraq (w)	Niue (np)	Tuvalu (np)
Chile (np) (w)	Ireland (w)	Norway (w)	Uganda
China (w)	Italy (w)	Oman (w)	Ukraine (np) (w)
Colombia (np)	Jamaica	Pakistan (w)	United Arab Emirates (np)
Comoros	Japan	Palau	Uruguay (w)
Congo, Dem. Rep. of	Jordan	Panama (w)	Vanuatu (np)
Congo, Rep. of (np)	Kenya	Papua New Guinea	Vietnam (w)
Cook Islands	Korea, Dem. People's Rep. of (np)	Paraguay	Yemen, Rep. of (w)
Costa Rica (w)	Korea, Rep. of	Philippines (w)	Yugoslavia, Fed.
Côte d'Ivoire	Kuwait (w)	Poland (np)	Rep. of (Serbia/Montenegro) (w)
Croatia (w)	Lao People's Dem. Rep. (np)	Portugal (np)	Zambia
Cuba (w)	Lebanon	Qatar (np) (w)	Zimbabwe
Cyprus	Lesotho (np)	Romania (w)	
Czech		Russian Federation (w)	
Denmark (np)		Rwanda (np)	
Djibouti			

Note: no abbreviation = ratification; np = not currently a Party; w = with declaration or understanding.



Starting in the late 1970s, public concern over hazardous wastes set in motion an international chain reaction that led first to stricter domestic regulation, then to unchecked world trade, and finally to stricter international regulation. The process began in industrial countries, notably the United States, where scandals erupted after it was discovered that hazardous wastes had been dumped in residential neighborhoods. New laws were passed that raised the cost of disposal, while heightened sensitivities made it harder to find suitable sites. In response to these new pressures, generators of hazardous wastes began exporting to countries whose regulatory systems were weak or nonexistent. This international commerce soon came under criticism, notably from developing countries, where the wastes were often destined, and from environmental NGOs.

International Legal Regime

In the context of increasing trade in hazardous wastes, but also opposition to that trade, countries negotiated the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes. The Convention was opened for signature in 1989 and entered into force in 1992. It is the most comprehensive international agreement on hazardous wastes and spurred several

Hazardous Wastes

supplementary agreements. There are 53 Signatories and 114 Parties to the Convention.

Like CITES (see Endangered Species), the Basel Convention was negotiated on the premise that regulating trade is a first-best response when stricter domestic solutions may not be immediately feasible. The preamble expresses the hope that "enhanced control of transboundary movement of hazardous wastes and other wastes will act as an incentive for their environmentally sound management." The Convention also states that "hazardous wastes and other wastes should, as far as is compatible with environmentally sound and efficient management, be disposed of in the State where they were generated."

Along with the Basel Convention, other stricter agreements have been reached on a regional basis. Under the Lomé Convention between the European Community (EC) and Africa-Caribbean-Pacific (ACP), trade in hazardous wastes was banned (with limited exceptions) starting in 1991. The 1991 Bamako Convention among African countries bans imports of hazardous wastes. In 1995 the Parties to the Basel Convention itself agreed to ban all hazardous wastes for the purposes of disposal in the case of wastes coming from OECD countries, the European Union, or Liechtenstein. As of the end of 1997, this ban is intended to in-

* In spite of these efforts, controversy exists as to the definition of certain recyclables.

clude all exports of hazardous wastes intended for reuse or recycling. To date, however, the amendment has yet to enter into force.

Defining Hazardous Waste

A major challenge facing any effort to regulate hazardous wastes is determining what should be regulated. The Basel Convention uses several criteria to arrive at this determination.* Annex I to the Convention establishes "Categories of Wastes to Be Controlled." Examples include "wastes from the production, formulation and use of organic solvents" and "wastes from heat treatment and tempering operations containing cyanides." A subheading under Annex I includes wastes having specific constituents, such as "cadmium; cadmium compounds" or "mercury; mercury compounds." Annex II includes "Categories of Wastes Requiring Special Consideration." These categories refer to household wastes and incinerated residues. Annex III establishes a "List of Hazardous Characteristics." Examples include substances that are explosive or infectious. Under the Convention, all wastes in Annex I are subject to regulation, unless they do not possess any of the characteristics contained in Annex III. Wastes that come under Annex II are also subject to regulation. Finally, each Party to the Convention is required to inform the Secretariat of any other wastes "considered or defined as hazardous under its national legislation."

Notification and Consent

The regulatory system established by the Basel Convention is based on notification and consent.** The State of export is required to notify the State of import of "any proposed transboundary movement or hazardous wastes or other wastes." Notification documents must be in a language acceptable to the State of import. Once proper notification has been given, the State of import "must respond to the notifier in writing," and in all cases, countries have the sovereign right to reject any wastes that come under the Convention's jurisdiction.

To prevent improper management of hazardous wastes when they enter the State of import, the Convention also stipulates the State of export must obtain "confirmation of the existence of a contract between the exporter and the disposer specifying environmentally sound management of the wastes in question." Finally, in no case can a Party send or receive wastes with respect to a non-Party, although wastes can be sent in transit through a non-Party with proper notification.

Enforcing the Convention

To ensure that the commitments are carried out, the Convention stipulates that "each Party shall take appropriate legal, administrative and other measures to implement and enforce the provisions of this Convention, including measures to prevent and punish conduct in contravention of the Convention." It further states that "the Parties consider that illegal traffic in hazardous wastes or other wastes is criminal." The Convention provides for verification procedures. It states, that "any Party which has reason to believe that another Party is acting or has acted in breach of its obligations under this Convention may inform the Secretariat thereof, and in such an event, shall simultaneously and immediately inform, directly or through the Secretariat, the Party against whom the allegations are made."

Cooperation among Parties

The Convention calls for international cooperation to help countries improve how they manage hazardous wastes. It states that Parties should share information aimed at the "harmonization of technical standards and practices" and that Parties "shall co-operate in developing the technical capacity among Parties." The Convention also calls for "training and technology transfers," but it does not establish specific funding streams. Instead, it says "the Parties shall decide on the establishment of appropriate funding mechanisms of a voluntary nature."

** This system is superseded in cases in which countries have agreed to ban trade in hazardous wastes.

Science

Science and technology are critical in the effort to control hazardous wastes. First, all regulatory efforts are contingent on scientific analysis of the risks that specific hazardous wastes pose to human health and ecosystems. Because many kinds of hazardous wastes have not been adequately studied and new chemicals are being invented continuously, the need for scientific analysis is permanent and ongoing. Second, science and technology are necessary to find safer ways to dispose of wastes and clean up those that were not properly disposed of the first time. And third, scientific research is necessary to reduce the hazardous waste stream by promoting more efficient production methods.

The ways in which countries dispose of hazardous wastes create special dilemmas, and depending on circumstances, different approaches will be preferred. In countries in which land is plentiful, the use of landfill or similar approaches remains more common, although in general, countries are trying to move away from such solutions, which, among other risks, can endanger the water supply. Chemical treatments are another means of hazardous waste disposal but create voluminous amounts of sludge, which themselves must be disposed of. Another policy issue is whether to establish more centralized or decentralized treatment facilities. Large treatment centers for hazardous wastes can improve efficiency but may also increase the risks associated with storage and transportation. Land-based incineration of hazardous wastes is another option, but this is not recommended in countries in which regulatory regimes are weak and incinerators may not be well maintained. Other forms of hazardous waste disposal, incineration at sea and ocean dumping, harm seas and oceans. In both cases, new restrictions have sought to reduce these forms of disposal (see Seas and Oceans).

Economics

A key principle that underlies the effort to control hazardous wastes is the "polluter pays" principle (PPP). As originally articulated by the

OECD, this principle states that "the polluter should bear the expenses of...measures decided by the public authorities to ensure that the environment is in an acceptable state." These expenses are captured either through enforcement mechanisms that require polluters to clean up hazardous wastes or through litigation that seeks to recover the costs that governments bear in cleaning up the wastes. In a promising reformulation of the PPP, Denmark and the Netherlands have "upstreamed" the costs of pollution by imposing taxes on the hazardous materials themselves. Such taxes are designed to encourage more efficient use and production of hazardous materials.

Because the PPP represents an explicit effort to internalize the social costs of pollution, it has particular appeal to economists and policymakers. Nonetheless, it has not been universally embraced in the international community. In the 1987 U.S. Superfund case, for example, which looked at the use of border tax adjustments to pay for hazardous waste cleanup, the GATT said that countries could follow the PPP for tax adjustment purposes but were not obliged to do so. At the 1992 Rio Earth Summit, objections to broad interpretations of the PPP led to compromise language that stated that "the polluter should, in principle, bear the costs of pollution, with due regard to the public interests and without distorting international trade and investment."

Law

Liability and compensation are important legal issues in the area of hazardous wastes, and the Basel Convention commits Parties to achieve agreement on how these issues should be handled. An "Ad Hoc Working Group of Legal and Technical Experts" has been meeting on these issues since 1990 but has not finished its work. Because progress on liability and compensation as they affect other areas of environmental law has been sluggish, this may not be surprising. In particular, countries have grown skittish in the area of state liability, for which the potential costs of compensation could be extremely high. An additional unresolved issue

in the area of hazardous waste concerns the requirement, as stated in the Convention, that transboundary movements of hazardous waste be insured. Lastly, agreement has not been

reached on a proposed fund to pay for emergency measures that may become necessary in relation to the dangers caused by hazardous wastes.

For further information

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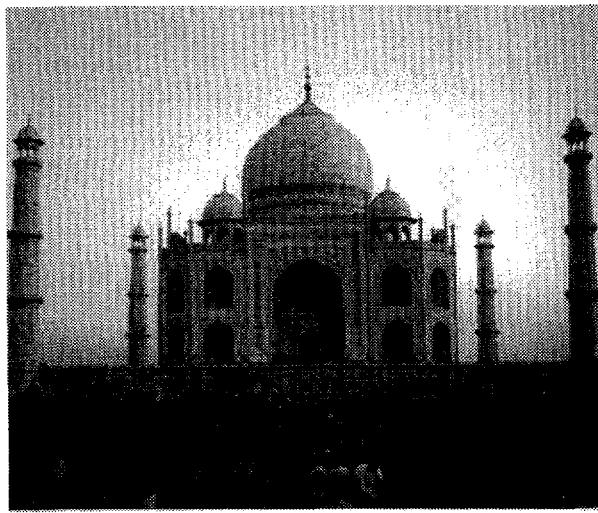
Fax: 41-22/797-3454

Website: <http://www.unep.ch/sbc>

Signatories and Parties to the Convention (as of July 1997)

Afghanistan (np)	Estonia	Malaysia	St. Lucia
Antigua and Barbuda	European Community	Maldives	St. Vincent and the Grenadines
Argentina	Finland	Mauritania	Saudi Arabia
Australia	France	Mauritius	Senegal
Austria	Germany (w)	Mexico (w)	Seychelles
Bahamas	Greece	Micronesia, Federated States of	Singapore (w)
Bahrain	Guatemala	Monaco	Slovak Rep.
Bangladesh	Guinea	Mongolia	Slovenia
Barbados	Haiti (np)	Morocco	South Africa
Belgium	Honduras	Mozambique	Spain (w)
Belize	Hungary	Namibia	Sri Lanka
Bolivia	Iceland	Nepal	Sweden
Brazil	India	Netherlands	Switzerland
Bulgaria	Indonesia (w)	New Zealand	Syrian Arab Rep.
Burundi	Iran, Islamic Rep. of	Nicaragua	Tanzania
Canada	Ireland	Nigeria	Thailand (np)
Chile (w)	Israel	Norway (w)	Trinidad and Tobago
China	Italy (w)	Oman	Tunisia
Colombia (w)	Japan (w)	Pakistan	Turkey
Comoros	Jordan	Panama	Turkmenistan
Congo, Dem. Rep. of	Korea, Rep. of	Papua New Guinea	United Arab Emirates
Costa Rica	Kuwait	Paraguay	United Kingdom (w)
Côte d'Ivoire	Kyrgyz Rep.	Peru	United States (np)
Croatia	Latvia	Philippines	Uruguay (w)
Cuba (w)	Lebanon (w)	Poland (w)	Uzbekistan
Cyprus	Liechtenstein	Portugal	Venezuela (np) (w)
Czech	Luxembourg	Qatar	Vietnam
Denmark (w)	Macedonia, former Yugoslav Rep.of	Romania (w)	Yemen, Rep. of
Ecuador (w)	Malawi	Russian Federation (w)	Zambia
Egypt, Arab Rep. of		St. Kitts and Nevis (w)	
El Salvador			

Note: no abbreviation = ratification; np = not currently a Party; w = with declaration or understanding.



This Convention is a unique international instrument recognizing and protecting both cultural and natural heritage of outstanding universal value. The accord links the conservation of nature and culture, thus challenging the limited perception that nature and culture are in opposition. Nature and culture are complementary and inseparable, the cultural identity of different peoples having been forged in their natural environment. Just as the creative works of humankind may be inspired by the beauty of their natural surroundings, some of the most spectacular natural sites bear the imprint of human activity over centuries.

The Convention came into force on December 17, 1975. As of July 28, 1998, there were 154 States Parties.

The accord is the most universal legal instrument for heritage protection, with 522 cultural, natural, and mixed sites on the World Heritage List; a number augmented each year. Inscription on the list has extraordinary implications, as it designates sites as valuable beyond national boundaries and significant to all humankind. The Convention establishes two basic principles: first, each State Party accepts the primary obligation to ensure conservation of listed sites on its territory, and agrees to perform this responsibility to the utmost of its resources. Second, all States Parties recognize the duty of the international community as a whole to exert influence and cooperate in conserving a heritage deemed to be of worldwide value.

World Heritage

The diversity of World Heritage sites and monuments is astounding: some are entire cities, such as Brasilia, Bath, or Luang Prabang; others are vast natural features, such as the Great Barrier Reef in Australia, or sites carrying traumatic memories of history, such as Auschwitz, the Hiroshima Peace Memorial, or the island of Goree, where slaves embarked for the New World. Still others are exemplary buildings, such as the Taj Mahal or the Acropolis in Athens, or protoindustrial sites, such as the Wieliczka Salt Mines near Krakow or the city and silver mines of Potosi. Also included are great natural parks like Yellowstone in the United States or Los Glaciares in Argentina, and frail ensembles of buildings made entirely of earth, like those of Sana'a in Yemen, or Ait Ben Hadou in Morocco.

It would be a mistake to assume that the list is simply an ever-expanding tourist's guide to hundreds of wonders in the modern world. Many of these sites are endangered, threatened by a variety of forces including: poverty, development and population pressures, war, indifference, inadequate management, ideological intolerance, the brute power of profit, and relentless touristic overuse. Above all, the sites are threatened by the exceptionally swift changes visited upon our age throughout the world. The framers of the World Heritage Convention intended neither to arrest change, nor to freeze development. Rather, sustainable development is the ultimate goal of the World Heritage conservation process.

The Convention is governed by a World Heritage Committee composed of a representative from each of 21 States Parties; nations participate on a rotating basis. A World Heritage Centre, housed at the United Nations Economic and Social Council (UNESCO), provides support services for the Committee and administers a World Heritage Fund supported by contributions from States Parties. This fund provides approximately US\$4 million per year, and is used to facilitate some international technical assistance for managing and restoring World Heritage sites, although the amount falls short of that anticipated by Convention drafters and current need.

Sites are inscribed on the World Heritage List through a four-step process consisting of identification, nomination, evaluation, and decision. During the identification stage States Parties prepare an inventory of properties in their territory deemed worthy of nomination. Nominations are considered, and sites added to the List, on an annual basis. Upon nomination of a site by a State Party, a dossier is prepared and submitted to UNESCO for examination by the World Heritage Centre and evaluation by the International Council on Monuments and Sites (ICOMOS), in the case of cultural sites, and by the World Conservation Union (IUCN) for natural sites. Nominations of cultural landscapes and mixed sites are evaluated by both ICOMOS and IUCN. Site nominations and evaluations are considered by the Bureau of the World Heritage Committee, which makes recommendations to the Committee.

Cultural sites must meet one or more of the following six criteria: (1) be considered a masterpiece of human creative genius; (2) exhibit an important interchange of human values over time; (3) bear unique or exceptional testimony to a cultural tradition, living or disappeared; (4) be an outstanding example of a structure, site, or landscape illustrating a significant stage in human history; (5) be an outstanding example of a traditional human settlement or land-use by a culture, especially a vulnerable one; or (6) be directly associated with events, living traditions, ideas, beliefs, or artistic or literary works of universal significance. Natural sites should also: be outstanding examples representing major stages of the earth's history or significant ongoing ecological and biological processes; contain superlative natural phenomena or areas of exceptional

natural beauty; or contain the most important natural habitats for on-site conservation of biological diversity.

A preponderance of sites in the European and Mediterranean regions has led the Committee to focus increasing attention on geographical representation and assuring an appropriate diversity of site characteristics. Hence the Committee initiated a global strategy to identify, at the regional level, properties suitable for inscription that would lead to a fully representative and universal list. In 1994 an experts' meeting on the global strategy prescribed regional meetings to assist States Parties less well represented on the list to identify and nominate cultural and natural heritage sites. Several meetings have taken place in Africa and East Asia and Pacific. Additionally, thematic meetings have been held on topics including: historic routes, heritage canals, and Asian rice culture and terraced landscapes. Other meetings have examined cultural landscapes in East Asia and Pacific, Europe, and the Andes.

Once a site is inscribed on the World Heritage List, what is the State Party's responsibility? Above all, it is to maintain the values that gained inscription for the site. Listing a site accomplishes little if it subsequently falls into a state of disrepair, or if a development project threatens to compromise the site's integrity. Conservation is an ongoing process. The credibility of World Heritage stems from regular monitoring of the state of conservation, reporting on the condition of sites, and on measures taken to protect them. Efforts to raise public awareness of the value and conservation needs are essential in this process. Submission by the States Parties of periodic reports on the condition of listed sites to the General Conference of UNESCO through the World Heritage Committee is considered a crucial part of the World Heritage conservation process. In regard to improving conservation and site management, sharing of experience on the international level is a great asset offered by the World Heritage venture.

States Parties are encouraged by the Convention to improve general practices for designating, managing, and protecting heritage areas. When nominating World Heritage sites, governments must vouch for their legal and administrative protection. Monitoring the condition of

World Heritage sites is an increasingly important and complex issue. The Convention calls for a List of World Heritage in Danger, to draw international attention to severely threatened sites. As of December 1997 this list contained 25 cultural and natural sites. The Committee may occasionally apply pressure on a State Party regarding stewardship of its World Heritage sites. In its advisory and oversight role, the Committee encourages good management practices and has, in some instances, discouraged threatening development projects such as dams, roads, and intrusive industrial or tourist facilities.

For long-range protection of the planet's cultural and natural diversity it is necessary to instill a deep sense of responsibility in young people. UNESCO's Young People's World Heritage Education Project aims to promote awareness of the World Heritage Convention among young people, and to involve them in World Heritage conservation through the integration of World Heritage education into secondary-school curricula. This is done with the expectation of creating a new synergy among educators, teachers, curriculum developers, heritage experts, and others from the local to the international level. In June 1995 the First World Heritage Youth Forum was held in Bergen, Norway. World Heri-

tage Youth Fora also convened during the following two years in Dubrovnik, Croatia; Victoria Falls, Zimbabwe; and Beijing, China. A World Heritage Education Kit called "World Heritage in Young Hands" including student activities, a poster, and photographs of World Heritage sites from all regions of the world, will be available from UNESCO in late 1998.

The effectiveness of the World Heritage Convention is impressive, since failure to comply with the recommendations of the World Heritage Committee does not invoke sanctions greater than the possibility of removal of a site from the World Heritage List. The Convention relies solely on the power of persuasion and the desire for general recognition felt by people everywhere who are concerned with the preservation of the world's remarkable heritage.

For the text of the *Convention Concerning the Protection of the World Cultural and Natural Heritage*, see *Conventions and Recommendations of Unesco Concerning the Protection of the Cultural Heritage*, UNESCO, Imprimeries Populaires, Geneva, Second edition, 1985 (ISBN 92-3-102101-X), or

<http://www.unesco.org/general/eng/legal/cltheritage/index.html#recomm>

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