Green overhead

Ecoroofs are growing business for cities and the green industry

BY ERICA BROWNE GRIVAS

GREEN ROOFS are not a new idea, but experts say they have powerful implications in an era of climate change.

In use for decades in European cities, fueling a multimillion-dollar market, they go by many names, from ecoroofs, green roofs, living architecture, green infrastructure, and roof gardens. In the U.S., Portland, Oregon, and Chicago, Illinois, were early adopters (Portland in 1996) with civic programs, and Seattle, Washington, New York, New York and Washington, D.C., have followed suit.

Many cities, including Portland, have implemented incentives for retrofitting existing buildings. Portland also mandates green roofs for new buildings of more than 20,000 square feet as a way of managing stormwater.

Beyond offering beauty and a leafy relief from hardscape, the public benefits of green roofs range from stormwater management and carbon sequestration to air filtration and urban heat island mitigation — not to mention the creation of jobs for people and bolstering habitat for pollinators. Private benefits to building owners and residents include lowering energy costs, reducing noise, extending the life of roof membrane and increased property value. And green roofs that are accessible to building residents also contributes to their wellness.

Rooftops in Portland's South Waterfront district are dotted with rooftop garden spaces and green roofs. PHOTO COURTESY CITY OF PORTLAND

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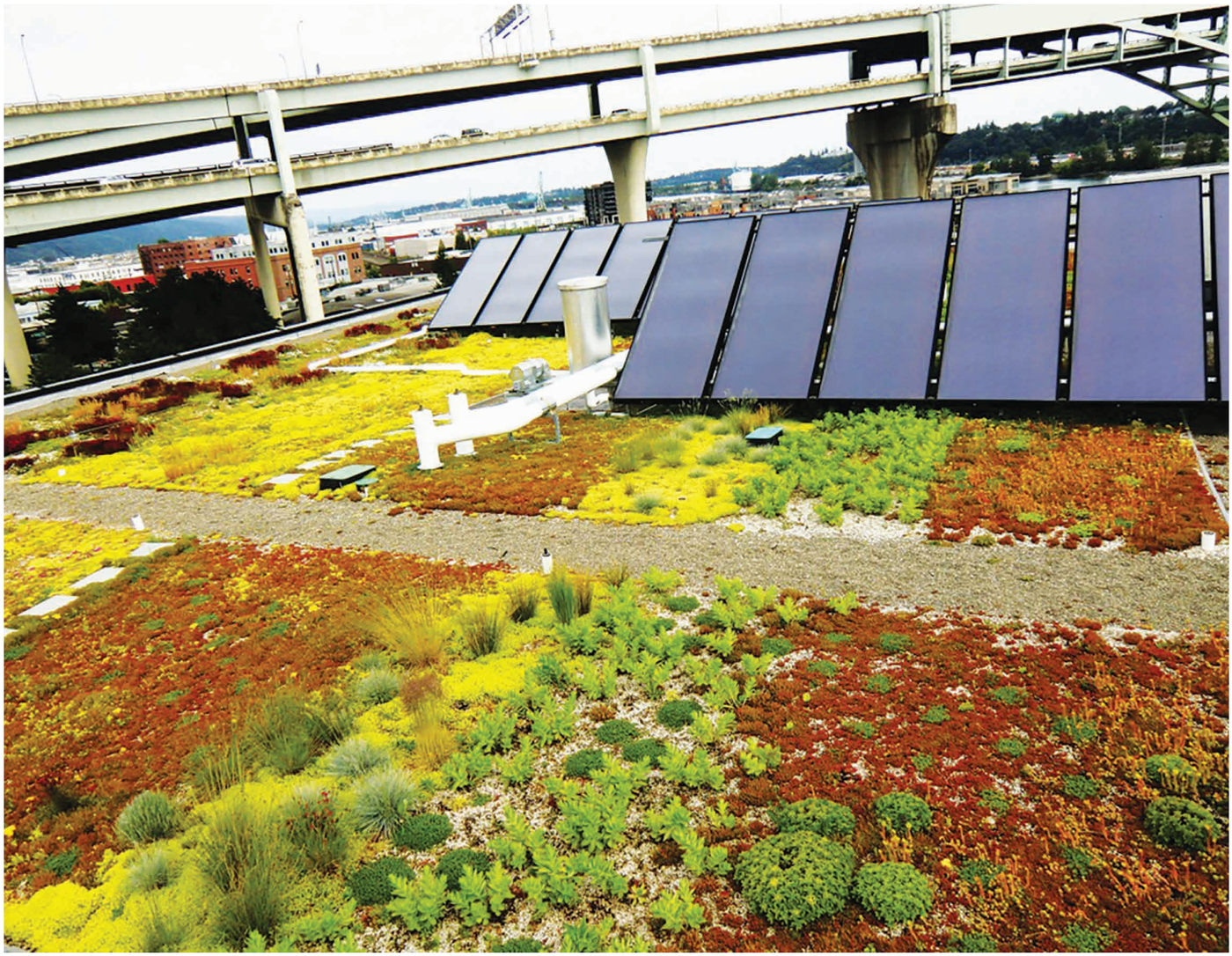

Many cities, including Portland, have implemented incentives for retrofitting existing buildings. Portland also mandates green roofs for new buildings of more than 20,000 square feet as a way of managing stormwater. PHOTO COURTESY CITY OF PORTLAND

"The big idea is we need to roof areas of our cities to prepare for the ongoing impacts of climate crisis which are well documented and being experienced everywhere," Steven Peck, founder of Green Roofs for Healthy Cities (**GreenRoofs.org**), an industry organization based in Toronto, Canada. "I don't think there's another green building technology that can match it in terms of the range and scope of benefits they provide."

While the amount of total green roofs in the U.S. is unknown, Peck said U.S. member surveys indicate 10% annual growth in the last few years.

Components and how they work

"Ecoroofs replace conventional roofing with a living, breathing vegetated roof system," the City of Portland stated on its website.

Green roofs are typically built atop a strong waterproof membrane. They incorporate root repellent systems, drainage systems, filter cloths, irrigation systems, lightweight growing media, and plants. The irrigation system is optional, but highly recommended for long-term success.

Green Roofs for Healthy Cities trains professionals on implementation and installation and recommends using a designer and contractor experienced with green roofs.

The plants most often used are sedums. Their shallow, horizontal root systems and high heat and wind tolerance from growing on rocky mountaintops make them adaptable to many sunny urban rooftops. They may be planted on-site or sold and assembled as modular tiles. For sedums, 4" of growing medium is typical; other plants with deeper roots can be grown if the structural analysis of the roof permits the extra weight. Ecoroofs can weigh 15–30 pounds per square foot saturated, according to Portland's Ecoroof Handbook.

Samuel Hoefler of Etera (**Etera.com**) (Forest Grove, Oregon) grows and sells *Sedum* tiles. He has seen business growing on average about 20% a year, and the last two, 30%. His stackable tiles which mix evergreen and deciduous sedums for year-round appeal are delivered in pallets and laid on the growing medium. "They look great right away," he said. He is interested in including native sedums.

Peck, of Green Roofs for Healthy Cities, anticipates that the drive for increased biodiversity will encourage the use of a range of pollinator-friendly

plants. "I think that as we move forward, people are realizing that ... there's a role for *Sedums* to play, but maybe it's not a dominant role with all green roofs," he said. "I mean, [not] if you want a biodiverse green roof, because we also happen to be in a biodiversity crisis."

Living Architecture Monitor, a quarterly magazine of the green roof and wall industry, predicts that new compact versions of native plants will help broaden the palette of plants used for green roofs. **Pac Fibre Soils** (Canby, Oregon) creates multi-layer system mixes designed for both extensive (up to 4" depth) and intensive (greater than 4") roofs. For one-time installation without replacing, Brad Zimmerman said the mix incorporates local pumice and uses a lighter ratio of organic matter than conventional planting mixes to reduce compaction and weight. The intensive mix has more organic matter than the extensive, so it retains more nutrients, but it's heavier in the rain.

What they do

"While other design approaches often do one thing well, ecoroofs do a lot of things pretty well," said Casey Cunningham, landscape architect for the Portland Bureau of Environmental Services. "In 2018 the Portland passed an ecoroof requirement for the central city, mandating ecoroofs on new buildings with a net area over 20,000 square feet, which is one of the most aggressive policies around."

Cunningham said Portland now hosts over 700 green roof projects, totaling about 57 acres.

In Portland's monitoring since 2002, eco roofs capture an average of 60 percent of the rainwater they receive, reducing runoff, and protecting sewers and streams. They improve air quality by trapping pollutants and reducing air temperature and increase natural biodiversity and habitat on urban sites that are usually "biologically dead spaces." The roof structure may last twice as long as conventional roof materials, saving replacement costs.

Dr. Olyssa Starry, an assistant professor of urban ecology at Portland State

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Portland now hosts over 700 green roof projects, totaling about 57 acres. PHOTO COURTESY CITY OF PORTLAND

University who researches green roofs, touts their unsung benefits and potentials. "We have good research that green roofs can lower people's stress levels," she said, based on cortisol level studies. Her studies have also shown green roofs can increase habitat and biodiversity and trap pollutants.

She sees them as a powerful tool for education. "These spaces are a catalyst for beginning conversations about difficult topics like climate change," she said.

Yet she would like to see more expansive policies. "We have been able to install acres and acres but compared to the acres of development in the same time period, we're not keeping up," Starry said.

"We're asking too much of these systems. We really need to see them as part of an overall greening strategy. Cities need to adopt comprehensive plans that incorporate bioswales, street trees and city parks, but they are an import component of that plan."

Are they expensive?

The biggest barriers to green roof implementation are the initial construction cost — and before that, the required structural analysis, said Peck.

"Before you know if you can put a green roof on, you need to know what the structural loading capacity is, and that could cost $1,000 or $2,000," he said. "So, people are reluctant to put the money in without knowing if they can proceed."

However, the economic and environmental benefits far outweigh the upfront costs, Peck said.

Peck notes that Toronto, Ontario's incentive program offers a buy-out option, which helps subsidize both incentives and structural analyses.

However, a 2011 report by the federal General Services Administration said that green roofs have a return on investment of 224%. "Costs range widely depending on what your design goals are," landscape architect Cunningham said. You can build up a naturalistic look slowly, with less upfront cost, but it may take longer to look full and will likely go brown in winter without irrigation.

"At the high-cost end, there are pre-manufactured trays that interlock and provide instant lush plant coverage …. These more manicured designs will cost more in carbon footprint and in dollars, up front and in maintenance, but this style looks green and controlled year-round. Both approaches and the range in between work, but an owner needs to be clear in what their expectations are and know that there are options."

Do they leak?

Addressing common misconceptions, Cunningham said, fear of leaks is a big one, but "We haven't seen any problems here where the ecoroof was the cause." He suggests minimizing seams and protrusions as much as possible to slow breakdown of the waterproof membrane.

These tips will prolong the life of your green roof, he said: "Some small but consistent maintenance steps will also keep an ecoroof providing all its benefits for a long time, such as keeping the drains clear, removing unwanted volunteer vegetation before it goes to seed, and a mow or remov-

al of dry material before July, to reduce any risk of an errant spark starting a fire."

Maximizing cooling

Beyond carbon sequestration, Portland State's Starry said she would like to see a focus on promoting the cooling benefit of green roofs to moderate the urban heat island effect. "When water is available, green roofs can cool the urban environment," Starry said. That doesn't happen much in the Pacific Northwest's dry summers, she said.

To prevent the plants from going dormant, "The question is finding a balance using smart irrigation strategies to provide that cooling benefit without wasting water," and to choose plants that would optimize that cooling effect, Starry said.

Sedums have been the traditional plant choice, but Starry said their conservative release of water during

Rooftop gardens and green roofs improve air quality by trapping pollutants and reducing air temperature. PHOTO COURTESY CITY OF PORTLAND

With careful plant selection, green roofs can increase natural biodiversity and habitat on urban sites that are usually biologically dead spaces. PHOTO COURTESY CITY OF PORTLAND

photosynthesis suggests that plants like warm-season grasses would go further toward cooling the air and the building.

There's another way green roofs may be able to help with cooling and save even more energy — by combining them with solar panels. The panels are mounted on stands above the green roofs in a concept sometimes referred to as a "biosolar roof."

The combination creates an energy-saving synergy of efficiency. The green roof helps cool the panels down, so they produce more electricity, and the soil can be used as ballast saving the construction and addition of sandbags and roof penetrations, Peck said.

"The compatibility of photovoltaic panels and ecoroofs is getting more and more recognition," said Cunningham, "which is exciting because plants benefit from the dappled shade, and the panels are more efficient with the cooler air around them.

Learn More

Portland's Ecoroof program: **TinyURL.com/PDXGreenRoof**

Olyssa Starry's research: Green Roofs for Healthy Cities, training programs, education and awards, **greenroofs.org**

Green Roof and Wall Policy Guide (2023) by Green Roofs for Healthy Cities, **TinyURL.com/RoofWallGuide**

Living Architecture Monitor, a journal published by Green Roofs for Healthy Cities **LivingArchitectureMonitor.com**

"This is probably the main way green roofs can help with climate change," Starry said

Increasing food growth

In addition, "there's work now to see if we can grow food underneath the solar panels," said Peck, which can help increase food security and equity in cities. "Those are called agrivoltaic rooms." In addition, "there's agricultural work that's being done with lighting, use of nutrients, hydroponics and aeroponics." to enable the growth of more food with less soil and weight on the roof.

Ultimately, Cunningham is optimistic about the outlook for green roofs.

"Also, just seeing more built projects and proof that greenroof technology works is slowly steadily trending us toward a mainstreaming of plants on buildings, which may be essential to livability in cities in the face of climate change.

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