The effect of Forest Management Intensity on the Diversity of Wood-Decaying Fungi and Dead Wood Decomposition (FunWood)

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German Biodiversity Exploratories

open research platform

Objectives:

- understanding of the relationship between biodiversity of different taxa and levels
- the role of land use and management for biodiversity
- the role of biodiversity for ecosystem processes

30 VIP (very intensive plots) along a gradient of forest management intensity
Managed coniferous (spruce, pine) forests
Managed beech forests
Extensively- or unmanaged forests
BELongDead Experiment
(about 1400 logs of 13 tree species)
Crown dead wood accumulation
(Floren, Gossner)
Main Hypothesis

1. Diversity of dead wood decay fungi increases with decreasing forest management intensity.

2. Increasing fungal diversity leads to increasing dead wood decay rates.
Fungal diversity
(Diversity of wood decaying and wood dwelling – saproxylic - fungi)

Gradient of forest management intensity → Fungal diversity → Dead wood decay

Comparative diversity study

Ceriporia excelsa (18.10.2010)  
Hericium clathroides (Coral tooth)
Fungal diversity - Methods

**Field inventory (sporocarps)**
1 Team of Mycologists per exploratory
3 Inventories per year

**Lab (see Poster)**
Molecular biology
Sampling in summer 2009

Björn Hoppe et al., UFZ Halle

![Schorfheide](image1.png)

![Fungal species, Schwäbische Alb](image2.png)
Number of additional fungal species per field inventory

- Juin-09: 77
- Sept.-09: 56
- Oct.-09: 27
- Nov.-09: 15
- Juin-10: 35
- Sept.-10: 17
Fungal diversity (sporocarps)
2009/2010 (Jun/Jul, Aug/Sep, Okt/Nov)

387 Fungal species

Schorfheide (216)
Hainich (150)
Alb (196)

Hainich
Fungal diversity (sporocarps) between management type

374 Fungal species

AC Conif. (142)
49
15
58
20
92 unmanaged (247)

AC Beech (213)
62

92
247

Fungal species (n)
0 5 10 15 20 25 30 35

In(Volume)
0 2 4 6 8

R² = 0.41
Hierarchical Cluster Analysis (Fungal Species)

Dendrogram using Complete Linkage
Rescaled Distance Cluster Combine

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A_PCAB_AC

H_PCAB_AC

A_FASY_AC

A_unmanaged

H_FASY_AC

H_selection

H_unmanaged

S_FASY_AC

S_unmanaged
Decay of dead wood and wood chemistry

Gradient of forest management intensity → Fungal diversity → Dead wood decay

Fungal diversity

Functional Diversity

Hypoxylon spec. (Kohlenbeere)

Trametes gibbosa (lumpy bracket)
Decay rates - Methods

Remaining mass
Dead wood density
Volume loss
Dimensions

Decay rate

Dendrochronology
to estimate
Time since death

Sampling of dead wood samples
with cordless drill

Crossdating between tree ring sequences
from living and dead trees
Dead wood decay (Fagus sylvatica)

\[ y = -2.89x + 79.37 \]

\[ R^2 = 0.49 \]
Effect of fungal diversity on decay rate
(Fagus sylvatica), Schorfheide

$$y = 0.003x + 0.035$$
$$R^2 = 0.222$$
Tinder fungus (*Fomes fomentarius*) (first from left)
Difference in dead wood decay between logs with and without Fomes fomentarius (Fagus sylvatica)

\[ y = -3.3x + 91.1 \]
\[ R^2 = 0.57 \]

\[ y = -2.49x + 71.4 \]
\[ R^2 = 0.31 \]
Conclusions – FunWood

- the more dead wood – the more fungal species

-(the more fungal species – the faster dead wood decays)

-Certain fungal species can dominate wood decay
Thank you!
CO2 and CO Emissions from F. sylvatica dead wood

\[ y = 0.0061x + 5 \times 10^{-5} \]

\[ R^2 = 0.577 \]
Wood decay fungi

Fomes fomentarius (tinder fungus)