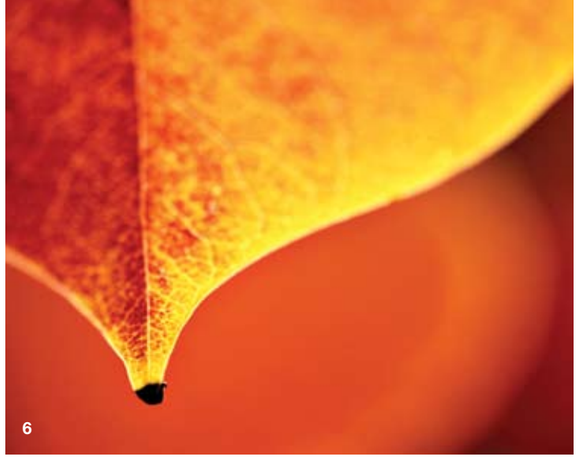
Annual Donor Report

2009

THE EARTH INSTITUTE
COLUMBIA UNIVERSITY

Photo: Alan Orling



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The earth institute is leading the way to a sustainable planet by mobilizing the sciences, education and public policy. Research in our many centers and programs ranges from the study of ecosystems to the investigation of carbon capture technologies and much more. Our associated academic programs are giving the next generation the skills they need to help bring about a sustainable future in a changing world.

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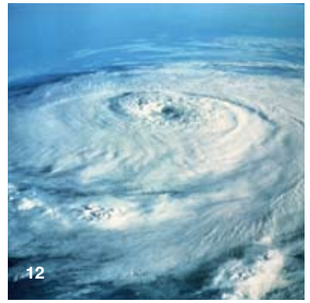

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Photo: Alan Orling

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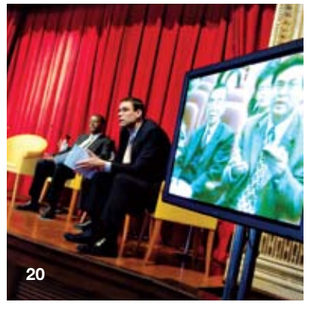

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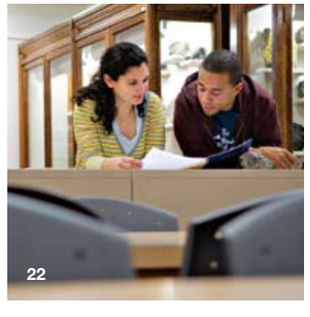

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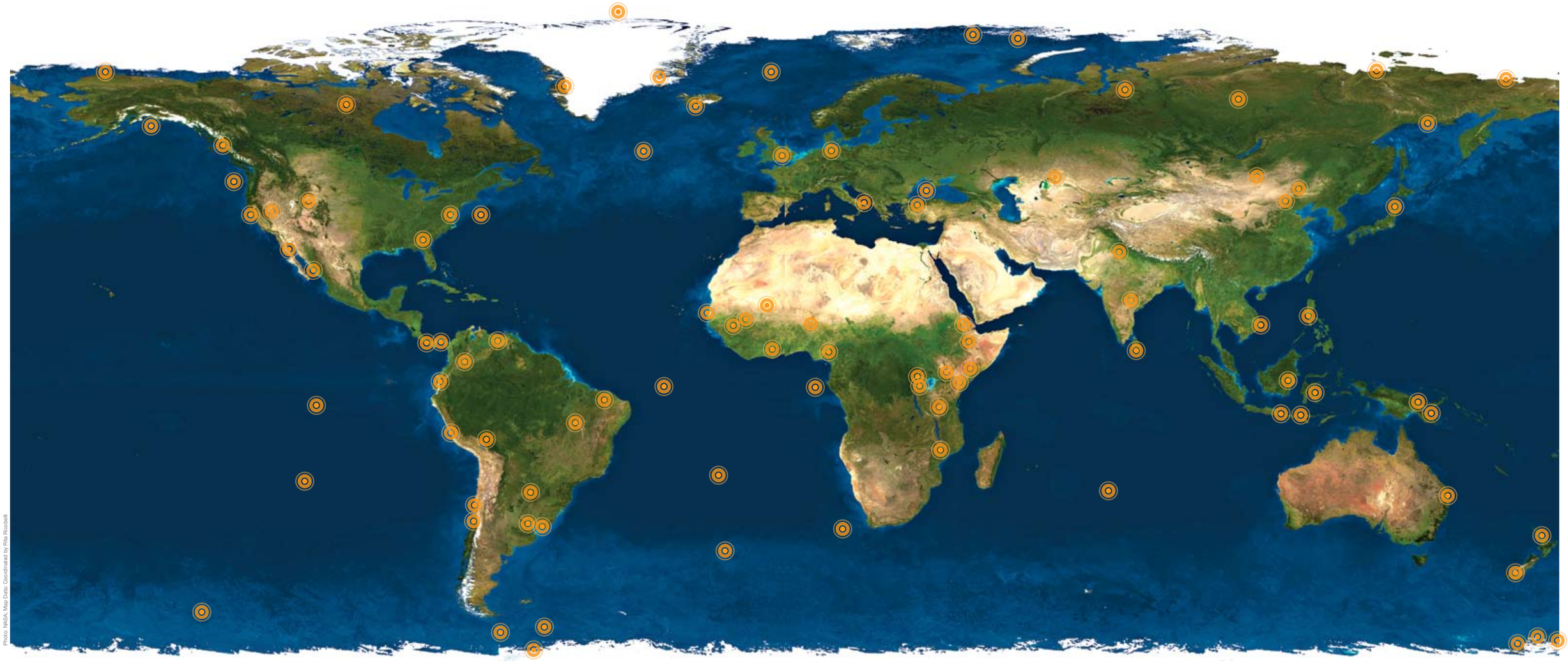

Photo: NASA; Map Data: Coordinated by Rita Ricobelli

Researchers, staff and students at the Earth Institute work around the world across nine cross-cutting themes: water; climate and society; energy; urbanization; hazards and risk; global health; poverty; ecosystems health and monitoring; and food, ecology and nutrition. This map shows some of the places where we work.

Photo: Eileen Barroso

During the past year, through the remarkable generosity of individuals and foundations, the Earth Institute has made strides on a number of fronts.

The university is an institution that not only transmits acquired knowledge; it is also an interactive environment where knowledge is constantly evolving as new horizons are explored to solve pressing problems. As a preeminent research institution, Columbia University, and its talented pool of interdisciplinary scientists, researchers and students, is engaged in translating knowledge into instruments for improving life, in its broadest sense, around the globe.

Our planet is at a critical crossroads, with its ecosystems under assault. Many of Earth's challenges are closely interwoven: climate change, its impact on human populations, contamination of our depleted water sources, deforestation, growing levels of poverty and urbanization, and the social and ecological effects of natural disasters; all demand innovative approaches to reverse their negative impacts.

Efforts by our scientific community to address these issues would not be possible without the support and commitment of those who share a sense of responsibility for these dire global crises. During the past year, through the remarkable generosity of individuals and foundations, the Earth Institute has made strides on a number of fronts. The Lenfest Center for Sustainable Energy continues to research and develop advanced technologies to reduce carbon emissions from coal-burning power plants and to capture and store carbon dioxide. In partnership with the PepsiCo Foundation, the Earth Institute is bringing cleaner, safer water to populations in need.

With the support of the Denning family, we created the endowed professorship held by Professor Ruth DeFries, the Denning Family Professor of Sustainable Development, who has championed the formation of an undergraduate major in sustainable development.

The evolution of this degree field, currently offered as a special concentration, will facilitate the study of this critically relevant area at the undergraduate level.

Columbia has been a leader in climate work for more than 50 years and is one of the few universities conducting advanced and comprehensive research on climate issues. The Columbia Climate Center was publicly launched in March 2009 to bring together and build upon the many climate-related activities and research efforts conducted throughout Columbia, linking expertise from climate science, earth engineering, public health, political science, economics and decision science.

For the well-being of our planet, continued efforts must be made in the area of sustainable development, and your support of the Earth Institute, Columbia University, has a direct and meaningful impact. Under the consummate leadership of Jeffrey Sachs, the Earth Institute will, with your help, remain at the forefront of addressing this challenge.

Lee C. Bollinger

Photo: Alan Orling

The challenges of sustainable development require a new kind of training that is intrinsically cross-disciplinary.

The greatest challenge of our time is sustainable development: to live peacefully and sustainably on a crowded planet, with everybody able to meet their economic needs while protecting the vital ecosystems for future generations. The Earth Institute is proud to be a world-leading center in this great challenge, helping to push forward solutions to sustainable development through education, research, problem solving and educating the public.

Some of the great challenges taken on this year by the Earth Institute include growing water stress in many parts of the world, the risks and complexities of climate change, scaling up health systems in low-income settings, and the challenges of the Millennium Development Goals in rural Africa, Papua New Guinea, Haiti and elsewhere.

Securing safe and plentiful water for all regions of the world will prove to be one of our most daunting tasks for global society. Water stress is already a grim reality in many regions, and climate change will further alter the water cycle on local and global scales, putting many regions in profound peril. The PepsiCo Foundation generously supports our crucial work on water sustainability in four countries. The HSBC Foundation saw the need for tackling the challenges of climate change in our own backyards and funded several of our educational workshops, internships and research assistantships on climate in New York City.

The challenges of sustainable development require a new kind of training that is intrinsically cross-disciplinary—addressing holistically the interconnected challenges of poverty, disease, climate change, biodiversity loss and more. Our students in the undergraduate special concentration in sustainable development are given a comprehensive understanding of complex global issues through study in a wide range of disciplines including political science, anthropology, environmental science, economics and urban studies. We are moving forward to launch a major in sustainable development as soon as possible.

In a joint effort with the John D. and Catherine T. MacArthur Foundation, we have also begun a two-year global Master's in Development Practice (MDP) program that will encourage the development of revolutionary graduate degrees around the world. The first of these, the Master of Public Administration in Development Practice, began at Columbia in the fall of 2009 and will train a new host of practitioners in a wide array of disciplines so that they are equipped to tackle complex sustainable development challenges.

As we advance the thrilling and groundbreaking work of the Earth Institute, we keep our eyes on global problem solving; a rigorous focus on scientific evidence; the mobilization of breakthrough technologies, including for the world's poor; and, most crucially, thinking globally and toward the future. Our donors and partners are assisting us in our mission to help bring about beneficial changes in people's lives through critical advances in sustainable development. Please accept my profound gratitude to all of the Earth Institute's generous supporters, partners and friends, who make this transformative work possible.

Jeffrey D. Sachs

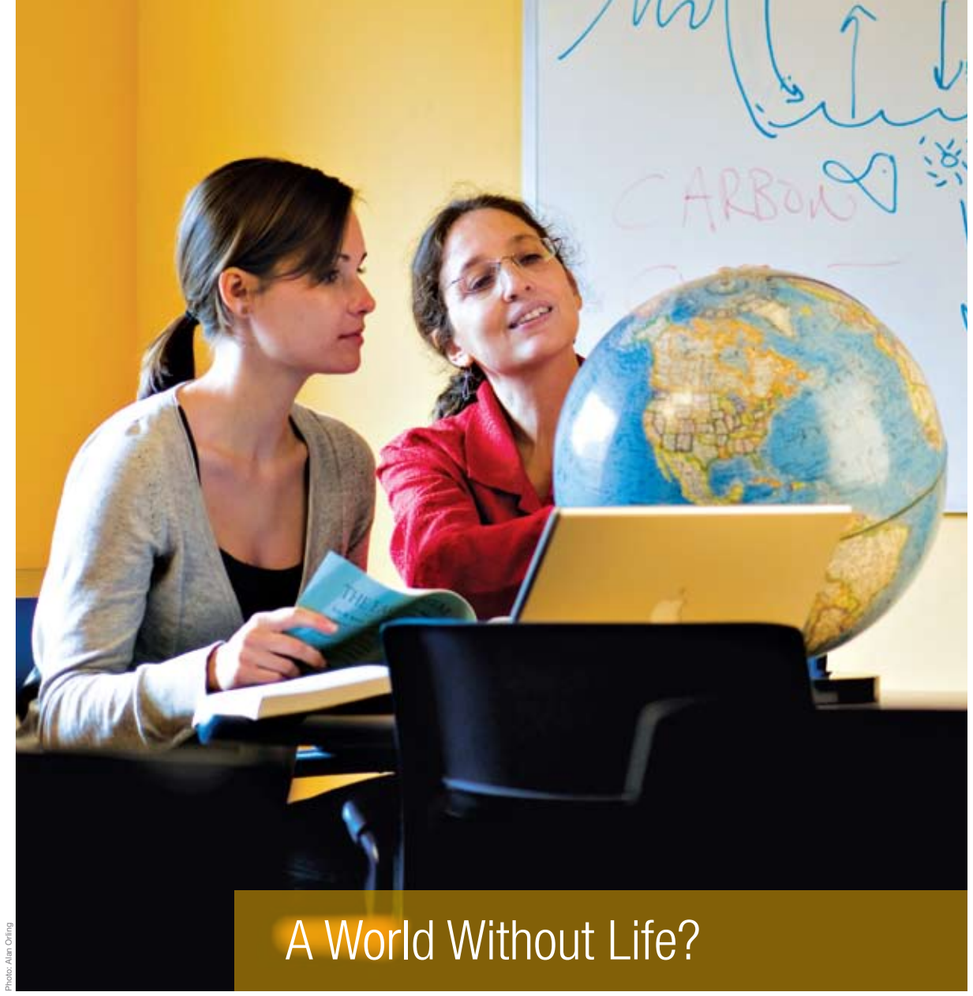

Photo: Alan Orling

A World Without Life?

"Successfully addressing the issues of sustainable development requires a strong, interdisciplinary approach. As a leader in research and education in this field, Columbia has both an opportunity and an obligation to tackle some of the most pressing and practical challenges facing Earth."

Robert Denning, *whose family endowed the Denning Family Professorship in Sustainable Development*

"Without life, Earth would become a planet that's halfway between Venus and Mars," says Columbia professor Shahid Naeem. Oxygen, so important to the world as we know it, is a very reactive gas that would rapidly combine with other elements and become only a trace gas in the absence of biological processes. Carbon dioxide would become the dominant gas in the atmosphere, and the temperature would rise to 290 degrees Celsius by some estimates.

"Earth wants to be something else, but life is doing its darnedest to keep it the way it is," says Naeem. But are Earth's ecosystems doing the job they used to do? With so much conversion of natural habitats for agriculture, housing and other human activities, there's a lot less than there used to be. Although 60 percent of natural habitats remain, humans have taken a lot of the good parts for themselves. Earth Institute scientists are studying the nature of this change and ways to maintain ecological diversity, even in converted landscapes.

Denning Family Professor of Sustainable Development Ruth DeFries (opposite page) and others study patterns of ecosystem change, like deforestation, to help find ways to balance the needs of a growing population and the natural world.

Ruth DeFries, Denning Family Professor of Sustainable Development, is looking at the world from space to understand the large-scale impacts that humans are having on natural ecosystems. "Land is what we need to grow food and live in cities," she says, "but it's important to get a full picture of the tradeoffs of putting land to use for our purposes versus leaving it in its natural state."

"I don't think of ecosystems as little furry creatures; I think of them as the basis of all life, in terms of the ecosystem services they provide and what humanity needs to survive," says DeFries. These critical services provided by ecosystems range from the filtration of water by wetlands to the absorption of atmospheric carbon dioxide, the key driver of man-made climate change, by forests.

DeFries focuses her work on tropical forests of places like Brazil and India, and her students have worked all over the world, from Jamaica to Myanmar, Kalimantan and other parts of Southeast Asia. Deforestation continues to be a significant part of human-driven ecosystem change, though the forces behind it are shifting. As the human population grows and cities swell, more food is needed and land must be converted to produce it. "People think of the subsistence farmer as being the main driver of forest clearing," says DeFries. "But we're seeing this new driver, intensive production of agricultural commodities, in some areas."

Finding ways to support ecological diversity in man-made landscapes is becoming increasingly important as natural landscapes are converted for agriculture and other purposes. "Whether in crops, or forage for animals, or in fallow fields, and in what remains of natural systems … the more diverse an ecological system, the more robust, resilient and productive it is, with lower needs for inputs like fertilizer and irrigation," says Naeem.

Naeem has teamed up with other researchers in the Millennium Villages of Africa and the grasslands of China to study the importance of ecological diversity in managed landscapes. "We're working to achieve the synergy between the social and the natural world that is the foundation for a healthy, stable and productive planet," he says. ■

Photo: Susan Vincent

Thinking Like Scientists

Photo: Andrew Shaw

Programs like the Lamont-Doherty Secondary School Field Research Program and LEEFs (above) provide opportunities for K–12 students and public school teachers to study the natural world and improve science education.

Learning the principles of scientific inquiry can broaden students' perspectives and give them the tools they need to understand environmental issues.

"Teaching students to think like scientists is key to helping our environment," says Nancy Degnan, director of the Center for Environmental Research and Conservation (CERC), a Columbia-based consortium of five organizations that includes Columbia University, the American Museum of Natural History, New York Botanical Garden, Wildlife Conservation Society and Wildlife Trust. Learning the principles of scientific inquiry can broaden students' perspectives and give them the tools they need to understand environmental issues.

"Too much stress has been put on natural resources, and the services of our ecosystems have been overlooked," says Degnan. "We often examine these issues in a patchwork manner, but a sustainable approach requires us to think in a systemic, big-picture way. We need better science-based inquiry to find sustainable, systems-based solutions. And we need all students to understand their role in shaping the future of this planet."

From the classroom to the field, Columbia programs are bringing scientific inquiry to students of all ages, from elementary school through graduate school. "It's not just about making students more knowledgeable," says Degnan, "it's about making them better problem solvers." When students experience the living laboratories in parks, rivers and estuaries, they become more aware of the natural world, question and hypothesize, gather and assess field-based data, and make informed conclusions.

The new Learning through Ecology and Environmental Field Studies (LEEFS) program, which builds on the ecosystem education expertise of CERC and the Lamont-Doherty Earth Observatory, with funding from the National Science Foundation, links Columbia graduate students with classrooms in low-income New York City public schools. The program gives graduate fellows the opportunity to think about new ways to communicate their research and learn innovative strategies to teach science in grades 6 through 12; the younger students benefit from improved science education and can become inspired to pursue careers in science themselves.

Now in its tenth year, CERC's Summer Ecosystem Experiences for Undergraduates (SEE-U) program aims to help build the scientific thinking skills of non-science majors and broaden their worldviews while they experience the ecosystems of New York, the Dominican Republic or Brazil. "I've spoken with SEE-U students who have said that the experience has changed them and the way they think," says Degnan, "not only about their own discipline but about environmental sustainability. This is what CERC is about. Our job is to equip, teach and guide these students as future environmental decision makers."

The Lamont-Doherty Secondary School Field Research Program brings students and their teachers to work side by side on projects with Lamont scientists, with activities ranging from collecting mud samples in Piermont Marsh to measuring air quality around New York City. Students gain a better understanding of the world around them as a result, says Bob Newton, the Lamont-Doherty researcher who launched the internship program. In learning about the natural world, "they become much more effective citizens and are better able to address the environmental choices we have to make as a culture over the next generation." ■

Undergraduates in the SEE-U program travel to Brazil (above) and the Dominican Republic to study different natural ecosystems.

Running Out of Water

In India and many other places around the world, fresh water is becoming increasingly scarce.

"The Earth Institute is a core partner of the PepsiCo Foundation's enviro-social portfolio, intended to help underserved communities adapt to the significant crises of poverty, climate and water scarcity.

Their masterful navigation of business needs and smart philanthropy has proven critical to the success of our collaboration."

PepsiCo Foundation

Agriculture is one of the biggest consumers of fresh water worldwide. Some crops, like rice, require large amounts of water.

The Columbia Water Center is working with farmers in India to promote the use of crops that reduce water consumption and boost incomes.

It's something many of us take for granted, but, in regions around the world, supplies of it are dramatically declining, both in terms of quantity and quality, and may soon vanish altogether. Fresh, clean water is a treasure of increasing value. From Mali to Brazil to India to the southwestern United States, people are facing drier times to come and the Earth Institute is searching for long-term solutions.

Take India, for example. When the monsoons rush across the subcontinent, the skies darken, the swollen clouds burst and the rain comes down in torrents. Yet groundwater supplies are dropping as a result of overconsumption, one to three meters a year or more in some places, faster than they can be replenished by the monsoons.

Will India run out of water? "This is a serious concern in many regions," says Upmanu Lall, the Alan and Carol Silberstein Professor of Engineering, who heads up work at the Columbia Water Center. India is one of many places where he and others from the Earth Institute are investigating strategies to reduce water stress while improving livelihoods—often closely tied to the state of water resources—with support from the PepsiCo Foundation.

Many factors are contributing: intensive agriculture to support a growing economy and population, changing land use patterns, increasing variability in rainfall and temperature due to climate change, and the absence of suitable government reforms in support for water sustainability. "All these taken together put a huge pressure on water and lead toward a situation of stress—water stress," says Kapil Narula, director of the Water Center's India office. "It results in crisis, the tragedy of the commons. What happens if no one comes forward to protect it? The water gets polluted, depleted in quantity, and there is a physical water stress (limited quantities of water) and an economic water stress (lack of infrastructure needed to ensure safe and equitable access and availability)."

The availability of water in a country like India is closely tied to its ability to maintain a secure food supply. Agriculture is by far the largest consumer of water in the country, using 80 to 90 percent, and is the main source of income for 60 percent of the population as well as a significant contributor to GDP. In many places, there is no incentive to conserve water, and subsidies support inefficient use. Over the long run, water stress will impact livelihoods and incomes, especially of farmers, and it can impact food security. Feeding the masses today may be creating a recipe for disaster later.

Narula, Lall, Vijay Modi and others from the Earth Institute are working with local partners to create and implement solutions through pilot projects in the states of Gujarat and Punjab, such as incentives for farmers to conserve water and the cultivation of diverse crops that reduce water consumption and increase incomes. The group is also working to sensitize the government and people to the risks of water scarcity. "The signs of water stress are visible today, but not fully understood by the common man, so the social-political system is not fully aware of the threats and the risks that it's prone to in the future," says Narula. ■

Photo: AP Photo/Wally Santana

It's Either Adapt or Move

What will climate change mean for New York City? Earth Institute researchers, and now student interns as well, are studying the potential impacts and ways we can prepare and adapt.

"The initiative HSBC in the Community created with the Earth Institute is a good example of our long-standing commitment to issues like climate change.

We hope it will inspire more young people to be responsible stewards of the environment while contributing to New York's climate needs now."

Heather Nesle, HSBC in the Community

Rising sea levels, warmer temperatures and storm-related coastal flooding are posing challenges to New York City's future. Portions of the five boroughs are on low-lying coastal land, already at risk. As the climate changes, what will be our collective response?

Helping to prepare the city for the effects of climate change is a topic Earth Institute scientists have spent a good amount of time addressing. They have been analyzing satellite imagery and precipitation data and helping to produce the "New York City Panel on Climate Change Report," for instance. A two-year grant from HSBC in the Community (USA) Inc. helped get students involved in work with Earth Institute scientists and a broad range of external partners, ranging from city planners to local nonprofits, to understand the impacts of climate change on the city and find ways we can prepare for them.

"Two things are fundamental," said Steve Cohen, executive director of the Earth Institute, when the first group of student interns gathered to present their projects. "Climate change is happening, and we're not moving, and so we have to figure out a way to adjust the infrastructure and to adjust the city to these changes. … The hope that we have for solving these problems is not with people my age, but with the next generation."

Photo: Alan Orling

One of 30 interns focused on climate issues, Diana Hsueh worked with researcher Wade McGillis on the measurement of atmospheric carbon dioxide levels at various sites in New York City.

Thirty interns participated in climate projects in the spring of 2009, teaming up with Earth Institute researchers to perform a broad range of projects such as analyzing the likelihood of hurricanes impacting the city, monitoring levels of carbon dioxide—the main driver of climate change—in the air at various points around the region, investigating the buffering potential of wetlands against sea level change, and exploring the capacity for soils in the agricultural lands around the city to absorb carbon dioxide.

School of International and Public Affairs (SIPA) student Emmanuelle Humblet worked with the New York City Mayor's Long Term Planning and Sustainability Office to identify critical infrastructure in New York City that could be at risk from the effects of climate change and to develop coordinated adaptation strategies to secure these assets. "New York City has implemented a unique approach to climate change adaptation by integrating the private sector and city agencies into the adaptation process," says Humblet.

Gabe Cowles, also a SIPA graduate student, worked with the New York City Panel on Climate Change and with CLIMAID and the New York State Energy Research and Development Authority (NYSERDA). He found the internship helped him develop the skills to work with both researchers and policymakers. "The skill is to be able to speak both languages and understand where both groups are coming from and then ultimately create a report that speaks to everyone," he says.

Chikara Onda, an undergraduate student in environmental science and economics, teamed up with Harlem's WE ACT for Environmental Justice to assess what health threats may be faced by New York City residents as a result of climate change and recommended steps planners could take to prepare and "make sure that vulnerable communities have access to information during potential health emergencies." ■

Photo: Alan Orling

Greening the Urban Roofscape

Photo: Alan Orling

Stuart Gaffin and other researchers at the University are making the case for the widespread use of green roofs, like the one on top of a Columbia building at 116th Street and Amsterdam Avenue (above).

Scientists at the Earth Institute are at the forefront of this new take on high-elevation gardening.

Heat waves are on the rise as the climate changes and average temperatures increase. Urban dwellers will likely be the worst hit. The planting of vegetation on the top of buildings, in what are known as green roofs, is part of the approach to cooling cities and helping control stormwater pollution, among other benefits. Scientists at the Earth Institute are at the forefront of this new take on high-elevation gardening.

New York City has between 30 and 40 square miles of roof space, covered primarily by asphalt membranes, which bake in the sun and can reach temperatures of 160 degrees Fahrenheit or higher in summer. The result is known as the "heat island effect," which can be observed in satellite images—the heating up of temperatures in urban areas compared to suburban and rural areas, largely as a result of the abundance of materials that absorb sunlight and heat and the lack of cooling vegetation. Rising global temperatures will exacerbate this effect and have an impact on energy demand, air quality, human health and heat-wave mortality.

Green roofs, assemblages of vegetated mats on special growth medium, can dramatically improve rooftop environments. Their plants lower surface temperatures to comfortable levels, control stormwater sewage overflows, remove air pollution, absorb acid rain and provide insulation for the buildings beneath them during the winter. They cool by evapotranspiration, a process plants have perfected to stay cool in strong sunlight.

Stuart Gaffin, called the "city's rooftop Johnny Appleseed" by *The New York Times*, first got involved in green roofs several years ago after he and colleague Cynthia Rozenzweig at the Earth Institute's Center for Climate Systems Research began studying the heat island effect. "We wanted to do more than modeling," he says. Green roofs seemed like a good way to explore the problem and possible solutions in a responsible and scientific way—and Columbia had plenty of roof space to work with. "They are very versatile systems; we are frequently thinking of new ways to use them," says Gaffin.

The green roof effort has grown to include researchers from other parts of the

Photo: NASA Landsat Thermal Image

Green roofs can help mitigate the urban heat island effect (shown above), which is felt in places like New York City, by significantly reducing temperatures on top of buildings.

Photo: Alan Orling

Photo: Alan Orling

Green roofs are composed of several layers that provide growth support to a colorful mat of plants.

Earth Institute, Columbia University and Barnard College. Known as the Columbia Green Roof Consortium, it is led by a team of two Earth Institute scientists—Gaffin and Wade McGillis, Doherty Research Scientist at the Lamont-Doherty Earth Observatory—and Columbia engineering professor Patricia Culligan. Seven Columbia rooftops now support green roof installations.

Gaffin is also involved in green roofs around the city—at the Fieldston Middle School in Riverdale, the Queens Botanical Garden and the Con Edison building in Long Island City. He measures conditions such as temperature, heat flow, water storage, relative humidity, sunlight and albedo (the reflectivity of a roof's surface). This data will help in designing more effective green roofs and help generate better estimates of the benefits New York City could experience if green roofs were installed on a large scale.

"I don't see why green roofs couldn't just take over New York," says Gaffin. "It would make a big dent in our urban heat and stormwater runoff problems and save energy." ■

Photo: Alan Orling

Carbon-Eating Rocks

Photo: Courtesy of Sam Krevor

"What attracted the Lenfest Foundation to the Earth Institute was how it studied the connected challenges of energy, climate change, poverty alleviation and other critical world issues."

Lenfest Foundation

"Imagine, for a moment, a world in which energy is cheap, plentiful, and environmentally sustainable," wrote Klaus Lackner, who is the Maurice Ewing and J. Lamar Worzel Professor of Geophysics, in 2005. Now imagine new and exciting ways of capturing carbon dioxide emissions before they reach the atmosphere and warm our climate—like rocks that absorb carbon.

Sound strange and novel? It is one of the many exciting climate change mitigating strategies Lackner and his colleagues at the Earth Institute's Lenfest Center for Sustainable Energy and the Lamont-Doherty Earth Observatory are pursuing as they push the envelope on how we approach energy. One of the areas they work on is known as mineral sequestration, the permanent binding of carbon dioxide into rocks, which is considered safer than other methods of carbon capture because it permanently changes the carbon dioxide into a harmless solid.

Keen to study "energy technologies that have the potential to play an important and large-scale role in the way we manage energy in the future," engineering doctoral student Sam Krevor was drawn to the Lenfest Center. Even as an undergraduate, he had "started to understand the importance of energy in the greenhouse gas problem and how difficult it was to manage in an effective way." What especially interested him was the way certain rocks react with carbon dioxide.

But where could these useful "carbon-eating" rocks—some of which are also known as ultramafic rocks—be found? "It was frustrating," says Krevor. "We did not have a definitive reference to hand to people." When the U.S. Geological Survey (USGS) called, Krevor and his colleagues jumped at the opportunity for collaboration; the Lenfest Center supplied the knowledge of what rocks would be useful in capturing carbon dioxide, and the USGS supplied the expertise in the evaluation and mapping of mineral resources.

The results showed that there is a lot of this rock out there and that "the sequestration process would not be limited by the amount of rock," says Krevor. The accessible ultramafic rock in the United States, much of it clustered along the mountain ranges of the East and West Coasts, would be enough to stash at least 500 years' worth of the carbon dioxide produced in the country.

This information will help researchers like Krevor back in the lab. Knowing what minerals are most common will guide their research on how to fine-tune the reaction of carbon dioxide with rocks. "The most important issue facing mineral carbon research right now is to find cost-effective solutions to making these carbonation reactions happen quickly," says Krevor.

Carbon mineralization has great potential, but is expensive to execute. Earth Institute scientists are exploring ways to make it more practical. In Iceland, Jürg Matter, Doherty Associate Research Scientist, and Wallace Broecker, Newberry Professor of Geology, are working to sequester carbon dioxide produced by a geothermal energy plant in nearby basalt rock formations. In a Columbia University lab, Alissa Park, Lenfest Junior Professor in Applied Climate Science, is fine-tuning the capture of carbon by grinding rocks into small pieces and attempting to accelerate their sequestration potential using chemical engineering processes. ■

Finding ways to mineralize carbon dioxide and permanently store it in the form of rock is an important focus of work by graduate students and scientists at the Lenfest Center for Sustainable Energy.

Photo: Courtesy of the Sabin Vaccine Institute

Improving Health, Bettering Lives

Photo: Courtesy of the Sabin Vaccine Institute

"We knew this was the right investment for us, and for humanity."

Financier Bill Gross *and his wife*, Sue, *who auctioned rare stamps from his collection to support the Millennium Villages project*

Suppose you need to see a doctor but have to wait in line with more than a thousand other people for the few physicians serving your community. This is the grim reality of Africa's health system—lack of access to crucial health services. Combined with other challenges like tropical diseases, a picture of poor health emerges that can hamper a marginalized population's ability to escape the trap of poverty.

With the help of donors—Merck, GlaxoSmithKline, the John D. and Catherine T. MacArthur Foundation, the Bill and Melinda Gates Foundation, Bill and Sue Gross, Nancy and Randy Best, and Betsee Parker, to name a few—Earth Institute staff and researchers are working through the Millennium Villages project to train community health workers and address malaria and other tropical diseases. The idea is that healthy communities will be better able to put their energy toward challenges such as education and environmental sustainability and work to improve their economic well-being—all part of the UN Millennium Development Goals set out to halve poverty by 2015.

Photo: Courtesy of the Sabin Vaccine Institute

Good health is an important part of escaping the trap of poverty, which affects many communities in Africa.

Through interactions with household members and health care professionals in clinics, community health workers (CHWs) can deliver preventative and curative services at the household level, and they form an important link to the larger health care system by providing information and directing referrals to clinics and district hospitals. Because community health workers are from the communities they serve, patients often feel comfortable volunteering information they might not otherwise reveal.

"The community health worker is the backbone of the health system for us," says Prabhjot Dhadialla, a program director at the Earth Institute's Center for Global Health and Economic Development, which runs the training program. New York–based staff and the staff in the Millennium Villages are working with national governments on key policy issues necessary to expand the model to a national scale. "Our goal is to make this a community and country program—replicable and adaptable," says Dhadialla.

There are between 350 and 500 million malaria illnesses occurring annually and more than one million needless deaths, despite it being a highly preventable and curable disease. The Earth Institute's Quick Impact Initiative and its key component, the Breaking the Bottlenecks to Malaria initiative, led by Awash Teklehaimanot, provide crucial expertise and advice to more than 10 African nations to boost their malaria control programs. Thanks to generous donors like the Morton K. and Jane Blaustein Foundation, the initiative is meeting its goals for interventions such as bed net distribution and expanded diagnostic capacities in seven countries.

Neglected tropical diseases (NTDs) are a group of 13 parasitic and bacterial infections that affect more than 1.4 billion people worldwide. They are diseases of poverty and are widespread among people in poor and marginalized communities. Yet, seven of the most common NTDs are easily controlled with medicines that cost roughly 50 cents per person, per year. As one of the co-founders of the Global Network for Neglected Tropical Diseases, the Earth Institute is helping to raise the profile of these ailments and is developing models for scaling up the prevention and treatment of the NTDs in Africa. The Earth Institute also leads a nationally scaled NTD control program in Rwanda. ■

Photo: David Wentworth

Better Training for Development Professionals

Photo: David Wentworth

An effort to change development training around the world was formally launched at the Earth Institute in October 2008 (above).

"At their best, foundations can play a key role in fostering innovation and change. … We look forward to the advancement of understanding across fields that will help aspiring practitioners tackle some of the greatest challenges of our century."

Jonathan Fanton,
John D. and Catherine T. MacArthur Foundation

When the MacArthur Foundation sent out a request for new ideas from the world's great thinkers, it was answered with a paradox, says Jonathan Fanton, the foundation's president: "A major category of development professionals … make decisions that affect the lives of millions of people. Yet their training is typically quite narrow or of short duration—certainly not aligned with the breadth of their responsibilities."

Around the world, development professionals are directing the flow of aid and designing programs to address problems such as extreme poverty and hunger. However, they typically do not have the background in the natural and health sciences they need to properly understand the forces affecting the issues they are trying to address: the interplay of changing climate conditions and water availability on food production and human nutrition, for instance.

Earth Institute research associate John McArthur (CEO and executive director of Millennium Promise), who pointed out the paradox, and Jeffrey Sachs, director of the Earth Institute, recognized that a revolution was needed in development education, similar to what *The Flexner Report* did for improving medical training in 1910. With the support of the MacArthur Foundation, they brought together experts and practitioners from around the world to lay the groundwork for a new set of Master's in Development Practice degrees.

"While no individual can master all or even most of the skills required—in science, policy design, politics, management, and cross-cultural understanding—for the success of broad-based progress in sustainable development," wrote McArthur and Sachs, "we certainly need a new generation of development practitioners who can understand the 'languages' and practices of many specialties, and who can work fluidly and flexibly across intellectual and professional disciplines and geographic regions."

One of the early initiatives of the new International Commission on Education for Sustainable Development Practice was the innovative Global Classroom, which joined together 300 students from 12 time zones in real-time discussions with professors and each other. "The Global Classroom formed a small international community in which students gathered to study about world problems," says Li Zhao, who applied what she learned to an energy efficiency project in her native city of Taiyuan, China, where heavy industry is the main source of income.

"I am helping fight poverty from within my native Sierra Leone," says Global Classroom graduate Mathew Sandy. "My goal is to deliver the most-needed ideas that affect real life."

The Global Classroom will be an important part of the Master's in Development Practice program, a network of graduate degrees to be started around the world. The first degree was established at Columbia—the Master of Public Administration in Development Practice—as a joint effort between the Earth Institute and the School of International and Public Affairs (SIPA). The program welcomed its first class of students in the fall of 2009 under the leadership of SIPA professor Glenn Denning, formerly of the Millennium Villages project where he was a founding director of the Millennium Development Goals Centre East.

"We had a very global and diverse application pool, from candidates who were coming from a computer engineering background to public health professionals," says Louise Rosen, director of the Office of Academic and Research Programs at the Earth Institute. "What connected them was that they all had very strong quantitative skills and a deep commitment to addressing issues of absolute poverty and inequity in the developing world." ■

Photo: David Wentworth

The MacArthur Foundation, under the leadership of Jonathan Fanton (above), committed $15 million to support the creation of new Master's in Development Practice programs at universities around the world.

The new M.P.A. in Development Practice at Columbia will give development professionals the interdisciplinary training they need to address issues like extreme poverty and hunger.

Photo: Alan Orling

Opening the Door for Undergrads

Photo: Alan Orling

Jeffrey Sachs (above) teaches one of the core courses in the popular undergraduate special concentration in sustainable development.

Sustainable development is a big challenge for this century. Students are asking for programs that prepare them to meet this challenge.

Until recently, training in sustainable development at Columbia University was available only at the graduate and doctoral level. This changed with the creation of a new undergraduate special concentration in the fall of 2007. The program has proven extremely popular among students, and the University is in the process of developing a full major, with plans for it to be in place in 2010.

"Sustainable development is a big challenge for this century. Students are asking for programs that prepare them to meet this challenge," says Ruth DeFries, Denning Family Professor of Sustainable Development, who helps support the program with Associate Professor Kevin Griffin, interim director of the special concentration. "We need to prepare them, whether they are going into law, finance or science. They need holistic systems thinking."

Victoria Diaz-Bonilla '11CC, an environmental science major who began the concentration as a sophomore, believes it is just what she needs to make more practical use of her major once she graduates. While the major in environmental science will give her technical skills in the sciences, the special concentration in sustainable development will give her the understanding of economics and social science she needs to go beyond the practice of scientific research and apply her knowledge in the real world.

"I see myself as bridging a gap, something that [Jim] Hansen has pointed out, that [President] Obama has pointed out, this gap between scientists and policymakers," says Diaz-Bonilla. "I've channeled my energy into learning about environmental policymaking and becoming part of this new generation that recognizes the importance of having policies based on sound science. … I've come to learn that Columbia is one of the best, if not the best, places to be as an undergraduate for sustainable development and environmental studies," says Diaz-Bonilla.

Students in the Sustainable Development Workshop worked with the Nature Conservancy to assess the impacts of sea level rise on Long Island salt marshes.

Yasmine Koukaz '09CC, who began the undergraduate special concentration as a junior, found it helped her gain direction and focus. "Some people come in and they know they want to be a doctor or a lawyer and they take their classes. For others, it's hard to know what they want to do when they come here," says Koukaz. She found the exposure to the many interconnected disciplines covered in the concentration—from natural science to policy—helped her realize her interest in focusing on medicine and public health and in applying her knowledge with a global perspective, something that was especially significant to her, having grown up speaking several languages in a family originally from Lebanon.

Michael Stennis '09CC says he and others who found out about the special concentration at the same time were all generally interested in the field of study, "but there wasn't an outlet for it" before the concentration was developed. He believes its program of study better prepared him "to verbalize global needs in terms of sustainable development"—in terms of achieving our current generation's needs without compromising the needs of future generations. This is an important ability to have as we face an era of global challenges like climate change and global poverty. ■

Reflecting on the Year's Successes

Photo: David Wentworth

Philanthropist and entrepreneur Ted Turner joined the Earth Institute for the public launch of the Columbia Climate Center in March 2009.

We are now more than 77 percent toward our campaign goal of $200 million.

Photo: Eileen Barroso

Despite a challenging economy, we ended another year of groundbreaking work at the Earth Institute having raised more than $17.7 million in gifts from individuals, corporations and foundations. We are now more than 77 percent toward our campaign goal of $200 million.

In March 2009 the Earth Institute launched the Columbia Climate Center to build upon the many climate-related activities and world-class research efforts conducted throughout the University. We welcomed entrepreneur and philanthropist Ted Turner, whose United Nations Foundation works with the Earth Institute on several projects on the environment and on malaria control, as our guest.

This year also marked the end of five years of the Global Roundtable on Climate Change (GROCC), funded by benefactor Gerry Lenfest. GROCC brought together high-level, critical stakeholders from all regions of the world to discuss and explore areas of potential consensus regarding core scientific, technological and economic issues critical to shaping sound public policies on climate change. Continuing this important work, some companies are now looking to engage with us on climate, energy, water and other key Earth Institute cross-cutting initiatives.

At the Lamont-Doherty Earth Observatory we celebrated the University Senate's approval in February 2009 of the "Lamont Research Professor," a new title within the Officer of Research track at Columbia. This prestigious position will enable the Observatory to boost its competitive edge in attracting high-caliber senior researchers into tenured faculty positions. No other Ivy League university plays such a prominent role in earth and environmental research and in training the field's future leaders. In the final phase of our campaign, we will seek to endow these new positions and ensure our continued legacy as a world leader in research and education.

As this report goes to print, we are more than halfway through a $20 million Millennium Development Goals grant from the Bill and Melinda Gates Foundation that supports the core of the Earth Institute's applied research efforts in the Millennium Villages project. Substantial progress has been made in the areas of policy, health, energy/ICT/transport, agriculture, and monitoring and evaluation. Our Millennium Development Goals Centers have provided support to national governments and other key stakeholders to finalize more than 12 national-level plans for an African Green Revolution. These plans will facilitate increased agricultural production and promote improved nutrition in Sub-Saharan Africa.

Our Capital Campaign Committee was launched in October 2008 and is comprised of leaders who provide strategic fundraising advice, support, participation, leadership gifts and connections to peers for our $200 million campaign. These individuals serve as "ambassadors" for the Earth Institute's work. This year, they helped us reach out to several new donors and friends through targeted events in the tri-state area. We remain grateful for their advice and support.

We continue to secure endowment funds to provide scholarships and fellowships to students, and we work to support programs like the innovative undergraduate special concentration in sustainable development, soon to be offered as a full major. We are also working to establish professorships in sustainable development that will attract visionary scholars to help forge the sustainable solutions of tomorrow.

From our work developing new carbon sequestration technologies, to our educational programming, to our research on sustainable water issues in countries including Brazil and India, the commitment and generosity of all our donors allows us to continue to be the world's leading academic center confronting the practical challenges of sustainable development. ■

Photo: Alan Orling

The labs of the Gary C. Comer Geochemistry Building, built with support from the Comer Science and Education Foundation, facilitate ongoing, innovative earth science research.

The fundraising teams from the Earth Institute's Office of Funding Initiatives, the Lamont-Doherty Earth Observatory and the Lenfest Center for Sustainable Energy (above). Top row, left to right: Gregory Fienhold, Teresa S. Karamanos, Megan E. Morytko, Cinnamon Coe, Barbara Charbonnet, Dove Pedlosky, Stacey Vassallo. Bottom row: Jasmina Metjaic, Lisa Phillips, Urania Mylonas, Jennifer Swift-Morgan, Ivy S. Morgan. Haresh Bhojwani of the International Research Institute for Climate and Society is not shown.

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July 1, 2008–June 30, 2009

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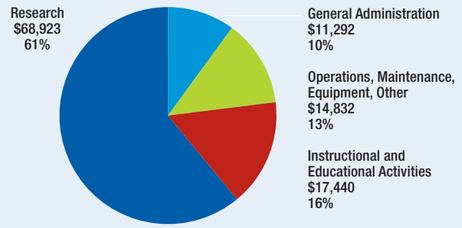

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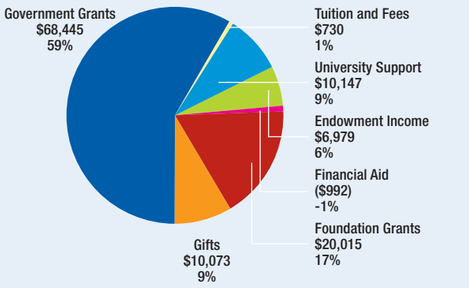
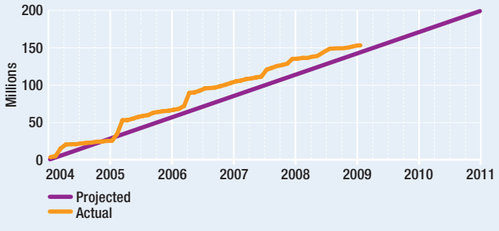


Thanks to the generous support of our donors, we have raised more than 77 percent of our campaign goal to fund research, professorships, scholarships and educational facilities.



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The Earth Institute is proud to thank and acknowledge the individuals, corporations and foundations whose support this past fiscal year (July 1, 2008–June 30, 2009) has allowed us to continue to be the world's leading academic center dedicated to the study of sustainable development. The incredible work of the Earth Institute could not exist without their trust, commitment and vision.

Photo: Bob Handelman

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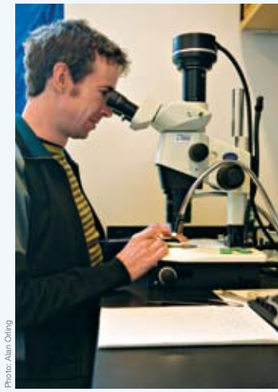
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Each year, the Earth Institute hosts events that bring together influential thought leaders and decision makers from around the world.

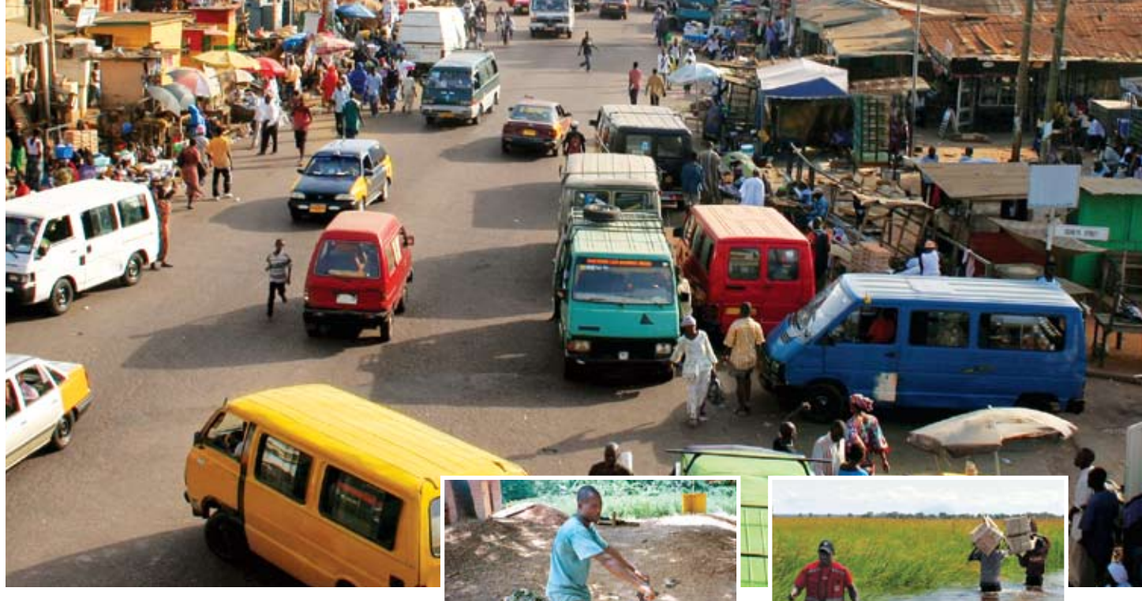
Shown above are Jeffrey Sachs, Shakira and Mexican President Felipe Calderón, one of six Latin American presidents who attended the event launching the Earth Institute–ALAS partnership to address early childhood development issues.

This is a summary list of donors to the Earth Institute, which includes the Lamont-Doherty Earth Observatory and other Earth Institute centers.

In addition to the generous support we receive from individuals, corporations and foundations, we remain grateful for support from entities such as the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), the Royal Norwegian Embassy in Luanda, the United Nations Development Programme, and the World Bank.

We have made every effort to ensure this listing of contributors is complete, and we apologize for any errors or omissions. To report corrections, please e-mail us at support@ei.columbia.edu or call 212-854-7878.

Earth Institute Project Highlights



The Earth Institute is composed of more than 30 research centers and programs. Here are a few more highlights of the many projects we have conducted during the last year.

Visit us online at www.earth.columbia.edu for regular updates on our work.

Science and Religion: Finding Common Ground

Over the last six years, the Earth Institute's Center for the Study of Science and Religion and the Fetzer Institute of Kalamazoo, MI, have held four public symposia on issues requiring both a scientific and a religious perspective. This year, the symposium held a public dialogue on the most pressing of these issues: global sustainability. Scholars, clergy and activists from diverse perspectives met to elaborate a common path toward a sustainable and equitable future.

Millennium Cities Initiative and the Tides Foundation

A landmark challenge gift from the Tides Foundation is helping the Millennium Cities Initiative (MCI), the urban counterpart to the Millennium Villages project, assist several mid-sized cities across sub-Saharan Africa in the promotion of sustainable development and achievement of the Millennium Development Goals. The $1.9 million gift, received in August 2008, will match all gifts made to the MCI on a 1:1 ratio through June 30, 2010. As this report goes to print, we will have matched gifts totaling $511,025 through the Tides Challenge.

Sustainable Transportation, Land Use, Planning and Governance

The Earth Institute's Center for Sustainable Urban Development (CSUD) contributes to the Volvo Research and Educational Foundation's Future Urban Transport program by developing more sustainable transportation systems in cities like Nairobi, Kenya. CSUD works within a wider context to address land use, planning and governance. This work is also financially supported by the Rockefeller Foundation.

Bamboo Bikes for African Villages

In many rural African communities, economic development and access to health care and education are limited by the fact that villagers can only get so far on foot. Bicycles are an increasingly popular mode of personal and cargo transport, but they can be expensive to import from China and made with cheap steel that does not stand up to the wear of unpaved roads. A project funded by the Earth Institute's Earth Clinic is designing bikes from bamboo, a locally abundant and sustainable resource, and the Millennium Cities Initiative is analyzing the feasibility of producing these bikes at a larger scale.

Joining Forces With the Red Cross

The International Federation of Red Cross and Red Crescent Societies and the Earth Institute's International Research Institute for Climate and Society have teamed up to save lives. The annual rate of weather-related disasters, now double the rate of the early 1990s, is increasing, in part, due to climate change. This has dramatic implications for the increasing number of people living in areas vulnerable to storms, droughts, floods and climate-related disease outbreaks. With its climate expertise, IRI is uniquely positioned to engage with the rest of the world on this issue, says Rajendra Pachauri, chairman of the Intergovernmental Panel on Climate Change and IRI's new board chairman.

Research Centers and Programs

Research Units of the Earth Institute

Center for Climate Systems Research (CCSR)
Center for Environmental Research and Conservation (CERC)
Center for Global Health and Economic Development (CGHED)
Center for Hazards and Risk Research (CHRR)
Center for International Earth Science Information Network (CIESIN)
Center for National Health Development in Ethiopia (CNHDE)
Center for Rivers and Estuaries
Center for Sustainable Urban Development (CSUD)
Center for the Study of Science and Religion (CSSR)
Center on Globalization and Sustainable Development (CGSD)
Columbia Climate Center
Columbia Water Center
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International Research Institute for Climate and Society (IRI)
Lamont-Doherty Earth Observatory (LDEO)
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Programs of the Earth Institute

ADVANCE Program
Cross-Cutting Initiative (CCI)
Earth Clinic
Global Roundtable on Climate Change (GROCC)
Program on Science, Technology, and Global Development
Millennium Cities Initiative
Millennium Villages Project
Tropical Agriculture and Rural Environment Program
Urban Design Lab (UDL)
M.A. in Climate and Society
M.P.A. in Development Practice
M.P.A. in Environmental Science and Policy
Ph.D. in Sustainable Development
Undergraduate Special Concentration in Sustainable Development

Joint Units of the Earth Institute

The following four units were established jointly by the Earth Institute and a second entity.

Center for Research on Environmental Decisions (CRED)
Cooperative Institute for Climate Applications and Research (CICAR)
Laboratory of Populations
Vale Columbia Center on Sustainable International Investment

Affiliates and Consortiums

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Black Rock Forest Consortium
Center for Climate Change Law (CCCL)
CERC Consortium
NASA Goddard Institute for Space Studies (GISS)

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