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# Spruce. Natural durability

## Ilze & Co

**ESF 146 seminar 30.11.-01.12. 2011**

**Silava, Kalsnava**

# “Natural durability: the inherent resistance of wood to attack by wood destroying organisms” (EN 350)

**LVS EN 350-1:2000.** Durability of wood and wood-based products - Natural durability of solid wood - Part 1: Guide to the principles of testing and classification of the natural durability of wood

**LVS EN 350-2:2000.** Durability of wood and wood-based products - Natural durability of solid wood - Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe

**LVS EN 113:2000.** Wood preservatives - Test method for determining the protective effectiveness against wood destroying basidiomycetes - Determination of the toxic values

## The AIM

to determine natural resistance of particular spruce clones regarding fungal degradation



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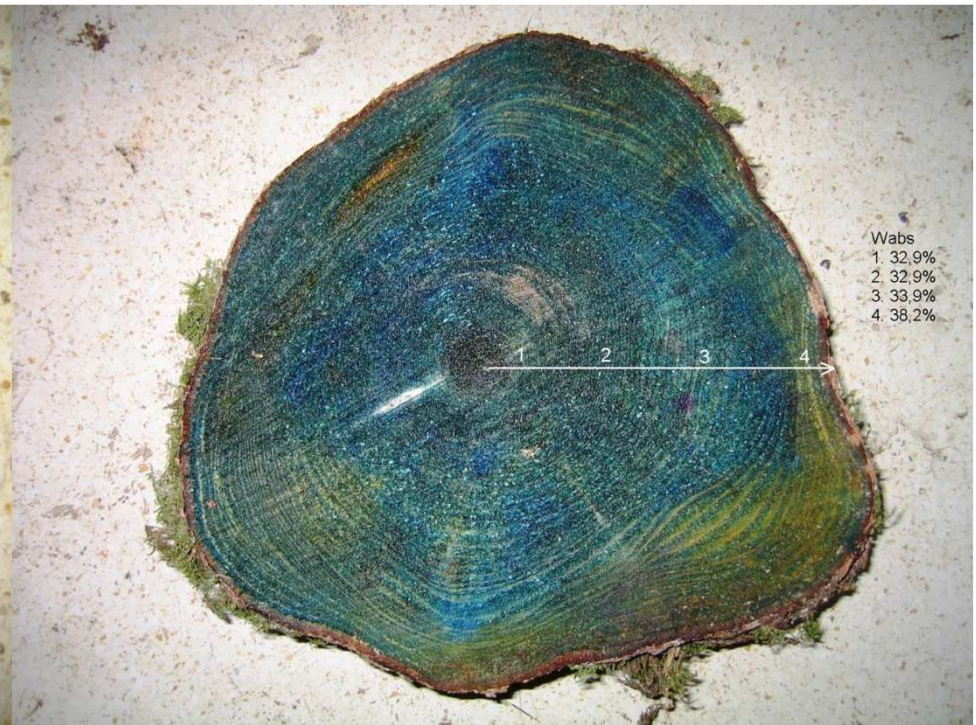
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## Sapwood/ heartwood

Bromcresol green: heartwood – blue; sapwood - yellow  
(KUTSCHA and SACHS, 1962).



**ESF spruce ~ 25 years**

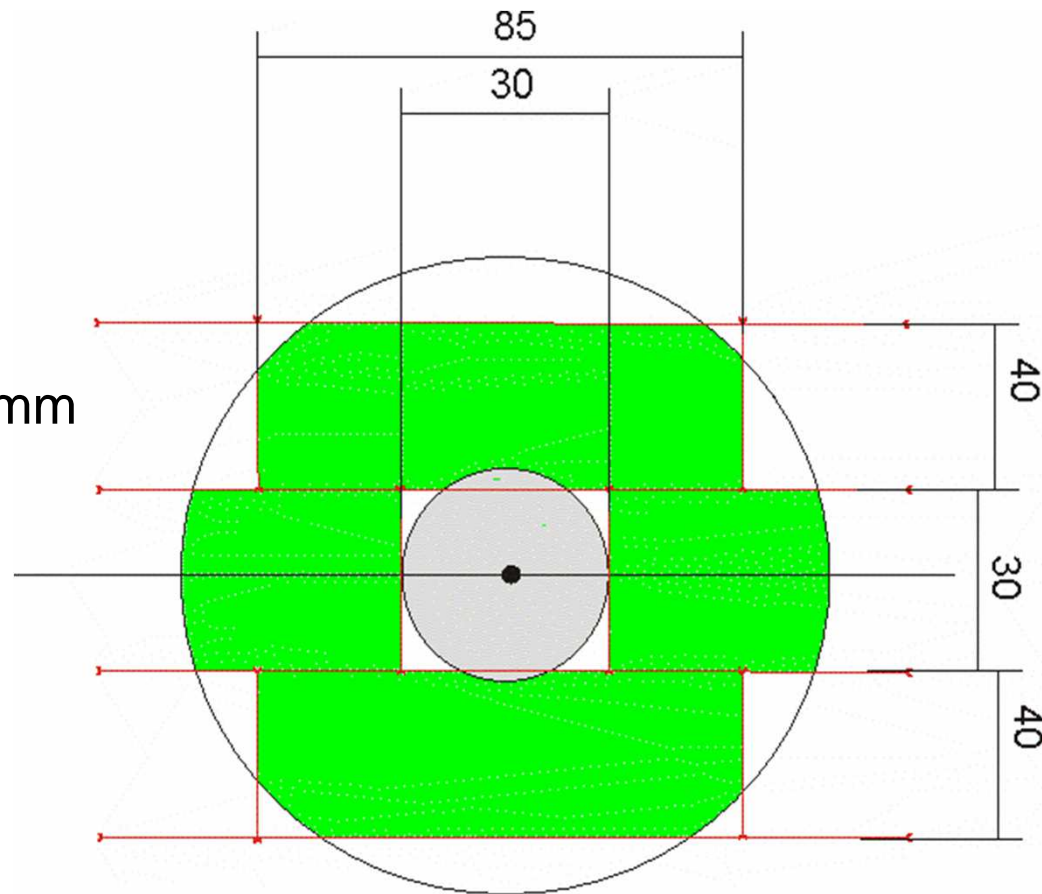


**Spruce > 60 years**

## Natural durability tests:

- 10 Norway spruce (*Picea abies*) clones: 26, 31, A10, A15, A7, B10, B15, B6, V7, V9
- Control – Scots pine (*P. sylvestris*) sapwood

Tree division in laths, mm





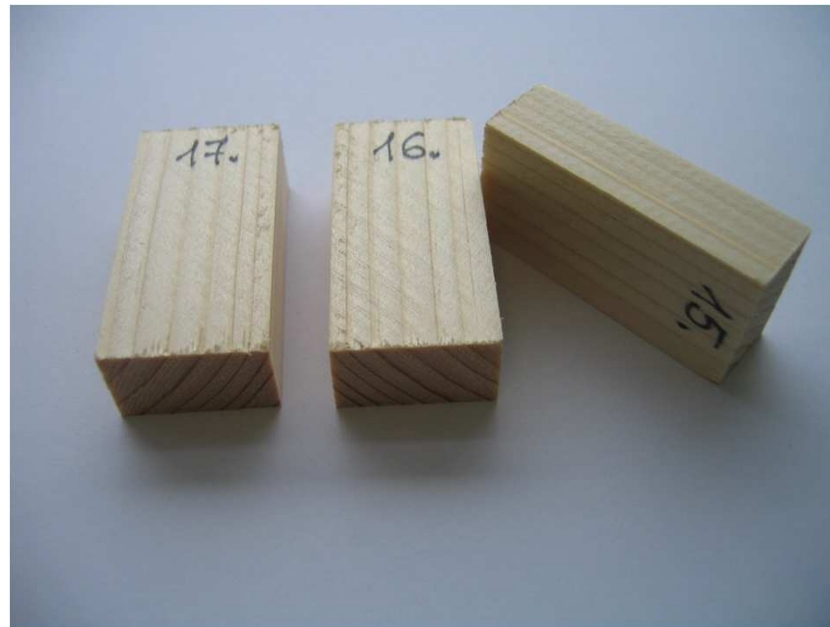
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# Drying-kiln, at 60°C



Specimens at 12% moisture (m/m): 50 x 25 x 15 mm  
Theoretical volume: 18,75 cm<sup>3</sup>

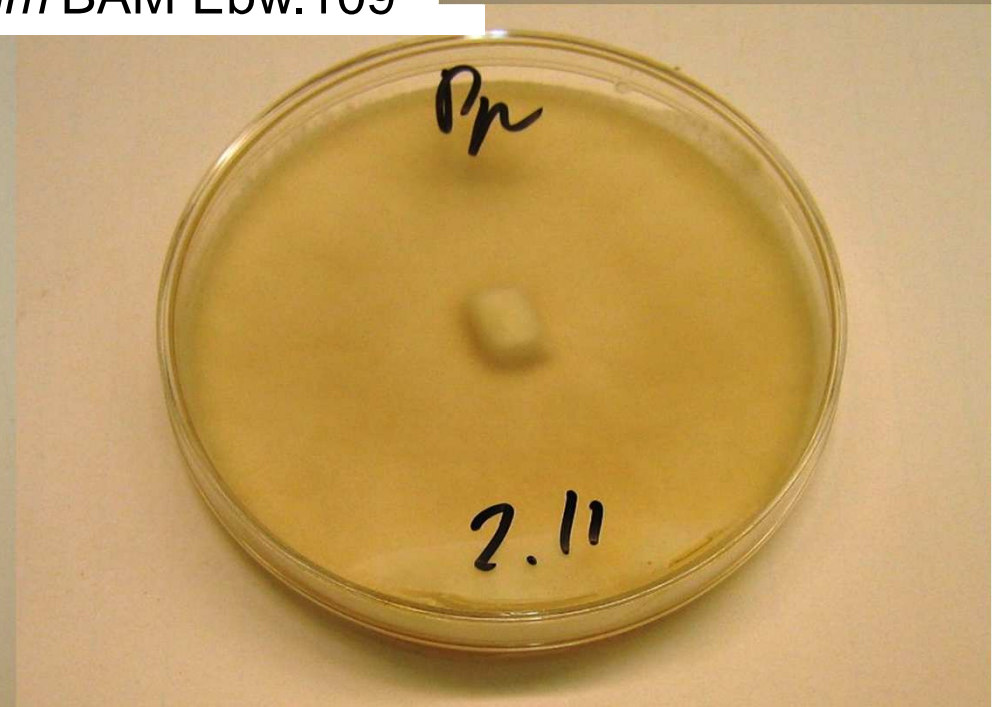
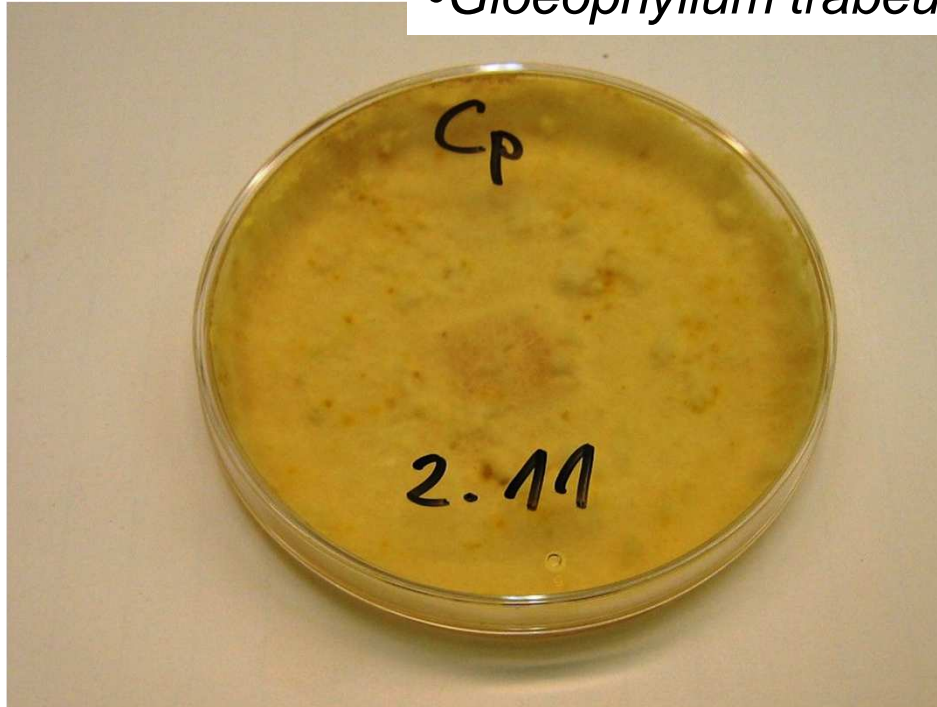


Wood quality:

- Free from cracks, stain, decay, insect damage or other defects
- Growth rings in any direction with exception of completely tangential orientation on the broad faces
- Longitudinal faces parallel to the direction of grain

## Fungal cultures for conifers:

- *Coniophora puteana* BAM Ebw.15
- *Poria placenta* FPRL 280
- *Gloeophyllum trabeum* BAM Ebw.109



# Kolle flasks



Malt-agar medium

## Fungal culture

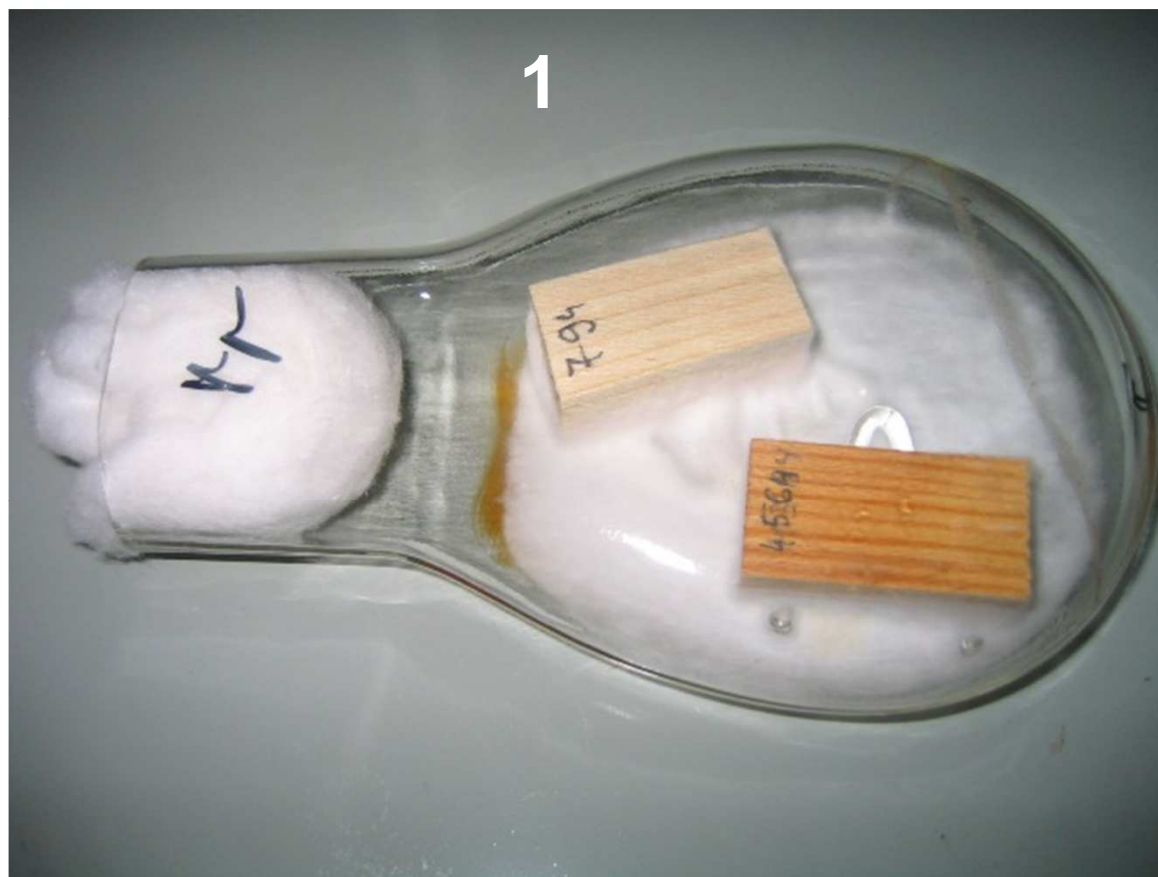




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## Test wood (spruce) + control (pine)





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Test conditions: 22°C/ 70%RH  
Duration:16 weeks



*Coniophora puteana*



*Poria placenta*



*Gloeophyllum trabeum*

Criterion – wood biodegradation i.e. mass loss after the test



*Spruce before test*

*After test (P. placenta)*

## EN 350-1. Classification of the natural durability to wood-destroying fungi

Durability class	Description	Lab test results given as X-value*
1	very durable	$X \leq 0.15$
2	durable	$X > 0.15$ but $\leq 0.30$
3	moderately durable	$X > 0.30$ but $\leq 0.60$
4	slightly durable	$X > 0.60$ but $\leq 0.90$
5	not durable	$X > 0.90$
*X = mean mass loss of test wood/ mean mass loss of control		



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# Summary results

## Spruce durability vs density, extractives, lignin

Spruce clones*	<i>C. puteana</i> x – value	<i>P. placenta</i> x – value	<i>G. trabeum</i> x-value	Density kg/m <sup>3</sup>	Extractives %	Lignin %
A 7	0.97	1.06	0.97	405.8	1.15	28.5
A 10	1.01	1.18	0.93	432.6	1.50	27.0
A 15	1.02	0.84	0.88	408.3	1.35	27.5
B 6	1.00	1.23	0.95	399.1	1.63	28.9
B 10	1.04	1.14	0.95	406.3	1.37	28.0
B 15	1.04	1.19	0.9	408.5	1.10	28.3
V 7	0.93	1.09	0.94	388.1	1.23	27.9
V 9	0.92	1.2	0.88	443.1	1.70	27.6
26	0.96	1.12	0.98	394.5	1.30	27.8
31	1.07	1.19	0.96	361.1	1.75	27.9

\* Clone = 2-3 trees (ramets); tree = 4 specimens

## Discussion

- Acetone extractives **2.22%** in *Picea abies* (Fengel & Wegener, 2003, Wood)
- EN 350-2: Density and natural durability of some wood species against fungi

Species	Origin	Density/ range of mean values at 12% (m/m), kg/m <sup>3</sup>	Durability class
<i>Picea abies</i>	Europe	440- <u>460</u> -470	4 (slightly durable)
<i>Pinus sylvestris</i>	Europe	500-520-540	3 – 4 (moderately durable-..)
<i>Pinus contorta</i>	N. America	430-460-470	3 - 4
<i>Quercus robur</i>	Europe	670- <u>710</u> -760	2 (durable)

Durability – heartwood only, sapwood – all species class 5 (not durable)

# CONCLUSIONS

- No clear relationship among the wood decay, wood density, content of extractives and lignin.
- Juvenile wood prevailed.
- Wood contained more sapwood with lower density and content of extractives.
- Use for interior structures; for outdoor structures -additional protection necessary.
- Recommended for manufacturing of wood based products (medium density fiberboards etc.), furniture or pulp and paper.



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Thank you!

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"Importance of Genetic Factors in Formation of Forest  
Stands with High Adaptability and Qualitative Wood  
Properties" (No 2009/0200/1DP/1.1.1.2.0/09/APIA/VIAA/146)**