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Radar Device Offers Non-Invasive Way to See What Ails Trees

Gentler Diagnosis Helps Save Plants

By Dan Morse
Washington Post Staff Writer
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A soft-spoken museum director, Steven Lee enjoys walking outside his office south of Baltimore and seeing the towering old trees. One of his favorites is a pecan that was recently ranked the seventh-largest of its kind in Maryland.

In the spring, he noticed more dead twigs and branches than normal. The leaves went on to turn color earlier than in previous years. "It didn't seem to have its usual vibrancy," said Lee, director of the Benjamin Banneker Historical Park and Museum, which is devoted to the life of the noted self-taught astronomer and mathematician.

Lee contacted Maryland Department of Natural Resources officials about the tree, seeking a house call. The examiner they sent was Tony Mucciardi, a silver-haired, silver-bearded 64-year-old whose invention is part of the state's answer to a perennial challenge: how to study the inside of important trees without drilling holes into them.

The tree-exam invention, called the Tree Radar Unit, looks like a small shoebox and is built around the principles of ground-penetrating radar, which is used, among other functions, to scan for underground utility pipes.

Holding the unit up to a tree's trunk, the user shoots electromagnetic waves into the interior, scanning for wave reflections that could indicate things such as decay and cavities. By directing the unit toward the ground, roots can be found.

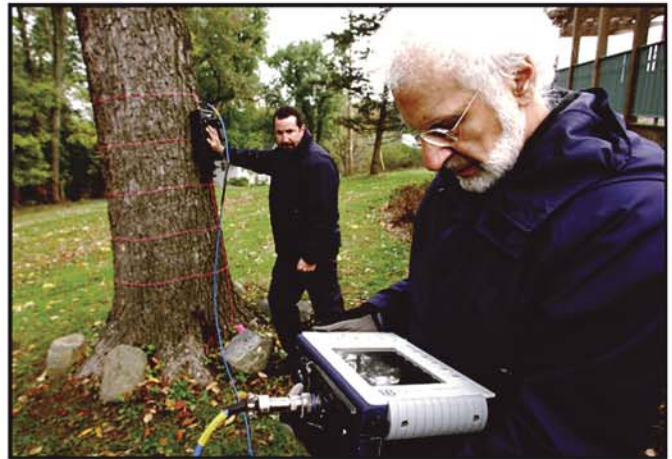
Maryland forestry officials expect to lease the service for use on five to 10 trees a year. The District has bought its own. The unit costs about \$17,000 and involves, in part, a modified high-end baby stroller, the kind used for jogging.

"For a tree person, this thing is the greatest," said Mike Galvin, supervisor of urban and community forestry for the Maryland Department of Natural Resources. "In my opinion, this revolutionizes tree diagnostics."

As for the troubled pecan, it isn't in the middle of a forest, where if it falls no one would get hurt. It towers near a walkway, and if tests revealed it to be in bad shape, it might have to be cut down.

Lee and others wanted a clean structural reading as part of their overall efforts to treat the tree. "I'm hoping to get a good, solid plan," Lee said as he watched Mucciardi set up the radar device.

Mucciardi works out of his home in Silver Spring. He has sold only nine of the devices, trailing a



Tony Mucciardi of Silver Spring, who invented the Tree Radar Unit, looks at the results for a pecan tree in Catonsville. With him is his son John.

competitor in Germany whose apparatus measures tree interiors with sound waves instead of electromagnetic ones, he said. One big difference is that Mucciardi's device can study the density of root systems, he said.

A native of Syracuse, N.Y., Mucciardi had studied engineering and earned a doctorate from the University of Illinois, focusing in his thesis on artificial intelligence and how computers could be used to analyze cardiograms. He became an expert in studying the wave patterns of ultrasonic, non-invasive sensors.

The closest Mucciardi got to trees early in his career was when he studied the condition of wooden utility poles for the Electric Power Research Institute. He used ultrasonic waves to search for hollow spaces that could cause the poles to fall during storms.

"That turned out to be fairly straightforward," Mucciardi said. "They're round. They're uniform. They have no bark."

Mucciardi thought about applying the technology to trees briefly but pursued other ventures. He invented a computer-based ultrasonic inspection system to test materials such as metals and plastics.

Five years ago, prompted in part by the urging of his computer scientist son, John, he started studying trees. Montgomery County officials let him work on some dead ones. Trees can be complicated. They are not uniformly shaped. Decay inside them can spread in asymmetric ways. The bumpy surface can momentarily misdirect measuring waves.

In 2002, he was awarded a patent for his device. He officially incorporated his company, TreeRadar Inc., last year.

He has invested \$50,000 to \$70,000 of his own money and hired six consultants, no full-time employees. One angel investor has stepped up, although Mucciardi declined to say how much he has given. He supplements his income by teaching at the U.S. Naval Academy and the University of Maryland.

"I really commend him because he's not a tree guy, he's a radar guy," said Galvin, the state official.

Mucciardi has encountered challenges. Private arborists are not used to spending \$17,000 on equipment. Some prefer estimating a tree's inner core by tapping it with a rubber hammer and listening. Real estate agents, who could use the device to determine the condition of trees hanging over houses, do not necessarily want a way to kill pending deals.

In examining the pecan tree last week, Mucciardi -- helped by his son the computer scientist -- first wrapped the trunk in five circles of bright pink string. Following those guides, they fired electromagnetic waves into five elevations, circling the three-foot-thick tree as they did.

Mucciardi showed reports of work he had done on past trees. One showed images of red and orange data points, meaning that he had found enough decay that the trees could well have to be cut down for safety reasons.

"I hope this tree doesn't look like that inside," said Lee, the museum director.

On to the roots. To examine them, Mucciardi attached the device to the bottom of the jogging stroller.

He and his son circled the tree, shooting radar waves into the ground.

"I'm concerned about the roots," said Bob Garner, a board member of a group that supports the Banneker museum. Garner had stopped by for the inspection. "I want to hear that there are a lot of [roots], especially on the uphill side," he said.

The news about the pecan tree was very good: no damage to the interior and a dense root structure. Mucciardi began mapping out what he would say in his report.

When told Tuesday what it would say, Lee, the museum director, said : "That is really good news. . . . We would like it to be here for another 80 years."

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