The Record
SPECIAL

COLUMBIA & the Environment

By Barbara King Lord

Yes, environmental stewardship is alive at Columbia University. It has expanded beyond rhetoric and recycling to all kinds of imaginative and tangible ways of living sustainably as a member of the Columbia community.

We can say this with certainty because of the grassroots and often unheralded efforts happening in all corners of our campuses. "...Working together as a community, we are taking a fresh approach to thinking about and managing our own environmental impact," says University President Lee C. Bollinger. The list that follows shows only a portion of what's going on this very day—and reinforces that in large, small and even surprising ways, the greening of Columbia gains momentum.

MAKING AND HELPING IT ALL HAPPEN.

Created last fall, the Department of Environmental Stewardship has become the center for Columbia's local efforts on behalf of the Earth. Director Nilda Mesa works with departments and student groups on each of the Columbia campuses as they brainstorm, plan, teach, build, and refurbish, encouraging and informing greener choices.

TRANSFORMING SPACE.

Student Health Services has gone paperless. Earth and Environmental Engineering's renovations include recycled carpeting, recyclable desk chairs, and energy saving light sensors and blinds. At the Law School, a lobby upgrade reuses and refinishes rather than discards. And at the School of the Arts, refurbishments center on green carpeting, energy-efficient lighting and environmentally friendly paint.

DRINKING LOCALLY ROASTED, ORGANIC, FAIR TRADE COFFEE.

Served in all dining service areas and coffee bars throughout the Morningside campus, the custom blend is roasted in Ozone Park, Queens. Columbia is the only university in New York City that serves 100 percent fair trade, organic coffee.

REUSING THROUGH GIVE + GO GREEN.

The Eco-Reps—an undergraduate student organization dedicated to sustainability awareness and activity among their fellow students—will collect "stuff" from Move-Out that might otherwise be thrown into the trash. This third annual collaborative effort with Housing & Dining, Great Forest, Salvation Army, City Harvest and Per Scholas will take place on May 9-11, from noon to 4 p.m.—making it easy to donate to local charities.

BUYING LOCAL PRODUCE.

Emphasis at John Jay Dining Hall is on buying more and more locally grown produce—all year long and mostly from farms on Long Island. Table ready right now: local lettuce and herbs. Local potatoes and other root vegetables were in the dining hall all winter long.

BUSING WITH BIODIESEL.

What if the oil that cooks Columbia's french fries could power shuttle buses between the Morningside campus and CUMC? Some of the University's best and most enthusiastic minds are working on just that, in a collaboration coordinated by the Environmental Stewardship department that includes student groups, various departments, the Fu Foundation School of Engineering and Applied Science and the Lamont-Doherty Earth Observatory. A SEAS Gateway project team of first-year students is now designing a process to make the vision a reality, either in powering shuttle buses or grounds maintenance equipment.

METERING.

Meters, meters everywhere. They're being installed at individual buildings and residence halls on the Morningside campus, Baker Field Athletic Complex, Nevis Laboratories, and Lamont-Doherty Earth Observatory—all to collect data in order to measure energy usage, then find ways to reduce greenhouse gas emissions.

REDUCING ELECTRICITY USAGE, TOGETHER.

When electricity is scarce in New York State—as it is during a heat wave, when air conditioners are in heavy use—Columbia will reduce set points on air conditioners, run HVAC systems at lower settings, and turn off lighting, elevators and non-critical equipment. Less stress on electrical grid reduces rolling brownouts and drawing from the dirtiest sources of power that create the most harmful emissions. Columbia's decisions on reducing consumption will be based on day-ahead notice from power companies that the power grid may be unstable.

SETTING UP A BIKE-FRIENDLY CAMPUS.

New bike racks are arriving within weeks that will bring the number of such bike parking spots to 300 on the Morningside campus, conveniently scattered in 21 spots around the campus.

HANDWASHING SUSTAINABLY.

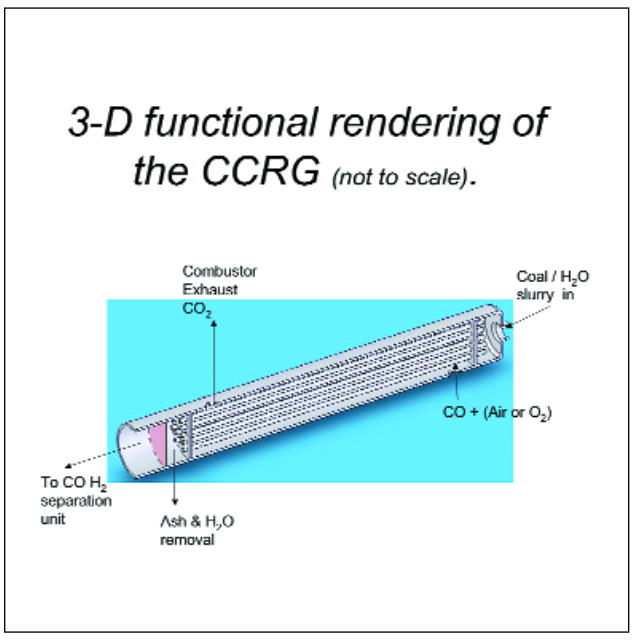
By year's end, environmental friendliness will extend to clean hands on the Morningside campus. All Morningside soap dispensers and their contents will start using recyclable cartridges of liquid gel soap that foams in hand, requiring less water to rinse. And because each dispenser gives 2500 "shots" of soap (versus about 500 for traditional liquid soap), that means less packaging material and carbon emission in transporting.

Environmental Research

Columbia's commitment to environmental sustainability extends far beyond the here and now, looking into the future with a multitude of research projects throughout the University. In such departments across a multitude of disciplines, professors are conceptualizing, researching and developing ideas that will have huge implications for environmental stewardship in the 21st century and beyond.

"Columbia's students, faculty and staff have a long-standing commitment to responsible environmental stewardship," noted President Bollinger last year. In particular, "Columbia researchers have led the way on environmental issues worldwide."

Indeed, these two pages present just a fraction of the work faculty members are tackling on the environment, working on on innovative and imaginative solutions to these complex problems.



MARCO CASTALDI

Professor Marco Castaldi is hoping to take his environmental research out of the lab and put it on the market—and he is closer than most to doing so. The assistant professor of earth and environmental engineering worked as an engineer in research and development for a company that manufactured emissions-reducing catalytic converters for several years prior to coming to Columbia in 2004. He owns a number of patents that could have an impact on the environment.

"I've taken things from conception to commercial venture, and what I can say is it takes longer than you think," he says. "That said, we're getting blueprints to manufacturers and we hope to have a pilot test off within a year."

The blueprints Castaldi is referring to would build his most promising current invention: the Catalytic Reactor Gassifier, or CRG. The CRG can take solid fuels and biomass and break them down into pure streams of hydrogen, carbon monoxide, and greenhouse-producing CO_2. He is developing it with Dr. John Dooher of the Dooher Institute of Physics and Energy.

The CO_2 is then "sequestration" ready, meaning it can be processed and made into something that won't harm the environment. The gaseous hydrogen, meanwhile, can be used to power fuel cell engines—which release only water as a byproduct. And the carbon monoxide can be used as a power source—it can actually be fed back into the CRG and used to convert more biomass into its component parts.

The CRG process leverages the attributes of catalytic combustion and radiation heat transfer to efficiently gasify carbon. At the end of a complicated process a stream of CO_2 exits the combuster and is ready for sequestration.

"It's scalable and can process 10 pounds an hour of waste to tons a day," he says. "We're sizing it to get it ready for testing."

If all goes according to plan, the CRG will field a prototype within the year and have it to market within five years, Castaldi says.

Castaldi has also filed a patent on an invention that treats wastewater. One of the key processes in treating wastewater and sewage is removing the nitrogens. His patent employs biological and chemical processes that use less energy than traditional methods, which rely on combustion.

Castaldi estimates the process could reduce emissions while saving a typical wastewater treatment plant about $300,000 a year.

Adam Piore

DICKSON DESPOMMIER

Dr. Dickson Despommier of the Mailman School of Public Health has one possible solution for CO2 emissions. He envisions a day when cities grow their crops in 30-story buildings that span entire city blocks. Just one such "vertical farm" could feed 50,000 people, he claims, while freeing up thousands of acres of farmland for newly-planted, global-warming reducing trees.

"We're extremely convinced it will be an energy friendly way to raise crops," he says. "Vertical farming frees up land."

Despommier's urban sustainability concept has been featured in a number of publications—including a four-page spread in *New York* magazine earlier this month. But the route he took to local renown wound through some decidedly unglamorous territory.

For the first quarter-century of his career, Despommier focused on parasites, such as the roundworm *trichinella spiralis*. When his NIH grant ran out six years ago, he decided to broaden his focus to look at how diseases spread from person to person. The prime culprit was the use of human feces to fertilize crops in developing nations.

It was with that in mind that Despommier originally conceived of vertical farming. He saw it as a way to create "food security" by placing a barrier between the inside and the outside world that would keep out pathogens from neighboring farms.

However, he soon realized that the idea could help solve environmental issues like global warming—and his students have played a major role in pushing the concept along.

"The ecological footprint of a city is very small, compared to that of the land needed to feed a city," Despommier explains. "The biggest disrupter of ecologic processes is farming."

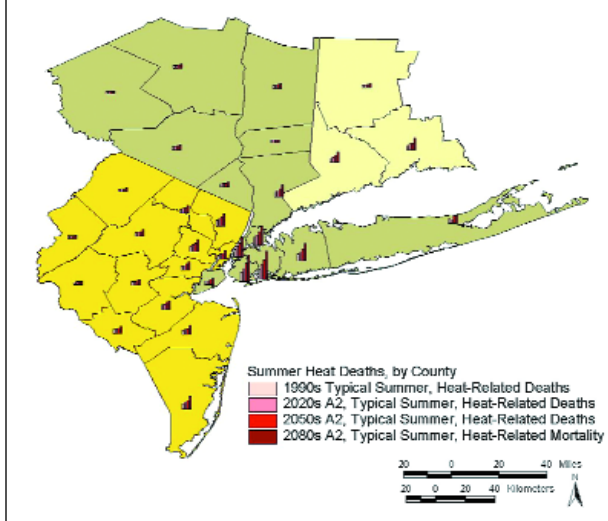
Building up instead of building out would dramatically reduce that footprint, he says. Cities could use remediated sewage for fertilizer and water (see Marco Castaldi's work on this page for one possible approach), and rotate crops.

"It only takes 10 days to grow a head of lettuce," says Despommier. Producing corn, wheat, chickens, trout, shrimp and mussels also would be no problem, he adds.

In the Oscar-winning documentary *An Inconvenient Truth*, former Vice President Al Gore suggests that those who want to do something to fight global warming plant a tree, Despommier notes.

"This is a way to do that," he says. "My real ultimate goal is to allow trees to grow back."

Adam Piore



PATRICK KINNEY

Dr. Patrick Kinney of Columbia's Mailman School of Public Health was getting his Ph.D at Harvard University during the late 1970s and 1980s when university researchers released a series of landmark studies on air pollution and public health in six cities. The studies demonstrated an elevated risk of death in areas where air pollution was strongest.

Drawing on data from those six cities, Kinney explored the impact of small particles and ozone pollution on children who lived in them. On high pollution days, he found the children had diminished lung capacity. His work, along with that of his colleagues at Harvard, eventually led the government to regulate what is known as "particulate matter."

Now Kinney is leading a collaborative research study looking at the long-term impact of climate change on human health. Specifically, the five-year-old project examines the effect of climate change on the health of residents in the 31-county New York metropolitan area and compares results from the 1990s to projections for the 2020s, the 2050s and the 2080s.

"There will be more extreme heat events and also increased air pollution because of ozone pollution," he says. "This is an idea that five years ago, nobody was thinking about."

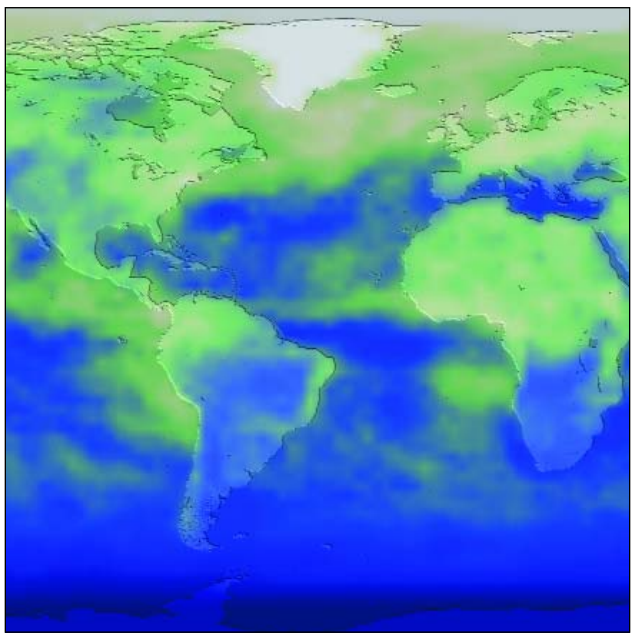
The impact could be dire. By his estimate, according to a soon-to-be published study he is working on, heat-related deaths will increase approximately 70 percent by 2050. Currently the daily heat-related death rate varies by county, from an average of between one and three a day per every 100,000 residents, according to the study.

Kinney is also collaborating with the Earth Institute and Columbia University Medical Center on a study of African villagers in rural Kenya, Rwanda, and Ghana. That study examines the health impacts of cooking stove smoke on women and their children.

With all the attention on climate change and the environment, Kinney says his job has never been more exciting.

"Good students are attracted to the subject matter and want to get involved," he says. "Research advances faster when good students are knocking on your door, which has been happening for several years now. Also, there hasn't been much funding for research on the federal level, but that's changing too, all of which will make the work more productive and fun."

Adam Piore



BEATE LIEPERT

When she was working on her Ph.D at the University of Munich in the 1990s, Professor Beate Liepert decided to take on a question that had mystified climatologists studying global warming for years.

Nations had been releasing greenhouse-causing gases into the atmosphere since the Industrial Revolution, yet it wasn't until nearly 200 years later–in the 1980s and 1990s–that global temperatures began to increase dramatically. How could that be?

Liepert is one of a handful of scientists to solve the mystery of what's come to be known as "global dimming." She hypothesized that rising temperatures are, ironically, partly a product of our improved environmental stewardship.

Burning fossil fuels creates not just CO2 and other greenhouse pollutants, but air pollution. And for years, that layer of smog threw up an "umbrella" that reflected the trapped sunlight back off the earth's surface, keeping daytime temperatures down.

With the passage of Clean Air Acts in the United States and Europe, however, that smog began to dissipate, allowing the full force of global warming to be felt.

"The umbrella from the air pollution was like a sunscreen," she says. "We unmasked global warming and now what we see is the actual effect of greenhouse gas."

Liepert was able to prove that global warming was actually present long before the Clean Air Act, by showing that nighttime temperatures had steadily increased from 1960 to 1990. That's because nighttime temperatures are caused by indirect sunlight–heat from other hemispheres where it is daytime–rather than direct sunlight that could be reflected off the earth's surface.

Those rising nighttime temperatures still caused some glacial melting. They also affected what is known as "the water cycle." Without the sun getting through, less water evaporated, which had an impact on rainfall and naturally occurring processes that purify water. That caused some disruption in rainforests in particular.

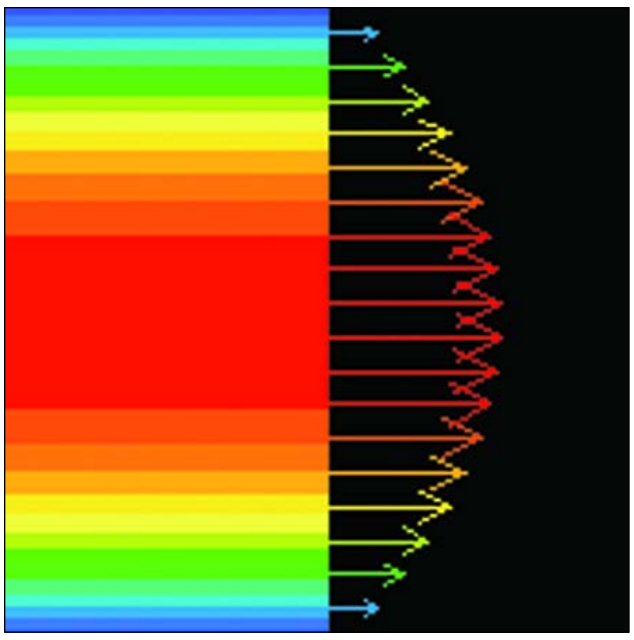
In the early days of the environmental movement, none of this was as obvious as the impact of unchecked smog on human health.

"Air pollution causes asthma and health effects," Liepert says. "We had to do something about it." (see Patrick Kinney's work on the opposite page).

Still, some have hypothesized that the release of some form of particulate matter into the atmosphere–controlled "global dimming"–could someday be used to slow global warming. However, greenhouse gases sit in the atmosphere for hundreds of years, and the small particles that could block out the sun only last, at most, a matter of weeks before falling back to earth, Liepert says. In addition, it is not yet fully understood which emissions negatively impact human health, and so far they are all regulated in similar ways.

Liepert is currently analyzing data sets and climate models that look at the effect of reduced air pollution on rainfall patterns.

Adam Piore



VIJAY MODI

Vijay Modi is working on an engine that runs on raw vegetable oil. It's a goal that–believe it or not–a number of researchers around the world are also reaching for.

Modi aims to distinguish his model by paying special attention to the conditions of his future customer base: impoverished villagers living in developing nations. It's a world he knows well, having studied energy usage–or the lack thereof–in such nations as Uganda, Kenya, Ethiopia and his native India.

"We are looking at settings where energy is a real limiting factor," Modi says, "places where you find that the lack of power for pumping water and grinding can be a real bottleneck."

"This is a stationary engine that will allow remote communities to have power for the first time," he says. "It can be used at schools, clinics and homes."

It could also have environmental advantages. Modi hopes to replace dirty diesel engines with engines that can be powered by locally produced products, like palm oil. Locally grown trees could then serve multiple functions in remote areas–preventing soil erosion, helping water management and providing a source of power by yielding seeds that could be ground into the oil.

"Even if it costs $3 a gallon for palm oil and it already costs $3 a gallon for diesel, the local people could benefit from it by strengthening their economy," Modi says.

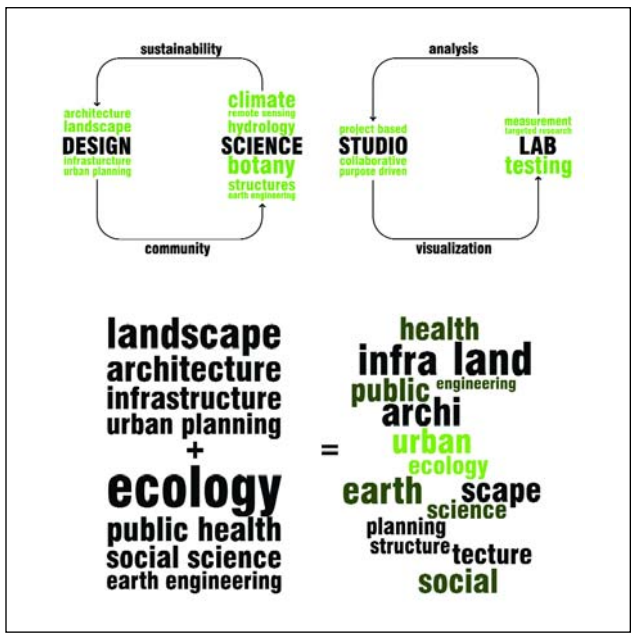
The key challenge is finding a way to process the oil in real time as it moves through the engine. Many researchers are simply trying to modify existing engines made for diesel to use vegetable oil, "and not many people are succeeding," says Modi. Others are converting to bio-diesel solutions, which require users to add methanol as a catalyst to burn the vegetable oil.

Modi and his team are taking a different approach entirely, designing an engine that "likes" vegetable oil. Rather than using methanol, they aim to use the heat coming off the engine itself to help burn the vegetable oil, controlling its viscosity and thus the rate at which it burns. The engine will be able to run for at least 500 hours in field conditions, he says.

Though the engine has the potential to help reduce emissions, Modi warns that "the devil is in the details." If, for instance, people begin producing the vegetable oil in an environmentally unfriendly way, it could offset any gain made by avoiding methanol.

Modi is also working on developing a cooking stove that is more efficient at burning wood, thereby reducing emissions.

Adam Piore



KATE ORFF

Many New Yorkers would be surprised to learn that a national park stretches from Queens and Brooklyn across a stretch of Staten Island to a spit of land in New Jersey. Others may know that Gateway National Park exists, but have never set foot in its 27,000 acres.

Created by Congress in 1972 with the goal of bringing the national park experience to urban dwellers, Gateway quickly faded from New Yorkers' memories, in part because Congress failed to fund needed improvements. As a result, Gateway has remained an "incredible habitat in a state of abject neglect," says Kate Orff, an assistant professor of architecture and urban design at the Graduate School of Architecture, Planning and Preservation (GSAPP) and director of the school's Urban Landscape Lab. The park's wetlands, essential to some 300 species of migratory birds, are seriously polluted, and its land masses are dotted with asbestos-laden buildings.

Orff, 35, is determined to help lay the groundwork for transforming these polluted parcels into a world-class park. The first stage of her multi-year undertaking is well underway: With the support of GSAPP (and a $500,000 grant from the Tiffany & Co. Foundation), Orff helped organize an international design competition to "help figure out what Gateway can be."

Competitors were asked to come up with a general design for the entire park, as well as a more detailed plan for making Floyd Bennett Field, an abandoned air base in Jamaica Bay, its focus. The competition documents–including a 225-page report (downloadable at www.van-alen.org/gateway) on Gateway's natural and physical resources–were authored primarily by Orff and her team. A 14-member jury, which includes GSAPP Dean Mark Wigley along with city officials and landscape architects, will meet May 12 to choose the most promising entries. The selected entries will be publicly exhibited in the fall and then presented to the National Park Service as it prepares to create a new management plan for Gateway in 2009.

Orff, the principal of SCAPE, a lower Manhattan landscape architecture and urban design firm, is no stranger to projects that harness academic resources to advance real-world projects. She has spent two years teaching a joint design-engineering studio, in which students plan reclamation projects for abandoned industrial sites in the Bronx. The studio, which involves students from GSAPP and the Fu Foundation School of Engineering and Applied Science, is supported by an Academic Quality Fund (AQF) grant from the Office of the Provost.

At Gateway, Orff says, the long-term goal is to create recreational facilities that can coexist with viable wildlife habitats. The idea of using design to improve conditions for birds and marine life may sound oxymoronic to anyone who thinks the best habitat is the one nature created. But Orff believes that notion is sadly out of date, given the degradation of the natural environment.

"We've entered an era," she explains, "where you can no longer say the Earth will take care of itself." As a result, Orff says, "It's not just Columbia's Earth Institute that should be dealing with issues of environmental quality. It's also the design school. At Gateway and elsewhere," she said, "there are habitats that need design."

Fred A. Bernstein

THE COLOR OF BUILDING: GREEN

By Barbara King Lord

They may have different architectural styles, physical sizes and academic purposes, but there is a unifying element to the three biggest construction projects the University currently is undertaking: They're all green.

These three highly visible projects—the Northwest Science Building, McVickar Hall and Lamont-Doherty Earth Observatory's new geochemistry building—are the strongest statement yet of Columbia's commitment to build within the highest environmental standards. This means seeking Leadership in Energy and Environmental Design (LEED) certification, "the nationally accepted benchmark for design, construction and operation of high-performance green buildings," says the United States Green Building Council.

In fact, Northwest Science and McVickar are Columbia's first buildings to be registered for LEED certification, and they won't be the last. "As a practical matter, we've begun to use the LEED checklist in our internal planning process for major construction around the University," says Nilda Mesa, Columbia's director of environmental stewardship.

LEED uses a scorecard-type rating system that awards points in specific areas: sustainable site development, water conservation, energy efficiency, environmentally sound building materials, and indoor environmental quality.

Applying for LEED certification, a voluntary designation, usually starts at the beginning of the construction planning process. That's when project managers, architects, contractors and engineers make decisions on how their project aligns with LEED criteria in each key area. For the Northwest Science building, "we're making sure all the design-related points are in the drawings," says Karrie Wilhelms, a project manager at Facilities and the Department of Capital Project Management.

NW Science Building by architect José Rafael Moneo.

Because seven of Northwest Science's 13 floors are lab areas, ventilating requirements need 100 percent outside air. "Lots of air changes each hour are lab safety concerns; moreover we use lots more water and energy per square foot than other buildings. So LEED certification for a lab building is more challenging," Wilhelms adds. The design team will work with Labs 21, another voluntary partnership that helps build sustainable high-performance, low-energy labs.

McVickar Hall's gut renovation includes "practically the entire interior of the building," says Donald Eggleton, a project manager. McVickar can claim LEED points for reusing the building shell, and the internal systems construction will also comply with the LEED checklist for new buildings. Eggleton says.

At LDEO, the new geochemistry building replaces an existing building that houses the Geochemistry Division. It will be "a state-of-the-art laboratory building consisting of wet and dry chemistry labs, including ultra clean chemistry labs," says Patrick O'Reilly, assistant director for facilities and engineering at LDEO.

To date, the building doesn't have LEED certification, but O'Reilly is confident certification is attainable. "All of us recognize the value of institutionalizing and publicizing good environmental stewardship," he said.

FACULTY Q&A

NILDA MESA

Interviewed by Alex Lyda

POSITION:
Director of Environmental Stewardship

LENGTH OF SERVICE:
7 months

FAVORITE QUOTE:
"Be the change you want to see in the world."
— *Mahatma Gandhi*."

EILEEN BARROSO

"My job is to lessen the environmental footprint of Columbia."

Nilda Mesa works fast. Halfway into her first full year as the Director of Environmental Stewardship at Columbia, is working on a number of initiatives to make Columbia "greener."

As a reflection of how important that mandate is, she reports directly to Senior Executive Vice President Robert Kasdin, who has long been focused on the issue.

Born in Cuba and raised in Chicago, Mesa's immigrant upbringing taught her how to adapt to new environments quickly, a skill she's used frequently in a career that spans law, environmentalism and even fine art. After graduating from Harvard Law School in 1988, Mesa worked for California's attorney general, enforcing laws on toxic waste management and natural resources laws. She also held several positions with the Clinton administration, including lead legal negotiator on the environmental side agreements of the North American Free Trade Agreement after its ratification, and as the Assistant Deputy Secretary for Environment for the U.S. Air Force. These jobs, in which she helped craft programs to mitigate environmental impacts and promote environmental justice, mesh well with what she does at Columbia. She is also trained as a fine artist, and lived in rural France for a number of years.

Q. *What does Columbia bring to its environmental efforts?*

A. We are unbelievably strong on earth and environmental issues as well as public health on the academic side and within the student population. It is hard to think of any other institution, frankly, that has the depths of knowledge and expertise on environmental issues that Columbia has. We also have strong leadership from Housing and Dining, and are improving daily on green building issues.

What we are working on now is on the operations side and on communications. We know we must conserve energy and look at ways to diminish our environmental footprint and reduce our greenhouse gas emissions. And to do that, we are putting in place tools to collect the data that we need in order to come up with effective strategies to carry out our goals.

Q. *What's on the top of your to-do list?*

A. I spend a lot of time on green building issues. Existing buildings as well as new construction. Columbia is starting several construction projects over the summer, and two of the buildings will be registered LEED buildings. [Leadership in Energy and Environmental Design, a nationally accepted benchmark for the design, construction and operation of high performance green buildings.]

Q. *What about recycling?*

A. The biggest category of e-mail I get is on recycling. It's a marker for how seriously a campus takes its environmental efforts. There's an urban legend that Columbia doesn't recycle. It's a stubborn myth, and consequently people may not try to recycle. What's true is that there's no central solid waste recycle overseer. That's because each department does its own recycling—catering, facilities. But we want to know if recycling isn't going on that should be, and if we know where or when we can have the problem addressed. I'm currently looking for a recycling and solid waste coordinator.

Q. *Other universities have people doing jobs similar to yours. Do you talk with them?*

A. There are a couple of different organizations, and one has an annual meeting to discuss environmental issues. We go through everything. People talk about what their student groups are working on. Everybody faces different challenges. At some colleges, the issues may center around developing a transportation plan that helps eliminates greenhouse gas emissions from autos. We don't have that issue here. But we do have aging buildings that aren't the most efficient when it comes to energy. We'll trade names of architectural groups with expertise in the environment, suggest solutions for each other. We exchange information about what works and what doesn't. Because, in the end, we're all after the same thing.

COLUMBIA GETS A "B" ON GREEN REPORT CARD

Even universities get report cards. Columbia recently ranked among the top schools in environmental practices, earning a grade of "B" on the first-ever sustainability report card issued by Sustainable Endowments Institute of Cambridge, MA., a special project fund of Rockefeller Philanthropy Advisors. One hundred colleges and universities in the U.S. and Canada were ranked on their practices in seven areas, with the highest grades of "A-" going to Harvard, Stanford, Dartmouth and Williams.

Of the remaining schools, 22 earned leve "B" grades, 54 earned level "C" grades and 20 earned a "D".

At Columbia, researchers noted that "housing and dining services prioritize local, organic, and fair-trade certified purchasing, and...all the dining halls' unused food is sent to City Harvest, a nonprofit dedicated to ending hunger in New York City."

The report singles out Columbia's the new Office of Environmental Stewardship, and a planned Sustainability Advisory Committee of students, staff, and faculty, which might earn Columbia higher marks on future report cards.