Fungal Decay Hazard Map

The American Wood Protection Association (AWPA) use category system (AWPA 2014) is currently used to set above- and below-ground retentions for all commercial wood preservatives and follows the AWPA hazard map for many of its decision criteria. The AWPA hazard map is a composite based on information from several sources, such as utility pole condition surveys by the Rural Electrification Association and climate zones as described by Scheffer (1971). Decay hazard has been used extensively for approximating likelihood of biodegradation of wood-based products, but there is currently little biological component to these calculations. They are simply measures of the physical environment (mean temperature and rainfall) and do not account for the contributions or biodiversity of micro-organisms in each decay hazard zone. We are using metagenomic analysis to identify micro-organisms present in soil under both pine and hardwood overstory in National Forests to identify fungal species found within each decay hazard zone. Our data would strengthen and expand the existing decay hazard map with detailed biological information.

Background

Wood decay is a major contributor to early failures of wood and wood-based materials in service; replacing decayed wood and wood-based materials accounts for 10% of the global lumber market (Morrell 2005). Wood preservatives are the primary means for extending the useful service life of wood and wood-based materials. Founded in 1904, the AWPA is an ANSI-accredited standards writing body that oversees wood preservative treatments in North America. The use category system is the basis for setting preservative treatment retentions for above- and below-ground contact and is based on a combination of service life and climate data from North America. This information was
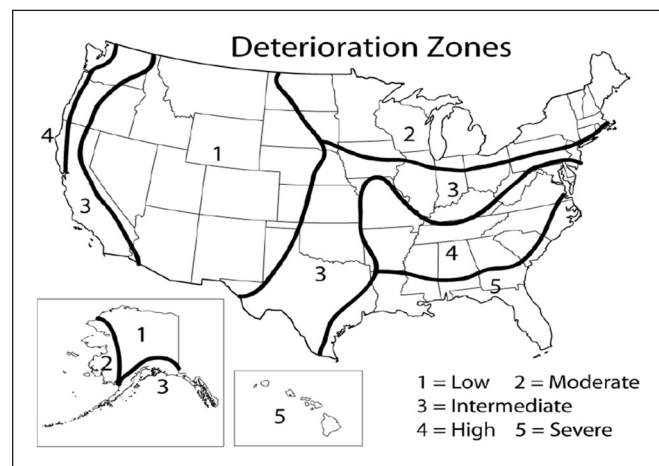

Figure 1—AWPA decay hazard zone map. Zones with higher decay zone designation have higher estimated rates of wood decay.

compiled and used to create the current AWPA decay hazard zone map (Fig. 1). This map was approved by the AWPA technical committees in 1992 and includes five zones, ranging from 5 (severe decay hazard) to 1 (low decay hazard). The basic concept is that areas in a higher decay hazard zone have conditions conducive to decay and therefore higher fungal activity. The work of Scheffer (1971) and updates by others (Carl 2009 (Fig. 2), Morris and Wang 2008 provide good estimates for the "conducive to" part of the problem, but there has been very little characterization of the fungal biodiversity of the different zones. Work currently being done at the Forest Products Laboratory is characterizing and identifying soil- and wood-associated fungi in similar forest types in each of the AWPA decay hazard class zones in order to provide biological estimates of fungal activity within each zone. Similar work is being conducted in Europe (Niklewski et al. 2016), and our work will provide comparative data for a large continental landmass such as North America.

Objective

The objective of this research is to characterize fungi that are found in the soil and colonizing wooden field stakes within different decay hazard zones of North America as described in the AWPA Hazard Zone map.

Approach

Fungal DNA will be analyzed using metagenomic analysis of the fungal ITS 2 region. (ITS, the internal transcribed spacer region, is an evolutionarily conserved ribosomal DNA region that is routinely used for DNA barcoding for fungal species designation.) Identified fungi will be categorized based on their ecological roles (symbiotrophs, saprotrophs—which includes wood rot fungi, pathogens) and compared between the different hazard zones.

Expected Outcomes

This research will provide much needed baseline data on what fungi are present within these different hazard zones and allow much more detailed characterization of the wood decay environment on a regional level.

Timeline

Soil samples will be collected and analyzed starting in May 2016. Concurrently, untreated southern pine field stakes will be put out for future collection after 12 months of exposure. Soil fungal analysis will be completed by mid-2017, and wood fungal analysis and general soil analysis will be completed in 2018.

Cooperators

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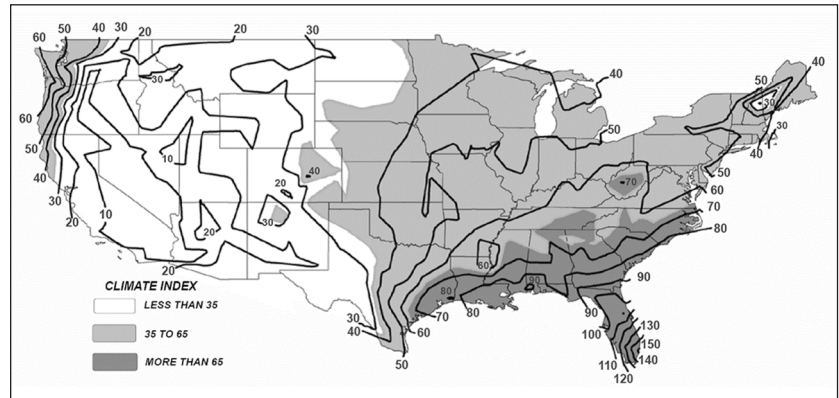(608) 262-9018; wjhickey@wisc.edu

Figure 2—Updated above ground hazard map based on Carll (2009) from climate data from 1971–2000.

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