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TOP SOIL

THE CITY'S PUSH FOR 'GREEN ROOFS' IS BEGINNING TO TAKE ROOT

By Katherine Millett. Katherine Millett last wrote for the Magazine about lion expert Tom Gnoske

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The Sachs sisters have to take a step up to play on their lawn. Surrounded by a brick wall, Madeline, 6, and Nina, 4, can run across lush turf to their wooden playhouse or their father's vegetable garden. It's much like any well-tended suburban yard, with landscaping and flowers, except for the location: It sits on the roof of the family's garage in Sandburg Village, one of the first "green roofs" built for a single-family residence in Chicago.

"At first I thought the step up was weird," says their mother, Naomi Sachs, "but we've gotten used to it." A grid of 30 interlocking plastic containers, each about 4 feet square and 1 foot high, covers most of the roof, and a border of wood conceals its black edges. During installation, the containers were filled with a soil mixture engineered to be light and long-lasting. Sod was rolled over the containers, hiding their rims, and Sachs arranged planters of flowers and shrubs around the perimeter to complement the landscaping.



"After four years of living here with concrete and small planters of flowers," she says, "my husband and I wanted to have a real yard for the kids to run in. It has made the house so much more enjoyable."

The tradition of green roofs goes back to the time of the Vikings, who threw thick masses of grass and soil on top of their stone houses and hefted up a sheep or goat to do some grazing when the grass needed a trim. (That technology hasn't disappeared: A sod roof with a goat still attracts tourists to Al Johnson's Swedish Restaurant in Door County.)

Modern green roofs use materials and methods developed primarily in Germany over the last 30 years. In addition to grids of containers, there are layered systems that waterproof the roof, protect it

from root penetration, catch water during rains and slowly release moisture during dry spells. Both technologies can support a wide variety of plants in engineered soils.

When Mayor Richard M. Daley first saw green roofs during a tour of Hamburg, Germany, in 1998, it was like a conversion experience. By the end of 2001, City Hall had a 20,300-square-foot rooftop garden with an assortment of plants and technologies. The project, greeted with international fanfare, required repairs to the surrounding masonry and replacement of the roof at a total cost of \$2.5 million. The bills were paid from a \$100 million fund the city recovered from Commonwealth Edison after a series of blackouts during 1999.

Daley and his staff ardently preach the power of green roofs to cool buildings, clean the air and control storm-water runoff. Within the city, 48 green-roof projects are completed or in the works, many of them partially funded by the \$100 million, which is now exhausted.

"This is not just Mayor Daley's fantasy," the mayor says. "It's a great idea. They have a lot of different soils . . . and they can roll out certain kinds of plants and flowers like a carpet. We're going to ask private

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developers to put green roofs or reflective roofs on their buildings, because with all the flat roofs we have, and the urban congestion, it's just common sense. And a private garden changes the whole dynamic of a building. The developers know it's the right thing to do, because their customers like it."

Unlike rooftop gardens that use potted plants, green roofs are permanent parts of their structures. They are initially more expensive because roofing materials, containers, dirt and plants have to be hauled to the top of a building. When a green roof was installed on the new Apple Computer store at Michigan Avenue and Huron Street in June, cranes worked in the middle of the night to put dirt and sedums, the easy-care succulents most favored by green roofers, above the third floor. Delivery by helicopter is the norm for taller buildings.

"You don't see economies of scale until you reach about 3,000 square feet," says Scott Moritz of Weston Solutions, the company that oversaw construction of City Hall's roof. Based on an informal survey of green roofers, the installed price of a grid system ranges from \$13 to \$25 per square foot. A layered system with a 10-year warranty costs about \$15 for a residential installation with a soil depth of 12 inches or less.

"Literally, the sky's the limit," says Ron Rediger of American Hydrotech, a Chicago-based company that manufactures layered systems. This summer, the company installed a roof garden at Schwab Rehabilitation Hospital, with trees planted in 2 feet of soil, planter walls, fountains and waterways. "These projects can get extremely complex," he says, "and cost up to \$70 a square foot."

Because of the expense, green roofs are most likely to be installed in common areas, like public buildings and the shared spaces of condominiums.

"We love ours," says Jim Corirossi, president of the condo association for Church Street Station in Evanston. "It's next to the pool and the hospitality room, so on a nice day you can have people over and relax by the lawn. It was a big attraction when we decided to move here." Units in the building sell at a premium if they have a view of the green roof, which includes a lawn with a white veranda, a border of trees and colorful flowers.

Simple "extensive" roofs have shallow soil (2-6 inches) planted with drought-resistant, low-maintenance plant varieties like sedums and native grasses. An "intensive" roof, as the name implies, requires more maintenance, uses deeper soil (8-36 inches) and yields greater aesthetic rewards. Flat roofs are ideal, but roofs with a pitch of up to 30 degrees can be accommodated with moderate adjustments.

Planning a green roof should begin with a structural analysis, cautions Chicago architect Bill Warren. One of his clients recently had to abandon the green roof part of her plan to renovate a vintage house in Bucktown. The original house was well built in the late 1800s, but a subsequent rehab had weakened the structure. Warren advises special scrutiny for houses built after World War II; that's when a 2-by-4 became a 1 1/2-by-3 1/2.

Waterproofing and root resistance are other key issues. Some manufacturers guarantee installations only if they prepare the roof before plants are installed. The roof should be thoroughly checked for leaks and treated with waterproofing material, such as a membrane of rubberized asphalt that can be applied like paint. Whether the planting system involves layered materials or pre-formed containers, it must include a barrier, usually a layer of specially woven fabric, to keep roots from growing into the underlying roof.

Sharon Casillas learned the waterproofing lesson the hard way. She bought a house on South Fairfield Avenue in Chicago that had been refurbished as part of the city's "green bungalow" project to showcase rain barrels, passive solar systems and other sustainable technologies in moderately priced bungalows. Hers was the only house in the program equipped with a green roof--a grid system on top of the new garage. As heavy rains fell this spring, a leak developed in one corner of the roof.

"I'm still waiting for the contractor to come fix it," she lamented in July. "At least the green roof is in containers, so when they finally do get here, they can move them out of the way to find the problem."

Part of the benefit of a green roof is its cooling effect. On a 90-degree day, the green side of City Hall's roof is likely to hold steady at 90 degrees, while the asphalt "black roof" on the Cook County side of the same building hits a sweltering 169. The difference is explained by Karen Liu, a Canadian scientist who studies the effects of heat on roofs: Traditional insulation merely delays the flow of heat from outside to inside; a green roof prevents the heat transfer from ever taking place by holding heat in water until it evaporates.

"It's like a person sweating," she says. "The evaporation actively cools and keeps the roof surface at the

same temperature as the ambient air."

Yet, despite the millions it spent on the new roof, City Hall's air conditioning bills have not gone down, says Kimberly Worthington, deputy commissioner of the Department of the Environment. Letting the roof dry out has sometimes negated the cooling effect, but even more important, the building is simply too big for the roof to make much of a difference. Heat penetrates from the sides as well as the top, so it takes a proportionately large green roof to significantly reduce energy use.

"City Hall is an 11-story building with a lot of windows," says Chris Wark, whose Shade Consulting analyzes the effects of various "green building" techniques. "With heat transfer taking place through all those surfaces, the roof's cooling effect is minimal. The buildings with the biggest savings in energy costs are long, low industrial and commercial structures like warehouses and Wal-Marts."

Somewhat surprising is Wark's observation that shallow, extensive roofs cool as effectively as deep, intensive ones. A 2-inch roof planted with sedums will save as much energy as a 2-foot roof planted with grasses and roses, and it weighs about the same as a gravel ballast roof.

Some advocates of green roofs believe the extra foliage can help reduce pollution and offset the "urban heat island" effect in Chicago and other cities. With so much pavement and asphalt roofing, metropolitan areas are significantly warmer in summer than their less-developed surroundings. According to a five-year study by Northwestern University engineers Kimberly Gray and Mary Finster, Chicago's heat island peaks over Lisle in the western suburbs. During the summer, Lisle is consistently 3 to 5 degrees hotter than the Loop, where lake breezes alleviate the buildup of heat reflected from paved surfaces. The study also found that the area with the worst ozone pollution was Evanston. During a four-year period, the north suburb had six days with hazardous ozone levels, compared with two or three days in various sections of Chicago.

But Gray says it's "absurd" to expect a few green roofs on skyscrapers to significantly reduce either the heat-island effect or levels of air pollution. A study of Toronto showed that greening 6 percent of the city's roof space would reduce summer temperatures 3 to 4 degrees. Gray notes that when all the currently planned green roofs have been installed in Chicago, they will cover only .0235 square miles of the city's 228-square-mile area, and she says that more extensive measures are needed.

"Green roofs are pretty, but they aren't going to do anything to reduce energy use in skyscrapers or cool the heat island. It is far more effective to plant shade trees, and Chicago is doing a great job of that. Green roofs shouldn't distract people from measures with real impact, like retrofitting coal-fired power plants and paving streets with light colored materials instead of asphalt. "If everyone painted their roof with reflective paint or used reflective shingles, especially in the suburbs, it would be a lot cheaper than green roofs and would really do something about the heat island."

Chicago has modified its Energy Conservation Code and is using the building-permit process to give builders and developers incentives for environmentally beneficial practices. A project can have more floor space if it has a green roof, reflective roof or solar panels. Beginning in 2004, roofs on new buildings will be required to meet reflectivity standards.

Green-roof promoters note that cooling isn't the only possible benefit: Planted surfaces also help control storm water by absorbing rain and slowing its flow into the Chicago sewer system, where it combines with sanitary waste. When a sudden downpour overwhelms the system, raw sewage can end up in Lake Michigan, as it did last summer.

To trumpet the virtues of green roofs, Chicago hosted an international conference in May that attracted more than 500 people from North America and Europe to discuss technical, environmental and economic aspects of green roofs. Organizer Steven Peck, director of the Canada-based organization Green Roofs for Healthy Cities, says Chicago was selected, because along with Portland, Ore., it leads the United States as a promoter of green building technology.

According to Daley, education is paramount. "Big retail stores are starting to do green roofs," he says, "but a few years ago, developers never heard of them. It was just, 'The mayor has a whim, so I guess we have to put four little bushes up there and we've accomplished a green roof.' Now we're kind of leading the way. We want to be the number one leader in this."

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