

# 2002

## STATE OF THE PLANET

### SCIENCE AND SUSTAINABILITY

## Science in Place for Sustainability

### State of the Planet Speakers Show Surprising Optimism

By Lewis Gilbert

#### A Current of Hope

In a surprising contrast to the prevailing sustainability imagery, speakers at the State of the Planet 2002 Conference conveyed a strong current of hope that ran throughout much of the discussion held in May at Columbia University. Twenty-six speakers addressed an audience of more than 400, who gathered at Columbia University's second State of the Planet Conference on May 13 and 14 to discuss the role of science in achieving sustainability. Results of the conference, including archived Web broadcasts of all presentations, may be viewed at The Earth Institute at Columbia University's Web site, <http://www.earth.columbia.edu/sop2002/sopmedia.html>.

Jane Lubchenco's opening keynote address set the tone. Lubchenco, president-elect of the International Council for Science (ICSU), noted that while humankind faces substantial global challenges, scientists and others do have hope that sustainability can be achieved. "We are more aware, and more people are engaged" than they were 10 years ago, Lubchenco said.

The conference closed on a similar note. Even when ABC Correspondent Robert Krulwich challenged his panelists to back off from their optimism, they refused. Harvard's Calestous Juma reaffirmed his view that scientists have already made the transition from working out what needs to be done to an operational mode. "What this conference has been about is what to do, not whether it's important," said Juma.

#### Expanded Role for Science

Technological innovation has rendered Malthusian concerns regarding food security moot, noted green revolution founder M. S. Swaminathan and Columbia's Stuart Pimm. Advances in both agricultural practice and genetic engineering ensure that human societies have enough land available to feed Earth's population without necessarily destroying vital ecosystems.

The uneven spatial distribution of industrialization makes it possible for the developing world to achieve advances in quality of life without incurring the same environmental costs as the developed

world. As noted by José Goldemberg, secretary of the environment in the state of São Paulo, Brazil, "You don't have to wait until you have the same GDP as the developed world before choosing modern technologies that perform the same task with less environmental impact."

Several speakers noted that the most environmentally sensitive locations in the world are concentrated in relatively limited locations, mostly inhabited by poor people. Climate science, connected to water science, agriculture, and other fields, can contribute to solving the ongoing conflicts between development and sustainability in these "hot spots."

Noting that "complexity is that which you don't understand," H. J. Schellnhuber of the Potsdam Institute for Climate Impact Research said that understanding of Earth's complex systems could be dramatically improved if answers are found to a finite set of important questions such as "What is the dangerous level of anthropogenic interference with atmospheric CO<sub>2</sub>?"

#### Local Knowledge-Producing Institutions Needed

If the research and development enterprise of the developed world has contributed to this sense of optimism, achieving a transition to sustainability will require building scientific capacity in the developing world.

Institutions rooted in the developing world will not necessarily replicate the structures and norms of Western universities, development organizations, and laboratories. Instead, they will reflect the needs and contexts of the country or region of their work. For instance, they are likely to place greater emphasis on the development part of the sustainable development equation.

"We need to take the capacity to think for ourselves," said London School of Economics' Saleemul Huq, who comes from Bangladesh. Huq called for bringing local and regional groups "into the network" of thinkers who can influence sustainability and development.

An indigenous scientific and technological infrastructure, especially in environmentally sensitive locations, will allow developing countries to identify innovations in other countries that will be appropriate to their own sustainable development. Not all advances will translate from their point of origin into other settings, but local knowledge institutions will provide their societies with assistance in planning and implementing the best solutions for each place.

"The dominant thinking is to centralize, but exactly the opposite is needed," added Juma.

#### Policy Leadership Wanted

The biggest gap in the potential for achieving a transition to sustainability is the need for political will, backed by resources, that will lead to development policies that are effective in stopping and reversing degradation of Earth's life support systems. Only when local understanding of sustainability is high can political will be strong. ♣

## Urban Sustainability: Not a City, an Urban Ecosystem

By Kristen Fountain

Scientists and political leaders will make progress toward achieving urban sustainability by realizing that the megacity is a global biome, said the panelists for the State of the Planet 2002 Conference's session on Urban Sustainability. Like rainforests or intertidal regions, large cities from New York to Johannesburg share a complex ecology and a common set of challenges. Viewing cities from this new conceptual framework can foster scientific research and technological development targeted toward cities' special needs, as well as international cooperation between city governments.

#### Science for Livable Cities

Urban sustainability has two goals that are frequently viewed as conflicting: to create conditions within cities that make them livable indefinitely for all residents and to reduce cities' large environmental impact on other world ecosystems. Bringing these goals into harmony is a challenge common to urban biomes around the globe.

Both Cynthia Rosenzweig, Columbia climate scientist, and Gordon McGranahan, director of the Human Settlements program at London's International Institute for Environment and Development, spoke of cities' need to solve problems aggressively, even in the absence of perfect scientific understanding. Rosenzweig spoke of the need to prepare for sea level rise and to work on adapting architecture and reducing emissions that cause urban heat islands (pockets of warm air over cities caused by combined factors like heat-absorbing black rooftops and heat-trapping smog). These preparations are needed even in advance of more detailed research and localized data on how global warming will affect coastal megacities (including New York, Sydney, and Shanghai, among others).

Another way in which science can inform cities is in the creation of an "urban biosphere reserve," a concept that would allow planners, policy makers, and others to view an urban area as an integrated system. "We won't get the right answer if we look only at health and not energy, if we look at ecosystems and infrastructure separately," said Rosenzweig.

McGranahan, while pointing out that "epidemiologists still do not really understand what environmental factors cause health problems in low-income neighborhoods," called for action on localized problems that disproportionately affect poor people as well as on global problems that are largely a product of overconsumption by the wealthy.

Initially, the environmental burden of city activity falls upon the local poorer classes, as resources are extracted and waste and pollution are discharged within city boundaries. Local burdens on health later become global burdens on all world ecosystems, with city growth leading to wider air and water pollution, global warming,

(continued on back page)



ABC News Correspondent Robert Krulwich concluded the two-day conference by leading a panel discussion with some of the speakers including Roberto Lenton, Jo Beall, Calestous Juma, M. S. Swaminathan, and David Dickson.

# Conservation of Biological Resources

By Jennifer Freeman

## Resources Concentrated in Small Land Area

Alarming, Earth's species are currently disappearing from the surface of this planet at a rate at least 100 times greater than normal. To preserve the diversity of species on Earth, conservation research must focus on entire ecosystems—land, water, plant and animal life including humans—rather than preserving one endangered species at a time, according to speakers on the Conservation of Biological Resources panel.

To succeed, the people living in environmentally sensitive places must take the lead in research and expertise, for they will be most directly affected by the losses.

One piece of good news, according to Columbia biologist Stuart Pimm, is that humans technically need only about 15 percent of Earth's surface for agriculture. In theory, even the growing human population expected in the next 50 years could eat without converting any additional land to agricultural use.

Another cause for optimism, Pimm noted, is that half of all Earth's plant and animal species live in just 10 percent of Earth's area. Many of these "biodiversity hot spots" are located in tropical areas that are also home to some of the world's poorest peoples. If resources and science were focused urgently on just these limited areas, not only could inroads be made against poverty, but perhaps half the species otherwise likely to become extinct in this century could be saved.

In this time of escalating extinctions, all agreed that strong, immediate action is needed to reverse the trend.

## Marine Reserves: Space to Reproduce

The global decline of fisheries can be reversed, said Callum Roberts of the University of York, if marine preserves are created to give fish enough space in which to thrive. Roberts suggested that approximately 30 percent of international waters be set aside for this purpose.

Ocean marine life generally has successful reproductive strategies, including large numbers of eggs and their wide dispersal via ocean currents. This ability gives fish and other marine species the resiliency to quickly reverse the results of overfishing, if given a little space. As an example, a marine preserve off the coast of St. Lucia in the Caribbean

resulted in higher area fish catches within 3 years after it was implemented in 1993.

Fishermen will need compensation, similar to farm subsidies, to carry them through a time of transition while marine preserves are established, Roberts suggested. His goal is to see an international body created to set aside one-third of the ocean's surface as a marine preserve.

## Need for Preservation While Understanding Grows

Destruction of ecosystems is especially dangerous given the depth of our ignorance about the planet's species, said Cristian Sámper, acting director of the Smithsonian Tropical Research Institute.

The majority of Earth's estimated 30 million species are invertebrates, and many remain uncatalogued, said Sámper. He illustrated his point with a slide of dozens of fungi recently discovered to be growing inside the leaves of tropical trees on Panama's Barro Colorado Island.

Sámper's point was that areas of biological importance to Earth should be preserved while we build understanding of such things as the minimum size of forest fragment adequate for preserving biodiversity and how or when biodiversity came about in the first place. Some of this information is just becoming available for study through advances in computing and DNA analysis techniques.

## Realizing the Value of Conserved Land

From an economic point of view, conservation can be the most valuable use of land. In many cases the economic value of preserved land can be the best conservation incentive, according to Columbia Business School professor Geoffrey Heal.

Heal gave the example of game ranching in Zimbabwe (charging people a fee to hunt on preserved wildlands stocked with specially bred game animals), which is more profitable than cattle ranching. He also told the story of million-dollar housing developments in Montana used to finance conservation easements there.

Heal noted that after New York City officials studied the cost of processing water artificially, they realized that it was cheaper to spend millions of dollars to protect New York's natural watershed by buying land upstate, upgrading rural towns' sewage

systems, and planting buffers to reduce runoff. Heal called for others to similarly look for the economic sense in conservation.

Some scientists were concerned that Heal's solutions were not applicable (the Zimbabwe example notwithstanding) in many third world locations with great preservation needs, but where no wealthy property buyers are on hand or where ecotourism is difficult to develop.

## Conservation Must Be an Indigenous Process

Conservation must be an indigenous process, according to Calestous Juma of Harvard University's Center for International Development. The tendency of international funding organizations is to centralize, whereas the opposite is needed, he said. "There must be convergence of where action is needed and where knowledge of how, what, and why to conserve is generated," said Juma.

In the case of biodiversity, the problems are often very localized, he said. Different strategies, maybe even different laws and regulations, are needed in different areas.

The role of institutions, including universities, is to reduce uncertainties, provide incentives, allocate resources, and reduce conflict, said Juma. He added, "I have become interested in seeing universities starting to become conservation entities" rather than simply producers of ideas.

In the last 10 years, said Juma, standards and guidelines have been developed around which actors can converge on the sustainable use of genes, species, ecosystems, and landscapes. Institutions may not have caught up yet with the need to address problems with great complexity, such as entire ecosystems rather than individual species.

He struck an optimistic note that "much of what we can say has already been said in the past." What is now needed, he added, is benefit sharing, independent thinking about how to use resources (not just taking the advice of funding organizations), and ideas that are generated on a local or regional level "where the action is."

Responding to the global call for greater clarity about the sustainable future of planet Earth, Columbia University, in collaboration with the London School of Economics and Political Science, Harvard University, and UNESCO, convened the State of the Planet 2002 Conference on May 13 and 14, 2002.

## Highlights of the Conference

### Agricultural Productivity



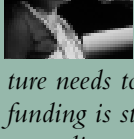
**Pedro Sanchez,**  
University of California, Berkeley  
"We can do a lot of leapfrogging of technology, but one thing we cannot leapfrog is agricultural development."

**M. S. Swaminathan,**  
M. S. Swaminathan Research Foundation



"An evergreen revolution, with benefits in perpetuity, has to take an integrated approach, considering land management, water management, exploitation of resources, and genetic diversity."

**Uma Lele,**  
World Bank



"We have to address the consequences of plenty for the poor of the world. Agriculture needs to become central to development again. The funding is stagnating even as the agenda becomes much more diverse."

**Saleemul Huq,**  
International Institute for Environment and Development (IIED)



"Very little research on sustainable development has been done by the developing countries themselves. The poor will always be poor unless they build the capacity to do research."

### Urban Sustainability



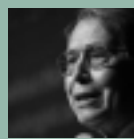
**José Goldemberg,**  
Secretary of the Environment, São Paulo, Brazil

"There is enormous pressure from all kinds of political agents and entrepreneurs to develop at any cost. The role of environmental agencies is not to be an impediment to development, for they will surely be overruled, but to lead the way to technologies that can contribute to a sustainable future."



**Cynthia Rosenzweig,**  
Columbia University

"The Biosphere Reserve project offers an opportunity for reconciliation between the city and its long-estranged natural home."



**George Bugliarello,**  
Polytechnic University

"We need the explicit involvement of science advisers for urban needs, goals, and policies."



**Gordon McGranahan,**  
International Institute for Environment and Development (IIED)

"It may seem that it is the green agenda that requires new science while the brown agenda just requires political will, but truly we don't understand very well the environmental health problems of low-income neighborhoods."

**Jo Beall,**  
London School of Economics and Political Science



"The urban agenda is almost exclusively associated with the brown agenda: water supply, sanitation, air quality, and waste collection. This agenda has been closely linked to the policy/environmental nexus."

### Conservation of Biodiversity



**Jane Lubchenco,**  
Oregon State University

"We have entered the sixth mass extinction of life on this planet, this one due to human activities. This is my memo to Johannesburg: Making the transition to sustainability is the most important challenge of our time. If we can't figure out how to do it, nothing else matters."



**Stuart Pimm,**  
Columbia University

"Half of all the world's biodiversity is concentrated in about 10 percent of Earth's area. It is locally and regionally where the problems of balancing biodiversity and development lie."



**Callum Roberts,**  
University of York

"Marine reserves offer us an extraordinary and humbling lesson: we can get more out of the sea by leaving some of it alone."

# Global Food Security

By Greg Meyer

Food security is not only about growing enough, but also about health, access to clean water, and employment opportunities. In the words of moderator Roberto Lenton, the task is “to meet the needs of the world’s hungry and achieve the reduction of poverty, without reducing the resources on which development depends.”

## Tree Fallows: A Local Approach to Ending Hunger

In one of the bolder claims to come out of the State of the Planet 2002 Conference, tropical soil expert Pedro Sanchez said that farmers in much of Africa can end hunger by following farming techniques that restore their nutrient-depleted soils.

Africa is the only part of the world where food security is still directly connected with production, said Sanchez. African farmers have not benefited much from the green revolution, he said, because their soils are depleted of nutrients.

The price of fertilizer in much of Africa is “absurd,” Sanchez said. In Malawi, for instance, a ton of urea fertilizer costs the equivalent of \$792, more than five times its wholesale price in Europe.

To overcome this expense (which, he said, should also be addressed at a policy level), Sanchez worked with farmers to develop a planting technique called “tree fallows,” in which nitrogen-fixing trees are planted between rows of corn. The technique not only increases crop yields after boosting nitrogen and carbon levels in the soil, but also provides much needed fuel wood close to the farmers’ homes.

Farmers growing fuel wood could eventually be enlisted in carbon dioxide mitigation efforts as well. “I would love for there to be carbon farmers sequestering large amounts of CO<sub>2</sub> and making money at it,” Sanchez said, noting that the technique is not useful in either semiarid or very humid conditions.

The next step is scaling up, from the current 50,000–100,000 farmers using tree fallows techniques to 50 million to 100 million farmers, a level at which carbon sequestration could bring about a meaningful change. “The question is political will and cooperation from international agencies and NGOs,” said Sanchez.

## Creating Farm Employment

For rural people of the world living on less than a dollar a day, the fastest route to better nourishment

and cash income is small-farm employment, argued Michael Lipton of the University of York.

Scientific advances are “the main single reason” why the percentage of so-called “dollar poverty” has fallen and caloric intake has risen in the past 25 years, Lipton said. In spite of scientific advances in farming, poverty rates have come down at a disappointingly slow rate. Successful food production is not sufficient to reduce poverty. Employment opportunities are an important part of the equation as well.

Agricultural policies and new research should recognize the importance of earning opportunities, Lipton said. Herbicide-resistant crops, for example, are not useful because they reduce demand for weeding, which in turn reduces opportunities for farm employment.

A major obstacle to poverty reduction is the fact that in much of the developing world, about 90 percent of water is already utilized. Pressure is strong to take water from farms and direct it toward expanding cities. A much lower percent of water is controlled through irrigation in Africa (about 3 percent) than in Asia (over 30 percent). “Crises will not be manageable without new water science,” Lipton said.

Demographics in the developing world present a great opportunity. The working population, between 15 and 50 years of age, is growing. These workers can provide income to lift countries out of poverty, if employment opportunities are available. Lipton concluded that only farms can provide workplaces for the rural poor. Although science also needs to focus on yield instability and sustainability, “employment and income expansion is central.”

## An Evergreen Revolution

“Where hunger rules, peace cannot prevail,” is the credo of M. S. Swaminathan, one of the architects of the green revolution in agriculture. Thirty years after the first great advances in plant engineering, Swaminathan realizes that an “evergreen revolution,” to make agricultural advances last in perpetuity, requires an integrated approach.

Maintaining genetic diversity, managing land and other resources carefully, and using water wisely are all essential to sustainable agriculture, he said.

The green revolution was a great “product of synergy between technology and public policy.” An evergreen revolution must also focus on aspects of

food security other than crop yields, such as purchasing power, education, and health, and on food distribution in times of war and natural disaster.

Genetic engineering still has much to offer. Genes from the salt-tolerant mangrove plant, for example, could help food crops grow in salty soils. “Golden Rice,” which is genetically engineered to contain vitamin A, could improve nutrition for mothers and babies in many locations.

Still a fan of technology, Swaminathan called for future advances that are sensitive to sustainability of Earth’s systems. He labeled these advances “ecotechnology.”

## The Problems of Plenty

Uma Lele of the World Bank called for a stronger “moral and ethical foundation” of public policy. The current situation, she said, “is poverty in the midst of plenty, islands of security surrounded by conflict, and environmental degradation caused not just by poverty, but also by plenty.”

“Public funding for agricultural research is stagnating even as the agenda is becoming much more diverse,” Lele said. “We definitely need to make sure that agriculture becomes central to development again.”

Private sector research should have relevance for the world’s poor as well, she said. In a searing critique of how underfunded agricultural research is, Lele pointed out that development assistance from rich to poor countries now totals only \$7.4 billion per year, a mere 2.5 percent of the \$362 billion the Organisation for Economic Co-operation and Development (OECD) countries use to subsidize their own agriculture each year. The United States committed \$330 million toward preservation of biodiversity, whereas the amount needed to save biodiversity is \$30 billion.

The United States’ farm bill, passed this spring, will deliver \$180 billion in aid to American farmers over the next 10 years. “One has to ask oneself if the aid provided to developing countries to invest more in agriculture will allow them to really be able to develop,” she said.

While donor countries may be impatient with the rate of benefit of past scientific research, the poorest countries are bearing the brunt of climate change. Yet they lack enough scientists and technicians to implement even existing innovations. Industrialized countries have 10 times more research and development scientists per capita than developing countries, she said.



**Cristián Samper,**  
Smithsonian Tropical Research Institute  
“Biodiversity actions must be national and local. We need to develop the right institutions within countries to carry out research and decision making needed at those levels.”



**Calestous Juma,**  
Harvard University  
“We have assumed that conservation is a task for technicians, when in fact the only way we can make a difference is to have convergence between where the action is and where knowledge creation is taking place.”

## Solutions



**Michael Lipton,** Sussex University  
“The number of people between 15 and 59 is doubling in many developing countries currently. This is a tremendous opportunity for a decrease in poverty if employment and earning potential is available.”



**Jeffrey Sachs,** Columbia University  
“By spending just one cent out of every ten dollars earned in industrialized countries, roughly \$25 billion annually, we could control the spread of HIV/AIDS, malaria, and TB; we could end death during childbirth and from

diarrheal disease. We could save 25,000 lives daily, 8 to 10 million annually for this amount. This is a bargain on a global scale.”



**Geoffrey Heal,** Columbia University  
“It is clear that tourism is a major driver of land preservation in several parts of the world. If we want to make a dent in habitat conservation, the way forward is to continue finding mechanisms by which we can reap value from the way we use the land.”



**H. J. Schellnhuber,** Potsdam Institute for Climate Impact Research (PIK)  
“Organized by a fundamental set of questions, we are poised to dramatically advance our understanding of the complexity of Earth systems and the interactions between human activity and Earth functioning.”



**David Dickson,** SciDev.net  
“Small-scale solutions won’t generate the necessary commitment to solve problems.”



**Michael Crow,** Columbia University  
“It is the academy’s moral responsibility to conceptualize the means to produce a sustainable planet.”

## State of the Planet 2002 Newsletter

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**Dr. Lewis Gilbert,** Columbia University  
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and Ji Mi Choi, Mariellen Gallagher, Kathleen Mastriani, Columbia University

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# Urban Sustainability

(continued from front)

and habitat loss. Lightening this global burden is essential to the future sustainability of both city-based and rural human life.

McGranahan cited the history of the nineteenth-century sanitation movement as an example of action before perfect understanding. The movement resulted in municipal waste cleanup, even before the discovery that germs cause disease.

In an accurate summary of the session, George Bugliarello, an engineer and chancellor of Polytechnic University in New York, strongly recommended that above all, cities need “accessible, affordable, and deployable technologies and systems” to meet the twin challenges of urban sustainability. Faced with burgeoning populations, aging, inadequate infrastructure, and increasing levels of ambient pollution, megacities cannot wait for unquestionable science and elegant technology.

## Cities, Political Realities, and the Environment

In Johannesburg, the extremes of the industrialized

and developing world collide, explained Jo Beall of the Development Studies Institute at the London School of Economics and Political Science. “Urban services in Johannesburg have become the fault line along which postapartheid fears and expectations are played out.”

Beall emphasized the special challenge faced by developing cities in providing services for the inflow of rural poor. Though all megacities are destinations for immigrants, cities in the developing world see far more migration-related population growth. “Developed world cities are not necessarily a model for the developing world,” said Bugliarello, echoing a call that was made throughout the conference for nurturing and heeding local and indigenous knowledge.

Bugliarello noted, however, that in spite of their many challenges, urban ecosystems the world over represent a remarkable collection of material wealth and human knowledge. He envisions the practice of “city mining” (recovering resources such as scrap metal, used equipment, and building materials) and new techniques for re-manufacturing to dramatically increase intra- and intercity recycling.

City dwellers have a close relationship with the other species and natural processes among which they live, said Rosenzweig, even if urbanites often feel alienated from the natural world. Even in the nineteenth century, as McGranahan noted, the debates were not just about health, but also about recycling and the disruption of natural cycles.

When making urban policy, then, it is important to recognize the relationships between cities and the natural environment, both within a city and over its “urban footprint,” the lands affected by the behavior of city dwellers.

Beall added, “We still have to worry about issues of inequality. New York is growing in its capacity and will to preserve biodiversity, but not everyone has the capacity.”

In sum, speakers concluded that despite their obvious differences, world megacities have more in common with each other, in many ways, than with the rural and suburban areas of their own nations or states. This conclusion has clear implications for both science and policy.

## World Summit on Sustainable Development Johannesburg, South Africa • The Earth Institute at Columbia University

Sunday, 1 September 10:00am—12:30pm • Water Berry Room, Wanderers Club, Ubuntu Village • Breakfast Meeting

### Investing in Science and Technology: Top Ten Strategies for Successful Sustainable Development

Today's debates on sustainable development focus too much on politics rather than on science and technology. Many funding agencies and rich-country policy makers have been lulled into the mistaken belief that if technological fixes are indeed needed for sustainable development, they will magically appear through the

invisible hand of market forces. The Earth Institute at Columbia University will present advances that deserve implementation now and several more in critical areas where immediate investment is required to relieve extreme poverty and get ahead of global climate change risks. Many suggestions were gathered last spring

from leading scientists who attended Columbia University's State of the Planet 2002 conference in New York City.

Compared to the stakes involved, and the realistic promise for dramatic breakthroughs if global R&D efforts are enhanced, current investment is miniscule. A decision in Johannesburg to

bolster the world's scientific and technological capabilities in sustainable development would set the world on a much more secure, equitable, and sustainable course for our new century.

Presenters from The Earth Institute at Columbia University include:

**Dr. Jeffrey Sachs**, Director, The Earth Institute at Columbia University and Special Advisor to UN Secretary General Kofi Annan  
**Dr. Klaus Lackner**  
**Dr. Roberto Lenton**  
**Dr. Don Melnick**  
**Dr. John Mutter**  
**Dr. Pedro Sanchez**, 2002 World Food Prize Laureate



Dear Colleagues:

On our planet today, more than a billion impoverished people struggle daily for their survival. Hundreds of millions more live in conditions of destitution. Twenty-five thousand people die each day from hunger and diseases that are easily preventable and treatable. Extreme poverty contributes to environmental degradation as poor people enter marginal lands in search of new farm plots or bushmeat or firewood for sustenance and subsistence incomes.

Elsewhere on the globe, the one-sixth of humanity living in rich countries have the good fortune, and the scientific and technological means, to be in a position to help change this stark reality. With properly applied resources, we can reduce absolute poverty and disease, while helping to preserve the fragile ecosystems on which all of us depend.

Scientific innovation is a critical factor in meeting this challenge. In recent times, we have mobilized scientific knowledge to limit ozone depletion, improve tropical crop productivity, and fight killer tropical diseases such as African River Blindness and African Guinea Worm.

Yet there is much vital work to be done. Technological challenges, such as reducing the risks of anthropogenic climate change, and conquering AIDS, TB, and malaria, seem to be within scientific reach but will require intensive and steadfast efforts to achieve. It is also certainly the case that science alone will not solve these global problems. We require the political will, novel institutional arrangements, and increased financial resources to put science and technology to work on behalf of the world's poor and the global environment.

The international governance structures we currently have in place are not enough. The money currently assigned to the tasks of sustainable development remains woefully inadequate, especially in view of how much we could indeed accomplish with well-placed investments. If the rich nations, with a combined annual GNP of \$25 trillion, were to set aside just one penny for every \$10 of GNP, we would amass an annual fund of \$25 billion, sufficient to avert around 8 million deaths per year in the poorest nations through targeted investments in life-saving health interventions.

Given the unprecedented wealth of the rich countries, and the remarkable worldwide progress of science and technology in areas ranging from genomics to ecology to climate modeling to energy systems, we now have an unrivaled opportunity to achieve the twin goals of economic development and sustainable environmental stewardship. The ideas shared at the second State of the Planet Conference at Columbia University reaffirm the power of science and technology to help promote the tremendous changes that will be required. I applaud your efforts and I look forward to working with you to tackle these complex issues in the years ahead.

Cordially,

Jeffrey Sachs

Director, The Earth Institute at Columbia University

