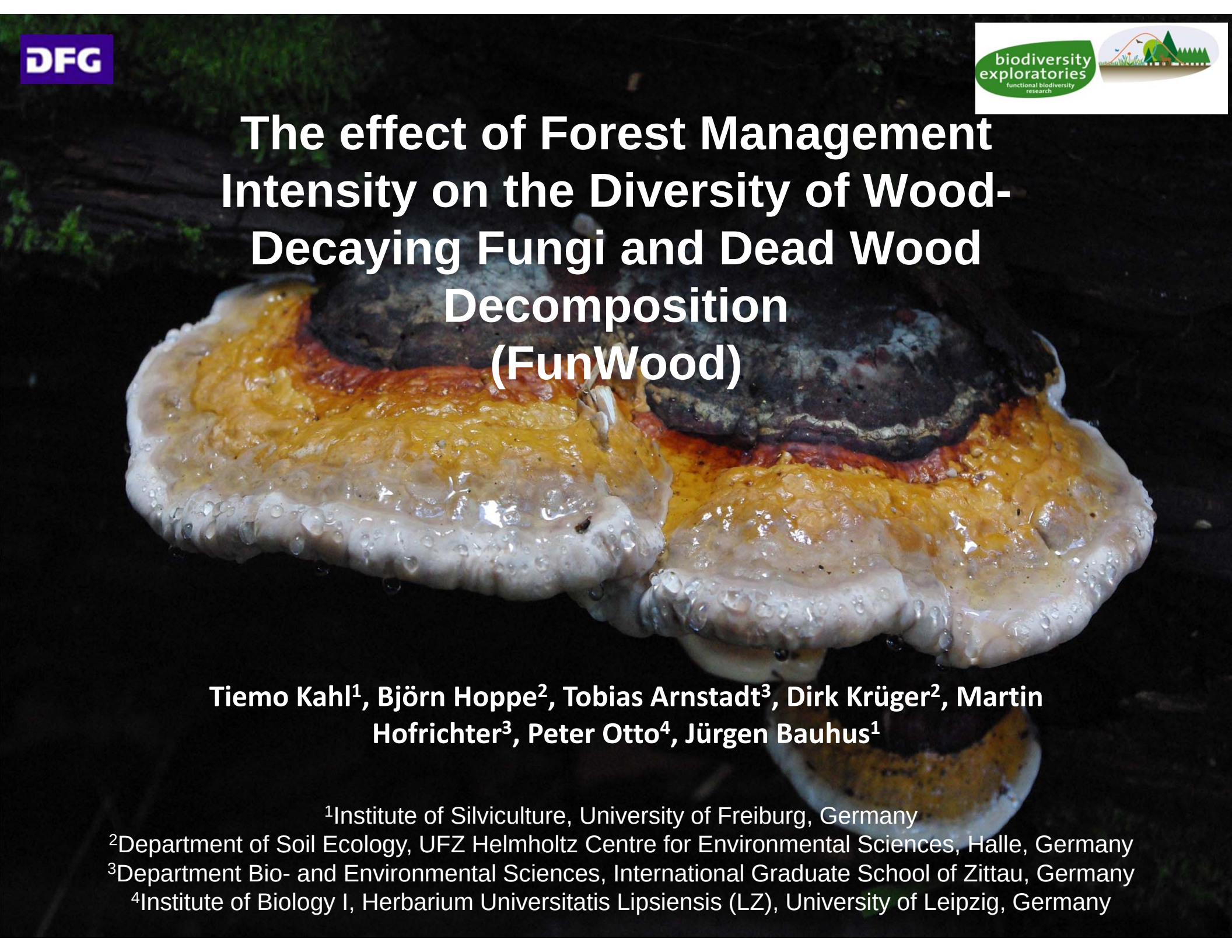
The effect of Forest Management Intensity on the Diversity of Wood-Decaying Fungi and Dead Wood Decomposition (FunWood)



Tiemo Kahl[1], Björn Hoppe[2], Tobias Arnstadt[3], Dirk Krüger[2], Martin Hofrichter[3], Peter Otto[4], Jürgen Bauhus[1]

[1]Institute of Silviculture, University of Freiburg, Germany
[2]Department of Soil Ecology, UFZ Helmholtz Centre for Environmental Sciences, Halle, Germany
[3]Department Bio- and Environmental Sciences, International Graduate School of Zittau, Germany
[4]Institute of Biology I, Herbarium Universitatis Lipsiensis (LZ), University of Leipzig, Germany

German Biodiversity Exploratories

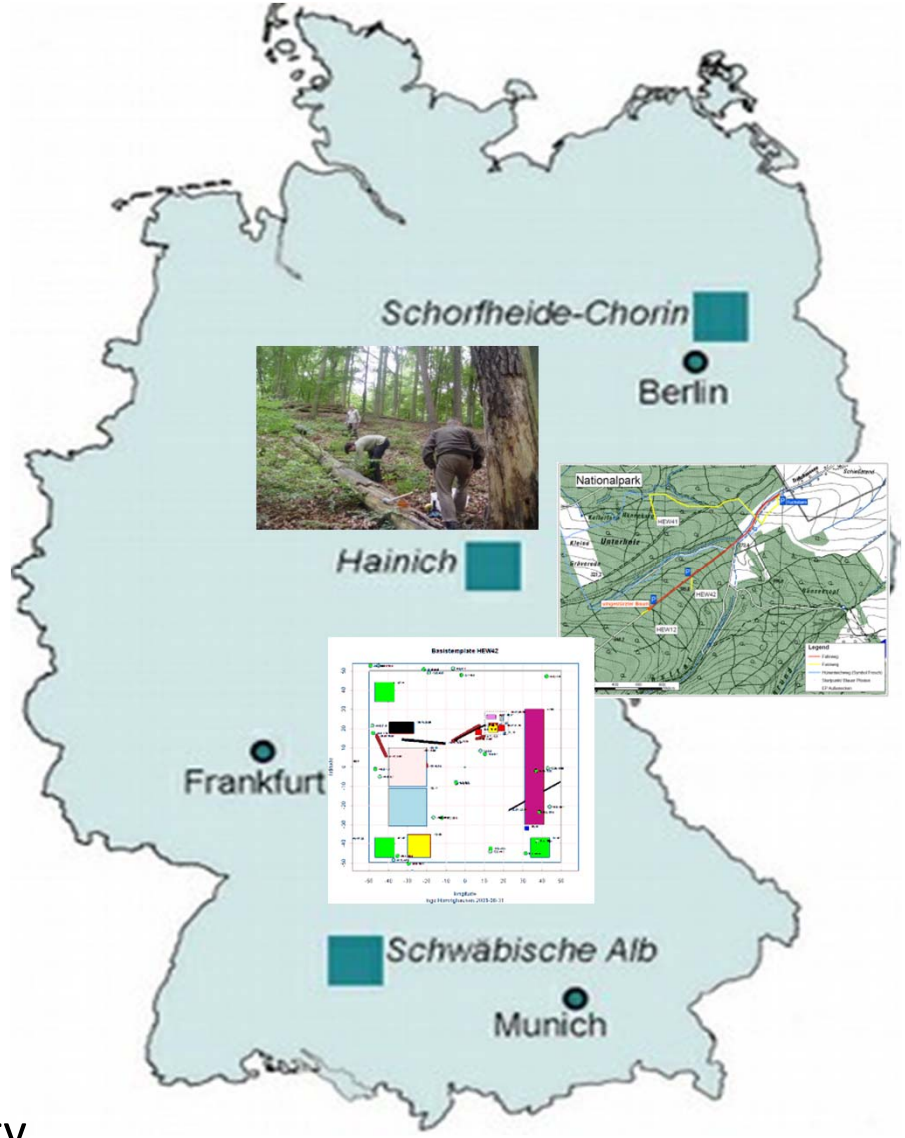
open research platform

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

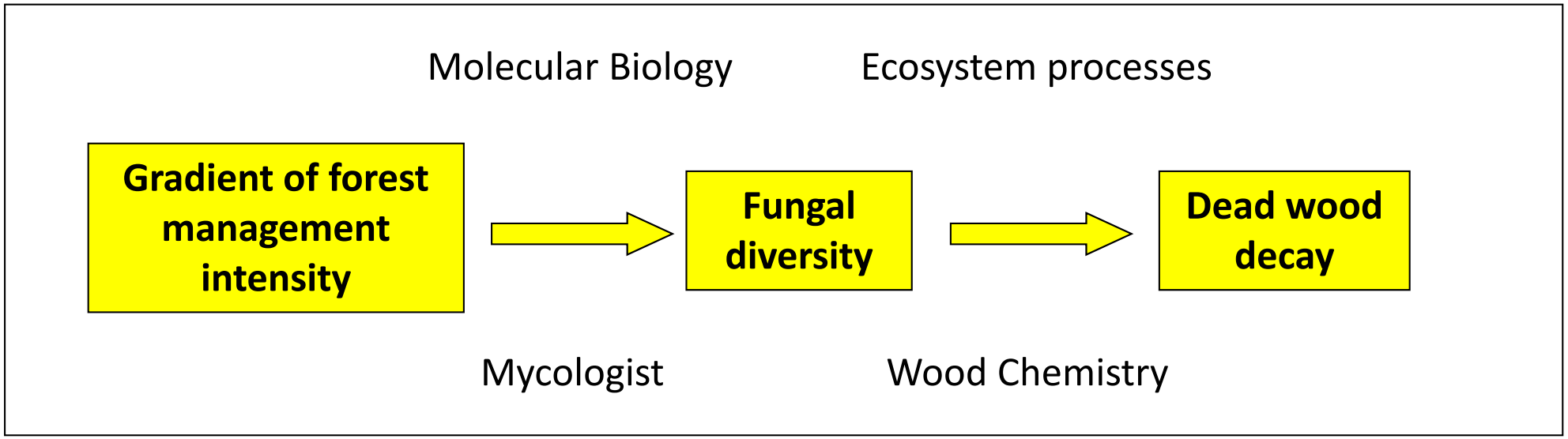
Managed beech forests

Extensively- or unmanaged forests

BELongDead Experiment
(about 1400 logs of 13 tree species)

Crown dead wood accumulation
(Floren, Gossner)

FunWood - Structure



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

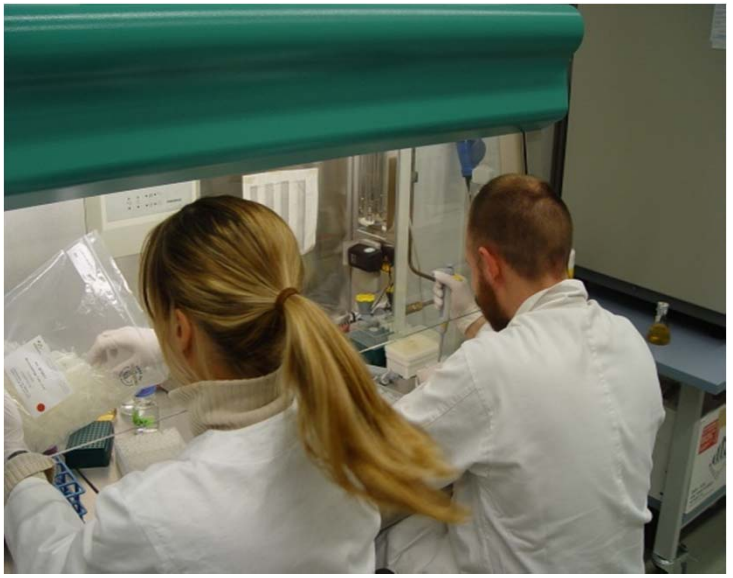
3 Inventories per year

Schorfheide

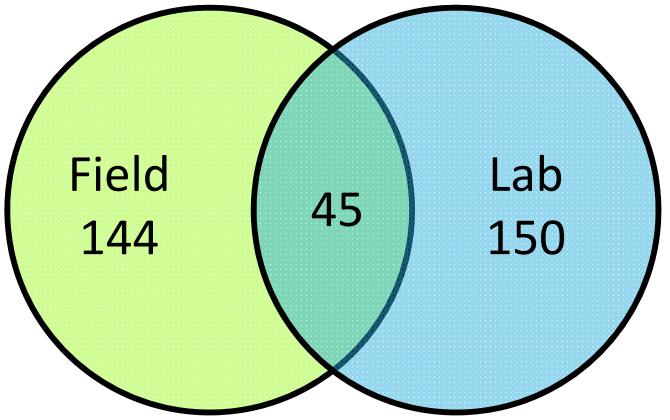
Lab (see Poster)

Molecular biology

Sampling in summer 2009

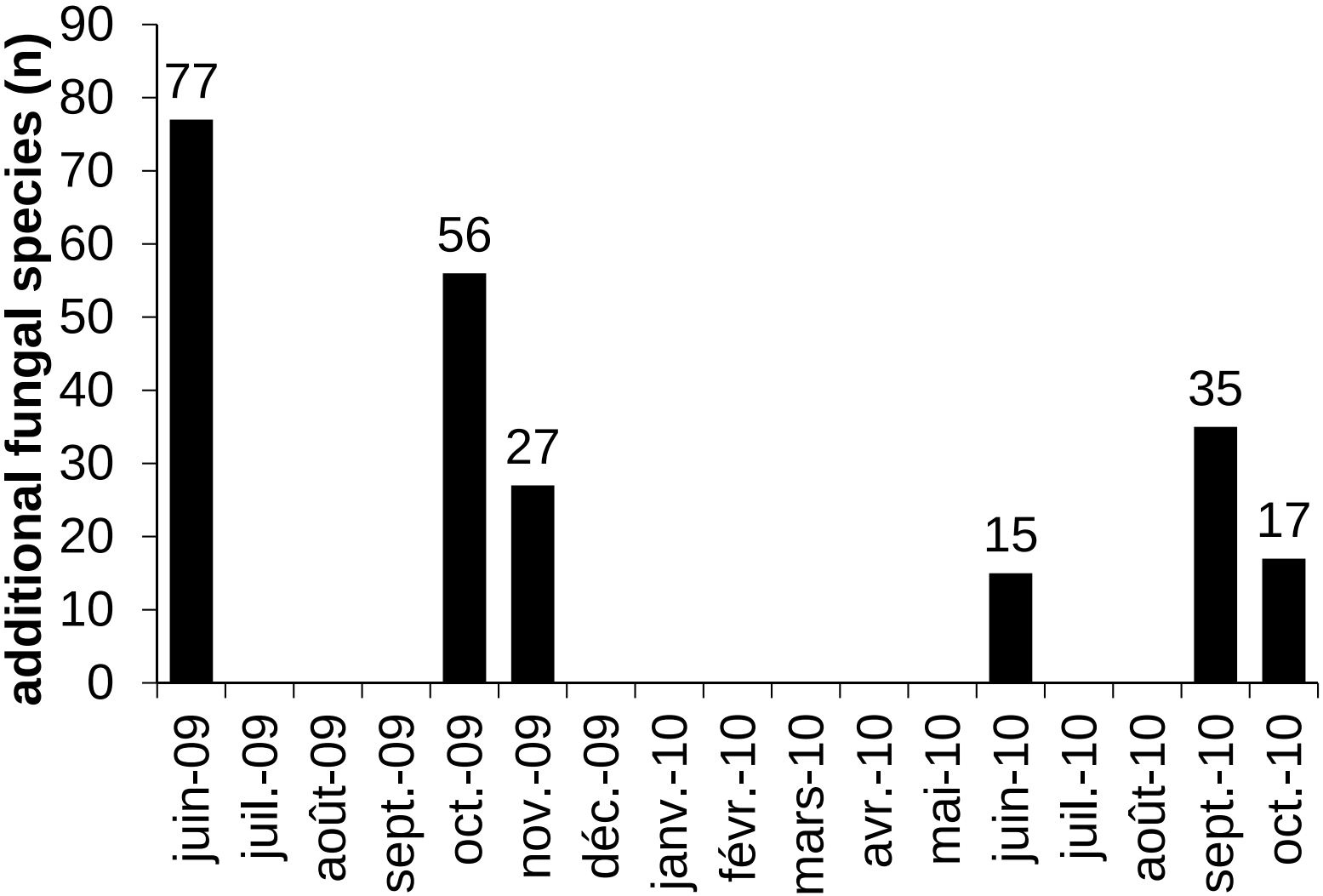


Björn Hoppe et al. , UFZ Halle



Fungal species, Schwäbische Alb

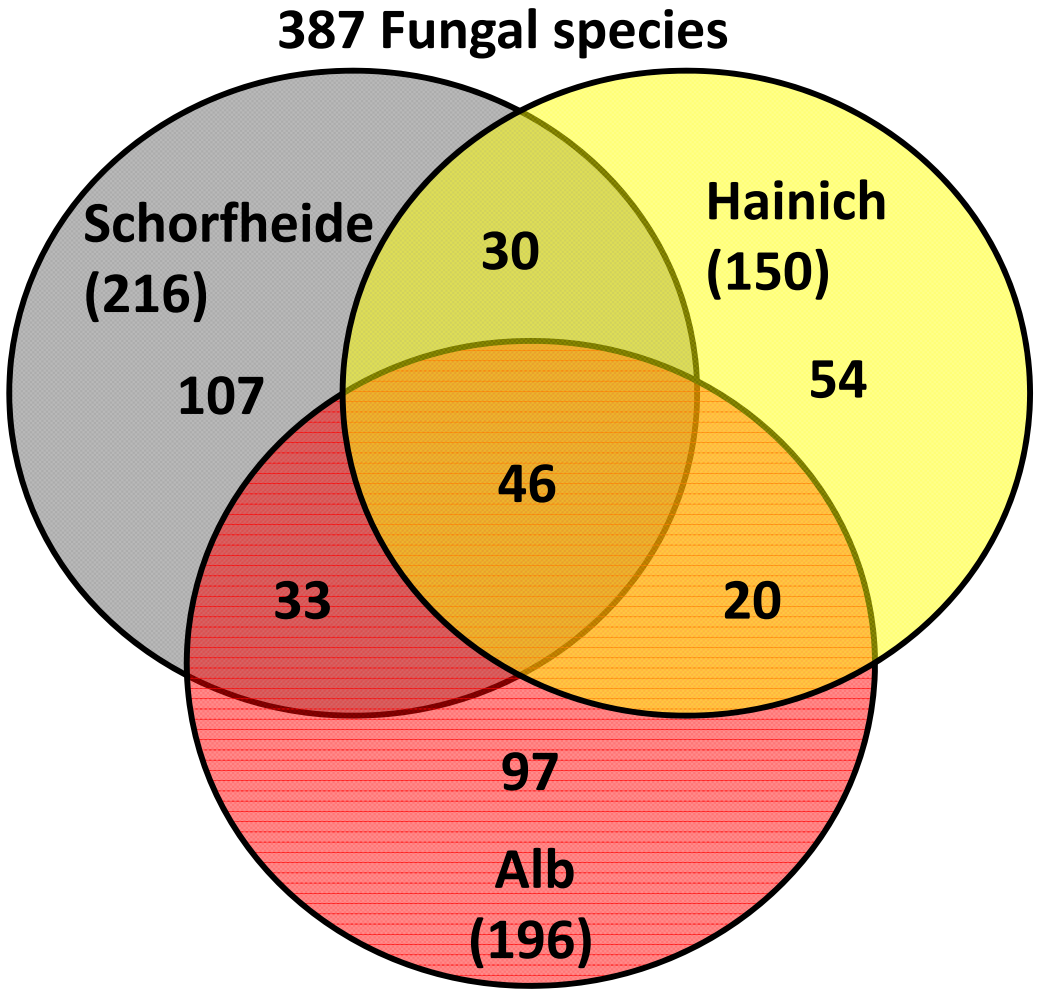
Number of additional fungal species per field inventory



Fungal diversity (sporocarps)

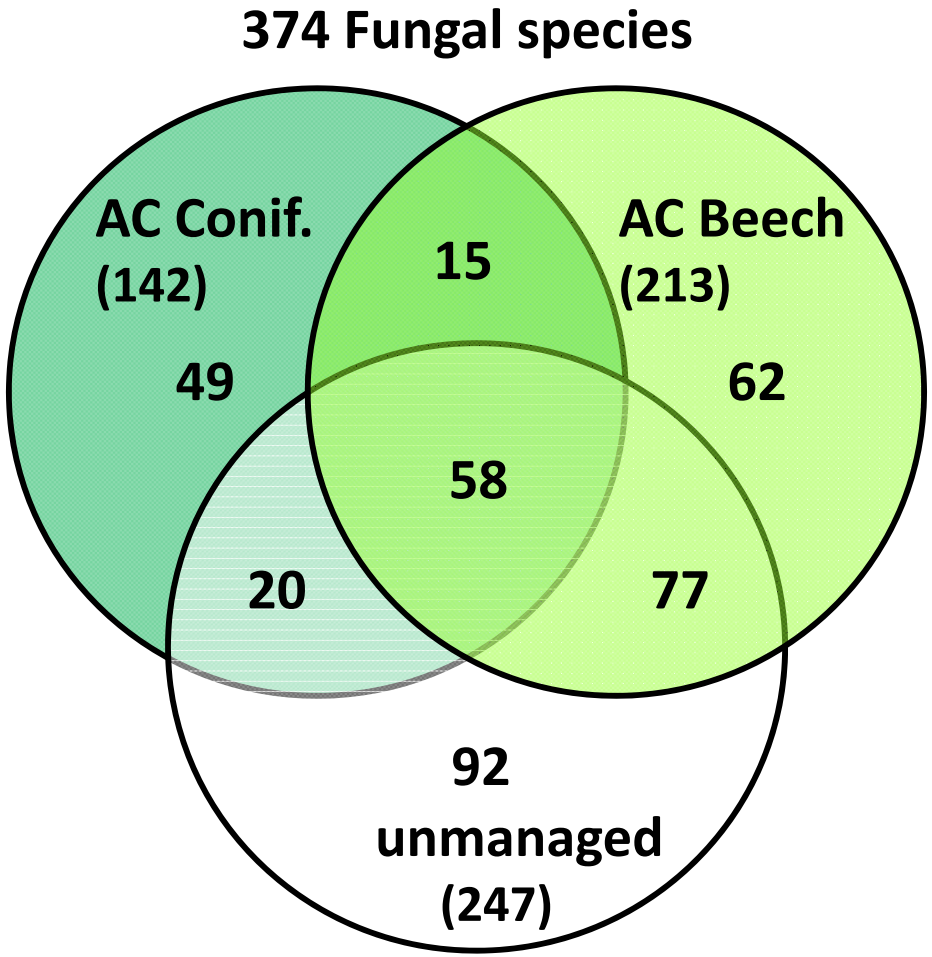
2009/2010 (Jun/Jul, Aug/Sep, Okt/Nov)

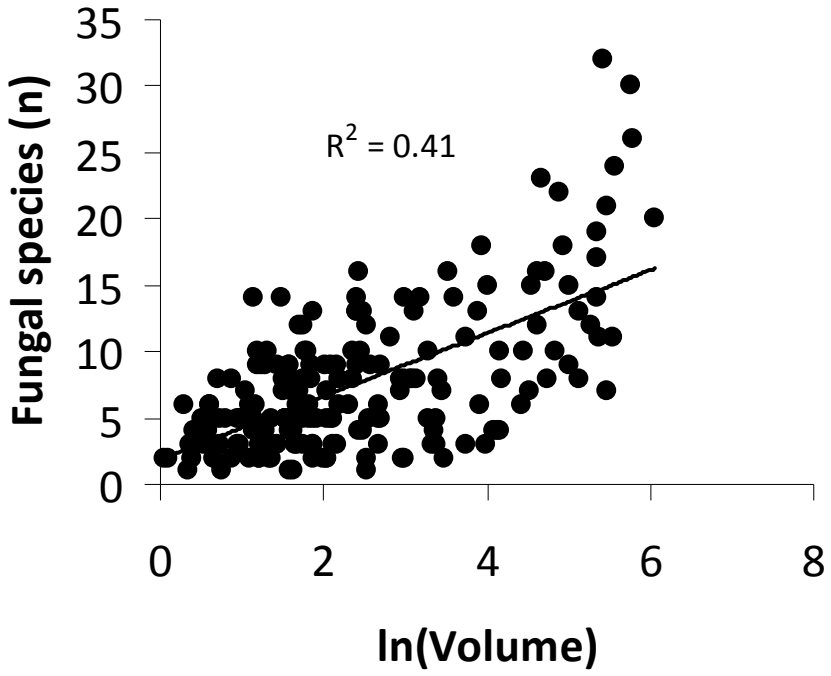
Hainich



Fungal diversity (sporocarps)

between management type

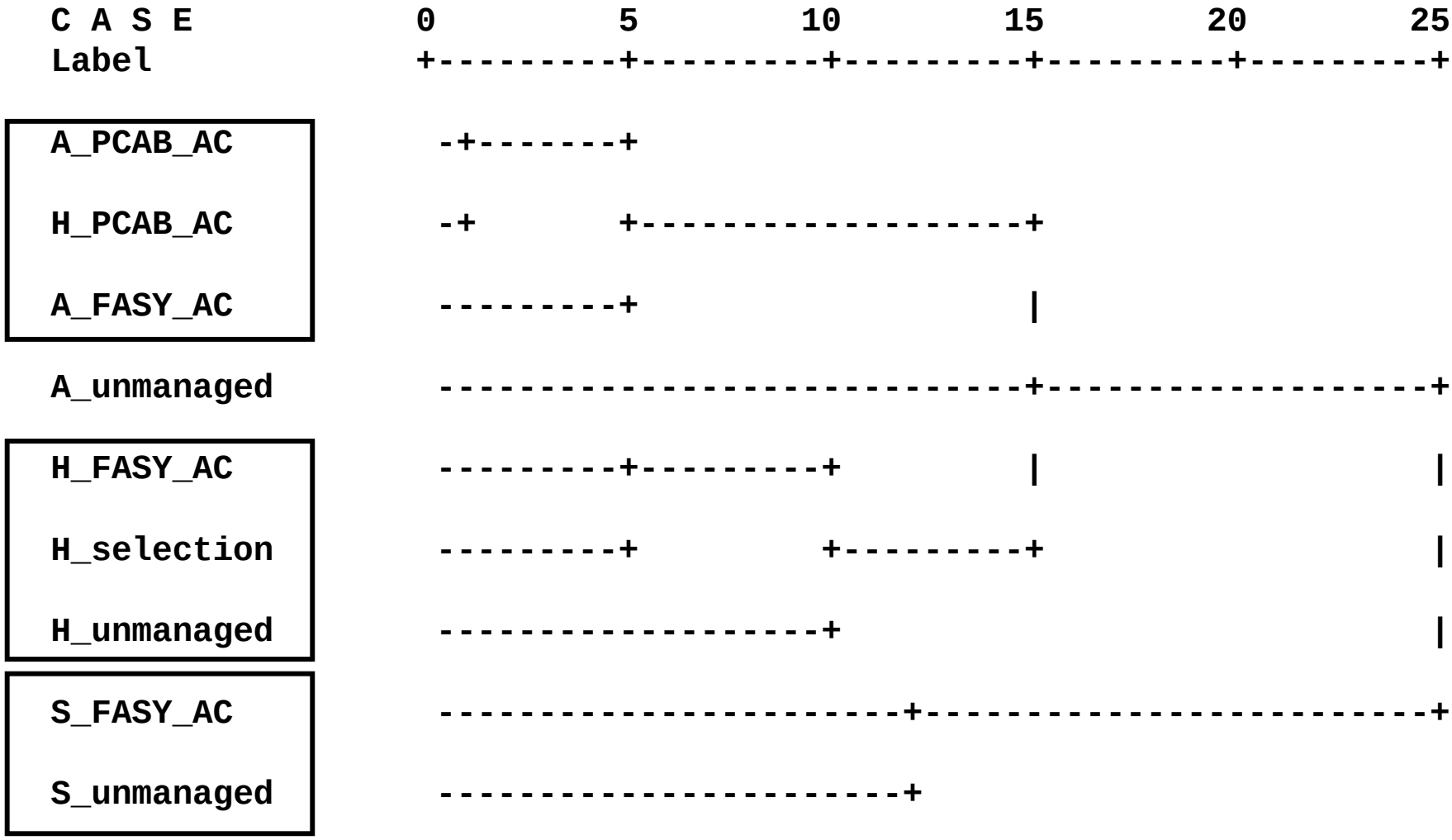




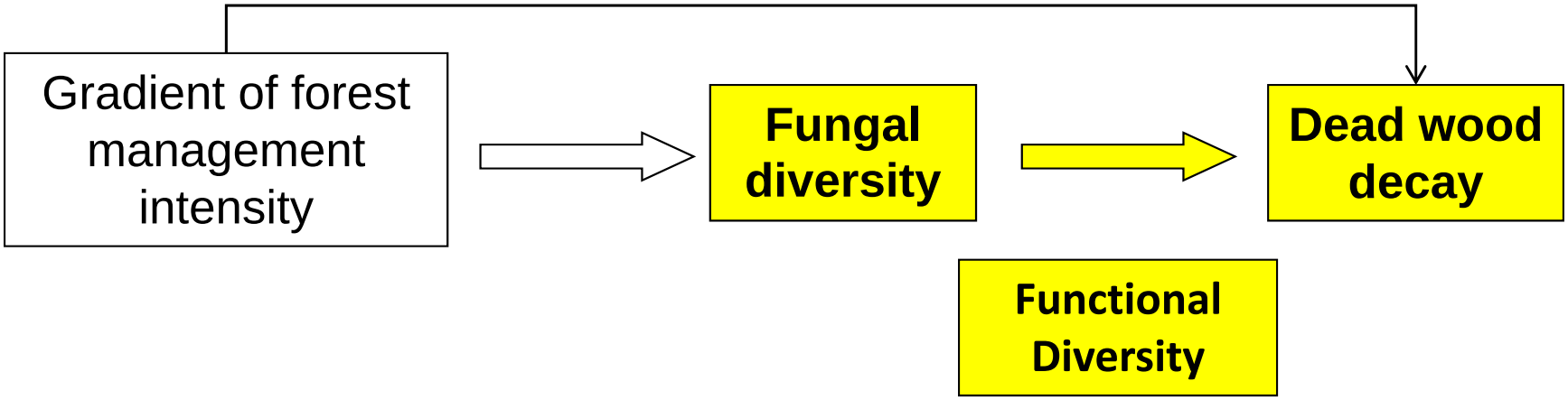
H I E R A R C H I C A L C L U S T E R A N A L Y S I S (Fungal Species)

Dendrogram using Complete Linkage

Rescaled Distance Cluster Combine



Decay of dead wood and wood chemistry



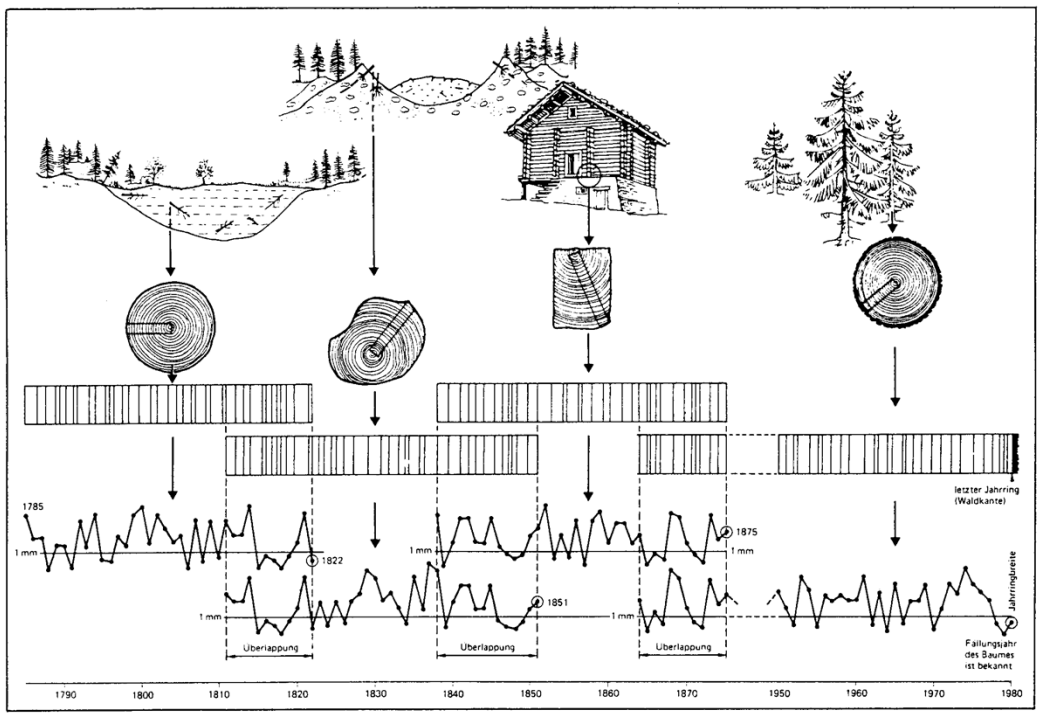
Decay rates - Methods

Remaining mass
Dead wood density
Volume loss
Dimensions

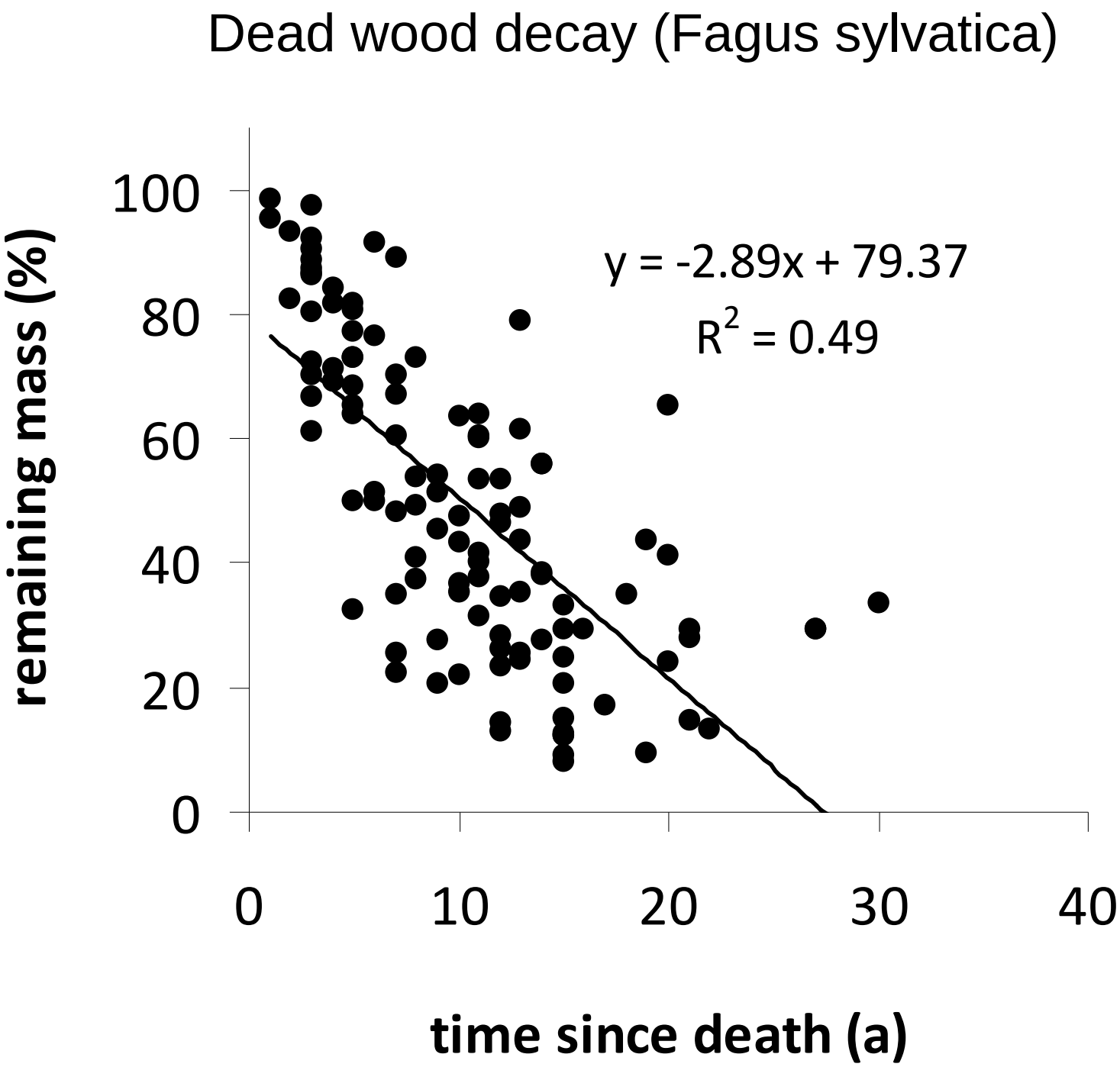
⇒ **Decay rate** ⇐

Dendrochronology
to estimate
Time since death

Sampling of dead wood samples
with cordless drill

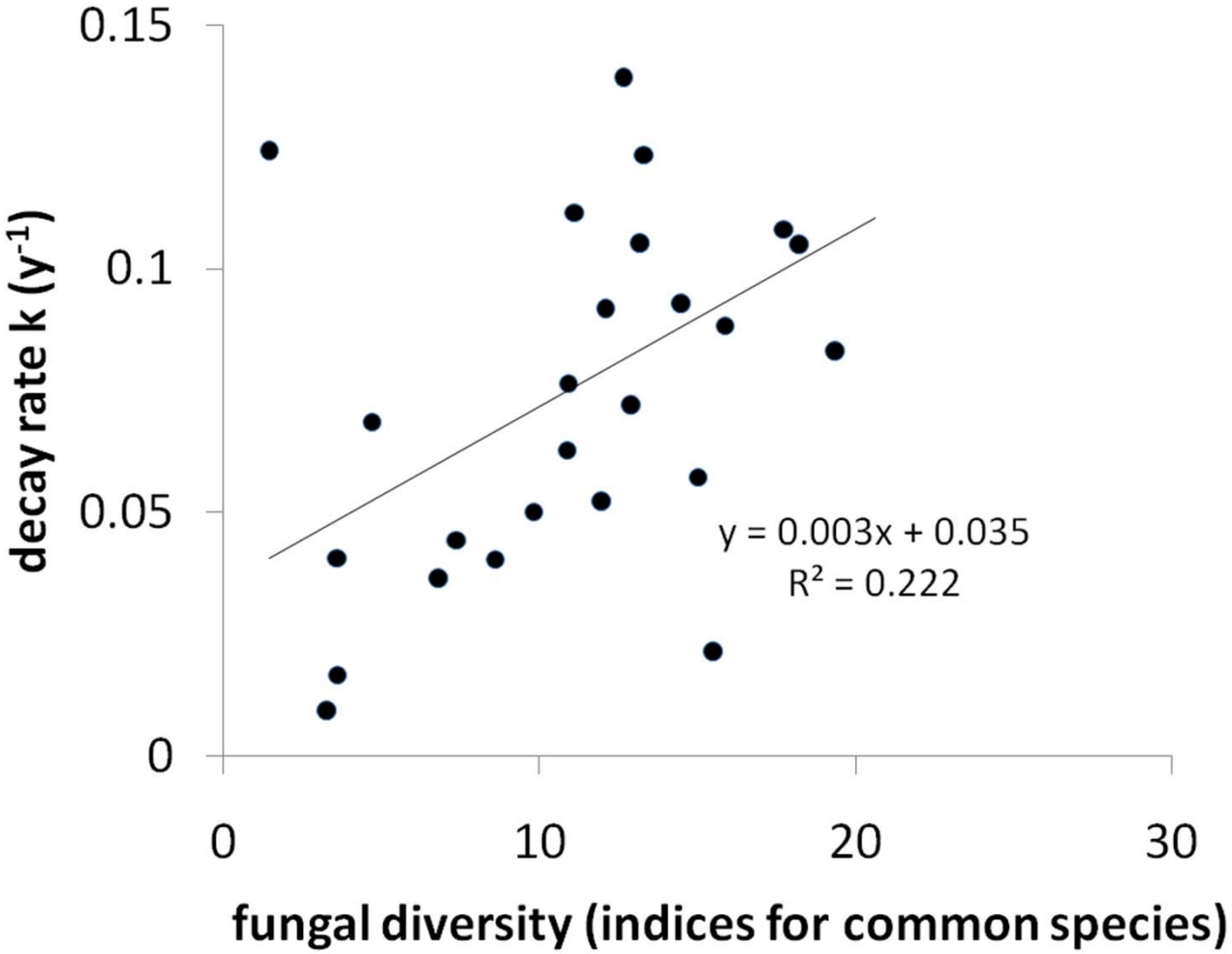


Crossdating between tree ring sequences
from living and dead trees


Dead wood decay (Fagus sylvatica)
y = -2.89x + 79.37
R2 = 0.49
remaining mass (%)
100
80
60
40
20
0
0
10
20
30
40
time since death (a)

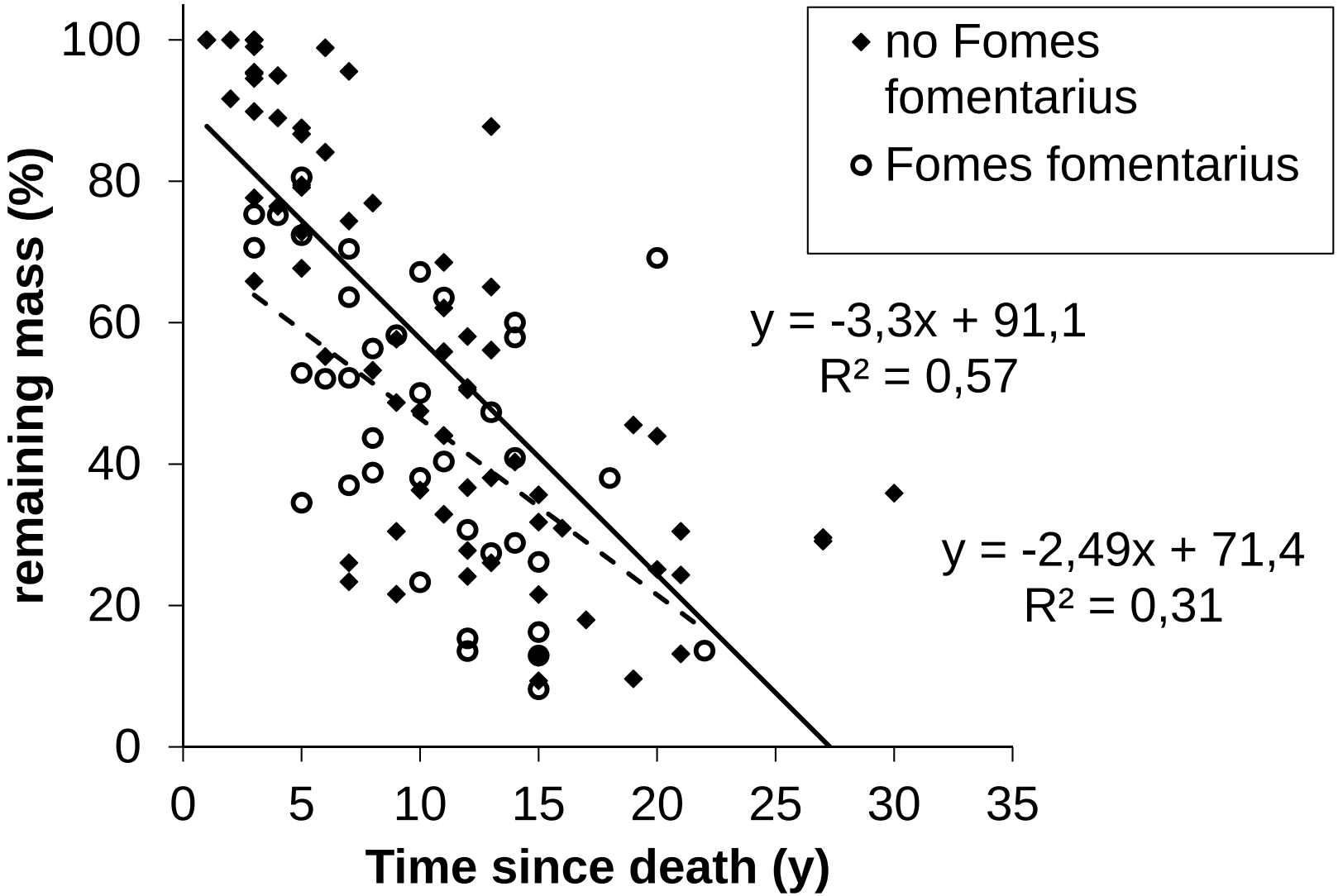
Effect of fungal diversity on decay rate

(Fagus sylvatica), Schorfheide



Tinder fungus (*Fomes fomentarius*) (first from left)

Difference in dead wood decay between logs with and without Fomes fomentarius (Fagus sylvatica)



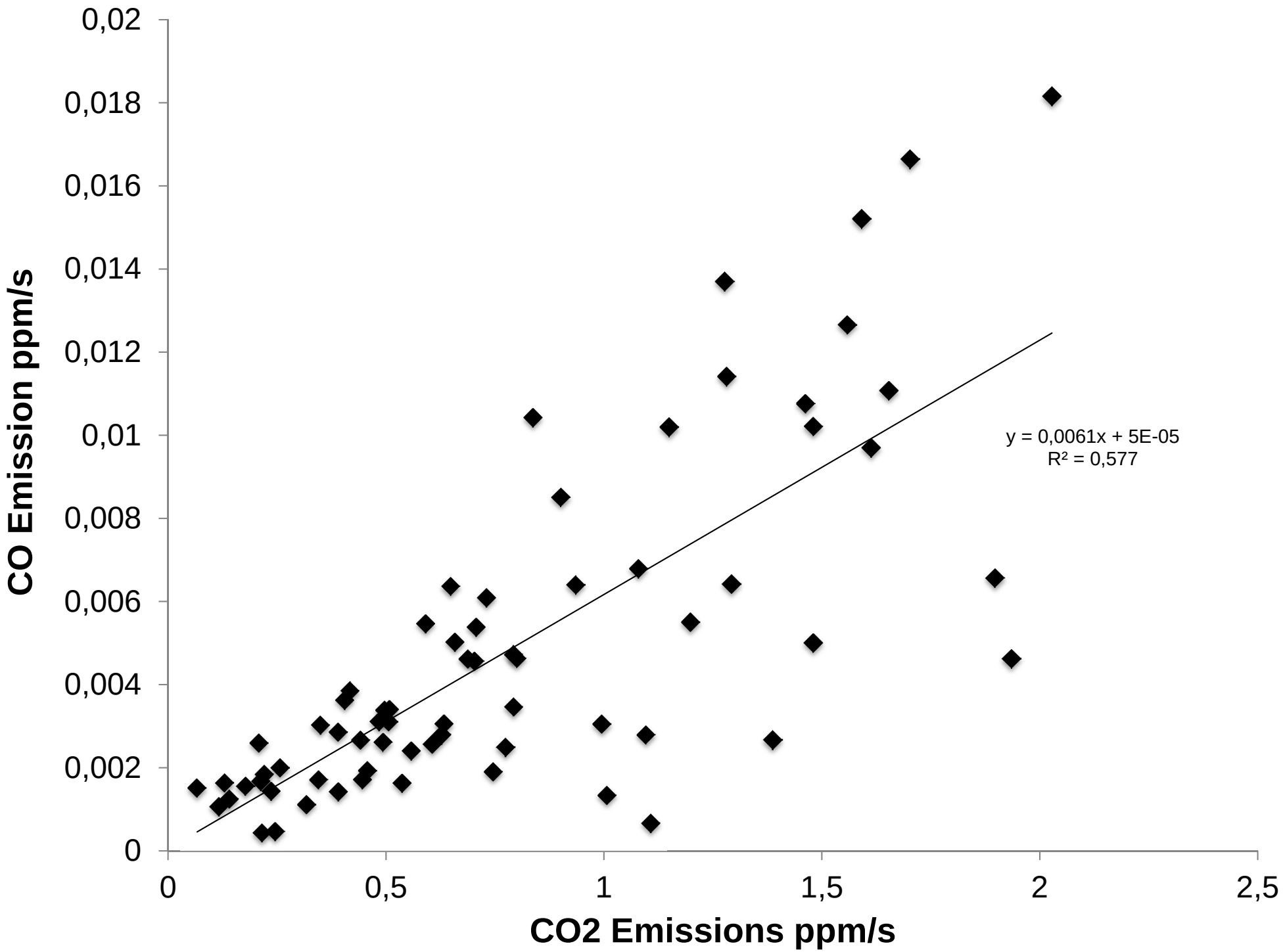
Conclusions – FunWood

- 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
CO Emission ppm/s
CO2 Emissions ppm/s
0,02
0,018
0,016
0,014
0,012
0,01
0,008
0,006
0,004
0,002
0
0
0,5
1
1,5
2
2,5
y = 0,0061x + 5E-05
R² = 0,577

Wood decay fungi

Fomes fomentarius (tinder fungus)