

Formation of cracks in wooden elements – design, moisture and durability aspects

L. Meyer-Veltrup¹, C. Brischke¹, C. Goritzka¹, U. Hundhausen²

¹Leibniz University Hannover, Faculty of Architecture and Landscape Sciences, Germany

²Norwegian Institute of Wood Technology NTI, Norway



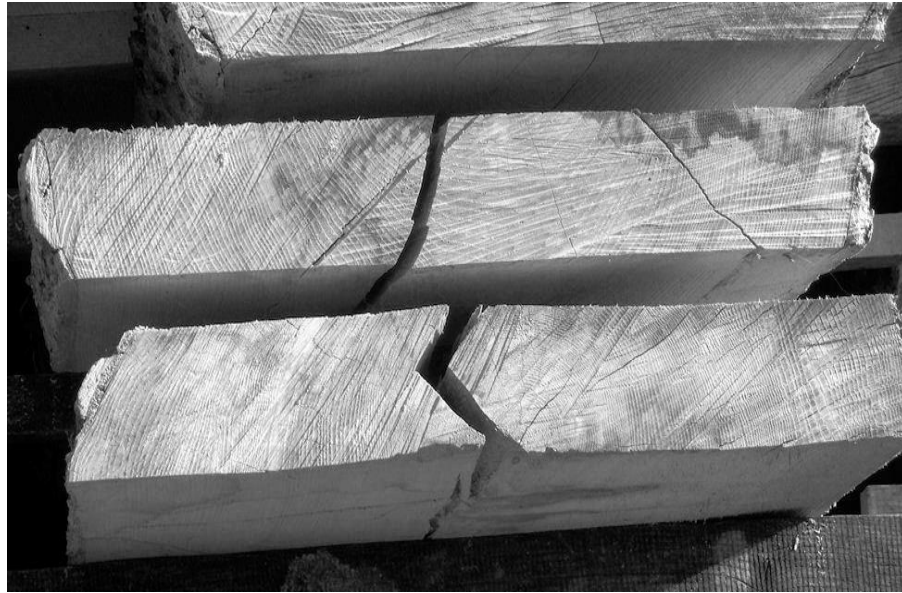
Leibniz
Universität
Hannover

COST FP 1303 4th Conference
24th - 25th February 2016, Madrid, Spain

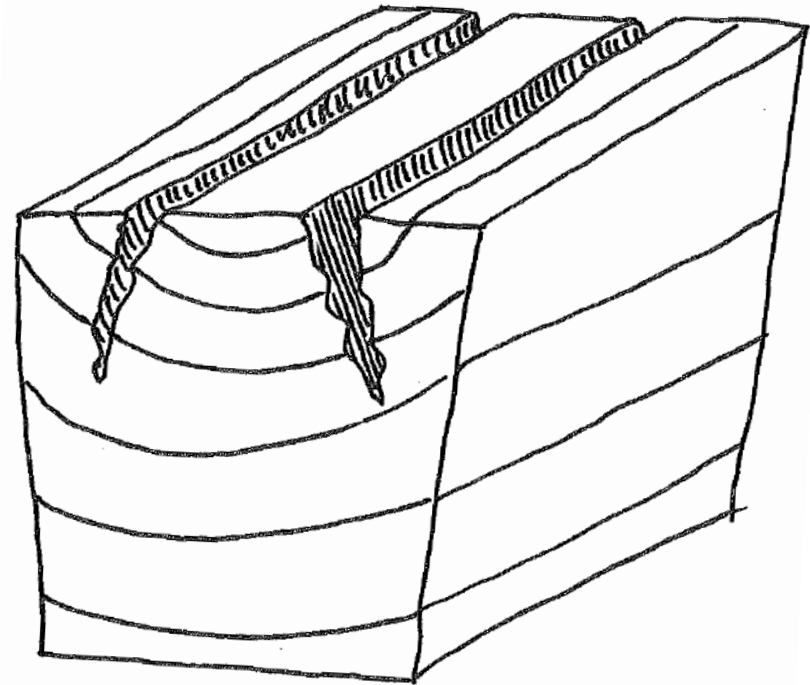
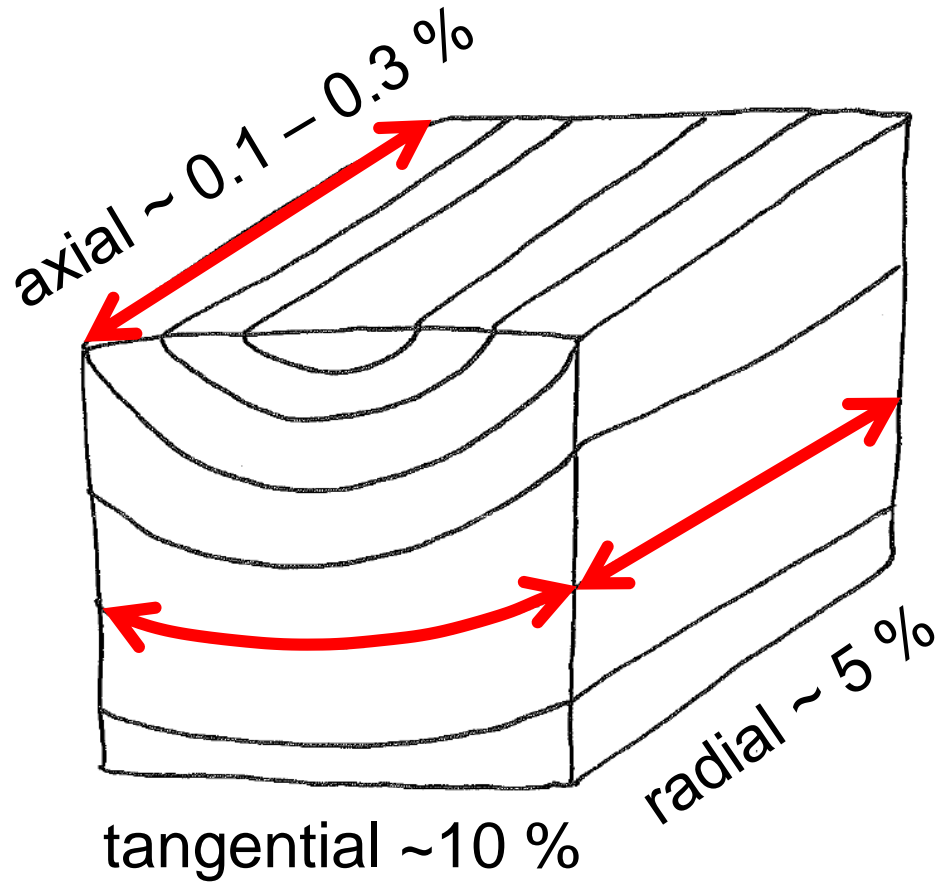
Crack development

11
102
1004

Leibniz
Universität
Hannover



Crack development



Reduced surface quality



Splinters



Mechanical defects



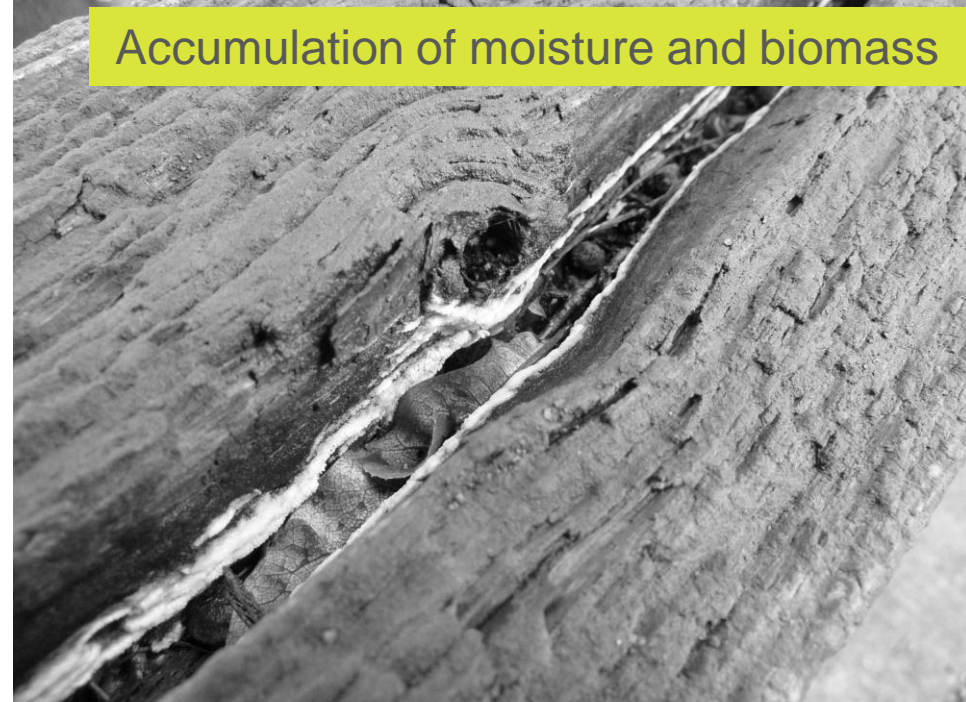
Opening of shell treatment



Coating flake offs



Accumulation of moisture and biomass



Decay development



Open Questions

- Do cracks provoke decay ?

→ Dimension trial

- If so...do cracks provoke high moisture content ?

→ Crack study 1

- If so...which materials are susceptible to cracking ?

→ Crack study 2

Dimension trial

11
102
100/4

Leibniz
Universität
Hannover



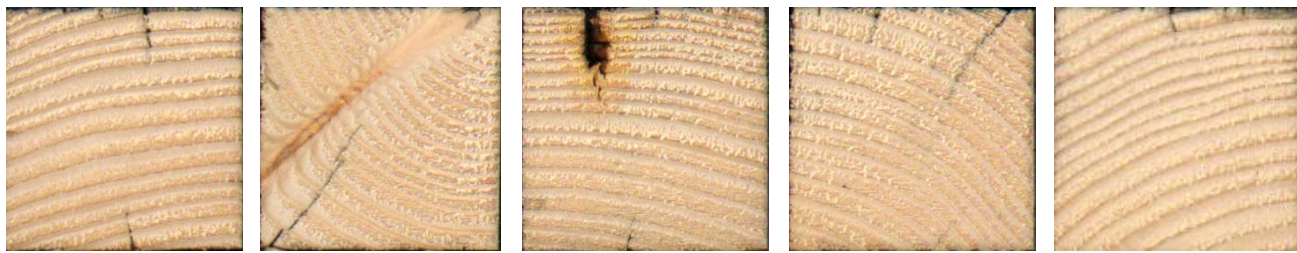
- Exposed 2009-2014
- Single members with different cross sections
- Scots pine and Norway spruce

Decay patterns

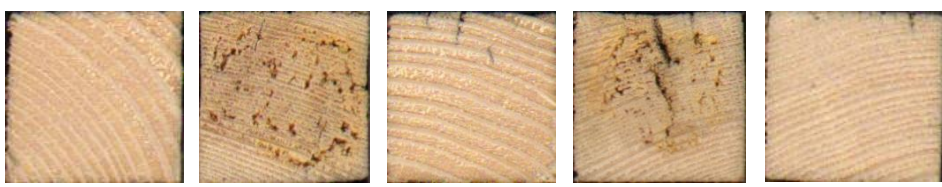
→ Norway spruce



50 x 50 mm



35.4 x 35.4 mm



25 x 25 mm

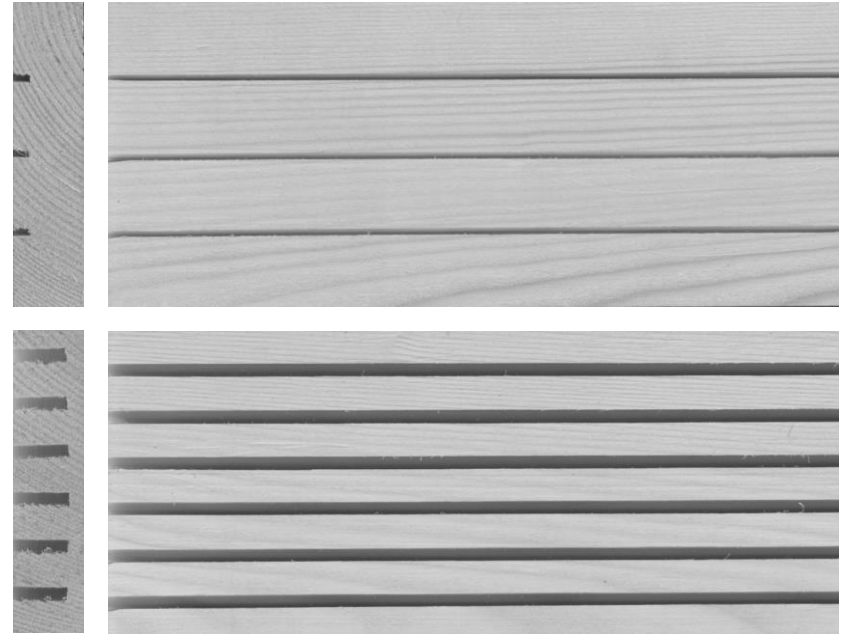
Findings - Dimension trial

- **No clear effect of cross section on decay**
- **Weak points for decay development:**
 - **Cracks**
 - **Contact faces**
 - **BUT: Interior rot also occurs**
- **What about moisture?**

Crack study 1

11
102
1004

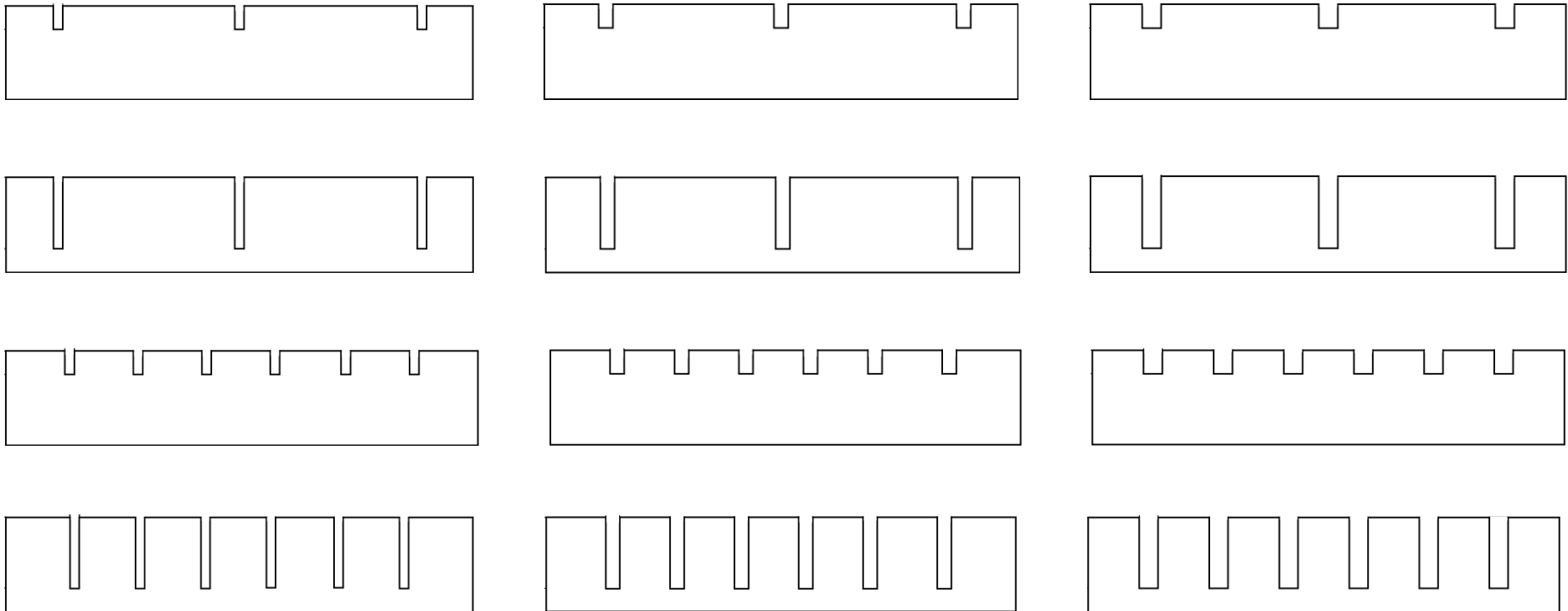
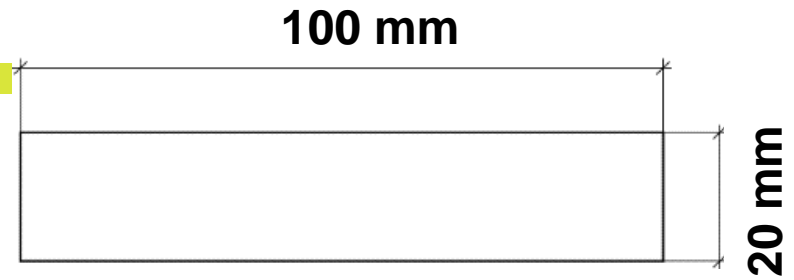
Leibniz
Universität
Hannover



- Exposed in 2015
- Norway spruce with artificial cracks
- Gravimetric MC measurements 05.2015 – 08.2015

Crack study 1

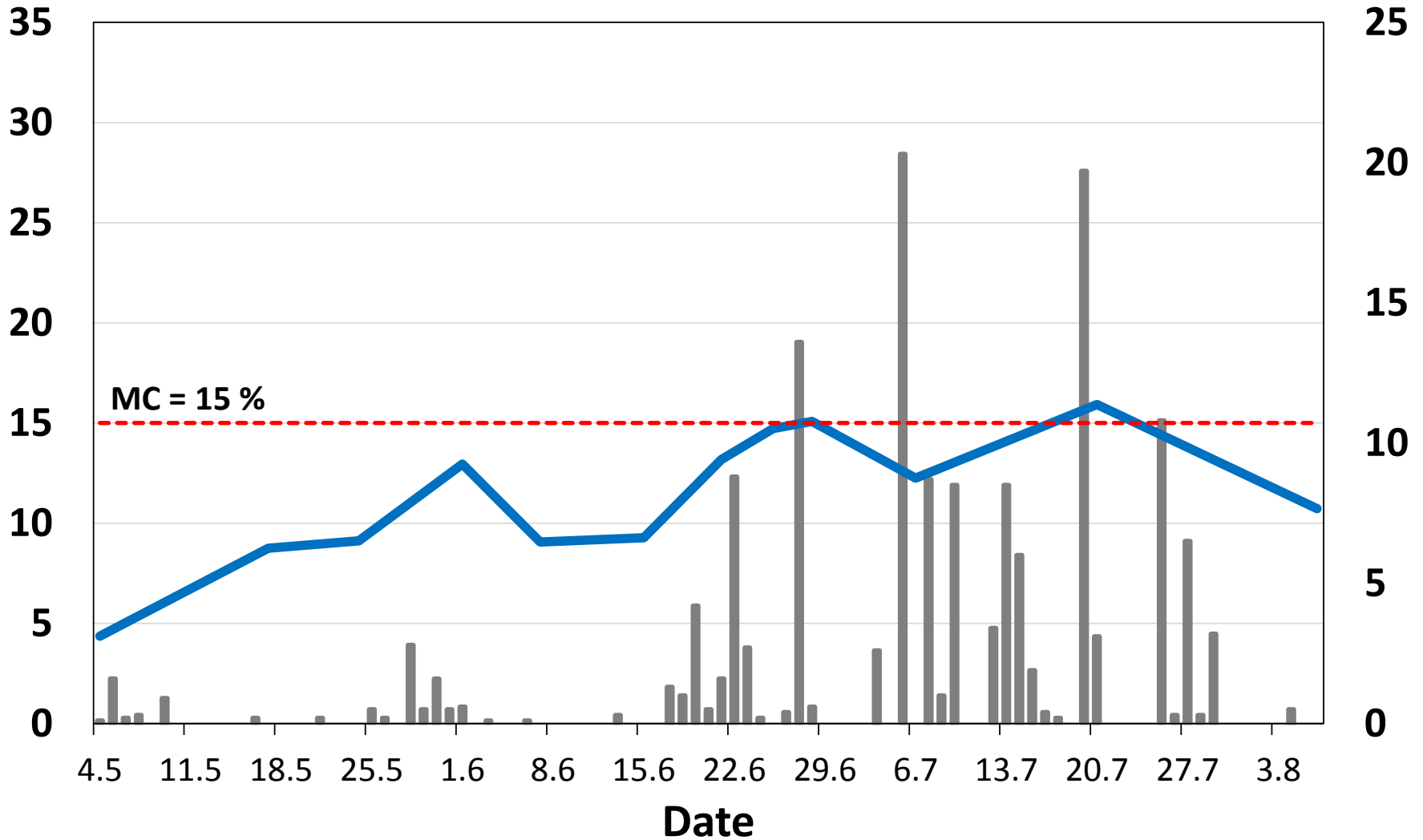
- Norway spruce (100 x 20 x 300 mm³)
- Artificial cracks
- Varying in width (0 - 3 mm), depth (5 - 15 mm) and number



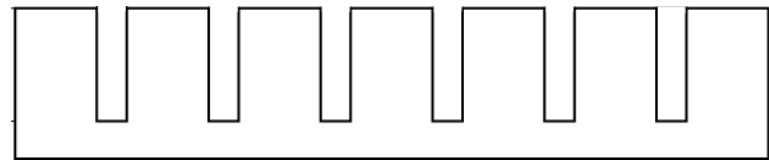
Spruce – no cracks

Moisture content [%]

Precipitation [mm]

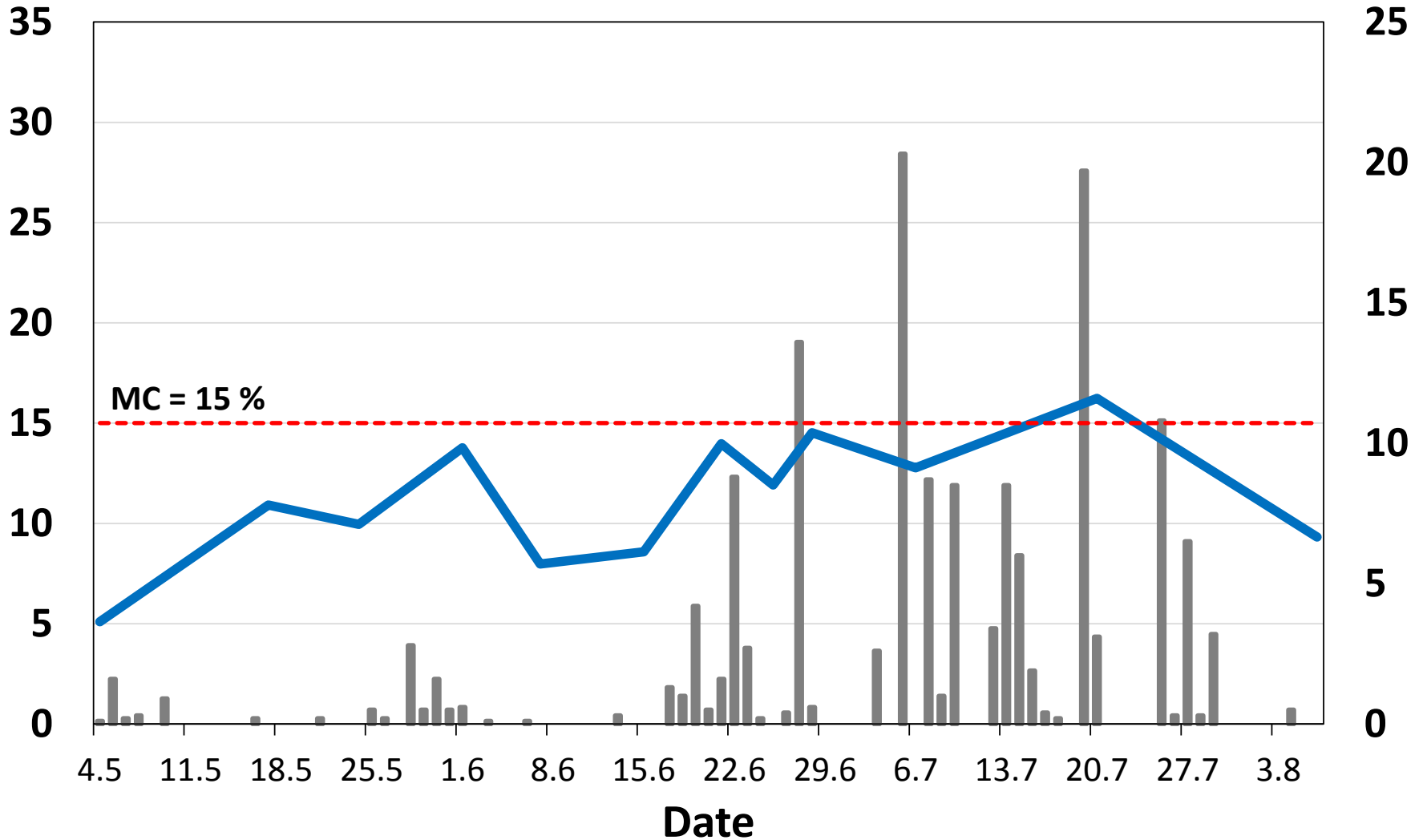


Spruce – extreme cracks



Moisture content [%]

Precipitation [mm]



Findings - Crack study 1

1 1
1 0 2
1 0 0 4

Leibniz
Universität
Hannover

- No significant effect of artificial cracks on MC
- Similar findings for naturally developed cracks
- Note: limited exposure time (3 months)
- What about cracking of different materials?

Crack study 2

11
102
100/4

Leibniz
Universität
Hannover

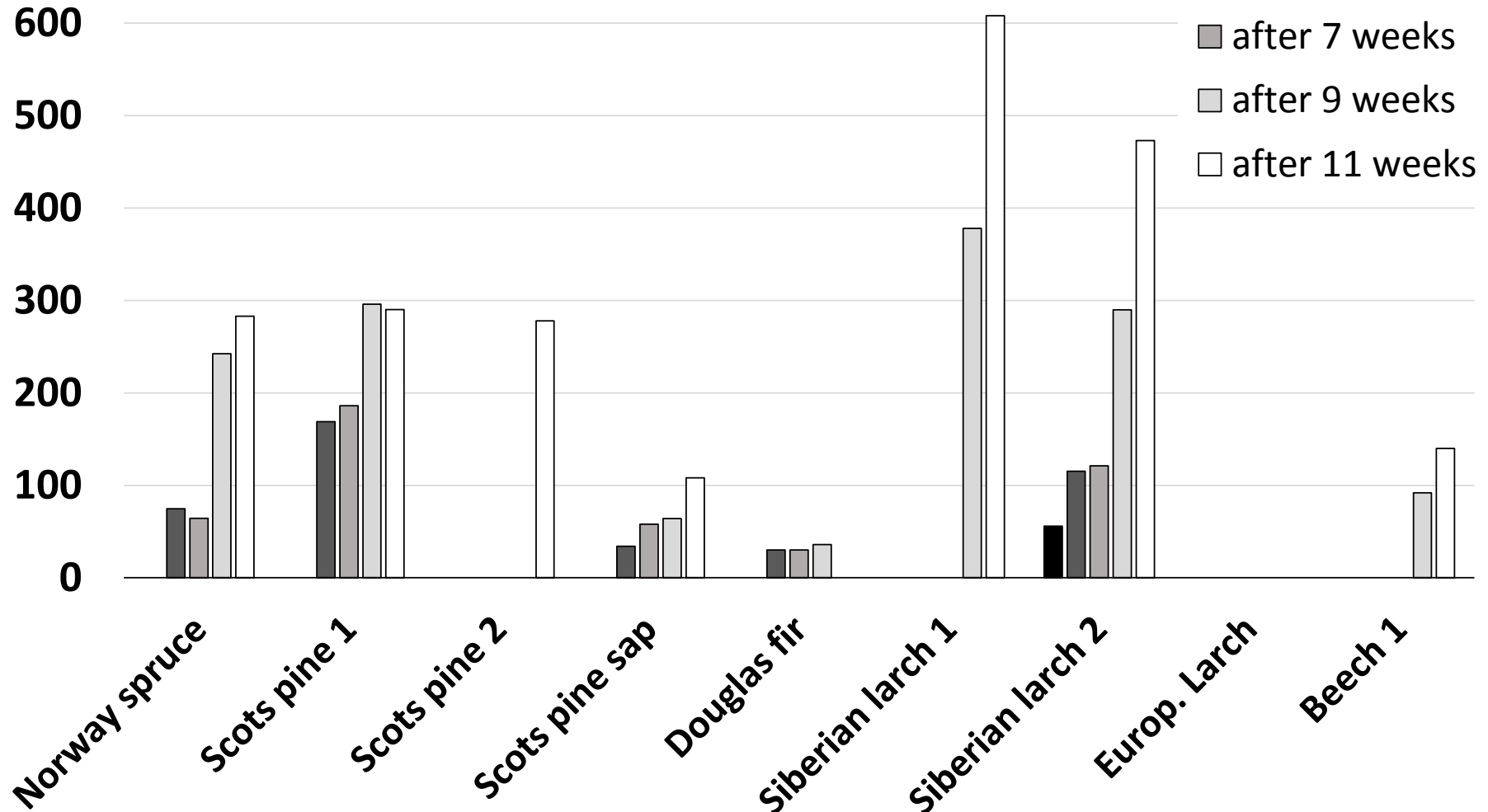


- Exposed in 2015
- 45 wood materials
- Determination of crack length and MC

Native wood species		Treated materials
Norway spruce	Black locust	Acetylated Radiata pine
Scots pine	Bangkirai	Furfurylated Radiata pine
Scots pine sap	Teak	Furfurylated Scots pine
Douglas fir	Ash	TMT Norway spruce
Siberian larch		TMT Scots pine
European larch		TMT Ash
Beech		TMT Beech
English oak		OHT Ash
Norway maple		TMT+Dens. Spruce
Elm		TMT+Royal Scots pine
Cherry		Different Royal Lowey and Full cell
Birch		Wolmanit CX8
Poplar		WPC & BPC

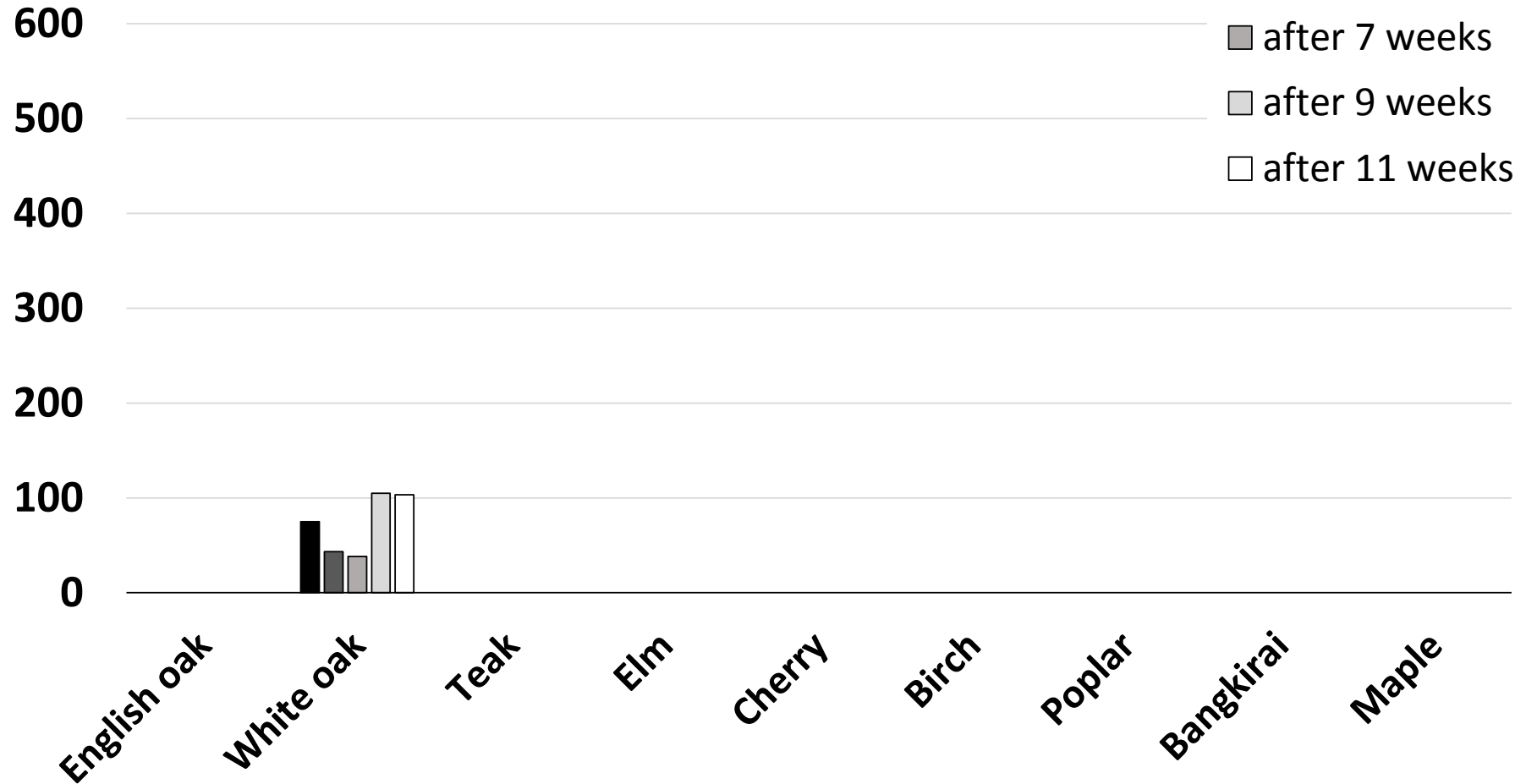
Untreated materials

Mean crack length sum [mm/specimen]



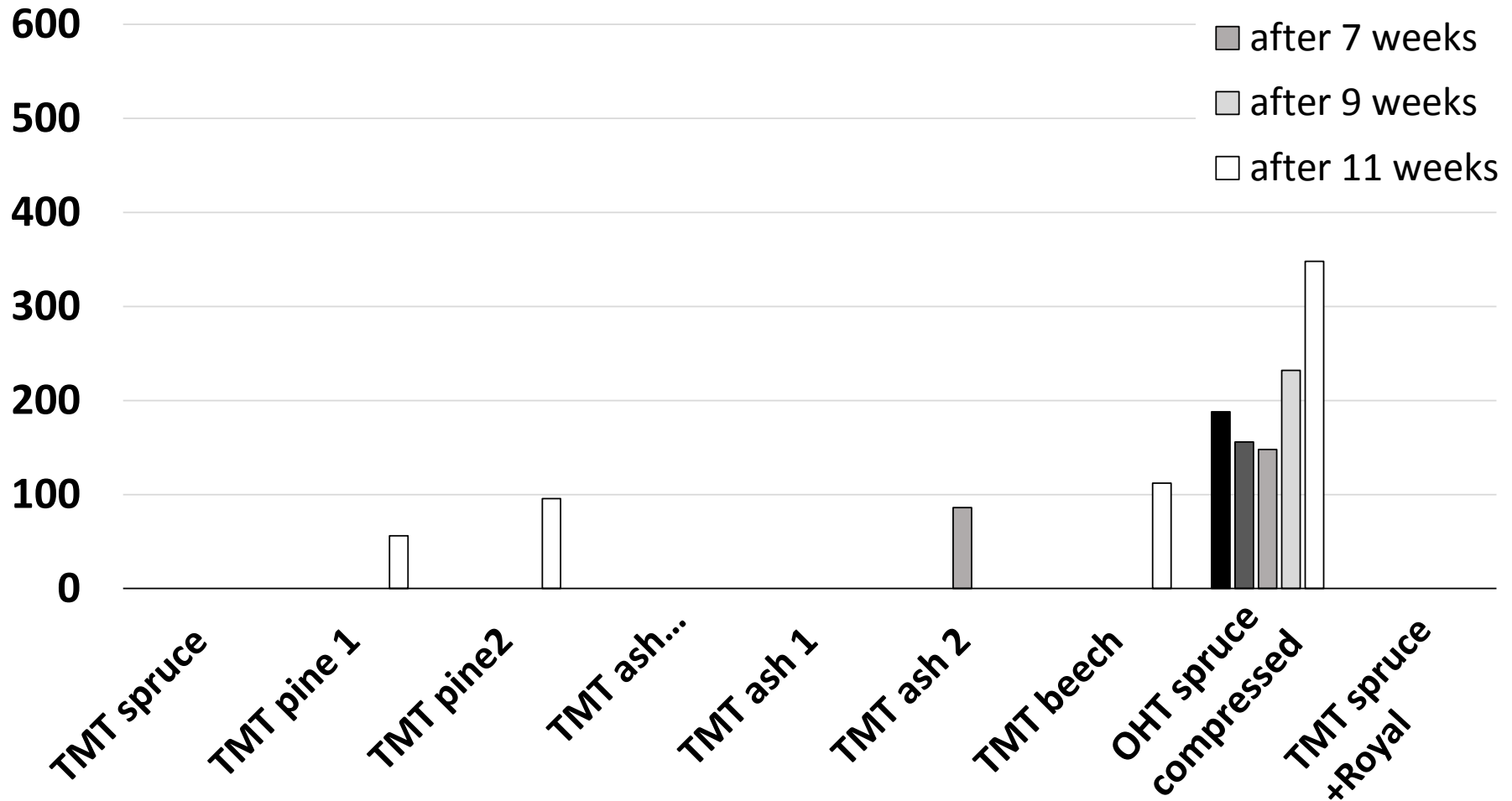
Untreated materials

Mean crack length sum [mm/specimen]



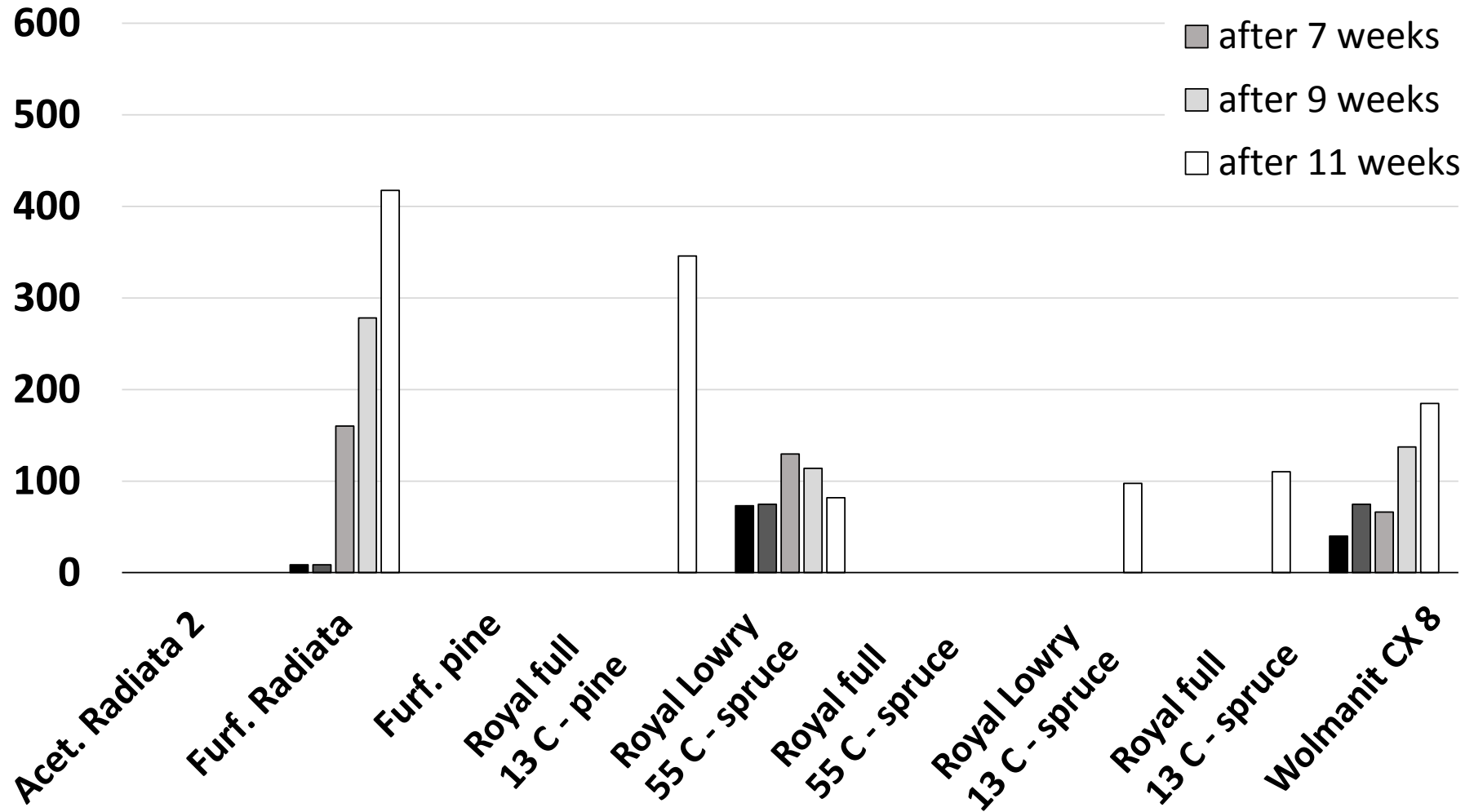
Treated materials

Mean crack length sum [mm/specimen]



Treated materials

Mean crack length sum [mm/specimen]



Findings - Crack study 2

- **Significant differences in crack susceptibility between materials**
- **Time-dependent formation of cracks**
- **Again: No clear effect of cracks on MC, even within one wood species**

Conclusions

- Cracks can be a starting point for rot
 - No clear effect of cracks on MC
(and resulting MC induced decay risk)
 - Formation of cracks differs a lot between materials
 - Most cracks on Scots pine, Norway spruce and Siberian larch
 - Drastic effect on optical appearance
- Future task: 1) Study cracks in bigger components
2) Monitor MC close to and remote from cracks

Thank you...

11
102
1004

Leibniz
Universität
Hannover

... for your attention