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Dead wood nitrogen dynamics and diversity of fungal species in managed forests

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Wood inhabiting fungi are directly dependent on the amount and quality of dead wood. In managed boreal forests, a loss of dead wood habitats is threat species diversity. In this study, we analyzed the changes in the wood quality along the decay gradient, modelled habitat requirements of the wood-inhabiting fungi, nitrogen dynamics in decaying wood and dead wood continuum in boreal forests. Species habitat models and dead wood dynamics were also integrated into the forest simulator, which is applied for predictions of future dynamics of polypore diversity. We found that wood N content increases during decay and asymbiotic N2 fixation has a major role in observed increase accounting for 60% of the total N accumulation. In addition, wood moisture and lignin content increased along decay continuum. Furthermore, wood inhabiting fungal community changes with the changes in the wood properties. According to species specific models habitat requirements of wood-inhabiting fungi varied. For instance, the abundance of Phellinus viticola and brown-rot fungi (e.g., Fomitopsis pinicola, Antrodia serialis, Coniophora olivaceae) peaked during intermediate decay and mycorrhizal fungi (e.g., Piloderma, Tylospora, Russula) increased in the later stages. The models based on modern DNA sequencing data were consistent with earlier models that are based on polypore inventory data. We implemented an ensemble of polypore habitat models to simulations of stand and dead wood availability estimated with a decomposition model. We asked how management influences the dead wood availability and polypore occurrence probabilities and their diversity. In a managed stand, diversity thrived after final harvesting, but declined to low level by mid-rotation. Our study suggests that dead-wood supply of managed stands could be optimized to lift lowest species expectations towards levels in natural-like forests, but it seems that reaching these levels requires deadwood quantities much higher than provided by conventional management.