Photos by Nick Ward/Pacific Northwest National Laboratory

Matt Norwood, a researcher at the Pacific Northwest National Laboratory, studies trees in Washington state's coastal forests and the East Coast.

Researchers probe methane in Washington's coastal forest

By COURTNEY FLATT
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Norwood uses a resistograph to drill a very tiny hole to figure out wood density.

Trees have a little secret you might not know about. Yes, they produce oxygen. Yes, they take in carbon dioxide, a heat-trapping greenhouse gas. But, they also emit methane.

Methane is a greenhouse gas that can be significantly more potent than carbon dioxide.

"Just about every tree we measured had elevated amounts of methane in it. And that was consistent across the Northwest with a variety of different species," says Nick Ward, a scientist with Pacific Northwest National Laboratory.

Ward has long been interested in methane.

After grad school, he was measuring methane coming out of the water in the Florida everglades. He sat down next to a giant cypress tree. Ward had read about methane actually coming out of trees, so he placed his tool over the knee — a part of the tree — at the base of the cypress.

"I just made a PVC thing and put it on there, measured it, and was like, 'Wow, there's like 100 times more methane coming out of this little knee than the water right next to it,'" Ward said.

After he began his career at Pacific Northwest National Laboratory's Marine and Coastal Research Laboratory in Sequim, Washington, Ward thought he'd see what happened when he took a sample of the nearby forest.

Yup, methane was there, too.

It might sound surprising. You likely don't think trees can emit methane, but there are several ways the process can happen.

First, the roots can suck up methane that's naturally produced in groundwater deep below the surface.

"So the tree is almost like a straw tapping down into the deep," Ward said.

That methane can travel up the tree's roots and make it into the trunk, where the wood releases it. Ward is studying the methane diffusing out of the wood. He's found the denser the wood, the harder it is for methane to escape, like in deciduous hardwood trees.

Besides wood density, air temperature and barometric pressure can also help predict how much methane might escape the tree trunk.

But that's not the only way a tree's trunk can release methane. In the second scenario, the methane comes from inside the tree — thanks to microbes, said Matt Norwood, a research associate at the Pacific Northwest National Laboratory.

"Microbes are chewing on the inside of the tree and producing such (high) levels of methane that you can actually drill into the tree, light the methane and get a visible flame," Norwood said.

The researchers set out across western Washington state to measure hundreds of trees in six different coastal forests.

They found the phenomenon happening everywhere. Later, they also studied trees on the East Coast.

Figuring amounts

Ward said just because the wood was releasing methane, that doesn't mean there were tons of emissions coming from trees.

To figure out the amount of methane in a tree, Ward has designed a novel system. He wanted to compare methane in the tree to how much is escaping through the wood, which is usually the only measurement scientists take.

First, the research team drills into a tree with a hollow tube. That takes out a sample of the tree core, like when you need to count tree rings. He puts a rubber stopper with a valve in that hole. Then, he can stick a large syringe in the valve and suck out the gas to analyze.

"That tells you how much methane is in the tree itself," Ward said.

For the second reading to measure methane emissions, researchers attach a "collar" to the tree. It's made of a PVC pipe, glued with silicone. The cap of the PVC pipe is connected to an instrument the researchers carry inside a backpack.

"With those two measurements, you can get at not only how much is in there, but also, how quickly it escapes," Ward said.

The team uses a resistance drill, called a resistograph. It drills a tiny hole to figure out the wood's density. They also measure oxygen in the tree and soil, and methane in the soil. It's all to figure out what's causing the changes in methane emissions.

Washington's coastal forests

One area they studied was Washington's coastal forests, where extremely high tides flood wooded areas. After five or six years of the tidal flooding, the spruce trees they were studying had started to die.

"These flood plains (had) approximately a half to about a half meter of water, depending on the extremes," Norwood said. "And we get out there. We're in our gear. And it's a cold Washington winter, rainy. The water starts piling up on the floodplain. And it's just shocking to see a little tidal creek turn into this river and then start flooding the landscape."

Those floods can saturate the soil and create environments where more methane is produced, Norwood said. Saturated soils, less oxygen and water can create good conditions for methane production. The floodwaters also carry methane with them into the ground.

Norwood said they're seeing the trees quickly uptake the extra methane produced or brought into the soil after a tidal flood.

Next, he wants to study what those increases in methane in the soil means for tree health. They already know the seawater exposure isn't good for trees.

"That's something that we are all looking into: What is the impact of these changing environments, and what's driving the decline in tree health?" Norwood said.

Ward says it's uncertain what tree methane might mean for climate change. There needs to be more studies, and a better way to model methane tree emissions across different forest types, in different conditions.

"On that prediction side, we really still have robust climate models, but they're not representing a potentially impactful environmental phenomenon," Ward said.

He also doesn't know if other climate feedbacks — such as rising sea levels — could change how trees uptake or emit methane.

Ward said they're discovering something new about methane every day.

"Even today there are mysterious environmental phenomena," he said. "Scientists really, truly are still discovering how the natural world works."