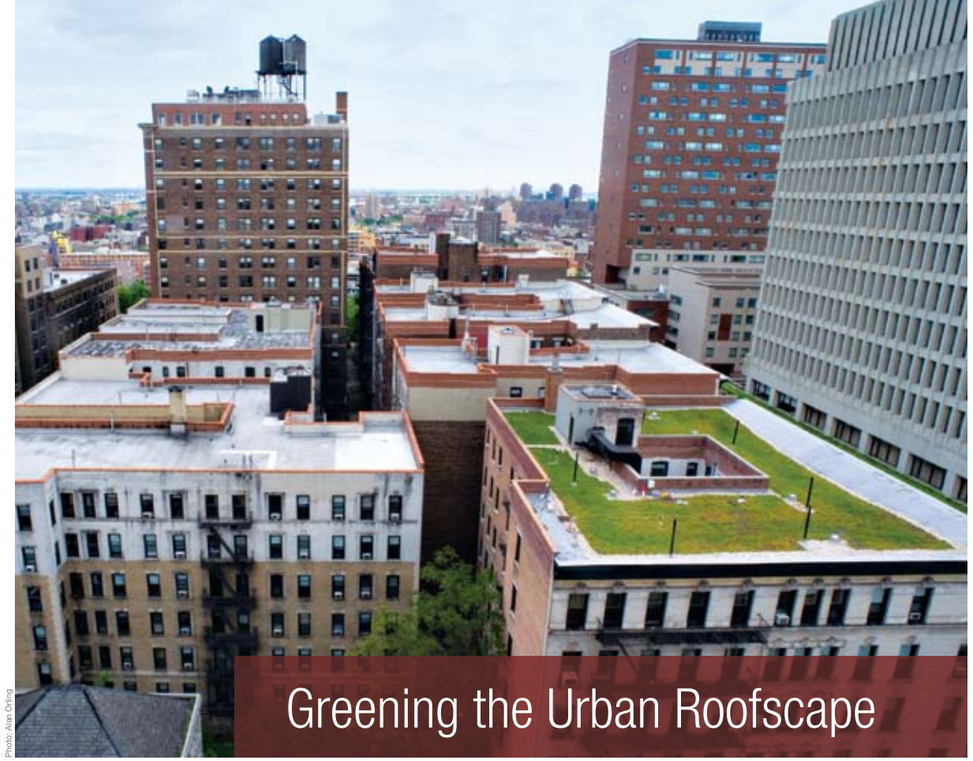

Photo: Alan Orling

Greening the Urban Roofscape

Photo: Alan Orling

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

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

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

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

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

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

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

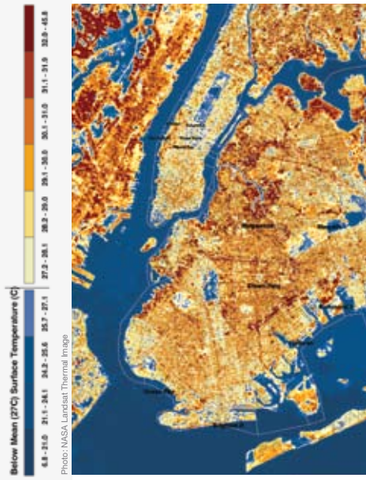

Photo: NASA Landsat Thermal Image

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

Photo: Alan Orling

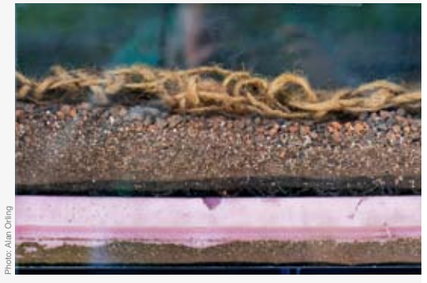

Photo: Alan Orling

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

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

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

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