Fungi-infected trees full of methane

A recent study found that trees infected with heart rot fungus contain higher levels of methane than was previously thought.

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Contributing Reporter

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Some trees, when infected by microorganisms, may be emitting significant amounts of the greenhouse gas methane, according to a recent Yale study.

This study, published last month by a team of scientists at Yale, Columbia University, and the State University of New York at Buffalo in the journal Geophysical Research Letters, found that heart rot can produce high, sometimes flammable, levels of methane, which decrease a tree's effectiveness as a carbon sink.

"This study identifies a new, important source of methane, a greenhouse gas that is more potent than carbon dioxide," said Stephen Wood, a graduate student in ecology, evolution, and environmental

biology at Columbia and one of the authors of the study. “To that end, it presents compelling data that methane production in trees should be figured into global circulation and climate models.”

This study dates back to September 2007, when Robert Warren, another co-author of the study and an assistant professor of biology at Buffalo State College, was extracting tree cores in the forest with his students. When they removed a core from one of the trees, they could hear a gas hissing out of the tree.

“One of my more troublemaking students, of course, probably the best student, pulled out his lighter and lit it,” Warren said. “I was pretty amazed that there was enough methane that he could light it.”

Foresters had already known that heart rot, a fungal infection caused by methane-producing archaea, produced methane, but they did not realize the magnitude of the phenomenon.The researchers also knew about three other pathways through which trees released methane, but none of those would be expected to contribute to the methane measured in the forest they studied, the Yale-Myers forest in northeastern Connecticut.

The team collected bark samples and trunk gas from about 60 trees in the forest, then analyzed the samples to determine how much methane was in the trees. Using a standard diffusion equation adapted by Xuhui Lee, professor of meteorology at the Yale School of Forestry and Environmental Studies, to take into account the structure of wood and the liquid contained within it, the team generated estimates of how much methane was being released into the atmosphere based on how much methane was present in the samples.

They found that trees infected with heart rot contained much more methane than expected, a result that could help scientists better understand the methane cycle if the group’s results are replicated on a larger scale, said Kristofer Covey, the corresponding author of the paper and a Ph.D. candidate in silviculture and biogeochemistry at the Yale School of Forestry and Environmental Studies.

He noted that the methane emissions partially offset the carbon dioxide sequestration effects of trees.

“The methane being emitted has a climate effect 18 percent as powerful as the carbon being sequestered,” Covey said. “It’s a little bit like forests are paying a tax on the carbon that’s being sequestered. This tax is around the capital gains rate. So everyone can just remember that no one ever went broke paying capital gains tax. We’re happy to keep paying that.”

Ed Dlugokencky, a researcher at National Oceanic and Atmospheric Administration, a federal environmental agency, warned against jumping to conclusions based on this study. He said in an email that the study measured only the methane in the tree, and it is unclear how much of that methane made it to the atmosphere.

Lee said in an email that directly measuring the methane diffusion out of the tree trunks is an important next step for the team.

“[This was] essentially a back of the envelope calculation. We may find dramatically different results when we do more intensive instrumentation of trees,” Covey said.

Josh Schimel, a professor of soil and ecosystem ecology at University of California, Santa Barbara, said in an email that the study, while only the beginning of a longer process, was executed rigorously and had solid data. He added that further research is needed before any conclusions can be reached as to the role of heart rot in the global methane cycle.

Mark Bradford, assistant professor of terrestrial ecosystem ecology at the Yale School of Forestry and Environmental Studies, also co-authored the study.