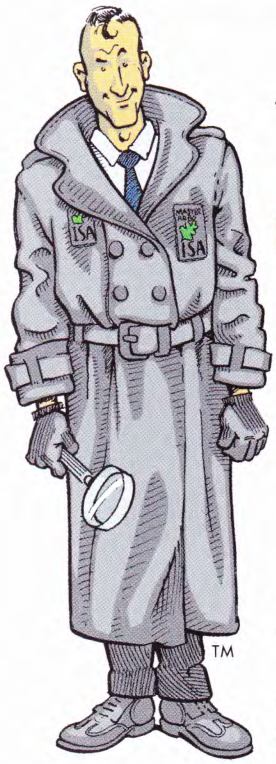

DETECTIVE DENDRO
THE DIAGNOSTIC SLEUTH

By James Komen and Bill Fountain

The Case of the Terrifying Twister

"Codit, we're going tornado hunting!" I announced one morning to my faithful assistant.

He looked up from his reports. As he processed my declaration, his face ran through a mix of emotions: surprise, confusion, and then sheer terror.

I chuckled and then clarified, "There was a big storm in Campbellsville, Kentucky. We've just heard from my contact, Dan Clancy of the National Weather Service, to investigate."

Terror subsiding, Codit put down his reports and closed his laptop. One, two, three deep breaths.

"Let's hop in the car, and I'll explain while we drive."

Sandwiches in hand, we journeyed down the interstate for a 90-minute drive south from Louisville, KY.

I briefed Codit on our assignment. "When large storms occur, there's rarely a wind sensor at the exact location of the center of the storm. When a tornado touches down, it covers a relatively small area. So, to determine the severity of the storm in a specific location, the National Weather Service will send out representatives after the fact to examine the damage. The severity and pattern of the damage can help determine what the wind speed must have been during the storm and if it was a straight line wind event or a twister."

By his reaction, my assistant was clearly not yet satisfied with his role that day. He mumbled something about going too far outside of our comfort zones.

"But since there are so many types of damage," I continued, "sometimes investigators bring in other experts to help with the damage survey."

"Oh! That's us!" Codit exclaimed proudly. "We're the tree experts!"

I nodded. "Yep. Our goal is to identify failed trees and tree parts and to help Dan determine the wind speed at the time of the storm, as well as if there had actually been a funnel cloud on the ground."

As we approached the arranged meeting place, we started seeing more signs of damage from the storm. Shingles had been blown off roofs. Some street signs were bent. Residents were working on repairing many of the homes that we passed. Whenever the road dipped low, we splashed through a remnant river of mud. There were many, many tree branches strewn about.

Codit commented and queried while we drove. The more he observed the destruction and aftermath of the storm, the more curious he was about how the storm came to be.

"Tornadoes can have wind speeds as low as 40 to 72 mph (64 to 115 kph)," I said. "Here in the northern hemisphere, almost all of our cyclonic winds rotate in a counterclockwise direction. But arborists in Australia and New Zealand see their cyclonic winds twirling in a clockwise direction. Also, one more bit of trivia, the U.S. has more tornadoes than anywhere else in the world."

Codit nodded, but it was clear his attention was transfixed on the aftermath of the tornado.

We parked off a state highway in a natural preserve area. A wetland extended around a bend in the Green River, an area bordered by a mix of deciduous and coniferous trees.

Dan had parked just ahead of us. I recognized him immediately; the man was a little on the shorter side, and plenty round, but he had knowledge and experience for the ages. He also spoke a mile a minute.

"Detective, thanks for joining me on this assignment! There was quite the storm here last night! From the Doppler radar maps, it appears this is the area where the wind speed was the highest, but we need to ground-truth our data and verify how fast the wind really was blowing—figure out if this was a tornado. And while Doppler radar is great at seeing rotation in a tornado, the distance from our radar and the curvature of the earth prevents us from seeing if the rotating winds actually got down to the trees."

I breathed for him. "Anything you need, Dan."

Codit nodded once.

Dan clapped his hands and continued: "There aren't any structures around to observe, so we have to use the trees as wind speed indicators. About 40% of the tornadoes we have here in Kentucky never even hit a man-made structure! That's why I'm going to rely upon your expertise in helping me to identify and evaluate the trees. Depending on the wind speed, tornadoes can break tree branches or completely topple trees."

He broke off toward his truck and quickly returned with a field guide. In the guide was a table of wind speeds and various types of damage that may be observed. As he flipped through the pages, a few entries caught my eye: chimneys and road signs toppled (64 to 73 mph) and mobile homes overturned (95+ mph). Dan eventually settled on two entries in particular: hardwood tree failure (80 mph) and softwood tree failure (65 mph).

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The damage caused by the winds of a tornado can be devastating to trees and structures.

"Let's walk along this trail here," Dan said, gesturing with the book in hand. "As we walk, we'll pick out tree and branch failures and go from there. I'll keep track of our findings on my map."

"So, what's our goal, then?" Codit asked. "If all we're doing is documenting storm dam–"

"Our goal is to create a gradient of wind speeds based on the damage we observe."

I love working with professionals who know their stuff. As important as it is to ask questions whenever something new comes into the fray, nothing beats a teammate with seasoned experience and firm expectations.

Wearing our steel-toed boots, we hiked into the wetland area along the edge of the trees. Codit picked up a few 10 cm (4 in) branches of cottonwood (*Populus deltoides*) trees, and Dan recorded the location and size, thus checking the "hardwood" box on his spreadsheet. This process continued for a while, Codit and I alternating identifying tree damage and Dan keeping pace by furiously scribbling his notes.

Tree damage grew more severe as our hike progressed. About a quarter mile into our hike, we saw a group of trees ahead that had been completely flattened. All of the branches had been broken off and were strewn about the center of the cluster.

"Wow! Would you look at that? The cyclone must have touched down right here!" Dan nearly dropped his notes he was so excited.

Dan and Codit trekked ahead of me as I gazed around at the branches of various trees that had been torn out in the storm. Codit picked up a branch and started examining the exposed heartwood.

"Looks like an angiosperm!" my assistant called back. "That means the wind speed was over 80 mph here!"

Dan hurried over and began scribbling notes and taking photos with his phone. Meanwhile, I continued to look around. The flattened cluster of trees was an impressive show of force, but within about 200 feet in all directions, other trees were still standing, including some softwoods. I identified them as shortleaf pines (*Pinus echinata*). There were various-sized branches between 4 cm (1.5 in) and 10 cm (4 in) in diameter scattered around, all broken where the branch joined the trunk, but no other whole-tree failures.

It seemed a bit odd that one cluster of trees would be completely flattened, and the neighboring trees were hardly touched. However, I had heard of cyclones leaving precisely that kind of damage patchwork before. Did this newly destroyed cluster simply have the misfortune of being in the location of the cyclone's touchdown?

Dan hurried back to me, resolutely out of breath. "This is great data we're getting! What do you think, Detective?"

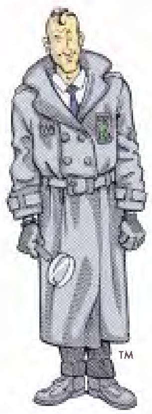
"Dan," I said thoughtfully, "there may well have been a storm here last night . . . but I don't think these trees indicate a cyclone."

My friend straightened his back and cocked an eyebrow. "Now what makes you say that?"

What did Detective Dendro see? Turn to Page 68 to find out!

WHAT'S THE SOLUTION?

Continued from page 21



I scratched my chin. "Simply put, the pattern of damage characteristic of a tornado is not here. As a tornado approaches, there is a strong updraft at the base of the funnel cloud that lifts the branches. This results in branches breaking away from the trunk making it look like the trees have been topped. All of these branches failed at the branch union where defect-free branches are naturally weaker."

There was a pause, but neither Dan nor Codit chose to jump in.

"And there's something even more important," I added for suspense. I walked over and picked up a branch. "These trees are the invasive seedling Callery pear (*Pyrus calleryana*). True, they are angiosperms, but they are known for their weak wood, included bark, and susceptibility to branch breakage. It doesn't take much wind at all to make these trees collapse."

Codit's face turned red. He should have been able to ID this common tree. Tree identification, after all, is part of the bedrock of knowledge of all practicing arborists. I decided to save the admonishment for later.

I gestured to our surroundings. "None of the other trees around us have collapsed. They all have stronger wood than Callery pear—even the old-growth shortleaf pine."

Dan yanked his field guide from his waistband and thumbed through, looking for something that might validate my hypothesis.

Pyrus calleryana, also known as the Bradford Pear, can't stand up to powerful storm winds.

The book had nothing. "I think your guide may have oversimplified trees into broad categories," I said. "While angiosperms (hardwoods) generally grow slower and have harder wood than gymnosperms (softwoods), there are exceptions to both. Basswood (*Tilia* sp.), cottonwood (*Populus* sp.), and ornamental pear (*Pyrus* sp.), all have wood that is softer than many 'softwood' trees. And old-growth shortleaf pine (*Pinus echinata*) is known to have wood that's about as hard as many oaks (*Quercus* sp.). There is variability even within a genus. Water oak (*Quercus nigra*) is known as the 'Bradford Pear' of the oaks because of its tendency to fail in storms."

Dan mulled this over. "It seems as though the hardwood/softwood distinction is inadequate for this guide."

Codit and I nodded in agreement.

I offered my two cents. "You might want to provide feedback to the National Weather Service and recommend they update the field guide to refer to a broader plant database on species-specific wood strength. Although it would be a large undertaking, it would be a useful improvement on the guide, and it would be an excellent opportunity to collaborate with ISA Certified Arborists® on their personal experiences with local tree failures."

Codit chimed in, "So we didn't see a cyclone?"

"It doesn't look like it—not here, at least."

Dan was glad to have us. He completed his report and was able to justify his explanations of wind speed based on our interpretations of the tree damage. We were even credited as researchers on the report when it was published!

A week later, I dropped a copy of the report on Codit's desk. "Looks like the National Weather Service got 'wind' of our research."

Codit looked up and couldn't resist: "What a twist!"

James Komen is a consulting arborist in the greater Los Angeles area and owner of Class One Arboriculture. He specializes in risk assessment and tree appraisal. William (Bill) M. Fountain, PhD, is a Professor of Arboriculture and Landscape Management at the University of Kentucky.