



**Faculty  
of Forestry  
and Wood  
Technology**

**COST Action FP 1407**

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**INFLUENCE OF STEAMING AT LOWER TEMPERATURES  
ON PERMANENT FIXATION OF COMPRESSIVE  
DEFORMATION OF DENSIFIED WOOD**

**Mendel  
University  
in Brno**



## FIXATION OF COMPRESSIVE DEFORMATION

### Introduction

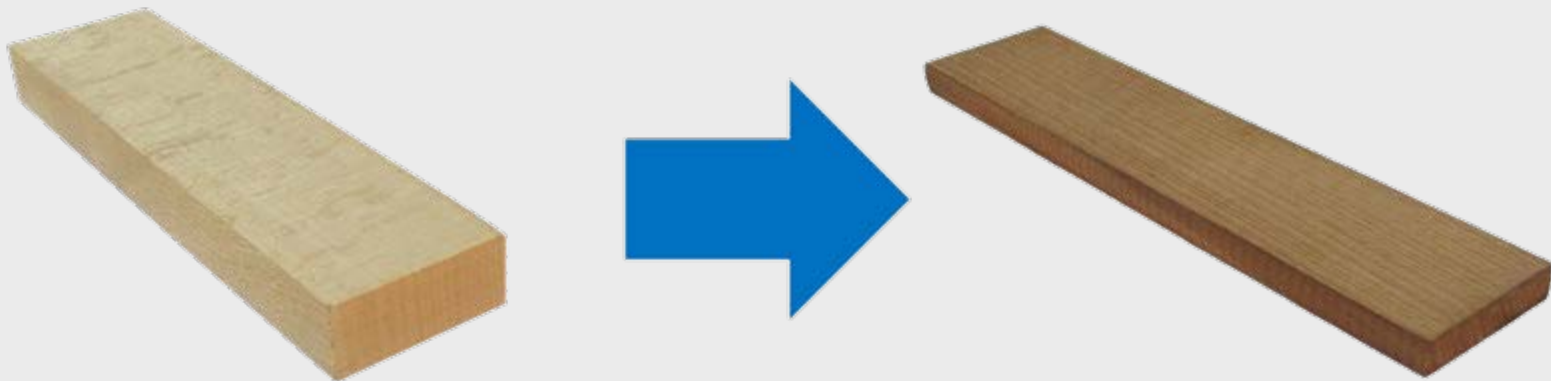
- 1) The aim and the reasons
- 2) Theory and calculations
- 3) Methods and first results

### Conclusion



## The aim

- To reach complete fixation of compressive deformation at temperature of 90°C
- To develop a new material that is strong and stable



## Why to densify wood?

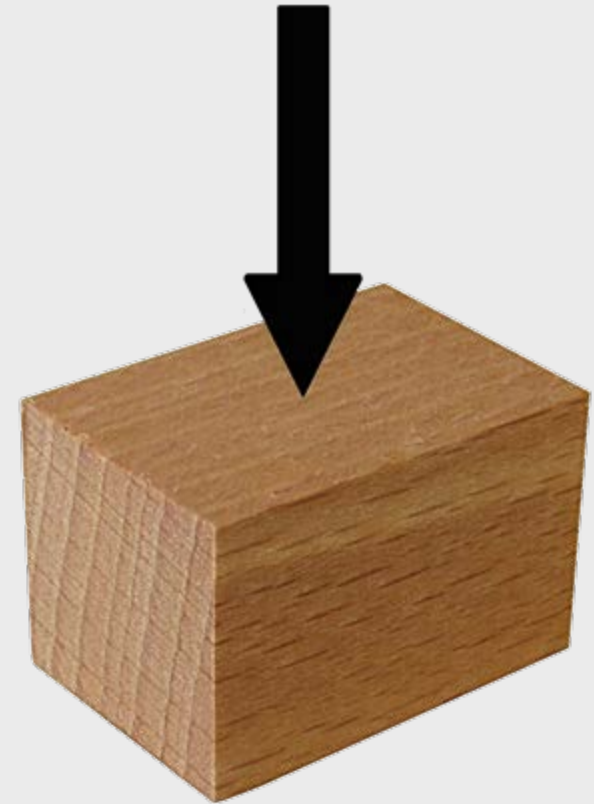
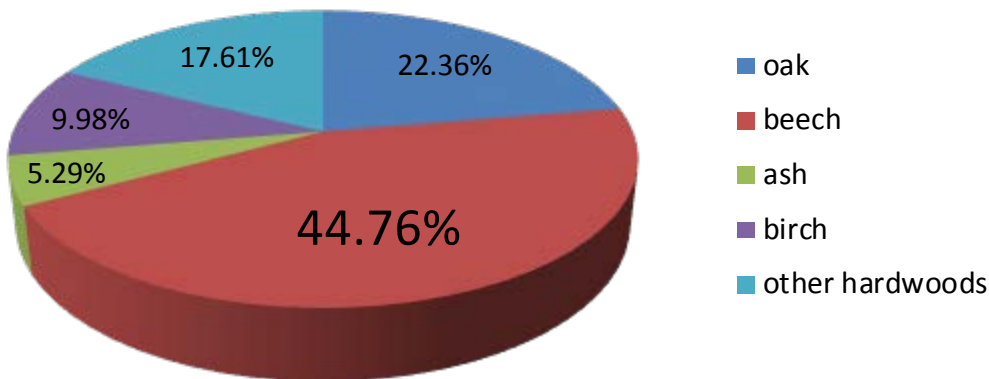
- Improved mechanical properties
- Substitute for tropical woods
- Better utilization of renewable material



## Why to densify beech wood?

- Available
- Easy to compress
- New utilization

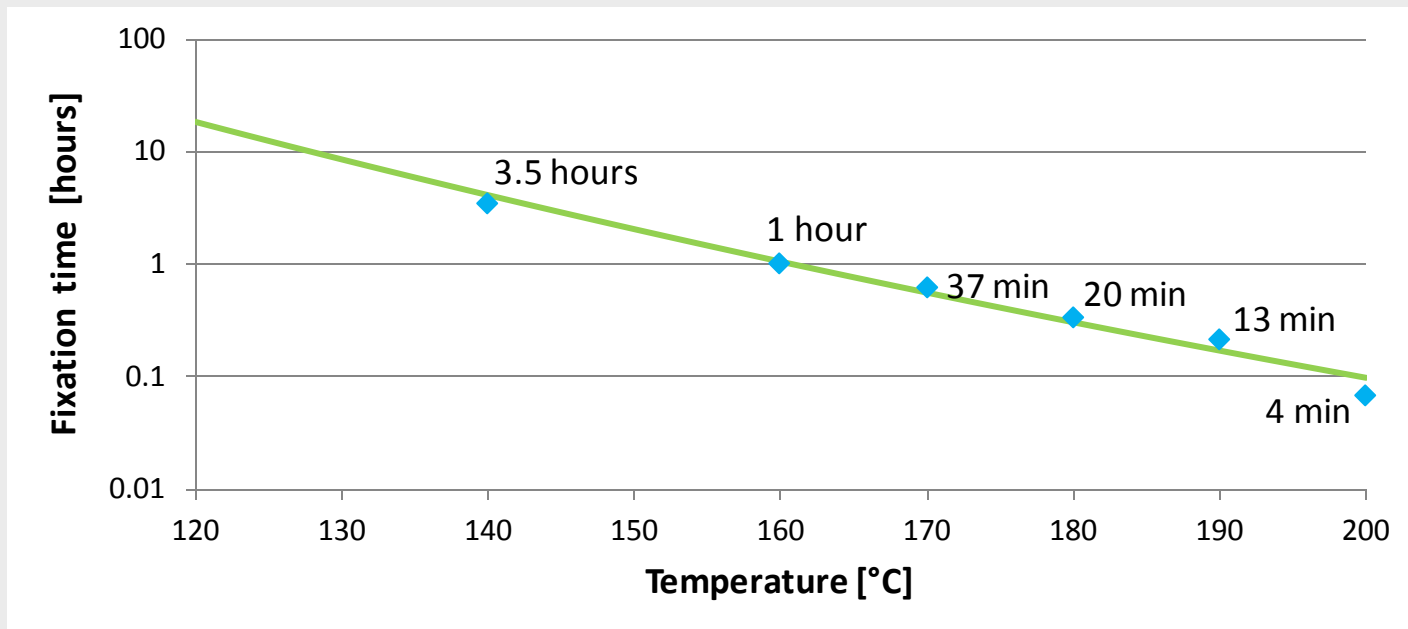
Hardwoods harvested in the Czech Republic in 2014



Beech wood  
(*Fagus sylvatica*)

## Why to use steaming at temperature of 90°C?

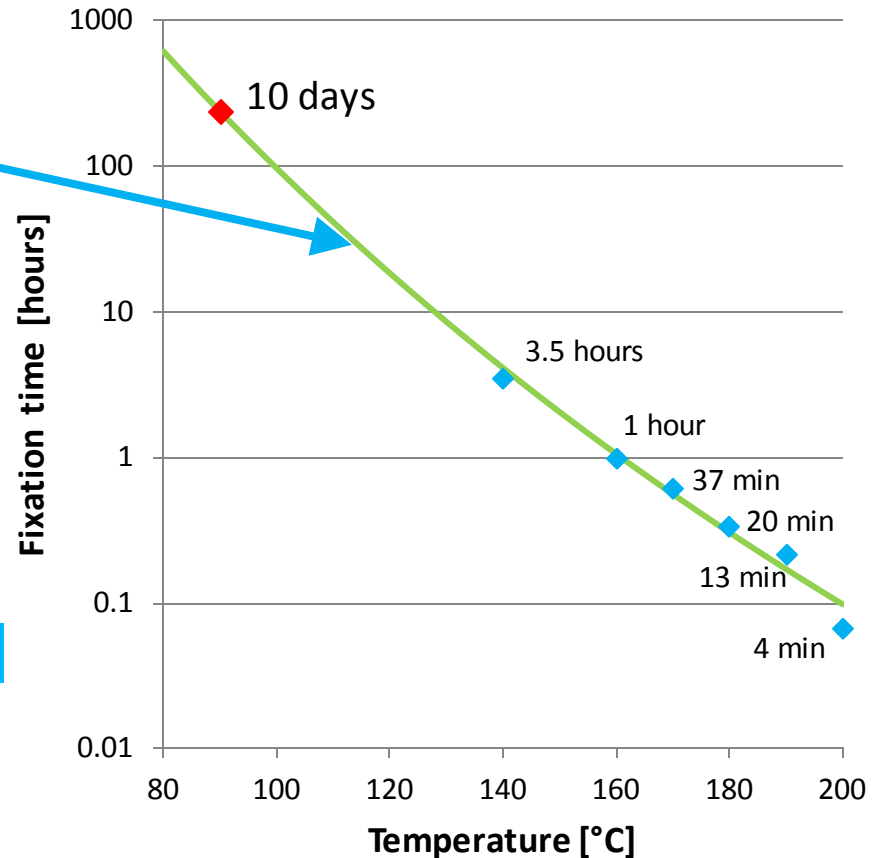
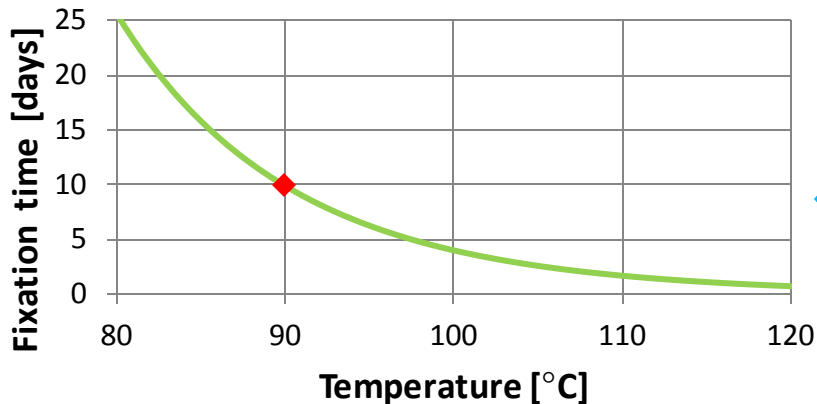
- Lower negative impact on strength
- Processed at normal pressure
- Suitable for thick material



Time of treatment in saturated steam  
necessary to achieve complete fixation

$$t(T, h) = \alpha e^{E_A/RT}$$

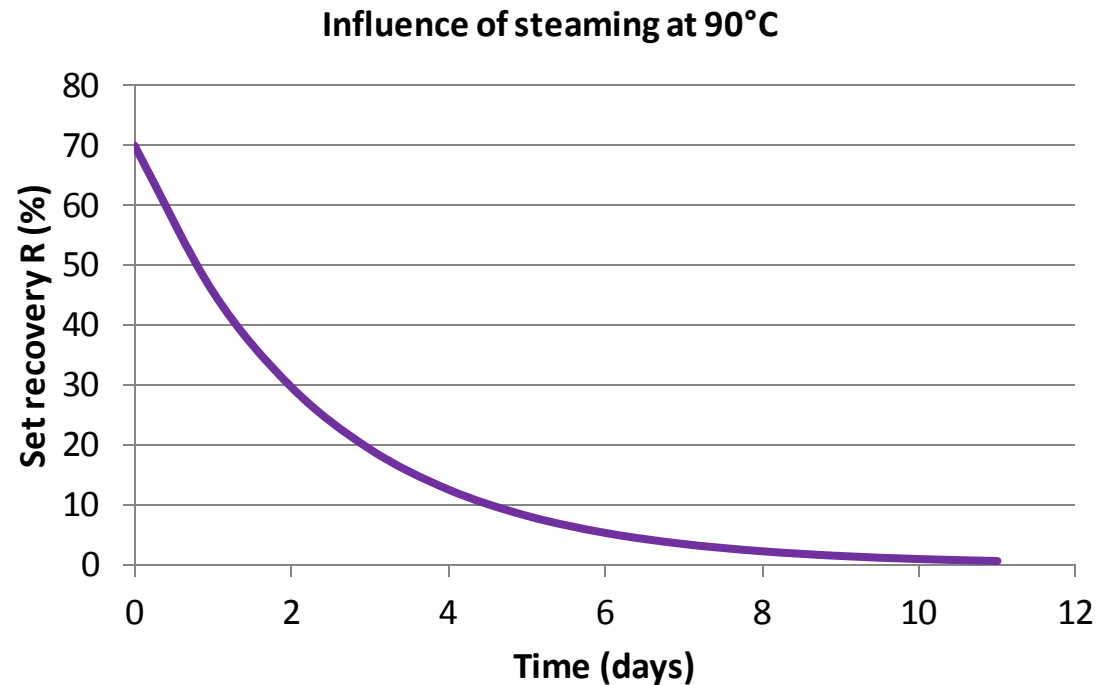
*Navi and Sandberg 2012*



Influence of steaming time on compression set recovery  
at temperature of 90°C

$$R(T, t) = R_0 \cdot e^{-kt}$$

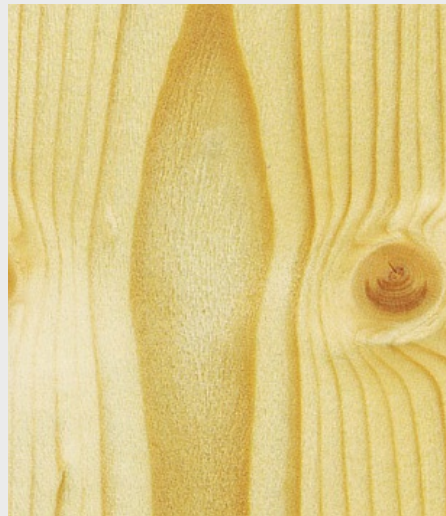
*10-day process*



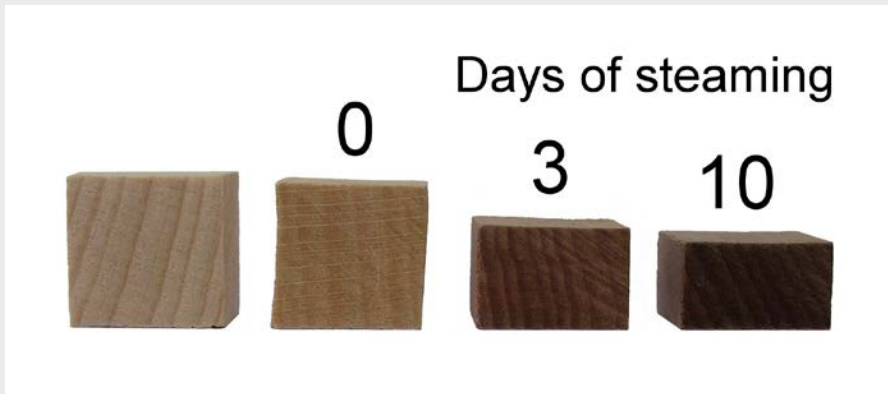


#### Material and methods

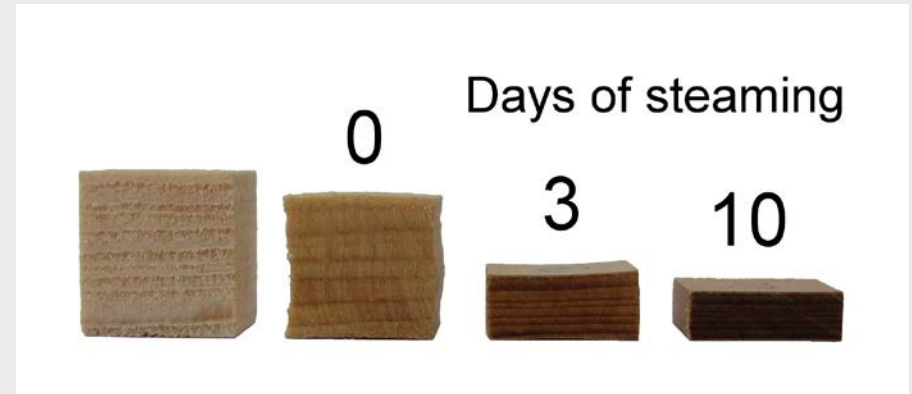
- Beech and spruce wood
- Compression of plasticized specimens
- Treatment in saturated steam at 90°C
- Measurement of compression set recovery



Results of compression set recovery  
after one cycle of swelling in water and drying

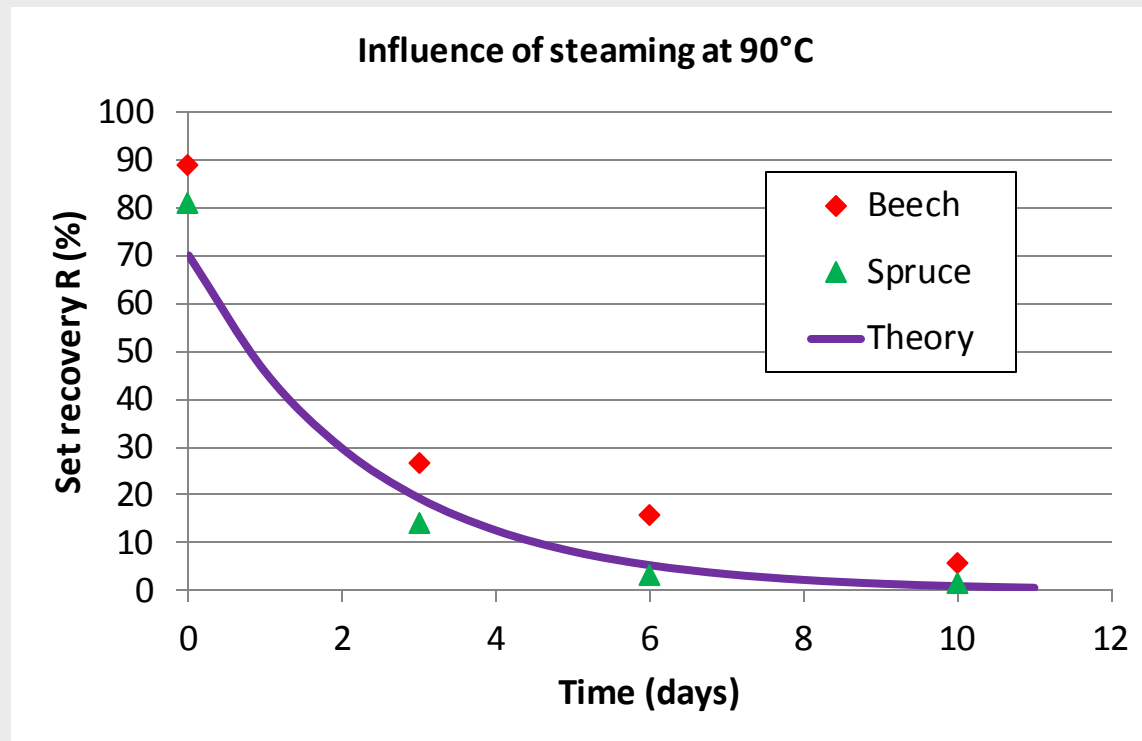
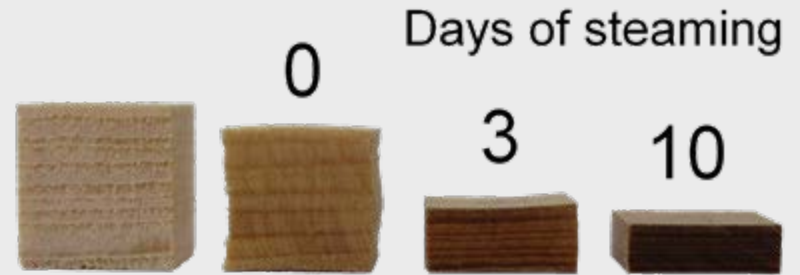


Beech (*Fagus sylvatica*)



Spruce (*Picea excelsa*)

Results of compression set recovery



## FIXATION OF COMPRESSIVE DEFORMATION



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**Thank you very much for your attention.**