Fungi research explains wood decay

A recent collaboration by researchers at Yale and other institutions sheds light on how fungi decay wood.

Contrary to the traditional scientific understanding, researchers discovered that the mere knowledge of abiotic, or nonliving, conditions is insufficient to predict how fungi will decay wood. Instead, the scientists found that biotic or living factors, like interactions between different species of fungi, were critical in predicting the rate of wood decay. Such predictions can help scientists better understand the effects of climate change on microbes like fungi and vice versa.

“The outstanding question when we’re looking at climate change is how microbes respond to increasing temperature or acid rain,” said Daniel Maynard GRD ’17, a postdoctoral researcher at the University of Chicago’s Department of Ecology and Evolution. Maynard and the researchers at Yale and the University of California at Irvine, among other institutions, published their findings in the journal Ecology on Feb. 21.

According to Maynard, an increase in soil temperature consistently leads to more activity in fungal communities and an increase in the decomposition rate, which releases more carbon into the atmosphere. By contrast, scientists have overlooked dead wood decomposition because it is harder to analyze. Research shows that wood does not respond in the same way soil does, as the decomposition rate does not necessarily increase as temperature increases. The purpose of the research, Maynard said, is to inquire into why there is more variability of decomposition in wood.

Kristofer Covey, lead scientist at the Ucross High Plains Stewardship Initiative and a Yale lecturer, said fungi are a big part of the decay process, which then feeds into the global carbon cycle system.

“The process of sequestering carbon is a net activity of fluxes just like your bank account,” Covey said. “You have income and expenses. So decomposition is that expense side. If you want to be able to build a budget, if you want to be able to understand what your future account balance is going to be, then you have to be able to keep track of both carbon coming
The fungi are a big part of making predictions about the carbon that will leave the system.

The study was conducted at the Soil Warming and Nitrogen Addition plots at the Harvard Forest Long Term Ecological Research site in Petersham, Massachusetts, from 2013 to 2015. To measure the effects of abiotic factors like temperature and nitrogen, researchers warmed the plot by five degrees and added nitrogen over the course of the two-year period. Researchers also identified different species of fungi on the plots and analyzed how they interacted with each other.

The researchers found that abiotic factors largely had no effect on the wood decomposition rate. Interestingly, Maynard noted, the basic properties of fungal communities, most importantly the evenness, or diversity, were far more influential than small changes in the environment.

Maynard attributed the influence of biotic factors to the fact that fungi fight with their neighbors for space, and this competition puts a huge physiological stress on them. He likened the fungi to gladiators in an arena. Forced to survive in competitive environments, they change how they’re growing and employ different strategies to win, producing various enzymes as grenades.

The fungi’s primary concern is surviving against the overgrowth of their neighbors, so the interactions between fungi are much more effective in predicting wood decomposition than the small changes in the climate the researchers applied.

“Five degrees is actually a big change from a climate perspective,” Maynard said. “Some organisms really respond to that, and some don’t. For the fungi, five degrees don’t affect what they’re doing. They’re more worried about competition than temperature changes.”

Covey referred to previous research that concluded that climate fails to predict the wood decomposition rate and said the correlation between the two in other research may be a statistical artifact — an example of the ecological fallacy, in which a person arrives at completely different conclusions when data are aggregated on the wrong scale.

“Dan’s research did a really nice job of explaining how those pressures from temperature and increased levels of nitrogen might affect how the fungal community is functioning, but also how interactions within the community affect its function,” said Eric Morrison, a postdoctoral scholar at UC Irvine’s Department of Earth System Science and a co-author of the paper. “This part has been largely unexplored because it’s hard to tease apart how the different species behave from the background of all the other species that are potentially there.”

Since 1998, the Harvard Forest has been a Long Term Ecological Research Site, funded by the National Science Foundation to conduct integrated, long-term studies of forest dynamics since 1988.

From: https://yaledailynews.com/blog/2018/03/09/fungi-research-explains-wood-decay/