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Denise Cowie

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The Philadelphia Inquirer

Denise Cowie | How does your rooftop grow?

With plants of green and flowers that gleam on city buildings all in a row. The green-roof movement sees many advantages

to gardens above.
By Denise Cowie
Inquirer Columnist

Imagine taking your usual train commute into Philadelphia. But instead of gazing from the window at an endless repetition of dingy metal or tar-paper roofs, you look out at a landscape of aerial meadows filled with grasses and flowering plants basking in the spring sun.

Sounds like science fiction.

But while the scenario isn't likely to become reality any time soon, the concept isn't pie in the sky. Think of it as roof gardening taken to its literal extreme, where the garden is the roof.

It's known as green-roof or vegetated-roof technology, and although it is just beginning to catch on in the United States as part of the green architecture and sustainable-design movements, it has been growing in popularity for a couple of decades in Europe. Many European cities subsidize green roofs, in an effort to counteract the negative environmental effects of development.

"Green roofs are basically a living biological community of plants and microorganisms growing in a lightweight medium," said S. Edgar David, an associate professor of landscape architecture at Temple University Ambler. "It is an environmentally sound alternative to a traditional roof system."

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Some of the ecological and economic benefits of green roofs are being demonstrated at the Philadelphia Flower Show, which runs through Sunday, by landscape architecture and horticulture students from Temple Ambler.

Much of the world's population lives in densely developed urban environments characterized by hard surfaces such as rooftops, roads, and concrete parking lots, David said.

In those areas, the biological processes of the Earth's surface have been thwarted, resulting "in a deteriorating air quality, degraded water, and devastating 'urban heat islands' that affect the quality of life," he said. But a green-roof system could help mitigate those effects by serving as a bio-filter.

"By their nature," David said, "green roofs mimic the natural processes that the buildings replace . . . [and have] the ability to improve our air and water quality."

For their exhibit on the flower show's main floor at the Convention Center, David's students built a structure of walls and roofs that suggests a house, but the garden isn't limited to ground level. Roofs with varying slopes provide growing space for a profusion of fringed bleeding hearts, sedges, sedums, dianthus, alliums, cactus, and grasses.

About 40 species of plants are part of the display, according to staff horticulturist Homer Elliott, although plant choices for an actual roof would be dictated by regional climate and conditions.

In one area of the exhibit, a bird's nest, complete with eggs, illustrates how green roofs also help provide wildlife habitat in urban settings.

It's the first time the school has competed at the show since 1997, and students put in weeks of work in the greenhouse and with carpentry and roofing tools to perfect the display.

Their efforts paid off. The exhibit, coordinated by David and Lisa Blum, manager of Temple Ambler's landscape architecture and horticulture department, won the Best of Show award in the academic/educational category. After the show ends, David hopes the structure will become an educational tool on the Ambler campus.



Just a handful of green-roof installations exist in Pennsylvania, said Charlie Miller of Roofscapes Inc. in West Mount Airy, who was a consultant on the exhibit. One of the first installations involving Roofscapes - which, unlike most green-roof providers, is based in the landscape industry - was a simple "meadow" at the Fencing Academy of Philadelphia on Lancaster Avenue in West Philadelphia in 1998. (Among the most recent is a terrace landscape on the 14th floor of the Heinz 57 building in Pittsburgh.)

But the history of planting vegetation on roofs goes back centuries. The legendary Hanging Gardens of Babylon - gardens purportedly built on terraces for their beauty and to help cool the rooms below - date to the sixth century B.C. In Iceland, sod roofs and walls have been used for hundreds of years. Green roofs were "rediscovered" between the 17th and 19th centuries, according to Temple Ambler's exhibit, and the idea was extolled at the Paris World Exhibition of 1867.

Technology for the new wave of green roofs was developed and is most extensively practiced in Germany, David said, "but more recently the ecological benefits have driven this type of application." Some urban districts in Germany have ordinances requiring green roofs, he said.

Consider some benefits of green roofs:

Unlike standard nonporous roofs, they cover impervious surfaces with permeable plant material. That lets rain soak into the rooftop garden. Stormwater that runs off does so slowly, instead of rushing into drains and streams.

They improve water quality. According to German statistics, Miller said, about 90 percent of atmospheric pollutants, except maybe nitrogen, are removed as rainwater is filtered through plants and microorganisms. And water that transpires from the roof attracts particulates that normally would float in the air and be absorbed into people's lungs.

They recharge the atmosphere by absorbing carbon dioxide and releasing oxygen.

They reduce the "urban heat island" effect by a few degrees. Where traditional roofs generate intense reflective heat, the vegetated surface of green roofs reduces this effect through transpiration and absorption of solar radiation.

They enhance the efficiency of the building's insulation and conserve energy by stabilizing indoor temperatures and humidity. And though they may be initially more expensive than regular roofs, they extend the life of roofs by protecting against extreme weather conditions.

They substitute for lost open space and some wildlife habitat. They beautify urban settings and make them more comfortable environments by helping people maintain a connection with nature.

Not a bad day's work for the roof over your head. But establishing a green roof involves a lot more than putting some plants into a soil-less growing medium.

First, the building has to be able to support the load. And any roof must keep the building beneath it waterproof, which is one reason the green roof installed by the Temple Ambler students has numerous layers and is about five inches thick.

The first layer is a "deck" of either plywood or cement, as in a traditional roof. On top of that is a fabric layer that buffers the third or waterproofing layer - the students used a PVC material. The fourth layer is drainage, which could be just a couple inches of gravel, but the students used a plastic drainage membrane sandwiched between protective sheeting that included a root barrier on top.

Next comes the soil-less growing medium, a lightweight mixture of organic and inorganic materials. On slanting roofs, the sixth layer is a structural reinforcing net that holds everything in place. Then comes more soil-less mix. The eighth layer is wind netting that fits over everything like a blanket. Plants are put in through the blanket, just as you'd plant through landscaping plastic at ground level.

Intensive vegetated systems can get very sophisticated, with shrubs, trees, and even wetlands on rooftops, David said. But green roofs similar to the one at the flower show are intended to be self-sustaining systems, with no need for irrigation, fertilization, or mowing - although like ordinary gardens they may need some help until they are established, he added. Lightweight systems can be retrofitted on existing buildings.

Which brings us back to those Philadelphia rooftops.

"Philadelphia is a perfect city for implementation of green roofs, because we have this vast expanse of flat, currently unused spaces

that largely have excellent structural support," David said.

Think of the bird's-eye view: A skyscape rich with texture and color as meadows of simple grasses and sedums start blooming in April and continue until November.

Contact Denise Cowie at 215-854-2719 or dcowie@phillynews.com.



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