Deadwood as Biogeochemical 'Hot-Spots' in Soil and Forest Ecosystems

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Introduction and Questions

Forest use removes substantial quantities of woody biomass. As such, a prominent feature of managed forests is the lack of deadwood, specifically coarse woody debris (CWD), in comparison to undisturbed forests. Yet the extent to which this disruption of litter cycling impacts the biogeochemistry of forest soil ecosystems remains unclear. We ask:

1. **Does CWD influence soil propoerties & functioning?**
2. **If so, how should we consider CWD in forest & soil ecosystems?**

Sites and Field Design

- Two Case studies:

1. *Abies alba* - *Fagus sylvatica* forest stand "Conventwald" (CV)
2. 7 additional *Fagus sylvatica* sites (Fig. 1)

- 4 decomposing CWD stems per stand
- Paired test and reference points (*Deadwood* and *Control*; Fig. 2)
- Oa and Ah (0-10 cm)
- Linear mixed effects models (site & CWD = random factors)
- Calculation:

$$\Delta\% = \frac{\textit{Deadwood} - \textit{Control}}{\textit{Control}}$$

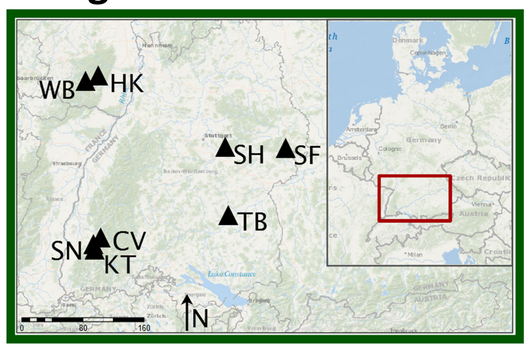


Figure 1: SW Germany and study sites. SF, TB, KT, and SN have Mull type forest floors (high biological activity); CV, HK, WB, and SH have Moder type forest floors (low biological activity). CWD decay classes are evenly distributed.

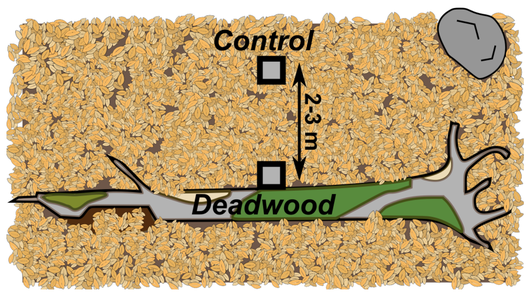


Figure 2: Field sampling design with Deadwood *and* Control *points relative to downed F. sylvatica CWD. Case study Conventwald included A. alba CWD and an extra* Deadwood-Control *pair per CWD 3 m away (8 pairs per sp. in total).*

Case Study - Conventwald

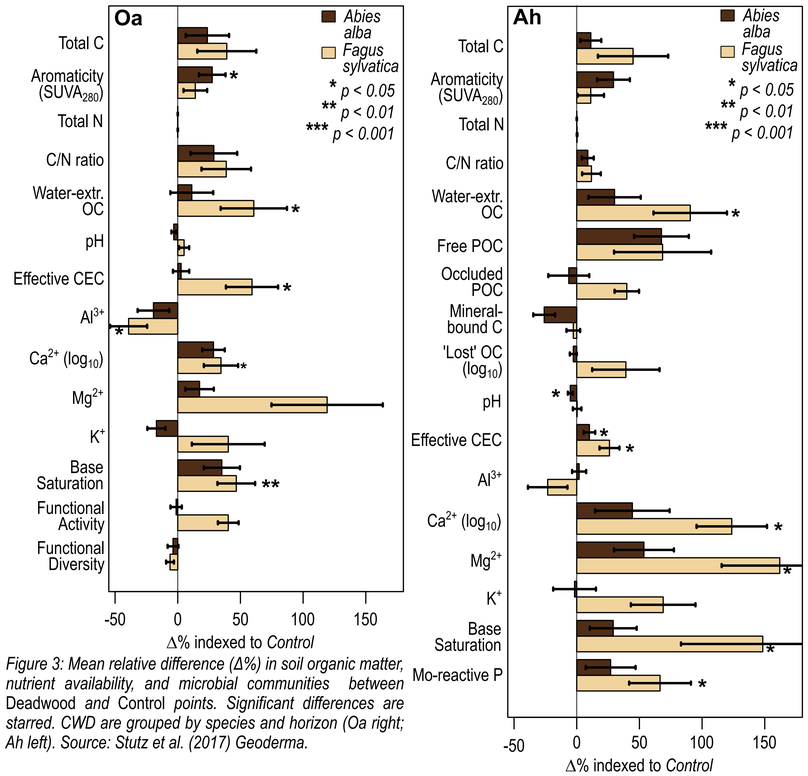
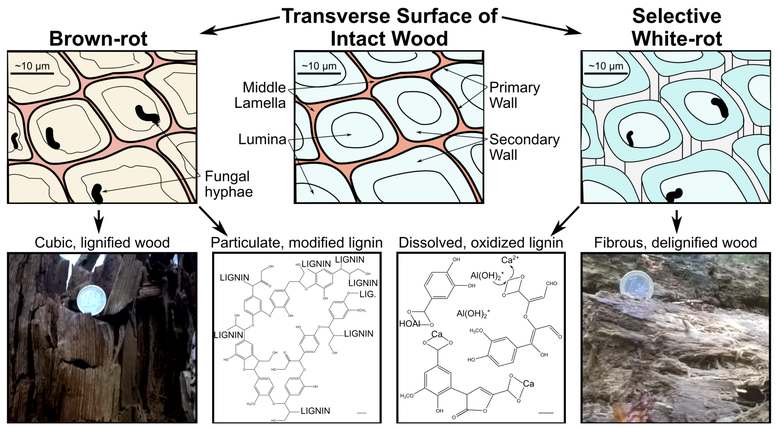


Figure 3: Mean relative difference (Δ%) in soil organic matter, nutrient availability, and microbial communities between Deadwood *and* Control *points. Significant differences are starred. CWD are grouped by species and horizon (Oa right; Ah left). Source: Stutz et al. (2017) Geoderma.*

CWD affects on soil were greater for *F. sylvatica*. Correlations with aromaticity ($SUVA_{280}$) also differed between species, implying CWD affects soil through compositoin of organic matter, namely phenols, that depend on decay processes such as brown- and white-rot (see below; Stutz et al., 2017 Geoderma).



Case Study - SW Germany

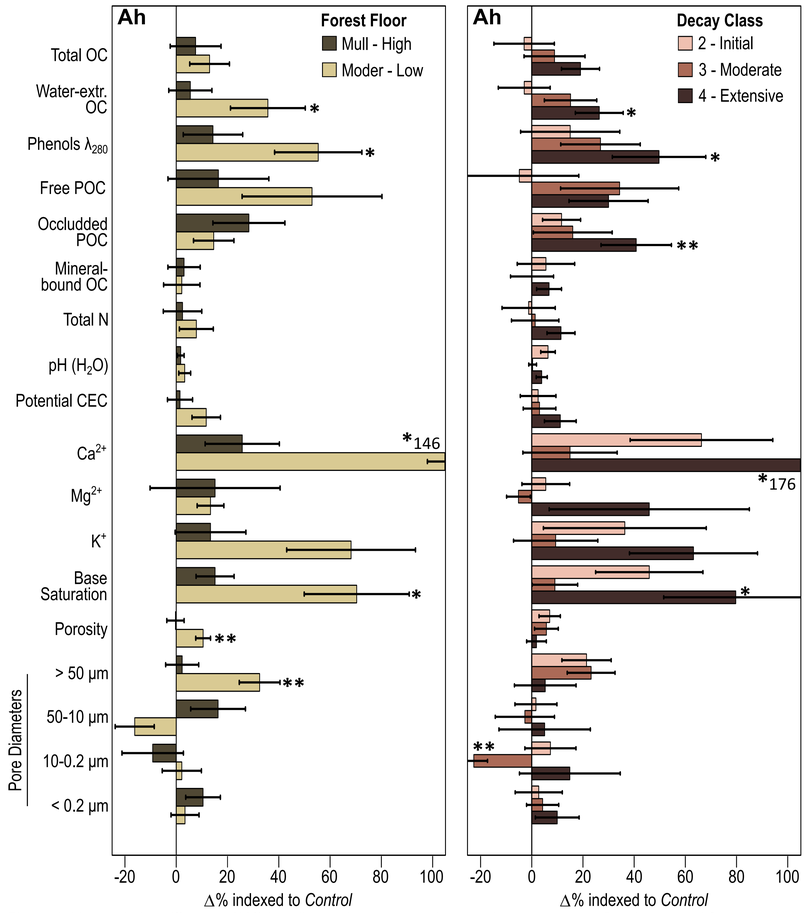
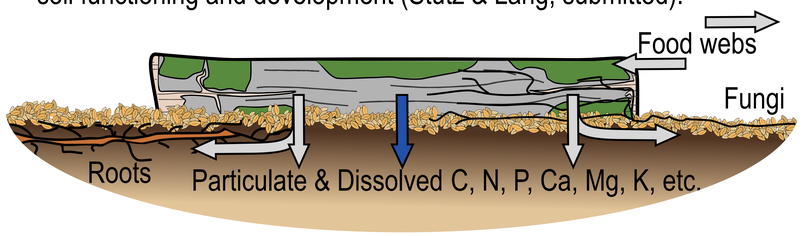


Figure 4: Mean relative difference (Δ%) in soil organic matter, nutrients and pores between Deadwood *and* Control *points. Significant differences are starred. Sites are grouped by forest floor (biological activity; Left), and CWD by decay (Right).*

CWD as biogeochemical 'hot-spots' in soils

CWD are transient, spatially limited systems of altered biogeochemical and biogeophysical processes controlled by decomposers, which alter soil functioning and development (Stutz & Lang, submitted).



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