

Succession of wood-inhabiting fungi during decomposition of the dead wood

*Raisa Mäkipää with
Tiina Rajala, Taina Pennanen, Mikko Peltoniemi,
Tapio Linkosalo and Jenni Hottola*

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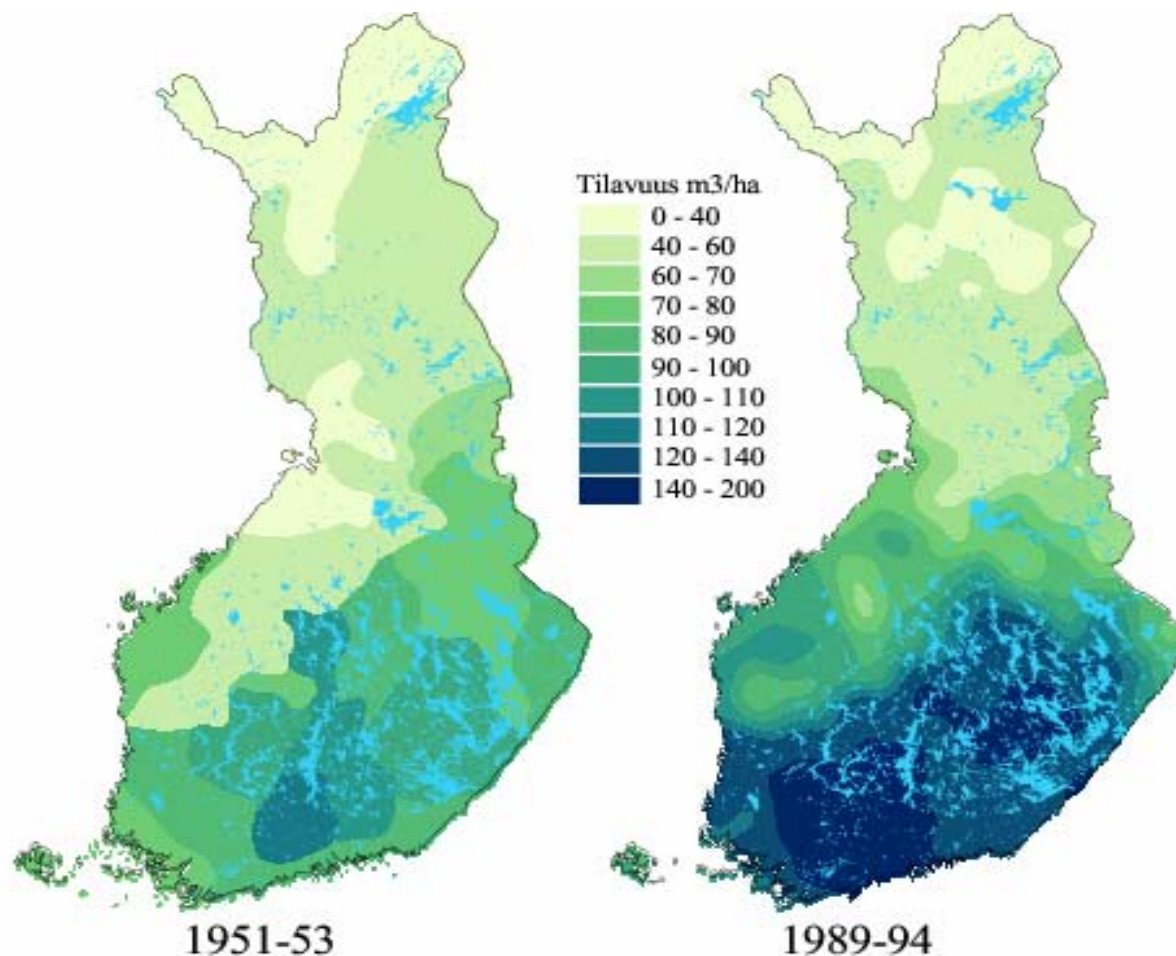
Outline

- Introduction
 - major changes in boreal forests
 - role of wood inhabiting fungi in forest ecosystems
- Succession of fungi along decay gradient
 - based on fruiting body observation data
 - based on DNA sequencing
- Quality of dead wood in different decay stages
- Niche models of wood inhabiting fungi to be linked to stand simulation models

Major changes in boreal forest landscapes in N-Europe

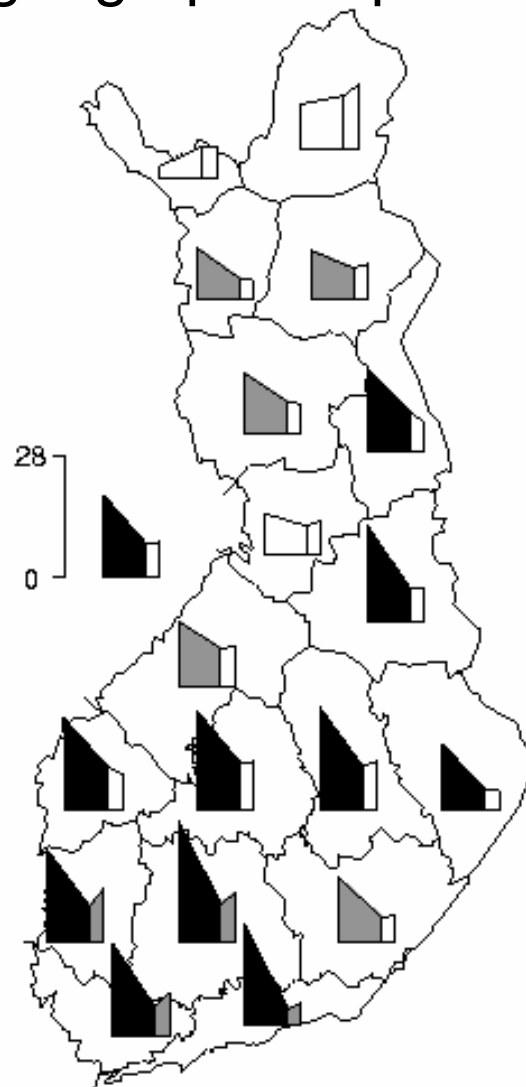
- Changes in the age-class distribution
- Changes in the dominance of tree species
- Increased amount of wood (timber volume)
- Changes in the abundances of plant species and vegetation structure
- Decline in the amount of dead wood

Major changes... increase in the amount of timber



Proportion of productive forest area, stand density and amount of timber have increased as a result of management

Changes in the forest floor mosses, e.g. relative abundance of *Hylocomium splendens* by biogeographical provinces in 1951-53, 1985-86 and 1995

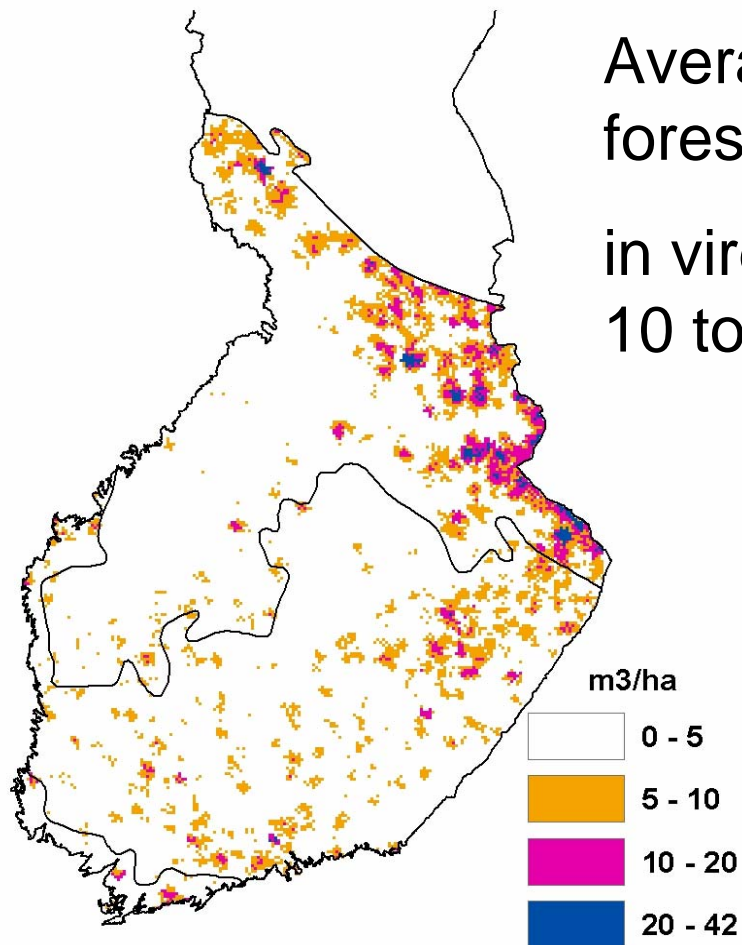


Dark/grey shading indicate significant changes

Source: Mäkipää & Heikkinen, 2003. JVS 14: 467-508

Decline in the amount of dead wood and fragmentation of forests

Kriging
interpolation
from 53 000
NFI plots



Average in managed
forests $<3 \text{ m}^3/\text{ha}$,
in virgin forests from
10 to $>100 \text{ m}^3/\text{ha}$.

Source: Luque & Vainikainen, in press & Finnish NFI data

Role of dead wood in boreal forest ecosystems

- Dead and decaying wood harbor numerous species
 - birds
 - fungi
 - insects
 - bryophytes
- Many of dead wood inhabiting species are currently rare or red-listed
- Species are threatened as a result of intensive forest management, which has decreased amount of dead wood in forests

Role of wood decaying fungi and gaps of knowledge

- Wood decaying fungi are key components of the forest biodiversity (used also as an indicator)
- Polypores as wood decaying fungi have functional role in the ecosystem (nutrient cycling)
- Habitat requirements of polypore species are not widely quantified
- Succession of the polypore species in the decomposing substrate not quantified
- Effects of biodiversity loss on rate of decomposition are not known

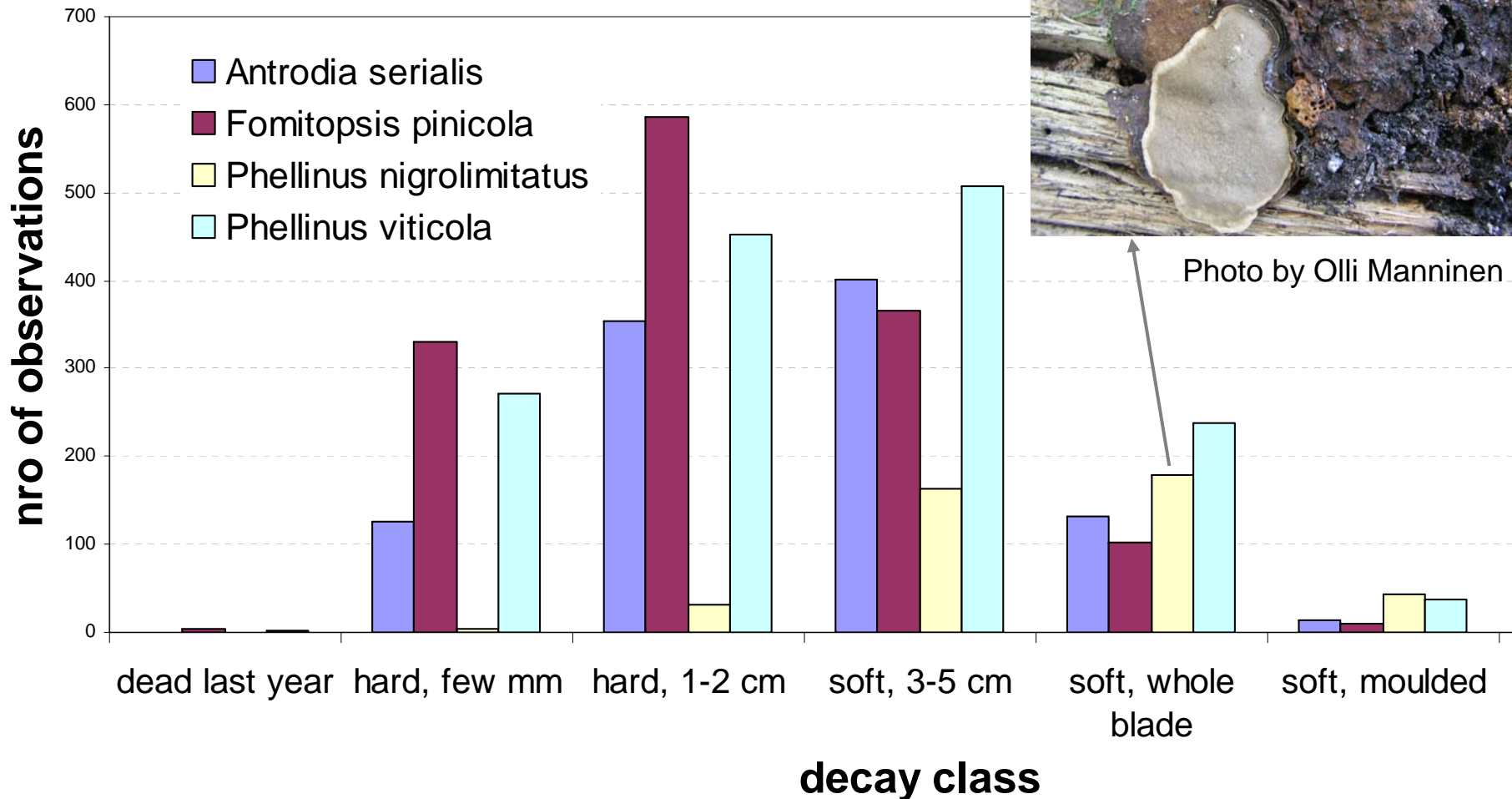
Objectives

- to quantify niches of major wood inhabiting fungi
- to quantify diversity of fungal community along wood decay gradient
- to analyse changes in the quality of decaying wood along decay gradient

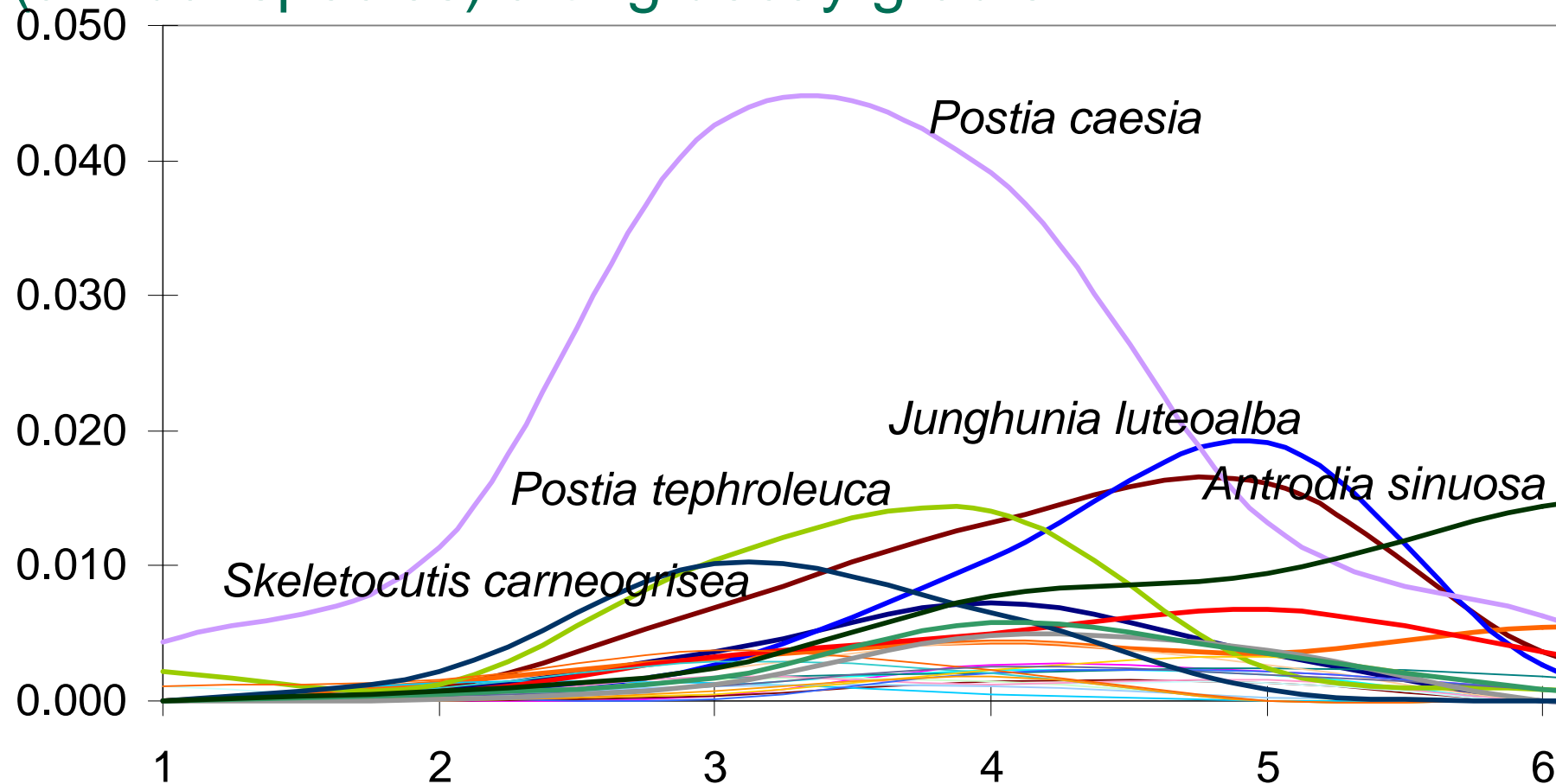
Material and Methods - I

- Inventory data: fruiting body observations of wood inhabiting fungi (*compiled by Jenni Hottola, Reijo Penttilä and Håkan Berglund*)
- 543 sites from boreal forests in S-Finland
- 125,000 dead-tree objects
- 186 focal species recorded
- roughly 60,000 occurrences

Occurrences of perennial wood inhabiting fungi along decay stage of logs



Propability of occurencies of wood inhabiting fungi (annual species) along decay gradient

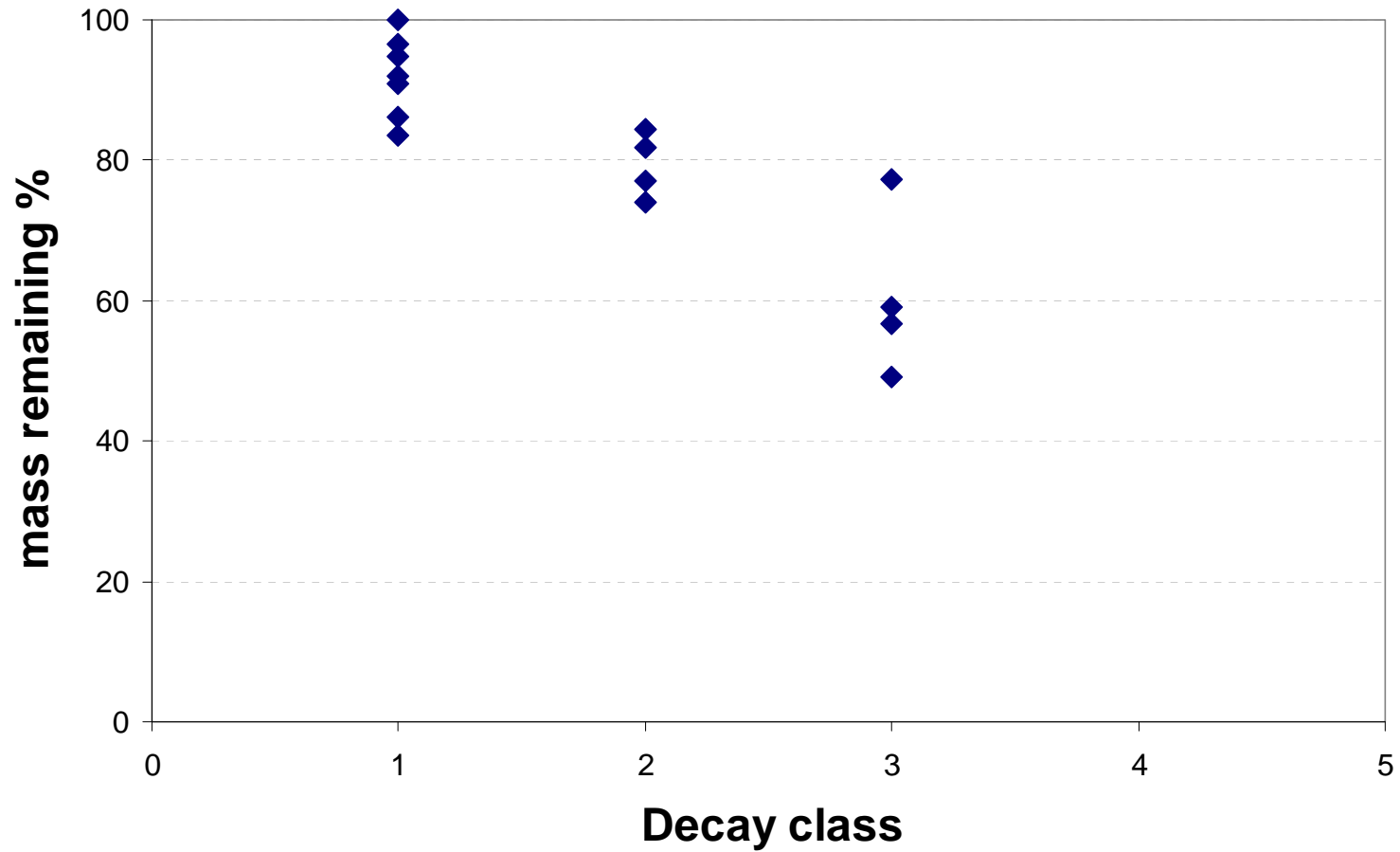


Models on species realized niches will be linked to decomposition model which is part of stand simulation model (predicting growth and dead of trees)

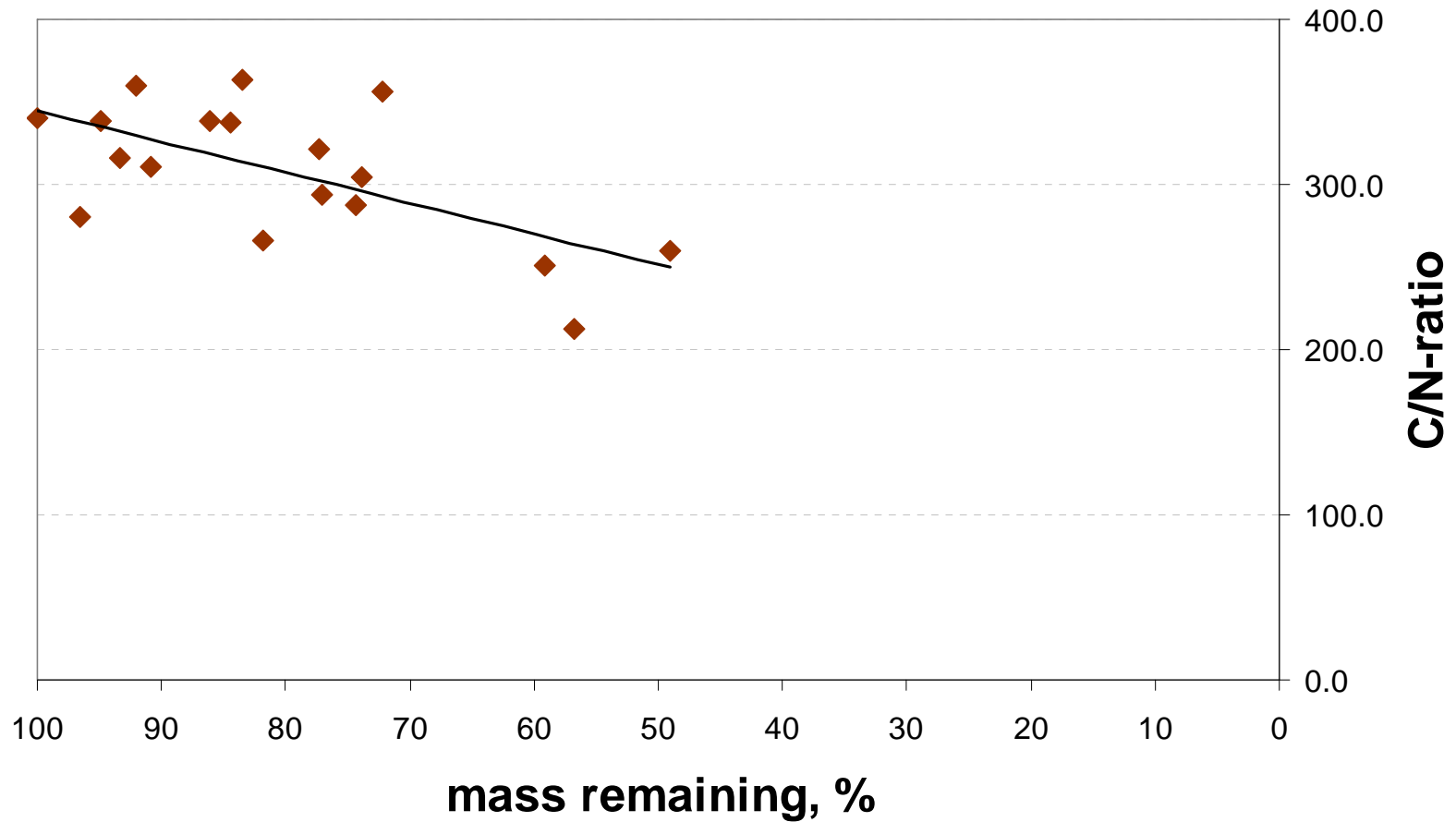
Material and Methods - II

- Fruiting bodies of polypores inventoried
- Dead wood samples analysed for
 - decay phase measured as a mass loss%
 - quality of dead wood substrate – C/N-ratio, lignin as well as water and ethanol extractable compounds
 - diversity of fungal community with molecular biological methods (DGGE-fingerprints and DNA sequencing, genetic region ITS, 18S rDNA)
- Pilot samples collected and analysed
- Sampling of 5 sites ongoing; over 200 samples of spruce logs of different decay phases to be analysed

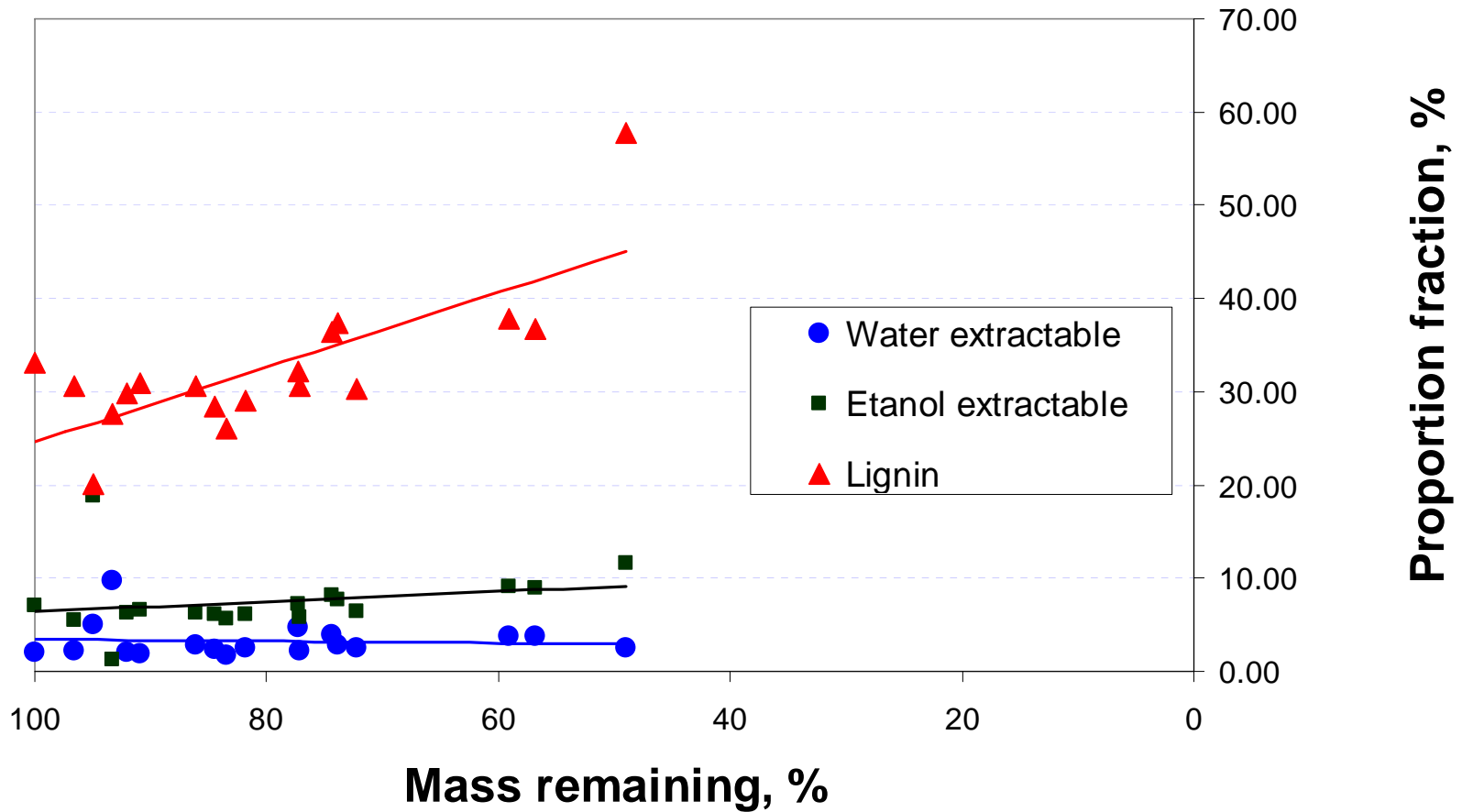
Results - Quality of dead wood substrate



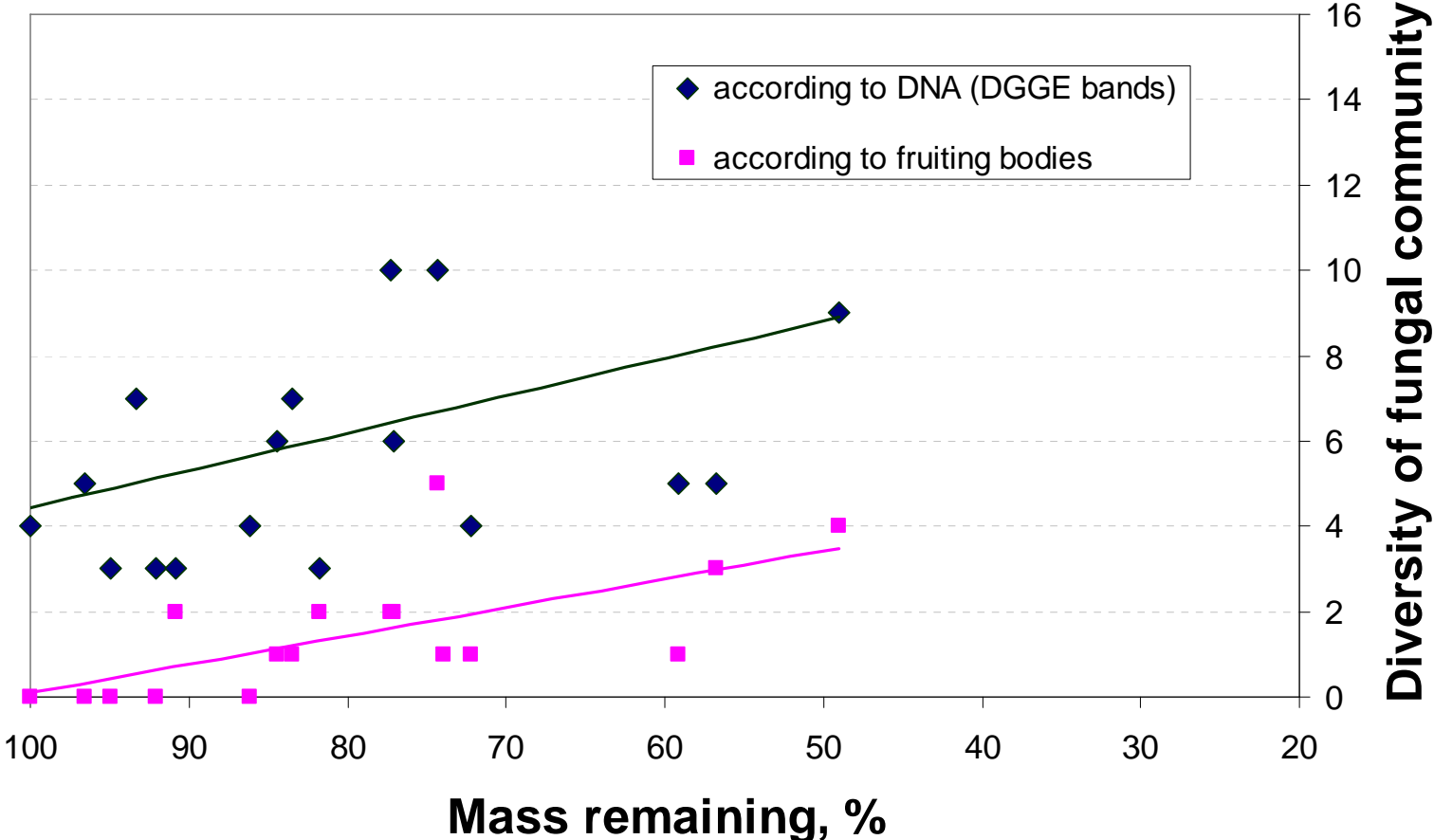
Quality of dead wood along decay gradient



Quality along decay gradient



Diversity of fungal community along decay gradient



Conclusions and future questions



Photo by Erkki Salo

- Wood inhabiting fungi are specialised to different decay stages and their realized niches can be modelled based on
 - observed fruiting bodies
 - fungi identified directly from dead wood samples
- Quality of decomposing wood changes along succession
- Number of species is highest in the late decay phases

Future questions to be answered

- What is relationship between rate of decomposition and species diversity
- How spatial and temporal continuum of dead wood substrate (of different quality) can be maintained
-> practical guidance to forest management
- What is potential fungi community with different management practices i.e. predictive models to be developed

Thank you for your attention



Photo: METLA/Erkki