THE EARTH INSTITUTE
COLUMBIA UNIVERSITY

Annual Donor Report 2010

The many challenges facing the planet—from poverty to climate change to urbanization—are deeply intertwined, as are their solutions. The Earth Institute's interdisciplinary approach to sustainable development and its extraordinary contributions in research, education and the creation of real-world solutions are helping pave the way toward a better future.

Cover Images: Alan Orling, Sandy Kaufman, NASA, Millennium Promise, Squared Design Lab

Jacques Descloitres, MODIS Land Rapid Response Team, NASA/GSFC

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"Columbia University is uniquely positioned to generate scientifically based solutions to these mounting problems because of the remarkable talent and creativity brought together by the Earth Institute."

THE CHALLENGES FACING OUR GLOBAL COMMUNITY are well known and pervasive. We understand the urgency required in addressing the impact of climate change on the environment, on the oceans, and on human populations living in increasing density that makes them more vulnerable to natural disasters. We know how lack of attention to controlling communicable diseases or eliminating contaminated water sources can undermine sustainable development. We see the critical need to identify and develop cleaner alternative energy sources.

Columbia University is uniquely positioned to generate scientifically based solutions to these mounting problems because of the remarkable talent and creativity brought together by the Earth Institute. Since its inception as a collaborative, interdisciplinary group of scholars, researchers, policymakers and students, Columbia's Earth Institute has been at the forefront of new ideas and insights essential to crafting a more sustainable future on our planet. Columbia has been fortunate to have the participation of a number of loyal and dedicated alumni and friends who, through their generosity and vision, have helped sustain the Earth Institute's pioneering efforts.

In one after another of the major earth science developments of 2009–10—from the natural disasters of the earthquakes in Haiti and Chile to the Copenhagen climate summit and the man-made disaster of the Gulf oil spill—Columbia's Earth Institute and Lamont-Doherty researchers have played critical leadership roles in our understanding of both what has happened and what we can do about it as a society.

At the same time, under our admired director Jeff Sachs and chief operating officer Steve Cohen, the Earth Institute has expanded its mission of teaching and training through the incubation of two new programs formed to respond to the changing landscape of sustainable development: the Master of Science in Sustainability Management and the undergraduate major in sustainable development.

Columbia University owes our generous donors and supporters a deep debt of gratitude for helping the Earth Institute fulfill its vital mission both within the University and in the world. In a truly global sense, you are taking an active part in assuring a more sustainable future for life on our planet. This is the mission of a great university in our society—and it is exemplified not only by the astonishing track record of pioneering breakthroughs by our Earth Institute, but by the extraordinary potential for good that we know is yet to be realized by its continued leadership.

Lee C. Bollinger

OUR PLANET FACES UNPRECEDENTED CHALLENGES of climate change, energy needs, water and food shortages, pollution, and natural disasters. Together these crises constitute the overarching challenge of sustainable development: how to combine economic progress with responsible stewardship of Earth's physical resources and biodiversity. This past year, the Earth Institute's students, scientists and researchers have been working in the classroom, on the ground and with governments around the world to help find answers to these crucial issues.

The Earth Institute's innovative educational programs at Columbia University empower students to be the next generation of leaders. This year saw the continued success of the Master's in Development Practice and the launch of the new Master of Science in Sustainability Management, which will train professionals to help lead organizations toward greener futures. And this fall, Columbia undergraduates could declare sustainable development as a major for the first time. These unique degree programs, and others we have pioneered, set the stage for Columbia to be a global center for education in sustainable development.

With support from Ericsson, The Economist, and donors Charles and Elizabeth Bowlus, we opened doors around the world in March 2010 for our flagship State of the Planet conference. World leaders, including UN Secretary-General Ban Ki-moon, Prince Albert II of Monaco and President Felipe Calderón of Mexico, addressed the challenges of climate change, poverty, economic recovery and reform of the international system for managing sustainable development. To expand Columbia's global reach, the University launched the Columbia Global Center | South Asia in Mumbai, India, which will build on the Earth Institute's work in South Asia.

In Africa and elsewhere, our scientists are studying how climate change influences the spread of diseases like meningitis and malaria. With a grant from Google.org's Predict and Prevent Program, they are leveraging the expertise of climate and health communities and using seasonal forecasting to help save lives.

The devastation of the earthquake in Haiti highlighted the urgent need for a cross-disciplinary response to extreme poverty and natural hazards. Before the earthquake struck, scientists and experts like Tatiana Wah, supported by the Green Family Foundation, were addressing poverty-related issues in Haiti. Work was stepped up after the earthquake, with several Earth Institute units involved.

As a remarkable, thriving and multidisciplinary hub for Columbia University's vast intellectual resources in sustainable development, the Earth Institute provides extraordinary solutions to some of the world's most pressing challenges. The support of our donors has allowed us to make great progress and will help ensure our planet is productive, equitable and sustainable for all.

Alan Orling

"The support of our donors has allowed us to make great progress and will help ensure our planet is productive, equitable and sustainable for all."

Jeffrey D. Sachs

Even before a devastating earthquake hit Haiti in early 2010, it was suffering from environmental problems, such as deforestation and soil erosion, and other challenges related to extreme poverty. Experts from the Earth Institute are working toward solutions.

A Future for Haiti

WHEN A MAGNITUDE 7.0 EARTHQUAKE hit Haiti in January 2010, the Earth Institute was already there, helping to restore the island's natural environment and address issues related to extreme poverty. The shuddering ground left devastation in its wake—more than 200,000 Haitians lost their lives and over a million were left without homes—but the earthquake itself was not the sole cause of the destruction.

"The well-known finding from studies of disaster impacts is that poor countries are hit much harder than wealthy countries," says Marc Levy, deputy director of the Center for International Earth Science Information Network. Haiti is the poorest country in the Western Hemisphere. When the same size earthquake hit the San Francisco bay area in 1989, only 63 people died. But Haiti had houses built with inadequate building materials and a limited ability to respond with food, water and disaster relief. When the earthquake hit, its devastation was inevitable.

In the months following the earthquake, relief efforts became the first priority for work in Haiti. Medical practitioners and volunteers from Columbia flew down to help. The Earth Institute set up a Haiti Task Force that met weekly to discuss how centers and programs could help. Scientists from the Lamont-Doherty Earth Observatory set out to study the causes of the earthquake and improve Haiti's ability to predict a recurrence.

But the long-term goals of addressing Haiti's underlying issues of poverty and environmental degradation remained important. "The problems that were plaguing the country before the earthquake are not going away," says Levy. "The hurricanes are not going to go on hold. The soil erosion is not going to stop. The agricultural yields are continuing to fall. So it's very important that we remember these long-term problems are also quite acute, and if we don't address them, the country as a whole will remain in very difficult circumstances."

About 80 percent of Haiti's budget relies on international aid, says Professor Tatiana Wah. She was hired as an expert consultant before the earthquake, with support from our partner the Green Family Foundation, when President Prevál asked Director Jeffrey Sachs for a policy advisor. With international attention focused on the island nation, Haiti had the opportunity to lift itself from its troubled past. But the process would take patience and learning on all sides, and progress would take time.

"Those who want too many quick turnarounds to move a whole society in a short amount of time can get disappointed," says Wah. Even the government offices were destroyed in the earthquake, and meetings about the future took place under mango trees.

One of the main priorities was restoring agricultural productivity in rural areas, according to Wah (whose work is also currently supported by donors like Betsee Parker, Nancy Best and Sara Miller McCune), especially because so many residents of Port-au-Prince, once the focus of development work, fled to the countryside. Other improvements, like infrastructure, would follow.

"As longtime supporters of Haiti, it was extremely beneficial to have a solid working partnership in place with the Earth Institute and Professor Tatiana Wah when the earthquake hit in January. The Earth Institute's initiatives will continue to assist Haiti in building back stronger and help provide sustainability for the long term."

— Kimberly Green
President, Green Family Foundation

Playing for the Planet

"Through endowed professorships, the Lenfest Foundation has invested in the long-term stability of the Earth Institute, which will provide benefits to students, faculty and programs year after year, generation after generation."

— The Lenfest Foundation

SCOTT BARRETT, the Lenfest-Earth Institute Professor of Natural Resource Economics and an expert in complex international negotiations, teaches game theory in his Global Collective Action class. Using a simple card game, Barrett helps his students understand the consequences of decision making in complex negotiations, like those involved in climate treaties, where each country's actions depend on the actions of others.

Barrett begins the game by giving each student two cards—one red, one black. Each player who keeps the red card and turns in the black gets five dollars. Each player who turns in the red card receives just one dollar, but in this case everyone else in the group also receives one dollar. There is no talking allowed, and students must decide which card to hand in without knowing what the other students will do. "Reducing greenhouse gas emissions is like handing in your red card," says Barrett. "Everyone benefits equally, but you're paying a cost." Typically, half of the students decide to keep their red cards the first time they play the game.

Barrett is the second of two faculty members whose positions have been endowed in the Earth Institute by Gerry and Marguerite Lenfest. "Endowment helps spur innovation, and boosts teaching and research," says Steven Cohen, executive director of the Earth Institute.

As a Lenfest professor, Barrett studies the interactions between economic and natural systems, with the goal of developing a sustainable and efficient economy. "What I like about economics is that it gives weight to everyone's voice," says Barrett. "It also provides a framework that acknowledges complexities, tradeoffs and hard choices."

Barrett became interested in international negotiations on September 17, 1987. "That was the day the Montreal Protocol was adopted," says Barrett. The Montreal Protocol is an international treaty designed to protect the ozone layer by phasing out the production of a number of ozone-destroying substances. "I was flummoxed, because the training I had in economics up to that point had taught me that cooperation like that didn't happen," says Barrett.

Cooperation among nations is essential for such consequential issues as avoiding nuclear warfare, improving public health, promoting sustainable economic development, and addressing the threats of climate change. "Climate change is the greatest collective action problem in human history," says Professor Barrett. With each country wanting to pursue its own agenda, it is not an easy problem to address as a group, he adds.

When Barrett has his students play the black and red card game a second time, close to 85 percent think of the greater good of the group and hand in their red cards. "I'm teaching students how to change the rules of the game—they're the next generation of decision makers, after all," says Barrett.

The endowment of faculty positions allows us to support talented scholars like Lenfest-Earth Institute Professor of Natural Resource Economics Scott Barrett, who teaches students about global decision making related to climate change and other issues.

Alan Ohring

NASA-Goddard Space Flight Center Scientific Visualization Studio

"It is truly satisfying for me to know that my gifts to Lamont-Doherty's annual fund enable the director to allocate money for leveraging large federal matching grants and supporting critical initiatives, like the Antarctic expeditions."

— Frank Gumper
Vice Chair, Lamont-Doherty Advisory Board, '71GSAS and '83BUS

Experts at the Lamont-Doherty Earth Observatory, including senior research scientist Robin Bell and engineer Nick Frearson (near left), are studying the behavior of ice in Antarctica in an attempt to better understand what could happen to it as global temperatures climb.

Secrets Beneath the Ice

THE ICE SHEETS OF ANTARCTICA are not something most people spend much time worrying about. But they have the potential to significantly impact our oceans. West Antarctica alone, an increasingly unstable ice sheet that rests on the ocean floor, contains enough water to raise global sea levels by almost four meters. And the ice sheets of Antarctica are melting much faster than scientists believed even a few years ago.

Beneath the ice of the polar ice caps lies a world of water—in the form of lakes and transient networks of flowing liquid—that scientists are racing to explain. Water accelerates the flow and the melting rate of ice, so its presence and its behavior are important to understand. "We're studying a piece of the plumbing system that nobody's thought about that will change the way people think about the physics of ice sheets," says Robin Bell, a senior research scientist at the Lamont-Doherty Earth Observatory.

In order to model the fate of polar ice sheets, we need to better understand what forces are acting on them. Achieving this understanding is fundamental to the work that Bell and others at Lamont-Doherty are pursuing, from areas where ice forms at the top of ice sheets to regions where it erodes at the edges. When Bell led an international expedition, funded by the National Science Foundation (NSF), to a range of mountains as big as the European Alps but buried beneath the ice of Antarctica, she was able to explore a place where ice is formed and peer beneath the surface to observe the hidden dynamics of the water below. Not long after, a team of Lamont-Doherty researchers joined a massive NASA expedition to study the edges of Antarctica and the behavior of the ice there, where warming ocean temperatures are causing increasing rates of erosion.

Ultimately, this research is "targeted at how ice sheets grow, shrink and are changing," says Bell. "We're trying to catch the whole life history of ice sheets." The work is vital, but also expensive. The logistics of running research planes back and forth across the ice cost millions of dollars. While exploring the Gamburtsev Mountains, Bell and Lamont-Doherty engineer Nick Frearson started thinking about a better way.

The result was IcePod, a project named after the "pod" they would design to contain a suite of measuring equipment that could be mounted on New York Air National Guard planes already making about 200 regular service flights across the continent each year, turning "delivery machines into science machines," says Bell. NSF has provided $4 million, and $2 million in matching funds will need to be raised from private donors. IcePod will make it possible to collect important data about the behavior of ice sheets more regularly and more cheaply.

Ian Webster/CRED

A new, easy-to-read guide helps scientists and others think about the most effective ways to communicate about climate change. Cartoons illustrate issues like how people have an easier time relating to concrete examples and real-life images than technical data (above), how scientists and lay people do not always speak the same language (opposite page), and how humans have the ability to worry about only so many things at a time (right).

Ian Webster/CRED

Changing Minds About Climate Change

HOW DO YOU MOTIVATE AND EMPOWER people to do something about climate change? Do you show them pictures of polar bears and melting ice? Or present complex graphics showing CO_2 emissions rising over a 50-year period? According to the guide "The Psychology of Climate Change Communication," published by the Center for Research on Environmental Decisions (CRED), while these methods can resonate with some individuals and groups, communicating climate change effectively to a broad audience and getting people to act is a lot more complicated.

To help navigate the complexities, the center created the guide as a synthesis of the research on decision making under uncertainty that it has been pursuing since its inception in 2004. The Charles Evans Hughes Memorial Foundation, which supports communication strategies to address climate change, provided the vital support that made it possible to apply years of learning into a timely and engaging guide filled with illustrative drawings and diagrams and intended for very practical applications. "The guide was a labor of love to get CRED's research out to a wider audience … to give people information they could actually put to use," says Debika Shome, a former assistant director at the center and co-lead writer of the guide.

The center's research has shown that people retain more factual information after viewing photos and videos, as opposed to being shown analytical information alone. "Most people don't turn abstract, analytic topics into powerful, vivid images," said Sabine Marx, associate director of CRED and co-lead writer of the guide, at the launch of the Columbia Climate Center in January 2009. "Using affective, emotion-evoking material, such as first-person accounts, pictures and stories can raise attention and is more likely to motivate action."

But while the idea of a drowning polar bear may play on one's emotions in the short term, appeals such as this "may backfire down the road, causing negative consequences that often prove quite difficult to reverse," according to the guide. This is a concern, especially given the significant drop between 2008 and 2009 in the number of people in the United States who said they were convinced human activity was causing the climate to warm, despite overwhelming evidence that it is.

Adrian Soghoian, a Columbia College senior who contributed to the guide and went on to help integrate best practices from it with Mayor Bloomberg's PLaNYC 2030, likes the way the guide speaks to the importance of recognizing who your audience is and what they care about. "I believe effective framing is what climate scientists and mitigation/adaptation advocates need to do better," says Soghoian. Framing messages for specific audiences can help scientists and others communicate the threats of climate change more effectively.

In the first few months after the guide was released, about 15,000 people from 140 countries requested print copies or downloaded it from the center's Web site. "We've had requests to translate it into a number of languages," says Shome.

Ian Webster/CRED

Research has shown that people retain more factual information after viewing photos and videos, as opposed to being shown analytical information alone.

Millennium Promise

Millennium Promise

The Millennium Villages project, a partnership effort to advance the scale-up of basic, science-based interventions aimed at reducing poverty, is demonstrating progress in sub-Saharan Africa. For example, in Mwandama, Malawi, maize production has climbed from 0.8 tons a hectare to 5.2 tons a hectare as a result of interventions such as improved access to fertilizer, the distribution of hybrid maize seeds, and the training of farmers in good agricultural practices.

Millennium Promise

Improving Lives by 2015

AT THE TURN OF THE CENTURY, world leaders gathered at the United Nations Millennium Summit and committed their nations to reducing extreme poverty by 2015. They set out an ambitious set of targets, known as the Millennium Development Goals (MDGs), which were aimed at the many facets of poverty, from hunger and nutrition to education and health, and signed off on by all 192 UN member states. "The MDGs are a pledge," said UN Secretary-General Ban Ki-moon at the Earth Institute's State of the Planet Conference in March 2010. "They are a commitment to the world's most vulnerable people."

Now, five years away from the deadline, where does the world stand in terms of achieving the MDGs? According to the 2009 MDG report released by the United Nations, there has been progress, but not enough. The world's economic challenges and the growing effects of climate change pose additional hurdles to overcome.

"The global community cannot turn its back on the poor and the vulnerable," wrote Ban Ki-moon in the report's introduction. "We must strengthen global cooperation and solidarity, and redouble our efforts. … Nothing less than the viability of our planet and the future of humanity are at stake."

The Millennium Villages project, a partnership between the Earth Institute, the United Nations Development Programme and Millennium Promise, is focused on achieving results in select villages across sub-Saharan Africa and demonstrating that by fighting poverty at the village level through community-led development, rural Africa can achieve the MDGs and escape extreme poverty. A midterm report, released this year with leadership from the Earth Institute, describes exciting progress in the first three years of the project as well as some of the challenges faced and priorities needed to reach the MDGs by 2015.

"We've seen very promising results from the 'quick wins,' namely increased agricultural production, improved child nutrition, distribution of insecticide-treated bed nets and school meals programs," says Cheryl Palm, a senior research scientist with the Earth Institute's Tropical Agriculture and Rural Environment Program. "These are all scientifically proven interventions that produce results very quickly."

The provision of subsidized fertilizer, improved seeds and best practices training has doubled and even tripled crop yields in the villages. As a result, household food security has increased and the degree of stunting in children, a sign of chronic malnutrition, has decreased. The improved yields are being used to feed children daily meals at school, which helps improve attendance. And since the introduction of insecticide-treated bed nets, the prevalence of malaria has declined, helping to improve health.

"Once food production is increased, people in the villages can begin to transition to income-generating agricultural opportunities and business development," says Palm. Other priorities for the next five years will include improving the delivery of health services at the community level, improving education quality, and increasing access to clean drinking water and improved sanitation practices (work that has received support from JM Eagle, the world's largest manufacturer of plastic pipe).

"The Earth Institute's research, education and outreach toward meeting the Millennium Development Goals in sub-Saharan Africa are what drew me to its work. The profound changes that are effected in people's lives are extraordinary, and I am happy to support these crucial efforts."

— Nancy Best
Earth Institute Campaign Committee Member

Klaus Lackner, director of the Lenfest Center for Sustainable Energy, and researcher Christoph Meinrenken (above) are part of a team exploring ways to turn solar energy and recycled carbon dioxide into liquid fuel. Allen Wright (right), senior staff associate, is helping design methods for filtering carbon dioxide from the air.

Alan Oring

Recycled CO_2 + Sunshine + Water = Fuel

THE SEARCH IS ON FOR CLEANER, better ways to fuel our future, while cutting emissions of climate-altering greenhouse gases. Scientists at the Earth Institute have long been investigating ways to capture and sequester carbon dioxide produced as a byproduct of human activity. Now they are looking at ways to put that carbon to use in the form of liquid fuel, instead of just storing it away underground.

Carbon is one of the basic useful ingredients in biofuels, which are created from CO_2-capturing plants such as corn. But standard biofuels have some disadvantages, like requiring a lot of land and the use of fertilizers to grow the crops from which they are made.

"We're working to accomplish the same goals as plants," says Chris Graves, who did his doctoral work at the Lenfest Center for Sustainable Energy. "But the process will look very different." Graves' thesis was on recycling carbon dioxide and water into hydrocarbon fuels by electrolysis, which produces synthesis gas, the precursor to liquid fuel. "When you want to store things compactly and conveniently, liquid hydrocarbon fuels are the way to go," he says. "Batteries can inherently never be as energy dense as liquid fuel."

Graves is part of a larger group of scientists—headed by Klaus Lackner, director of the center, and including others like Lenfest Junior Professor in Applied Climate Science Alissa Park—that is working to make more environmentally friendly fuels. The group is putting together a production process that builds on innovations in the capture of carbon dioxide from the air, desalination to produce large amounts of fresh water, photovoltaics to power the whole process with low-cost solar electricity, and electrolyzers connected to fuel synthesis reactors to convert carbon dioxide and water into liquid hydrocarbon fuel.

The process also makes use of the principles of mass production. "When you get smaller, and when you mass produce," says doctoral candidate Tom Socci, whose work is focused on refining the production of fuel from synthesis gas, "things can get cheaper and more efficient." Typically, energy production happens at big scales, with large machines performing many complicated production steps. But the team is proposing a strategy that would break the entire process into smaller units, so that pieces could be produced more cheaply and replaced more easily as technology improves.

"What attracted me to this work is literally reusing and recycling the carbon out there, rather than mobilizing new carbon," says Socci. Although traditional energy sources will likely be used in some form for years to come, the demand for liquid hydrocarbons is predicted to expand and could double by 2050. So finding new and novel ways to produce liquid fuels is an important focus for science—to say nothing about all that carbon dioxide that could be removed from the atmosphere and recycled.

The demand for liquid hydrocarbons is predicted to expand and could double by 2050.

"What is heartening is that the Earth Institute and Columbia University transcend academics and engage with issues that concern mankind. The Aditya Birla Group is proud to support the great efforts of the Columbia Global Center | South Asia, which will help make sustainable development in India a reality."

— Mrs. Rajashree Birla
Aditya Birla Group

Kuni Takahashi

A new Columbia Global Center in Mumbai, India, will build on the Earth Institute's work to address issues ranging from public health to water scarcity.

UN Secretary-General Ban Ki-moon (right) spoke at our State of the Planet 2010 conference, which brought together experts and leaders from around the world to address critical international challenges, from climate change to poverty.

Forging Global Connections

THINKING AND WORKING GLOBALLY are fundamental to the Earth Institute's approach. The activities of March 2010 were no exception. For example, the biennial State of the Planet conference, held in partnership with The Economist and Ericsson and supported by Charles and Elizabeth Bowlus, was more global than ever before, with speakers joining live from sites on four continents. UN Secretary-General Ban Ki-moon spoke from New York, President Felipe Calderón spoke from Mexico, and the panel debates on globally relevant issues—climate change, poverty, economic recovery and international systems—transcended boundaries, like the international event itself.

Only a few days before, Earth Institute Director Jeffrey Sachs (who is also special advisor to the UN secretary-general), Columbia President Lee C. Bollinger and others were in Mumbai, India, to announce the opening of a new Columbia Global Center, which will build on the Earth Institute's past work in the country. As President Bollinger said in a press release about the event, "…we are committed to providing new opportunities to deepen our engagement with scholars, ideas and challenges across the globe."

Why base a center in India? "You really can't do development without looking at India," says the Earth Institute's Nirupam Bajpai, founding director of the center. "It's one-sixth of humanity. It's the largest democracy in the world. There have been huge gains since the reforms, but there is much still to be done … And that's where the Earth Institute has a good fit to work with policymakers there, [the private sector] and other academic institutions."

The new Columbia Global Center in Mumbai, to be the hub of the University's presence in South Asia, is the fourth in a group of centers the University has established to increase its research and academic network abroad. Bajpai's current focus is the Model Health District project, which involves the Indian government, state governments, UNICEF and a number of other organizations. The goal is to put together interventions to improve human health at several pilot sites around the country such as a new structure for health management at the ground level, the training of community health workers, a focus on higher public spending by federal and state governments, and the integration of health with sectors like nutrition, water and sanitation.

Other Earth Institute projects currently underway in India address monsoon forecasting to benefit agriculture and rural livelihoods, the growing scarcity of fresh water (work supported with generous funding from the PepsiCo Foundation), environmental concerns in the redevelopment of Mumbai's eastern waterfront, and the effects of deforestation on India's ecosystems. Such issues are not unique to India, and the insights and strategies developed will be relevant in other places the Earth Institute works around the world.

From motivating global debate among experts and world leaders at State of the Planet to forging global connections and fostering on-the-ground sustainable development work through the new Columbia Global Center in South Asia, the Earth Institute is advancing progress toward a healthy, sustainable planet and global population.

Eileen Barroso

Predicting Weather-Related Disease Outbreaks

"The climate forecasting work of the International Research Institute for Climate and Society will help link weather and climate experts to health specialists, which will provide early warnings of infectious disease outbreaks and help save lives."

— Dr. Amy Luers
Google

THE SPREAD OF MANY DISEASES IN AFRICA is linked to patterns of wet and dry weather. For instance, at the margins of transmission, malaria can spread through lowland arid and semi-arid regions when rainfall increases or through cooler highland areas when temperatures warm. Bacterial meningitis can spread rapidly in the dusty dry season in the semi-arid belt between Senegal and Ethiopia. Epidemics of these and other climate-sensitive diseases can significantly affect the health and productivity of entire regions.

The earlier health experts know about seasonal weather extremes that can lead to disease outbreaks, the earlier they can respond, bringing in insecticide to kill mosquitoes or stockpiling meningitis vaccine. "Seasonal forecasting is not just an academic exercise," says Simon Mason, a research scientist at the International Research Institute for Climate and Society (IRI), which is known for its expertise in forecasting and its applications to agriculture, health and other sectors.

Seasonal forecasting works only in certain regions of the world, like the tropics, where rainfall is significantly affected by ocean temperature. Scientists can predict air temperature and rainfall extremes of approaching seasons up to six months in advance. When an already warm ocean warms up a bit more, evaporation can increase significantly, making more water available to fall as rain. If the same ocean cools, evaporation drops and there is less water for rain.

Scientists at IRI are helping put forecasting to work in Ethiopia, thanks to a grant from Google.org's Predict and Prevent Program. "We're building capacity in the climate community to help the health community," says Madeleine Thomson, a senior research scientist at IRI. "And we're building capacity in the health community so they know what they need to ask for from the climate community."

Judy Omumbo, an associate research scientist with experience in disease risk mapping, works on the ground to help local health teams use climate forecasting tools and acquire the data they need. "A lot of monitoring information is not available in the public domain," she says. At the same time, Tufa Dinku, also an associate research scientist at IRI, is working with Ethiopia's national meteorological service to put together a 30-year time series of rainfall and use satellite data to fill in the many data gaps not covered by existing rain gauges.

Malaria and meningitis alone kill thousands of people each year across sub-Saharan Africa. They can also have significant effects on already weakened economies and health systems. Implementing better seasonal forecasting systems and teaching people how to use them are important steps in the fight against these diseases.

Each year, IRI hosts a training session in New York for health and climate professionals from around the world. "IRI is trying to build a climate-smart community—to create a health community that can use climate information to promote good health," says Thomson.

Tufa Dinku and Judy Omumbo (left), associate research scientists at the International Research Institute for Climate and Society, are working in Ethiopia (above) to improve the health community's ability to predict and prepare for outbreaks of climate-sensitive diseases like malaria.

Alan Orling

From Harlem, New York, (above) to cities in developing countries, research centers at the Earth Institute are addressing issues facing an increasingly urban world.

Along with local partners, the Urban Design Lab is looking at strategies and policies to balance environmental and economic concerns in the redevelopment of the eastern waterfront in Mumbai, India (left).

Toward Sustainable Cities

MORE THAN HALF OF THE WORLD'S population lives in urban areas, and this number is rising rapidly. Cities will have to think creatively about ways to address problems ranging from the threats of climate change to general public health and infrastructure. The Earth Institute is working with local organizations, universities and governments to help cities prepare, both here and abroad.

In Harlem, New York, the corridor running east to west along 145th Street experiences noticeably high carbon emissions and poor air quality due to an abundance of traffic, in addition to other urban issues such as lack of walkability, a heat island effect that raises local temperatures and poor access to healthy food options. The Urban Design Lab (UDL) is working with local community groups such as WE ACT for Environmental Justice to help address these issues and implement solutions like planting more trees, installing green roofs, and making improvements to transportation and building infrastructure.

Many of the impacts of urbanization are felt in the developing world, where population growth is highest. Two of the key challenges that drive the work of the Center for Sustainable Urban Development (CSUD) are transportation and land use. In Nairobi, Kenya, highways are being built without concern for land use, displacing people and their businesses. "Along the new Thika Highway you see people selling fruits and vegetables," says Nicole Volavka-Close, associate director of CSUD. There is nowhere else for them to go. "They are inches from the cars, and many have been killed." And without an efficient public transportation system, increased mobility cannot be achieved.

Supported by the Volvo Research and Educational Foundation and the Rockefeller Foundation, CSUD works with the University of Nairobi on a variety of urban issues. It fosters research, education and dialogue to help stakeholders effectively address the problems of rapid urbanization. It is also working domestically on transportation and land-use planning issues.

The Millennium Cities Initiative (MCI), funded by donors such as the Bill and Melinda Gates Foundation, the Tides Foundation, Charles and Elizabeth Bowlus, and Ann Kaplan, is collaborating with the University of Ghana, the World Bank, Cities Alliance, UN-HABITAT, UDL, CSUD, the Accra Metropolitan Assembly and Mayor Alfred Vanderpuije on urban issues in Accra, Ghana. Work addresses the coastal city's response to issues like flooding, erosion, climate change, access to clean water, transportation, health facilities, schools, energy and jobs.

The largest of 11 Millennium Cities in sub-Saharan Africa, Accra provides the opportunity to help devise creative, comprehensive solutions to seemingly intractable urban problems. "We can't fix the city alone," says Susan Blaustein, director of MCI, "but what we can do is bring in partners, both local and multinational, and educational institutions that can start to think about cities as holistic organisms."

Accra will benefit from lessons learned in the China 2049 project—a partnership between the Earth Institute, the Brookings Institution, and China's National Development and Reform Commission—which is conducting research, with support from General Electric and Winnington Land Ltd., to guide economic growth and improve environmental sustainability.

"The Earth Institute's work in urban issues will allow for the development of economically dynamic, socially harmonious and environmentally sustainable societies today and in the future."

— Kenneth Hung
Winnington Land Ltd.

Training Green Managers

Michael Dames

The Earth Institute and Columbia's School of Continuing Education have developed a new degree to train sustainability professionals.

AS ORGANIZATIONS MOVE TOWARD a greener, more sustainable future, they require the skills of management professionals trained in sustainability issues such as energy efficiency and managing water resources. Where can an organization find such a unique combination of skills? A new degree developed by the Earth Institute and Columbia's School of Continuing Education, the Master of Science in Sustainability Management, which launched this fall, will prepare students to become invaluable members of organizations looking to integrate sustainability measures into their operations.

Directed by Steven Cohen, executive director of the Earth Institute, the degree will utilize environmental measurement tools, cutting-edge environmental science, and management and policy studies to help students fully understand the role of sustainability in any organization. "There are not many programs, especially part-time programs geared toward working adults, training people in sustainability management," says Louise Rosen, director of the Office of Academic and Research Programs. "There is a very real understanding that sustainability issues are key to the success of any organization."

The Earth Institute has excelled in providing programming in sustainable development education—from the doctoral level to the undergraduate level. This fall, the eagerly anticipated undergraduate sustainable development major was offered for the first time to Columbia College and School of General Studies students. Like these degrees, the M.S. in Sustainability Management draws from the rich intellectual resources of the Earth Institute and the University.

Dedicated to transforming knowledge and understanding in service of the greater good, the School of Continuing Education is uniquely placed to offer a degree that meets the needs of a rapidly changing society. "Our programs typically start with compelling and complex issues that concern the world and that cross many sectors of human activity," says Kristine Billmyer, dean of the School of Continuing Education. "The very interdisciplinary approach of the Earth Institute as well as its vast academic resources and the deep research it is doing make it the perfect partner for us."

To give students hands-on training, the program will place them in real-life settings, working with organizations. "We won't just talk about solutions," said Steven Cohen at an information session for the degree. "We will train you to find and implement solutions. In the near future, all traditional management education will need to include study of the physical dimensions of sustainability. Before long, all managers will need to be sustainability managers."

Incoming students have high-level backgrounds in finance, the automotive industry, the military and other fields. One student, Grace Arnold, is the sustainability manager for over one thousand branches of Citibank, North America. She expects that having this degree will allow her to better communicate with the engineers, financial managers, policymakers and others she works with daily. "My job looks to me to make the right sustainability decisions," says Grace. "This program will help me become the resident expert."

Michael Dames

Students in the new M.S. in Sustainability Management gathered in June 2010 to meet each other and professors in the program (above), which will train professionals who can help organizations increase the sustainability of their operations.

A Successful Year for Sustainable Development

Alan Orling

WHILE THE TURN OF A NEW DECADE brought more economic challenges for everyone, the confidence our donors have shown in the Earth Institute's initiatives, projects, events and educational programs has kept the momentum toward sustainable development charging forward, both here on campus and around the world. We ended the fiscal year having raised $26 million in gifts from individuals, corporations, foundations, foreign governments and multilateral organizations, which puts us at 90 percent toward our $200 million campaign goal.

This year Matt Berg, information and communications technology director for the Millennium Villages project, was named by *Time* as one of the world's 100 most influential people. Berg oversees an initiative that puts cutting-edge technology in the hands of community health workers who examine and treat children in some of the poorest villages in Africa, using mobile phones to send and receive real-time information, which allows for better health monitoring and faster interventions. Thanks to donors like Sue and Bill Gross, Nancy and Randy Best, and the Bill and Melinda Gates Foundation, this critical work will continue.

Another milestone this year was the successful conclusion of a landmark $1.9 million challenge gift from the Tides Foundation, which provided a 1:1 match of all donations made to the Millennium Cities Initiative. The gift supports the initiative's work to assist selected mid-sized cities across sub-Saharan Africa in promoting sustainable development and achieving the Millennium Development Goals.

Sime Darby, a multinational corporation based in Malaysia, bolstered our Tropical Agriculture and China 2049 programs with a $500,000 gift. The company created an international advisory panel to enhance its sustainability initiatives across its core business operations worldwide, and it became a member of the Earth Institute's Corporate Circle.

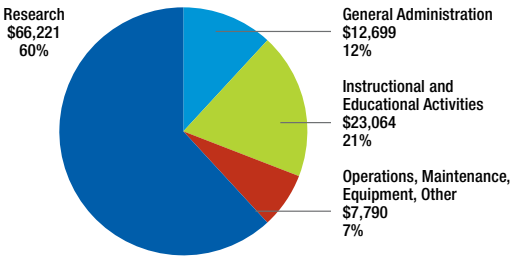
The Lamont-Doherty Earth Observatory secured two highly competitive federal infrastructure

Financial Statement

July 1, 2009–June 30, 2010

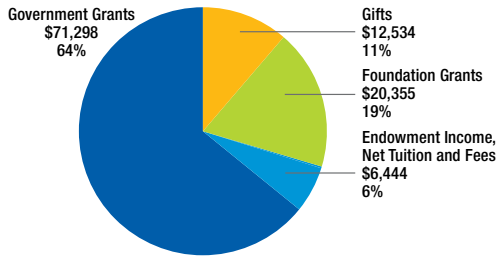
Direct Expenses

$109,774



Direct Revenue

$110,631



Dollar amounts in thousands.

Source: Office of Finance and Administration, The Earth Institute

grants in 2009. One of these, from the National Institute of Standards and Technology (NIST), is a $1.4 million challenge grant to aid in the construction of the world's most sophisticated ultra clean geochemistry lab in the Gary C. Comer Geochemistry Building. In order to meet the NIST deadline, an anonymous donor has pledged to match every dollar given during the fundraising campaign, up to $400,000.

The undergraduate major in sustainable development, championed by donors Joe and Barbara Ellis, was offered for the first time at Columbia College this fall, adding to our diverse educational programming in sustainable development. There are now almost 100 students enrolled in the special concentration in sustainable development. Given the interest expressed by current and prospective students, we anticipate a good number will have declared it as a major by the end of the academic year.

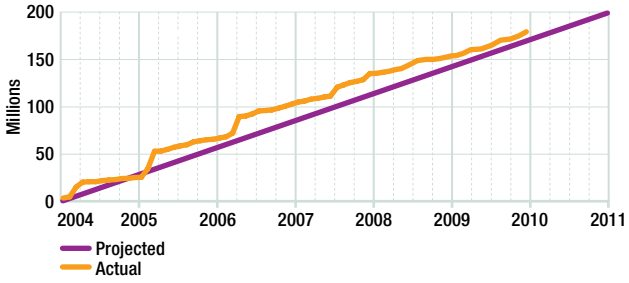
Finally, the establishment of the Earth Institute faculty in 2009 was a major milestone in the advancement of the academic field of sustainable development. The Earth Institute provides a university-wide platform for tackling the core challenges of global sustainability and has effectively developed a new area of knowledge.

With a tenth of our $200 million campaign goal to go, the continued commitment of donors like you will help us meet our 2011 deadline, thus ensuring the continuity of research and educational programs that promote the creation of a more sustainable planet.

David Wentworth

The fundraising team for the Earth Institute (above) includes the Lamont-Doherty Earth Observatory and the Lenfest Center for Sustainable Energy. Top row, left to right: Lisa Phillips, Urania Mylonas, Stacey Vassallo, Gregory Fienhold, Ivy S. Morgan, Jasmina Metjaic. Bottom row: Ronnie Anderson, Barbara Charbonnet, Dove Pedlosky, Teresa S. Karamanos, Jennifer Swift-Morgan, Megan Winston.

Thanks to the generosity of our donors and partners, we have raised 90 percent of our campaign goal of $200 million to fund research, professorships, facilities, fellowships, scholarships and educational initiatives.



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Thank You to Our Donors

We greatly appreciate our donors: the individuals, corporations, foundations, foreign governments and multilateral organizations who have supported us and partnered with us in our work. With their help, we continue to advance the science, technologies and policies needed to develop practical solutions for our planet's complex challenges. This invaluable group of supporters has been instrumental in allowing us to continue to find solutions to achieve sustainable development.

The following is a summary list of the 2010 fiscal year (July 1, 2009–June 30, 2010) donors to the Earth Institute and all of its affiliated units, including the largest, Lamont-Doherty Earth Observatory.

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We are deeply grateful to those who have shown extraordinary generosity and commitment to the Earth Institute since our foundation. Individuals and organizations whose cumulative gifts and pledges have exceeded $1 million or more are recognized below.

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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.

More Earth Institute Projects and Initiatives

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 earth.columbia.edu for regular updates on our work.

The Problem of Arsenic

In the 1970s, millions of simple pipe wells were drilled in Bangladesh to increase access to clean water. But many of the wells were found to be contaminated with arsenic, and long-term exposure is significantly affecting human health. Scientists from the Lamont-Doherty Earth Observatory and the Mailman School of Public Health are developing practical ways to reduce the threat of arsenic poisoning and meet the need for safe drinking water in rural Bangladesh. They are fostering the installation of deep, low-arsenic wells and studying ways that certain nutrients can help eliminate arsenic from the human body.

Designing the Future of Transportation

Automobiles enhance our personal freedom and are a critical component of modern infrastructure. However, they are unsustainable in terms of energy, the environment and congestion. Modern communication, energy and transportation technologies offer opportunities to reinvent automobiles for safer and more efficient personal travel. To make this new vision a reality, the Earth Institute launched the Roundtable on Sustainable Mobility, bringing together key private and public sector leaders to develop a roadmap for the way forward. The Prince Albert II of Monaco Foundation, a world leader in the promotion of ecological vehicles, has become an early supporter.

Projects at the Earth Institute range from strategizing about transportation alternatives (near right) to finding ways to improve the sustainability of agriculture and food systems (far right).

Squared Design Lab, Cover of "Reinventing the Automobile," MIT Press

A Global Network for Climate Solutions

With the support of the Skoll Global Threats Fund and the Planet Heritage Foundation, Inc., the Earth Institute initiated a low-cost, open-architecture, online network of research centers around the world tasked with designing country-based action plans for climate mitigation and adaptation. The goal of the Global Network for Climate Solutions is to inform the 2010 United Nations climate negotiations in Cancún, Mexico, with concrete proposals for how to solve the climate crisis.

Feeding a Growing Population

The global population could reach 9 billion by 2050, increasing food demand and stressing ecosystems. Donors like the Bill and Melinda Gates Foundation, the Packard Foundation, the Doris Duke Charitable Foundation, and Monsanto support Earth Institute projects to improve the sustainability of agriculture and food systems from Africa to America. Work includes optimizing the use of fertilizers—both mineral and organic—for food production, while minimizing negative environmental and climate impacts; mapping the world's soils digitally; and linking food systems to improved nutrition to tackle undernutrition in developing countries and fight obesity in developed countries.

Corporate Circle

Launched in the fall of 2009, the Corporate Circle is the Earth Institute's new program for engaging corporations dedicated to sustainable development in ongoing, mutually beneficial relationships that further our shared objectives. Partnering with the Earth Institute allows corporations to take advantage of the latest information, tools and networks in the field. Together we are building strong links between transformative corporate sustainability and sustainable development worldwide. At the time of the printing of this report, we have 21 members in the Circle and counting. For an updated list of members, visit earth.columbia.edu/corporatecircle.

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

Earth Engineering Center (EEC)

International Research Institute for Climate and Society (IRI)

Lamont-Doherty Earth Observatory (LDEO)

Lenfest Center for Sustainable Energy (LCSE)

Programs of the Earth Institute

Cross-Cutting Initiative (CCI)

Earth Clinic

Millennium Cities Initiative

Millennium Villages Project

Program on Science, Technology, and Global Development

Roundtable on Sustainable Mobility

Tropical Agriculture and Rural Environment Program

Joint Units of the Earth Institute

The following five 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

Urban Design Lab (UDL)

Vale Columbia Center on Sustainable International Investment

Affiliates and Consortiums

The Earth Institute is a member of or is closely affiliated with the following four entities.

Advanced Consortium on Cooperation, Conflict and Complexity (AC4)

Black Rock Forest Consortium

Center for Climate Change Law (CCCL)

NASA Goddard Institute for Space Studies (GISS)

Educational Programs Affiliated With the Earth Institute

Undergraduate Programs

Majors in:

- Sustainable Development
- Earth and Environmental Sciences
- Earth and Environmental Engineering
- Environmental Biology (Barnard)
- Environmental Science (Barnard)
- Environmental Policy (Barnard)

Concentration in Environmental Biology

Special Concentration in Sustainable Development

Summer Ecosystem Experiences for Undergraduates (SEE-U)

Postbaccalaureate Programs

Postbaccalaureate Program in Environmental Biology

Postbaccalaureate Program in Ecology, Evolution and Environmental Biology

Master's Programs

M.A. Conservation Biology

M.S. Earth Resources Engineering

M.S. in Sustainability Management

M.A. Climate and Society

M.P.H. Environmental Health Sciences

M.P.A. Environmental Science and Policy

M.P.A. in Development Practice

M.I.A./M.P.A Energy and Environment

Doctoral Programs

Ph.D. in Sustainable Development

Ph.D. Earth and Environmental Engineering

Ph.D. Earth and Environmental Sciences

Ph.D. Atmospheric and Planetary Science (APS)

Ph.D. Environmental Health Sciences

Ph.D. Programs, Department of Ecology, Evolution and Environmental Biology (E3B):

- Ph.D. Ecology and Evolutionary Biology
- Ph.D. Evolutionary Primatology

Certificate Programs

Environmental Policy Certificate

Conservation Biology Certificate

Certificate in Conservation and Environmental Sustainability

Fellowships

Earth Institute Fellows Program

Other Graduate Credit-Bearing Programs

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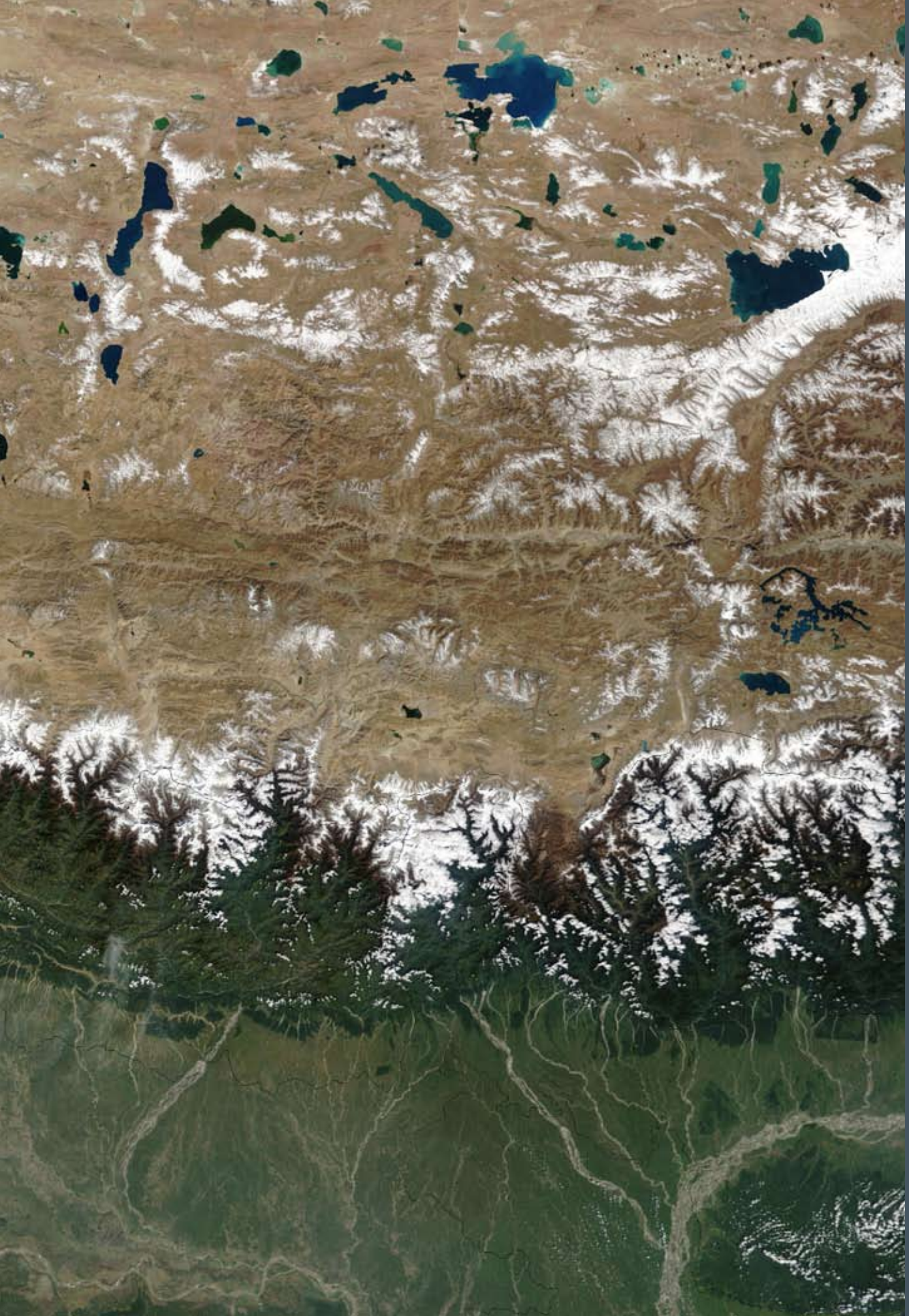

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