

Green Roofs: Building for the Future

By Dara Colwell, AlterNet

Green roofs have been around for millennia. But as the planet heats up and green space dwindles, they are gaining in popularity in the U.S. and abroad.

From the U.S. Food and Drug Administration building in Washington DC to Heinz Corporate head quarters in Pittsburg, an increasing number of buildings are swapping shingles for sedums. The movement is called green roofing, but far from an industrial paint job, it evolves around technology that's ecologically-sound -- and proving so useful that cities like Portland, Oregon, Chicago, Boston, Seattle, and the entire state of Maryland are eagerly exploiting the potential of this once forgotten façade.

"This technology offers us an opportunity to significantly improve not only the way our buildings operate, but to utilize wasted spaces -- there are millions of square miles," says Steven Peck, founder and president of Green Roofs for Healthy Cities, an organization established to increase awareness of green roof benefits. GRHC also hopes to advance the market in North America. "The roofing industry is just at the beginning of a process of transformation. Nothing can match the range of social, economic and environmental benefits green roofs provide."

As the name implies, green roofs are roofs made of plants. They're comprised of a waterproof membrane followed by a root barrier, a drainage layer, and finally the growing medium and a variety of plants, grasses, sedums, cactus or shrubs - - hence, the green. The technology, of course, isn't entirely new. For millennia, the natives of Scandinavia and Iceland, particularly barren environments with limited building materials, used sod on their roofs as insulation; in Tanzania, mud huts with grass roofs are common; and closer to home, many early settlers used sod to insulate their walls and prairie grass to cover their roofs.

Green Roofs Today

In more recent years, Germany spearheaded the modern movement back to grassy rooftops, but this time with an urban twist. During the 1970s, the densely-populated country began installing green roofs to prevent storm water from surging into its aging sewer systems, and the industry has since boomed, experiencing rapid and sustained growth. Today, roughly 14 percent of the country's total roofs are greened, the industry continues to grow 10 percent per year and some German cities actually levy a "rain tax" on non-greened, asphalt rooftops.

Germany's pioneering work has encouraged other countries such as Australia, Japan, Mexico, the Netherlands, the United Kingdom and Switzerland to actively

embrace the concept. But there's more to the mounting buzz than sheer novelty. In an era when global warming, catastrophic weather patterns, flooding, sustainability issues, and man's very-tangible impact on the planet's health grab daily headlines, green roofing offers positive solutions.

"If you pick up newspaper everyday, sometimes you don't want to lift your head out of bed. Good news doesn't always make the news. But green roofs -- it's encouraging stuff," says Ed Snodgrass, a horticultural consultant who owns and operates Emory Knoll Farms, a nursery specializing in green roof plants. Snodgrass recently covered the Library of Congress's 100,000 square foot top. "In the cities there's not much opportunity to do things down below, so now we're trying to do it up above!"

Why it Works

The benefits of green roofs are extensive. The primary advantage, and what initially spurred German research, is that it helps mitigate storm water runoff, a problem that costs millions every year. In cities, with thousands of square meters of solid, impermeable asphalt and concrete surfaces, when it rains it literally pours -- straight into drainage pipes, which then empty into the sewage system. Too much water too fast, the system can explode, leaking raw sewage.

But green roofs retain or absorb rainwater much like a sponge, slowing its flow, and according to Brad Rowe, Associate Professor of Horticulture at Michigan State University, which boasts its own green roof research program, retain between 60-100 percent of rainfall, depending on its intensity and duration. "Sixty percent is a surprising average. The normal roof might hold only five percent," he says.

MSU's research project was initiated to help grass up Ford Motor Company's Dearborn, Michigan assembly plant, a 10.4 acre project that took nearly two years to complete. Then it kept going. "When we first started doing this, no one had a clue what we were doing but now that's changed. I think people are learning that when you're building a building, it doesn't have to have a roof that's inert or not alive. Why not try to replace it with the plant life that was there, your ecological footprint as you look down on it?" says Rowe.

Another benefit green roofs offer is they combat "urban heat island effect," a phenomenon that essentially means that cities are hotter -- by roughly 10 degrees Fahrenheit -- than their surroundings.

"Modern architecture is essentially closed blocks of concrete and glass. Heating and cooling these structures is done with high energy output and considering limited oil reserves and rising energy costs, this is a highly negative effect," says Dr. Manfred Köhler, spokesperson for the Berlin-based World Green Roof Infrastructure Network, and also Professor for Landscape Ecology at

Neubrandenburg University of Applied Sciences. Köhler studied urban vegetation under Dr. Reinhard Bornkamm, whose scientific research kick-started the green roof movement in Berlin in the 1970's.

Because city surfaces absorb, rather than reflect the sun's heat, surface temperatures quickly rise. Green roofs, however, make a noticeable impact on a building's heat and gain loss. During the summer, for example, the temperature of a gravel roof can increase by as much as 77 °F, fluctuating between 140-176 °F. But covered with grass, the roof temperature doesn't rise above 77 °F. Not only do they absorb less heat, green roofs also help cool their surroundings, suck up airborne toxins and put oxygen back into the air.

In places like Los Angeles, which costs about \$100 million per year to cool, "a one degree reduction in the urban heat island effect translates into a four percent reduction in peak load -- that's a huge amount," says Peck, of Green Roof for Healthy Cities. Since Chicago installed a 20,000 square foot green roof atop its City Hall in 2001, the city has saved about \$25,000 in energy costs. Its Mayor Richard Daley has taken a proactive stance and 2.5 million square feet of roofs have gone, or are in the process of going, green since he took office.

As cities continue to expand, there's increasing concern whether their additional warmth will further impact global temperatures. The disastrous 2003 summer heat wave that led to 35,000 deaths in Europe has shown how global climate change adversely impacts health. While scientists debate what exact influence cities have on climate change, one thing is for certain, urban heat islands affect city dwellers -- nearly half of the world's population.

In addition to mitigating water run off and heat, green roofs boast a plethora of gains, the first being economic. Because they are protected from ultraviolet radiation and the extreme fluctuations in temperature that cause roof membranes to deteriorate, green roofs offer longer roof life -- they can last up to 40 years -- and lower roof maintenance. They beautify bare concrete stretches, are able to grow food, attract wildlife and provide habitat in areas with fewer resources; they provide business opportunities for nurseries, landscape contractors, and irrigation specialists, and also offer substantial noise insulation, which is why Amsterdam and Zurich use it at their airports.

"In my opinion, green roofs offer so many benefits -- they reduce energy consumption, create greater biodiversity, and help mitigate the effect of urban land use. For a few additional costs, they bring greater long-term economic benefits, as well as a hugely better environment in the city center," says Kohler.

Building for the Future

Increasingly, America is coming on board with this technology. Since Chicago set the precedent, other city halls across the country are now greening up, and

Harvard, Carnegie-Melon, Massachusetts Institute of Technology, University of Georgia, North Carolina-Chapel Hill, Pennsylvania State, and Michigan State all have green rooftops on at least one of their buildings.

"Early on in this industry we've seen more institutional clients, such as universities and the government, try to set the standard. Now we're seeing more commercial development and finally, we'll see residential," says Snodgrass, who says his business has seen "one hundred percent growth" since he started eight years ago. "It's very encouraging."

But there is a major, if predictable snag when it comes to greening residential roofs: costs. An intensive green roof costs from \$15 to 25 per square foot, so naturally the larger the installation, the cheaper the costs per square meter. As materials such as the root barrier membrane are only available through specialized contractors, and many roofs require structural repairs as well as local zoning permits, the technology is far from being a Do-It-Yourself project.

"Unfortunately, the financial side isn't completely there yet," says University of Michigan's Rowe. "A green roof costs about twice as much as a conventional roof -- and that takes a few years to pay off -- so in the short term, it's expensive, though in the long term, the energy savings far outweigh the original investment."

As it currently stands in America, there are roughly a dozen green roof installation companies -- many subsidiaries of German green roof companies -- although new ones are popping up all the time. While only a handful of federal energy financing programs offer financial incentives for those interested in installing green roofs, cities like Portland and Chicago have established community grant programs and tax incentives, and even Home Depot has earmarked sustainability funds. A full list can be found on the City of Chicago's Department of Planning and Development website.

If present trends continue, other major cities will likely develop similar incentives because the technology has proven, at least in Germany, to be a long-range investment with multiple benefits. "In the United States, the Green Building Council oversees an annual convention and this year there were around 14,000 attendees. Six or seven years ago, it was in the hundreds," says Snodgrass, certain that the industry will continue to grow.

If anything, those in the field believe we're now entering a new, exciting phase in the construction industry. "What we really have to embrace is that a new building has a net positive impact over its life expectancy and contributes to sustainability. Not just something less damaging, but a restorative building that actually generates power and replaces its footprint on the land with more greenery," says Peck, who has a background in public policy research and is currently compiling a comprehensive "green roof of knowledge" database tracking its development across regions.

"We need to turn the industry in this direction otherwise it will draw down the resources of the planet -- and every time a new building is built, it'll just be another nail in the coffin," he says. But he remains optimistic that the tide's turning. "If we can do this collectively, in one generation or 25 years, this will become a force for sustainability."

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