FIA–FSP Forest Science Corner

Examining CWD's role in fungal biodiversity

Jennifer Walker photo

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Top photo: *Spruce seedling and ectomycorrhizal mushrooms growing immediately adjacent to hard coarse woody debris.*
Bottom photo: *Ectomycorrhizal hyphae and rhizomorphs on root of spruce seedling growing in decaying coarse woody debris.*

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A comprehensive study looking at the importance of retaining coarse woody debris (CWD) in maintaining fungal biodiversity and improving seedling regeneration is now underway at the Sicamous Creek Silvicultural Systems Trial, with funding from the Forest Investment Account–Forest Science Program (FIA–FSP).

In a previous study, we evaluated whether we could detect any evidence that retained CWD was encouraging a taxonomically and functionally diverse ectomycorrhizal community 10 to15 years after harvest. We did this by sampling roots of 10-year-old spruce saplings and examining their ectomycorrhizal communities. We also tested the ability of these ectomycorrhize to release enzymes that degrade soil organic matter as an indication of physiological differences.

Harvesting originally took place at Sicamous Creek in the winter of 1994–95, with operational planting of spruce the following year. The experimental area included three replicate 10-ha clearcut blocks. In each block, two 1-ha treatment plots were established in 1996: one block which retained CWD generated during the harvesting, and one block where CWD was removed. Final coarse woody debris volume ranged from 57.0 m^3/ha to 112.9 m^3/ha at the removal plots and from 347.9 m^3/ha to 453.3 m^3/ha at the retention plots used in this study.

When we sampled roots from saplings in the blocks in 2006 and 2007, there was no indication that retaining CWD had a medium-term effect on either the structure or function of the ectomycorrhizal fungal community, at the scale of a 1-ha plot. We think that there are two explanations for this. First, because the roots were sampled randomly, many of those from the plots with retained CWD were not in close proximity to pieces of CWD and would not have been influenced directly by them. Secondly, the logs may not yet be decayed enough to provide habitat for ectomycorrhizal fungi.

For the current study, seedlings have been planted directly in decayed wood, immediately adjacent to intact logs, or some distance away from either of these. The ectomycorrhizae on these seedlings will be used to investigate the influence of CWD at the microsite scale, with the intact logs revealing influences over the medium term and decayed wood representing long-term effects. We expect that a more diverse soil habitat, created by different stages of decaying CWD, will promote a more taxonomically and functionally diverse ectomycorrhizal fungal community.

Why is CWD important?

From the point of view of soil organisms, decaying CWD can be characterized as a remnant of the original forest that retains and recruits old-growth-associated soil microbes, including ectomycorrhizal fungi. Large pieces of woody debris create microhabitats for immediately adjacent soil organisms by changing soil chemistry and physical properties. In the medium term, while the wood is still hard (i.e., up to 15 years), CWD moderates soil temperature and increases the amount of dissolved organic carbon in its immediate vicinity. Over the longer term, as the wood decays (i.e., greater than 50 years), ectomycorrhizal hyphae and/or new plant roots may penetrate and colonize the wood. This important niche could maintain a suite of fungi with a wide range of nutrient-mobilizing capabilities in the soil of the regenerating stand. A community of functionally diverse ectomycorrhizal fungi may, in turn, impart optimum growth to the newly established seedlings.

Ectomycorrhizal fungi were once considered only with respect to their role in increasing nutrient uptake by plants, but it is becoming increasingly apparent that they play a major role at the ecosystem level by influencing nutrient cycling. Some soil microbiologists now view ectomycorrhizal fungi as important decomposers. Ectomycorrhizal fungal biomass can make up 30% of microbial biomass in northern conifer forest soils; therefore, they contribute substantially to the breakdown of soil organic matter. In addition, turnover of ectomycorrhizal roots and hyphae directs at least 75% more carbon into forest soils than inputs of aboveground litter. The ability of ectomycorrhizal fungi to provide these important ecosystem services underscores the need for retention of a functionally competent ectomycorrhizal fungal community when forest harvesting takes place.

More Information

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