

ECOLOGY AND PUBLIC HEALTH

GLOBAL
ENVIRONMENTAL
CRISES YIELD
DANGEROUS NEW
HEALTH CHALLENGES



On his way to work on the UW-Madison campus, Jonathan Patz says biking represents a triple win. It reduces local air pollution, does not produce greenhouse gases and keeps people fit. Photo by Bob Rashid.

by Bob Rashid

Jonathan Patz, MD, MPH, sits in his sparsely decorated office in the WARF building on the UW-Madison campus, talking about the threefold benefits of riding a bicycle. Outside, on a perfectly beautiful summer afternoon, it is easy to imagine pedaling happily down a bike trail. But bicycling is more than recreation in Patz's world.

An associate professor in the University of Wisconsin School of Medicine and Public Health (SMPH) Department of Population Health Sciences, Patz speaks eloquently, with passion gained over a 15-year career of studying public health on a global scale. Biking promotes physical fitness, he explains, reduces local air pollution and does not produce carbon dioxide, the most abundant of the emitted greenhouse gases. Because transportation causes about one-third of the gases that form the source of global warming, Patz calls the bike a "triple win."

On the filing cabinet next to his blue and white bike helmet, a matted photograph shows a smiling Patz standing with nine other men in winter jackets (including SMPH colleagues Patrick Remington, MD '81, MPH, of the Department of

Population Health Sciences, and Jon Wolff, MD, of the Departments of Pediatrics and Genetics).

The photo was taken earlier this year when the American Birkebeiner cross-country ski race in northern Wisconsin was almost canceled due to lack of snow. Patz uses the example, although lightheartedly, to make a point: Global warming could mean canceled Birkies, which means way less incentive to stay fit during Wisconsin winters.

Patz uses exercise to stay fit year-round and, as a former family physician, has always been focused on preventive medicine. Even during his residencies, he worked on environmental exposures because they were the most preventable. He soon discovered that working at the population level allowed him to exert much greater impact.

"The further you can go upstream along the causal chain of disease, the more people you can prevent from getting sick," Patz says. "That's why I love being in public health."

Patz, who holds a joint appointment in the UW Nelson Institute for Environmental Studies, gives talks around the world on climate change and the health problems it is causing. In

almost every presentation, he focuses on prevention so that people understand the role each country—and individual—can play in reducing global warming. The message is particularly relevant to American audiences, because the United States, with only 5 percent of the world's population, emits about 25 percent of the world's greenhouse gases, more than any other country over the past 50 years.

"Considering that most developing nations are burdened by major infectious diseases and famine, which are highly dependent on climate, these countries are most vulnerable to the global warming that we in the industrialized world are causing," Patz says. "It's a huge ethical problem. One could make the argument that our energy policy is indirectly exporting diseases to other parts of the world."

Patz and colleagues from the World Health Organization made the case most convincingly in the November 2005 issue of the journal *Nature* when they compared the worldwide differences in health vulnerabilities due to global warming. The synthesis review paper, which was the cover story and for which Patz served as lead author, stated that climatic changes since the mid-1970s

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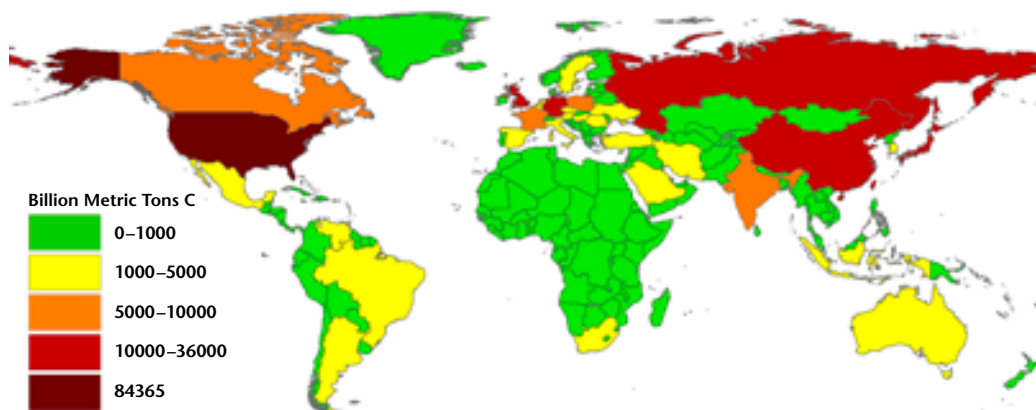
could already be causing over 160,000 deaths per year. These deaths were attributed to an increase in diarrhea, malaria and malnutrition in countries that have some of the lowest per capita emissions of greenhouse gases.

More recently, Patz and his collaborators published findings that link deforestation in the Peruvian Amazon with malaria. They discovered that the drastic change in mosquito habitat actually favored the most dangerous mosquito species, the *Anopheles darlingi*, whose biting rate was 278 times higher in deforested areas than in forested areas. Research indicates that other infectious diseases show similarly alarming connections: for example, urbanization and dengue fever or agricultural

development and Japanese encephalitis.

“So many diseases are changing their mode of transmission because we’re changing the landscape,” he says. “We’re looking at the interface between public health and ecology. Not only how disruption of the earth’s climate affects health, but also how disturbing ecosystems can impact on a variety of different infectious diseases and other health outcomes.”

Such problems may seem far away, adds Patz, but they are not. “We live in a global world,” he says, “and if climate change or deforestation can fuel epidemics in remote developing countries, international trade and



The map above shows the distribution of carbon dioxide emissions by country in 2000. Source: Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy. Map produced by Holly Gibbs, UW Center for Sustainability and Global Environment (SAGE) graduate student.

transport can bring these diseases to our doorstep.”

In July 1995, the U.S. experienced its worst heat wave in history—in Chicago alone 730 people died. Eight years later, an unprecedented heat wave scorched Europe,

driving temperatures to 104 degrees Fahrenheit and killing an estimated 45,000 people. The Intergovernmental Panel on Climate Change (IPCC), an arm of the United Nations Environmental Program and the World Meteorological Organization, in which Patz

has been involved, predicted more heat waves for the future.

Although heat waves claim more lives per year than floods, tornadoes and hurricanes combined, global climate change affects our health in other less

An Ideal Place to Address a Complex Issue

Precisely because climate change and its relationship to public health is such a vast issue that ripples across the globe in various ways, the problem may be best addressed at places such as UW-Madison. The university’s many world-class schools of differing disciplines offer Jonathan Patz, MD, MPH, the perfect platform for working on solutions. The situation has grown to be so complex that it is essential for people from myriad fields to work together, he says, and for students and future leaders to study across disciplines.

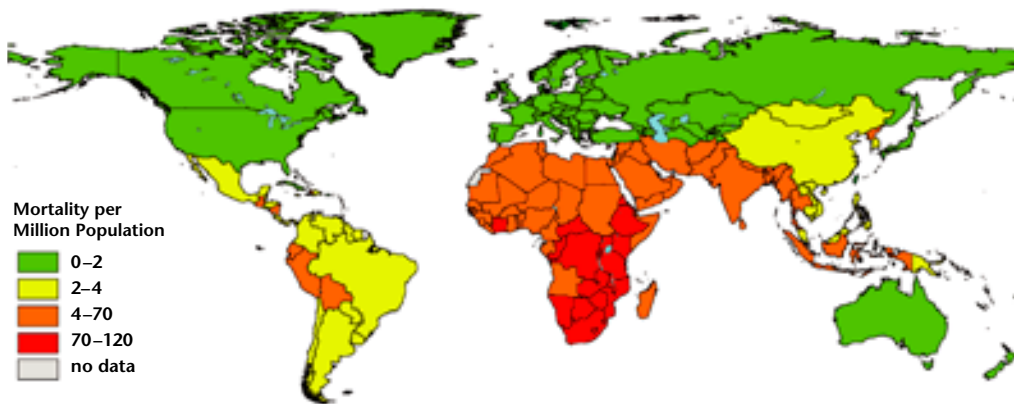
Patz directs a university-wide initiative called Global Environmental Health and is an associate professor

in both the Nelson Institute for Environmental Studies and the Department of Population Health Sciences in the School of Medicine and Public Health (SMPH). He serves on the steering committees of the SMPH’s vibrant new Center for Global Health and its Master of Public Health program, which is promoting interdisciplinary approaches by offering dual degree options for students from across campus. He is a member of the UW Center for Sustainability and the Global Environment (SAGE).

In October 2006, Patz chaired a conference held at UW-Madison that bridged the fields of public health, veterinary medicine and ecology

(including natural and human ecology). “EcoHealth ONE” attracted 400 scientists from 30 countries. Five UW-Madison deans also participated in this “transdisciplinary” venue. SMPH dean Robert Golden, MD, opened the conference with Patz and Gilles Bousquet, PhD, dean of International Studies at UW.

“Climate change and habitat destruction are likely two of the most serious environmental public health challenges we’ve ever faced,” Patz says. “They cannot be solved by people in one or two disciplines. Truly integrated education and research are needed—and there is no better place for that than here at UW-Madison.”



The map above shows estimates of regional distributions of climate-sensitive deaths due to diarrhea, malaria and malnutrition in 2000. Source: World Health Organization and The Hadley Centre. Map produced by Sarah Olson, UW population health sciences and SAGE graduate student.

direct ways as well. Higher temperatures lead to greater levels of ozone smog, which pollutes the air. Warmer air evaporates from the soil more quickly, resulting in droughts. Warmer air also holds more moisture, so rainfall is more severe, making floods more likely. More floods mean a greater likelihood of drinking water contamination. And as sea levels rise and

water temperatures warm, hurricanes increase in force.

Patz and colleagues are studying such health effects of climate change here in Wisconsin with funding from a U.S. Environmental Protection Agency grant. The research project brings together climatologists and public health officials from the university and the Wisconsin Department of Health and Family Services (DHFS) to look at

heat-related illness as well as rainfall-runoff and water contamination across the state and in Chicago.

“Preliminary analysis is showing that the number of severe heat waves will substantially increase in the Great Lakes region over the next 40 years,” says Patz, the principal investigator on the project.

One of the most serious assaults on public health—and one that, ironically,

holds the most promise for help—comes from the urban landscape. Oceans of black asphalt and dark rooftops absorb heat and create “heat islands” in summer, driving temperatures 7 to 8 degrees warmer in urban cores. With an increase in heat waves due to global warming, a synergistic effect will produce even more heat waves over these sprawling surfaces, Patz suggests.

Urban design also often prevents people from walking or biking, even when they want to, because cities are designed to accommodate the automobile. Patz, who received his master of public health degree at Johns Hopkins Bloomberg School of Public Health and completed a residency there, tried biking to work in Baltimore.

“I quickly realized that it was far more dangerous for my health to be on a bike

Key Leadership Roles

Patz has taken on key national and international leadership roles in the field of environmental public health. For example, he is:

- President of the International Association for Ecology and Health
- Past Co-chair, Health Expert Panel of the U.S. National Assessment on Climate Change
- Lead author, United Nations Intergovernmental Panel on Climate Change (IPCC)
- Convening lead author, World Bank and U.N. Millennium Ecosystem Assessment
- Co-editor of the journal *EcoHealth*
- Co-editor of the textbook *Ecosystem Change and Public Health: A Global Perspective*
- An Aldo Leopold Leadership fellow
- Member of the Board of Scientific Counselors, Center for Disease Control’s National Center for Environmental Health/Agency for Toxic Substances and Disease Registry

“Designing healthier neighborhoods that promote exercise can do more to improve health than an army of skilled clinicians.”

in Baltimore than to drive and miss that opportunity for exercise,” Patz says. “In Madison, thank goodness I don’t have this problem.”

Patz and others are taking a serious look at urban design and are employing a new integrated approach to creating a healthier environment. Aaron Carrel, MD, SMPH associate professor of pediatrics, initiated one such effort. Carrel studies exercise in

children and heads the group Wisconsin Initiative for the Prevention of Obesity and Diabetes (WiPOD).

The goal is to develop a network of experts from various fields who work toward reducing obesity and diabetes, not only through diet changes but by improving urban design as well. To this end, scientists from the UW departments of pediatrics, population health sciences, nutritional sciences, urban and regional planning, the Center for Transportation and the Nelson Institute for Environmental Studies are collaborating to achieve a sustainable solution to the obesity epidemic. By looking at the “built environment,” they hope to find ways to promote physical activity through urban design.

The center would be a resource within UW-Madison

that could be used by others outside the university, Carrel says. He hopes to work particularly with the Wisconsin DHFS.

“Obesity and diabetes are not just a healthcare problem,” says Carrel. “If we look at the big picture, we see that how we design cities has an impact on physical health.”

Patz stresses that interdisciplinary programs like WiPOD are essential to improvements in public health. “We need to augment medical expertise with innovative public health strategies. In the case of WiPOD, urban and transportation planning aimed at designing healthier neighborhoods that promote exercise can do more to improve health than an army of skilled clinicians.”

WiPOD serves as just one example of what Patz hopes

will be a much expanded, integrated public health research presence for the SMPH in the very near future.

Patz is aiming to grow the broad-based supply of experts who can work across disciplines to sustain the environment and people’s good health. One way is through a new \$3 million Integrative Graduate Education and Research Traineeship (IGERT) grant from the National Science Foundation. The grant supports doctoral fellowships for select students across schools and departments to learn to use various scientific and humanistic approaches to understand and address global environmental issues. An affiliated 12-credit certificate program is open to a larger number of students.



For more information

To read more about environmental health research under way at the UW Center for Sustainability and the Global Environment (SAGE), go to <http://www.sage.wisc.edu/pages/health.html>.

Patz heads the new Integrated Graduate Education and Research Traineeship (IGERT) program that sponsors doctoral fellowships to examine global environmental

issues. A 12-credit Certificate in Humans and the Global Environment (CHANGE) is available to graduate students across campus. Go to <http://www.sage.wisc.edu/igert/>.

The homepage for the International Association for Ecology and Health, and its flagship journal, *EcoHealth*, is at <http://www.ecohealth.net>.

Patz has created an educational Web site for middle school teachers and students covering a full range of global environmental health issues. The site, at <http://www.ecohealth101.org>, includes in-depth content and graphics, lesson plans, a glossary and an updated news page.

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“With IGERT we can begin turning out graduates who can work on interdisciplinary teams and who can take leadership in solving the health and societal changes posed by environmental change,” says Patz, who is director and principal investigator for the training program.

When Patz began assessing the risks of climate change—and solutions to the problem—he admits it was an uphill battle.

“There was a time when the U.S. administration put its head in the sand and pretty much denied climate change,” he says. “But attitudes began to change after the 2004 Arctic Climate Impact Assessment, which showed that at least

half of the summer sea ice is projected to melt by the end of this century, along with a significant portion of the Greenland ice sheet. The report’s findings were so significant that even climate scientists were shocked—and the public began to wake up. And that was followed by this year’s IPCC concluding with ‘90 percent’ confidence that humans are causing global warming.”

Now, Patz, like Al Gore—who has phoned him for advice—is hopeful. “I’m amazed at how rapidly public awareness and political will to do something about climate change have turned around in a period of less than three years,” he says.

Patz makes it clear that work can be done on the individual, municipal and national levels. The U.S. Mayors Climate Protection Agreement, for example, which was signed by more than 500 mayors, including Madison mayor Dave Cieslewicz, commits cities to meet or surpass the Kyoto Protocol targets in their communities. This movement started in Seattle on the day the Kyoto Protocol took effect and was a direct response to the administration’s refusal to participate.

Madison is also working to become the first city with a bona fide winter to be awarded “platinum” status from the League of

American Bicyclists. Already at the “gold” level, Madison is nothing if not bicycle friendly. Madison’s Platinum Biking City planning committee includes Javier Nieto, MD, PhD, the chair of the SMPH Department of Population Health Sciences, who also is a strong proponent of bicycling.

In talking about the “Triple-Win Biking Project” that is sponsored by the Center for Sustainability and the Global Environment (SAGE), of which he is a member, Patz points out that 40 percent of all trips by car in the U.S. are less than two miles—and thus easily bike-able.

“Many tons of carbon dioxide emissions as well as local air pollution could be eliminated, not to mention pounds lost, if people biked or walked for these short trips,” Patz says.

But since not everybody is able to bicycle, Patz emphasizes that biking should be part of a “multi-modal” transportation system as our nation strives to make its cities more health-promoting and environmentally sustainable.

“This will be a step-by-step process that will not happen overnight,” he says. “Nonetheless, I believe that the American people can be persuaded to change their behaviors—for their own benefit and for the benefit of future generations.”

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Doing His Part

Jonathan Patz saves energy and reduces emissions in the following ways:

- Bikes or walks to work
- Uses a bike trailer for hauling up to six bags of groceries
- Purchases bright LED bike lights for all his incoming graduate students
- Buys food grown locally as much as possible
- Has installed solar-thermal hot water and solar electric panels on the roof of his house
- Uses insulating blinds on windows and lowers the thermostat in winter
- Has put mini fluorescent light bulbs or LEDs in almost all of the light fixtures in his home
- Drives a 2001 hybrid car (one of the first purchased in the state)
- Tries to avoid flying to meetings by using teleconferencing (but admits he needs to work harder on this)

“All of these things, with the exception of the solar electric, are not that expensive, and there is absolutely no compromise in lifestyle,” Patz says. “As far as the biking part, I’m truly lucky to live in Madison. My hope is that we can become a model city, for both fitness and environmental sustainability.”