

## **GEL-GRAVEL-SOIL MIX GIVES CITY TREES ROOM TO GROW**

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**Trees bring both comfort and measurable benefits to urban environments. The problem is that tree roots don't flourish under all that pavement. Now scientists think they may have found the answer. "The way we lay pavement is antithetical to how we want trees to grow," said Nina Bassuk, director of the Urban Horticultural Institute at Cornell University in Ithaca, New York. Bassuk and her colleagues have developed a high-tech mixture of gravel, gel, and dirt that they hope will sort out the differences between pavement and trees, allowing humans holed up in high-rises to wake each morning to birdsong drifting from the treetops.**

The mixture, known as structural soil, overcomes a conundrum that has vexed urban planners for years: Pavement requires densely compacted soil that can stand up to the weight and abuse of cars and trucks. But tree roots need room to breathe and grow.

The status quo is for developers to plant trees in a pit in the pavement just large enough to get a sapling into the ground. But with nowhere for maturing roots to wander, these trees usually die within 7 to 15 years.

Structural soil, by contrast, provides urban planners with a rock-hard surface on which to pour pavement while still giving growing tree roots plenty of room to stretch.

"The whole thing is one of engineering of trees into infrastructure so they have the best chance of success from the get-go, not shoehorning them in as an afterthought," said Gregory McPherson, director of the U.S. Forest Service's Center for Urban Forest Research in Davis, California.

### **Value of Trees**

The sound of birdsong drifting up through an apartment window early on a summer morning may be reason enough for many people to cherish trees. But trees are also a measurable benefit to the health and pocketbooks of city dwellers.

The research of McPherson and his colleagues quantifies the value of trees. The plants provide services such as cleaning the air, reducing water pollution, keeping cities cooler in summer and warmer in winter, and slowing the pace of global warming.

"In a general sense any single benefit is not something that will knock your socks off, but when added together they begin to be substantive, and they do have an effect in the aggregate that is worth taking notice of," McPherson said.

Findings from the Center for Urban Forest Research indicate that each large, mature tree in an urban community provides environmental benefits valued between U.S. \$100 and \$200 per year.

Other studies have looked at the economic and social benefits of trees. For example, Kathleen Wolf, an urban forestry researcher at the University of Washington in Seattle, found that people will spend more time shopping and spend more money in a well-treed commercial environment.

University of Illinois at Urbana-Champaign scientists Frances Kuo and William Sullivan found that inner-city families with trees and greenery in their immediate outdoor surroundings have safer domestic environments than families who live in buildings barren of trees.

"We've been going through a paradigm shift, from thinking of trees as an amenity, a nicety, that helps make communities attractive to really recognizing they have a wide range of functional benefits," McPherson said.

At the same time, however, the amount of space available for trees in cities is diminishing. Single-family home lots are getting smaller, and more and more people are moving into high-density, large-footprint townhouses and condominiums.

This is where structural soil comes in. It provides tree roots room to grow underneath the pavement, allowing trees to mature beyond the average lifespan of 7 to 15 years.

"There are many benefits when we plant trees," Bassuk said. "But it is only when the trees get to some size when we reap those benefits."

### **Structural Soil**

Structural soil consists of one-size, sharp-edged gravel shaped like crushed ice. When compacted, the surface is hard and strong enough to land an airplane on, but there is ample pore space between the rocks for dirt.

Using a gel, dirt is bound to the gravel during the mixing process so that soil fills in the pores. "The roots follow the pores through the soil and can grow quite happily. And the dense, rigid mixture allows pavement to be put on top of it," Bassuk said.

Since Bassuk and her Cornell University colleagues began developing their structural soil<sup>o</sup>Xnamed CU Structural Soil<sup>o</sup>Xin the mid 1990s, it has been used by hundreds of developers throughout the U.S., Canada, and Puerto Rico. Similar mixtures are used in Europe.

The researchers recommend structural soil be laid to a depth of at least 36 inches (1 meter) and a soil volume of about 600 cubic feet (17 cubic meters) per tree<sup>o</sup>Xless if more than one tree is planted, such as in a row along the edge of a parking lot.

In concept, the tree roots will have ample room to grow for decades beneath the pavement, but how well the technology pans out is still an open question: "We have no more than 10 years experience of growing trees in this way. What will happen in 20 years? We'll have to wait and see," Bassuk said.

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