

# A GREEN ROOF

*The 13,000-square-foot rooftop garden at 899 West Evelyn in Mountain View has two mature trees, a bocce ball court, a lawn deck and a trellis.*

📷 LAURA KUDRITZKI

# OVER YOUR HEAD

 MARIA SHAO

IN AN ERA OF HEIGHTENED ENVIRONMENTAL CONSCIOUSNESS, developers and building owners are looking to green roofs as a way to reduce their environmental imprint and meet rising requirements for low-impact development. Living roofs are being incorporated into structures to cool buildings, limit rainwater runoff and get people outdoors to expose them to natural habitats and sustainable architecture.

Other U.S. cities including Washington, D.C., Chicago and New York have installed green roofs at a faster clip than the Bay Area, according to Green Roofs for Healthy Cities Inc., a Toronto nonprofit. But regional examples are proliferating.

“Every company is trying to leverage sustainable technology that will reduce their footprint. The green roof is another tool,” said Marlene Barneveld, branch manager in San Carlos for ValleyCrest Landscape Companies. “It’s also the social conscience of companies [and] the PR value of using the latest green technologies.”

The concept dates back to Mesopotamia, Greece, Rome and Persia. In Iceland, sod roofs have long insulated buildings from the cold. Germany is a leader in the technology.

In recent years, green roofs have cropped up in the United States. Ford Motor Co.’s River Rouge factory in Dearborn features a living roof. Chicago’s City Hall has one, and the city’s Millennium

## The ecology-minded Bay Area is catching up in the green-roof and green-wall movement.

Park, atop a garage and train station, serves as one of the world’s largest green roofs.

Locally, one of the oldest living roofs, an expanse of prairie vegetation, was installed in 1997 on the former Gap Inc. headquarters in San Bruno, now occupied by Google’s YouTube. San Francisco’s most renowned green roof was installed in 2007 atop the newly

*read more online:*



More Green Roofs Arriving  
to San Francisco  
<http://tinyurl.com/theregistry-roofs>

*“We see it as an amenity that becomes more valuable as cities require you divert rainwater.”*

■ CHRIS HEIMBURGER, VICE PRESIDENT OF DEVELOPMENT, KILROY REALTY CORP.



*Details on the green roof of 50 U.N. Plaza in San Francisco.*

📷 LAURA KUDRITZKI

built California Academy of Sciences in Golden Gate Park. Since then, green roofs have appeared on a San Francisco city government office building and a public library in its Sunset district; at low-income apartment buildings in San Jose and a Berkeley animal shelter; at a family home in Marin County and some private schools. In late August, the U.S. General Services Administration unveiled a 14,000-square-foot green roof at its new regional headquarters at 50 U.N. Plaza in San Francisco.

More green roofs are planned for high-profile future construction: the 5.4-acre park atop San Francisco's Transbay Transit Center that will be ready in 2017; Facebook's West Campus

headquarters building in Menlo Park where it proposes an eight-acre green roof; and the top of the nine-story suite tower at the San Francisco 49ers Levi's Stadium.

“The green roof is a way to make the building more sustainable, whether you're trying to get a LEED rating, return on investment or be environmentally conscious,” said John Loomis, principal at SWA Group, which did the landscape design of the Academy of Sciences' living roof.

Commercial developers are taking note. Kilroy Realty Corp. plans a six-story LEED Platinum office building at 333 Brannan St. in San Francisco that will have at least a 3,000-square-foot vege-

*“You can take your lunch  
and a laptop up to the roof deck,  
and it is another place to work.”*

■ DANIEL MINKOFF, THE MINKOFF GROUP

tated area as part of the 30,000-square-foot roof. Native, drought-tolerant plants will live in 12 inches to 15 inches of growing medium. Excess rainwater from the roof will drain into a tank onsite, where it will be treated and pumped back up to flush toilets. The vegetated area will be adjacent to a roof deck, where occupants can enjoy a verdant view. The greenery will add some insulation value to the roof.

The green portion will cost \$40 to \$50 a square foot compared to \$10 a foot to \$12 a foot for a conventional roof, and it probably won't mean higher rents. “We see it as an amenity that becomes more valuable as cities require you divert rainwater,” said Chris Heimburger, Kilroy vice president of development. Swinerton Builders is the general contractor at 333 Brannan St.

Daniel Minkoff of The Minkoff Group was so convinced that his new 70,000-square-foot downtown Mountain View office building needed a green roof that he returned to the city in 2011 to adjust his 2009 entitlements. After speaking to prospective tenants in downtown Palo Alto and Mountain View, he found that “they wanted to stay in Caltrain-served downtowns, but they needed an outdoor amenity space.” The 13,000-square-foot rooftop garden includes two 15-foot mature trees, a bocce court, lawn, deck and trellis. The additional weight required some special steel support in the building. “You can take your lunch and a laptop up to the roof deck, and it is another place to work while still being able to walk to Caltrain to get home at the end of the day,” he said.

Nuance Communications Inc. agreed in April 2012 to lease the building for 12 years, paying net effective rents of \$5.20 a square foot, according to Cassidy Turley Commercial Real Estate Services. Nibbi Bros. was the general contractor.

The city of San Francisco is stepping up its look at using roof vegetation to better manage storm water. Dense urban areas are full of impervious surfaces so there often are “no other opportunities for dealing with storm water rather than on the roof,” said Mark Palmer, senior green-building coordinator for the Department of the Environment.

In 2010, the city put in a 10,000-square-foot green roof on an eight-story city-owned office building at One South Van Ness Ave.

ABOVE, RIGHT:

*Casa Feliz Studios provide 60 affordable, energy-efficient units in downtown San Jose.*

■ COURTESY OF CASA FELIZ



## *what is* A GREEN ROOF?

A living roof has a growing medium, filter membrane, drainage layer, waterproofing layer, support panel, insulation, vapor-control layer and structural support.

An extensive green roof usually has hardy plants (sedum is often used) that do well in three-to-six inches of growing medium and requires relatively little care. An intensive green roof has growing medium deep enough for trees and is usually a more complex environment that requires additional maintenance.

### Among the benefits of green roofs:

**REDUCING HEAT:** Plants absorb heat and provide shade, reducing roof temperatures sharply and cooling building interiors. This can lower air conditioning and energy costs.

**CAPTURING STORM WATER:** Vegetation absorbs and evaporates rain, reducing and slowing water runoff. This relieves stress on sewer systems and limits pollutants that flow into the ecosystem.

**CLEANSING THE AIR:** Plants remove pollutants from the air.

**ENHANCING HABITAT AND BIODIVERSITY.**

**IMPROVING HEALTH AND AESTHETICS:** Greenery that is accessible or viewable can lower human stress, improve productivity and reduce absenteeism.

**LENGTHENING ROOF LIFE:** A green roof can double the life of a roof from 15 years to 30 years.

Green roofs cost significantly more than traditional roofs. They can start at two to three times more than a standard roof—roughly \$20 to \$30 a square foot—versus \$8 to \$10 a square foot on a conventional roof, said John Loomis, principal at SWA Group, a landscape architecture firm. Maintenance costs for a green roof can be three to four times more than maintaining the same type of plantings on the ground, said Nada Duna, senior vice president and regional manager at ValleyCrest Landscape Companies.

“It does add a lot of intrinsic value to the real estate from a programmatic viewpoint. The buyers we see today are more environmentally conscious. They’ll select an upcharge for these projects,” said Paul Kephardt, president of Rana Creek Inc., a landscape architecture firm in Monterey that has designed numerous living roofs in the Bay Area.

“It definitely costs more than a traditional roofing system, but over a longer period of time they will pay off. If you can make them accessible or a visual amenity, they will pay off more quickly,” said Steven Peck, founder and president of Green Roofs for Healthy Cities Inc.

Peck brings his 11th Annual CitiesAlive Green Roof and Wall Conference to San Francisco Oct. 23 to Oct. 26.

Numerous cities have joined the call for living roofs. Toronto requires the construction of a green roof on 20 percent to 60 percent of available roof space on new commercial, institutional and residential buildings of at least 2,000 square meters (~21,500 square feet). For industrial buildings of at least 2,000 square meters, a green roof is required on 10 percent of available roof space or 2,000 square meters, whichever is less.

Chicago offers grants worth 50 percent of the cost of placing a green roof on an existing building in its downtown central loop and awards \$5,000 grants for green roofs on residential and small commercial projects. Washington, D.C., provides funding of \$5 a square foot for living roofs on residential, commercial and institutional properties. Philadelphia credits 25 percent of green roof costs, up to a \$100,000 maximum, against the city’s business income tax. None of the cities and towns in the Bay Area offer such direct support for green roofs, Peck said. 



*Atop 50 U.N. Plaza (from left) are John Rahim, director of the San Francisco Planning Department; Ruth Cox, GSA Regional Administrator, Pacific Rim Region; Stephen Peck, president of Green Roofs for Healthy Cities; and Juliet Ellis, assistant general manager for External Affairs at SFPUC.*

 LAURA KUDRITZKI

# MORE THAN *a million* PLANTS

The roof has sharply reduced the amount of runoff sent into the city's sewer system. Sensors and emitters placed in the soil measure dryness and trigger watering during the dry months. Rainwater from an upper roof is collected and stored in a 6,500-gallon cistern on the living roof. The stored water has supplied 40 percent to 50 percent of the irrigation water used annually, Palmer estimated. The roof, which is accessible by a freight elevator to maintenance and operations staff, has attracted hawks, owls, dragonflies, ladybugs and grasshoppers.

First Community Housing, a San Jose nonprofit that develops affordable housing, has committed to green roofs. Two of its 18 buildings have living roofs and another will have one when construction is complete in November. So will three of the four new buildings it plans to build after that.

At downtown San Jose's Casa Feliz, a LEED Gold building with 60 apartments, five green roofs manage storm water onsite rather than dumping large amounts of runoff into city sewers. The roofs retain 90 percent of rainwater, while the remaining 10 percent drains into a bio-swale, a vegetated soil area in the backyard that filters the water before releasing it into sewers through mid-sized pipes. The green system cost \$320,000 to build—less than the \$350,000 it would have cost to build a larger piping system to carry a much greater amount of water two blocks directly to the city's sewers. "I'd rather put the money into our own building than storm piping in the street," said Jeff Oberdorfer, First Community executive director.

At its 100-unit Fourth Street Apartments, also in San Jose, there is a 50,000-square-foot green roof that captures most storm water. Excess water goes into a concrete basin with sediment filters that treat the water before it is sent to the sewer system. "This is basically for low-impact development to maintain the water onsite. Many cities have low-impact development guidelines. You're going to be required as a developer to do this sooner or later," said Oberdorfer.

Facebook plans an eight-acre green roof on the West Campus headquarters building it proposes to construct in Menlo Park across from its current headquarters. The company hired noted architect Frank Gehry to design a 430,000-square-foot building that can house 2,800 employees in one cavernous room in the 1,565-foot-long structure. The vegetated roof, about 45 feet above grade, will have lawns, meadows, gardens and potentially more than 300 trees. The roof, where soil will be deeper than four feet in some areas, will include paved gathering areas, outdoor dining, a half-mile walking path and space for a special events tent. The building is designed to integrate with the surrounding natural landscape. "The green roof will be both functional



✍ MARIA SHAO

The field wears a blanket of green. Rustic grasses, flowers, ferns and other plants cover not only flat sections but also several mounds. It is an undulating two-and-a-half acre verdant terrain that seems like a landscape from another planet.

It's actually the green roof atop the California Academy of Sciences in Golden Gate Park. This carpet of life—70 species of native Californian plants plus insects and birds—is a symbol of San Francisco and an important exhibit of the science museum.

"The mission of the California Academy of Sciences is to explore, explain and sustain life. Having a green roof ties in closely with our mission," said Ari Harding, director of building systems for the San Francisco museum that includes an aquarium, rainforest and planetarium. "The green roof is one of the icons of sustainability."

Museum architect Renzo Piano envisioned the roof as the result of lifting up a section of Golden Gate Park and sliding a building beneath. The public can view the expanse, with its seven hills blanketed by 70 native California plant species, from a rooftop terrace.

**The green roof at the California Academy of Sciences still inspires.**

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*Museum architect Renzo Piano envisioned the roof as the result of lifting up a section of Golden Gate Park and sliding a building beneath.*

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The roof, installed in 2007 when the museum was built, is one of the world's most complex green roofs and has helped the museum twice earn LEED Platinum ratings.

Initially, 1.7 million plants in over 50,000 biodegradable trays made of coconut husk fiber were installed. Nine species, including beach strawberry and self-heal, were planted; dozens more species have been planted since. Surrounding the roof's perimeter are 60,000 photovoltaic cells that contribute 5 percent or more of the museum's energy needs and also provide shade.

Because of the vegetation, the roof stays an average 40 degrees cooler than a standard roof, helping to keep temperatures inside exhibit halls 10 degrees cooler than with a conventional roof. The sharp slopes of the rooftop hills—up to 60 degrees—and automated skylights strategically placed in the mounds help funnel cool outside air into the central piazza inside, naturally ventilating the surrounding exhibit spaces. The skylights also allow natural light, reducing the museum's artificial lighting needs. Conversely, hot interior air rises and is released through

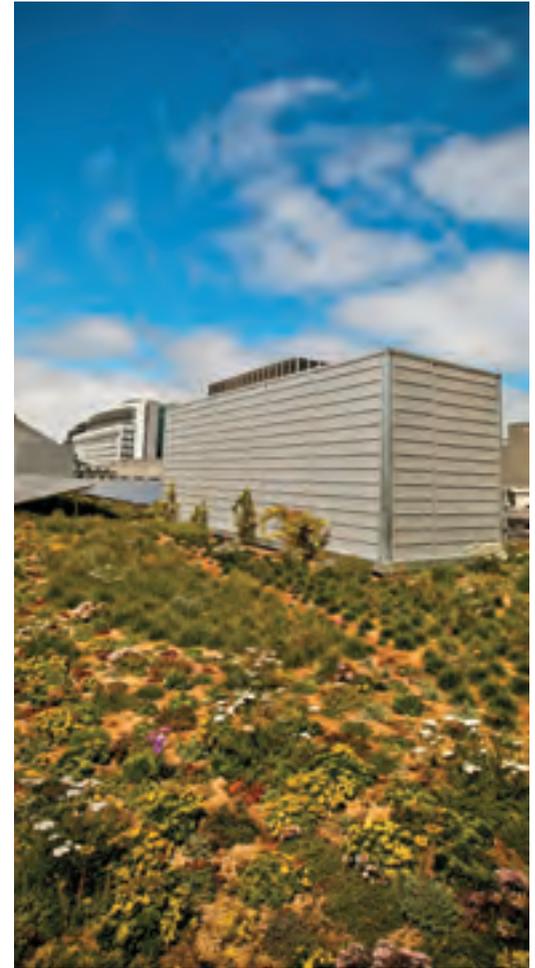
the skylights. The exhibit halls do not have conventional air-conditioning, only radiant heating beneath the floors.

The living roof also keeps rainwater out of the city's sewer system. The vegetation absorbs most precipitation, while excess is diverted to a recharge station under the building's loading dock, then sent to an aquifer under the park to be used to irrigate the park. "One hundred percent of rainwater is either used immediately by plants or is diverted into the aquifer. We get to keep it and use it for irrigation again in a closed loop system," Harding said.

The roof provides a vibrant habitat for dozens of insect and bird species that have been studied by scientists. But because the roof needs to stay green year round, the museum uses about 1.5 million gallons of water a year for irrigation during the dry months, an expense that Harding said is worthwhile: "It's teaching science and botany. It's bringing people in the door, so it's been a good investment," he said. "The more people see a green roof, the more they'll be interested in installing green roofs and thinking about sustainable architecture." ◻

*“People will be able to get off city streets, have a place to exercise, have a cup of coffee, be outdoors yet be in the heart of San Francisco.”*

PAUL KEPHARDT, LANDSCAPE ARCHITECT, RANA CREEK INC.



*Both the public and private sectors have embraced green roofs.  
From left: The Minkoff Group's new office development in Mountain View; exterior and rooftop of 50 U.N. Plaza.*

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and aesthetic. We build our campuses so that they promote activity—people sitting outside, eating together, or walking around,” said a company spokesman.

Not far away, in Mountain View, Google also planned living roofs at a nine-building campus it wants to construct near its Googleplex headquarters. Construction has been put on hold.

At the San Francisco 49ers new Levi’s Stadium set to open in 2014, there will be a green roof atop the suite tower overlooking the field. The 27,000-square-foot roof will feature native vegetation and will serve as a year-round event space that can host 500 people

to 700 people while offering a view of the surrounding valley.

In San Francisco, at the Transbay Transit Center, which is under construction, a 5.4-acre rooftop park will provide gardens, trails, grassy areas, lily ponds and an amphitheater. There will be oaks, redwood trees and diverse vegetation, providing a lush spot in the heart of a dense city. “People will be able to get off city streets, have a place to exercise, have a cup of coffee, be outdoors yet be in the heart of San Francisco,” said landscape architect Paul Kephardt of Rana Creek Inc. in Monterey, who participated in the initial concept design team. “It cleans storm water, freshens air, provides habitat, provides an amenity not otherwise available.”