



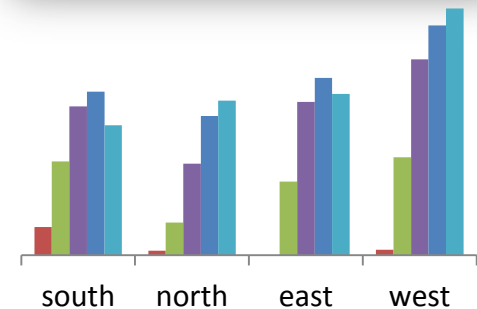
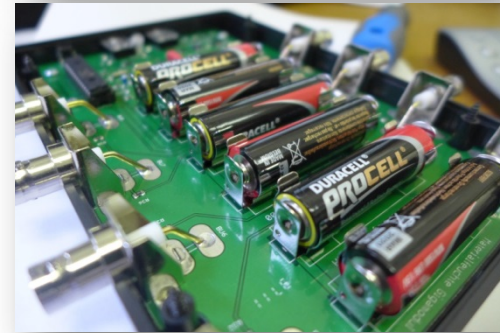
DEVELOPMENT OF THE BLUE STAIN FUNGI ON THE FAÇADE OF THE MODEL HOUSE IN LJUBLJANA

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THE AIM OF THE PRESENTATION

- Introduction of model house
 - ▣ Construction
 - ▣ Materials
 - ▣ Parameters that are monitored

- To show the first results
 - ▣ Blue stain development on some of the materials



MODEL HOUSE

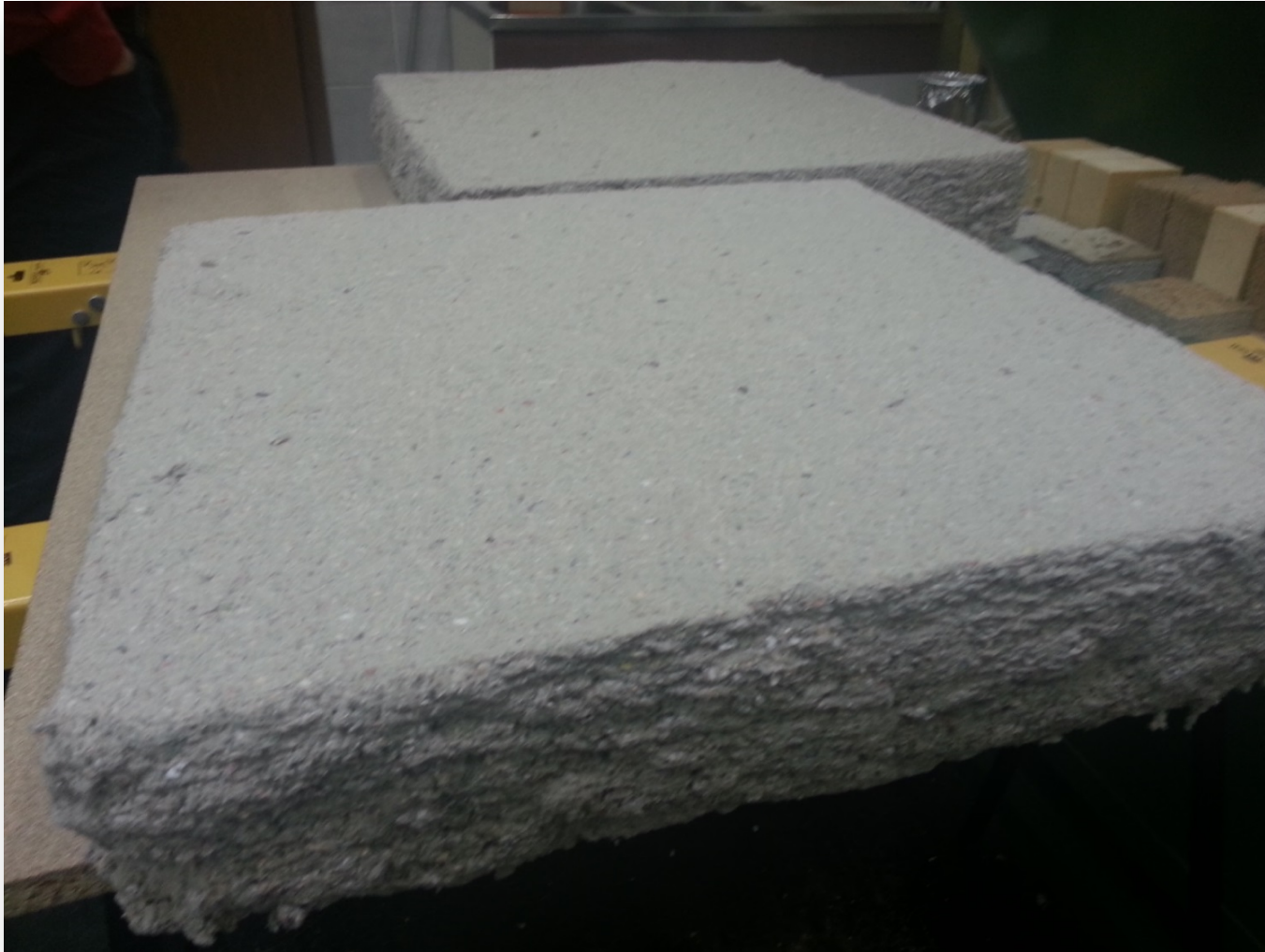


- in the garden of the Department of Wood Science and Technology
- made of 26 different bio based materials

Construction



Loose-fill cellulose fibres



Secondary water-shedding layer, watertight and vapour-open membrane



The wooden façade applied on this object has protective and aesthetic roles



The façade on the model house was finished in the mid of October 2013.

The decking in front of the house is made of the same materials.



Façade and decking

- Made of 22 different wooden based materials
- Façade elements are positioned horizontally and screwed on the vertically positioned, copper-ethanolamine treated wood elements
- Beside the untreated control specimens, 4 different treatments were applied to the materials:
 - ▣ Copper-ethanolamine impregnation (Silvanolin®)
 - ▣ Montan wax impregnation (Silvacera®)
 - ▣ Acrylic surface coating (Silvanol® Lazura B)
 - ▣ Thermal modification (Silvapro® Wood)



Materials used in the façade and decking application on the model house

Wood species	Treatment
Norway spruce	Untreated
	Treated with montan wax
	Surface coated with acrylic coating
	Treated with copper-ethanolamine solution
	Treated with copper-ethanolamine solution and montan wax
	Thermally modified
	Thermally modified and impregnated with montan wax
	Thermally modified and impregnated with copper-ethanolamine
	Thermally modified and coated with acrylic coating
European larch	Untreated
	Thermally modified
Beech	Untreated
	Thermally modified
	Thermally modified and impregnated with montan wax
Sweet chestnut	Untreated
Scots pine sapwood	Untreated
Scots pine heartwood	Untreated
Black poplar	Untreated
	Thermally modified
Ash	Untreated
	Thermally modified

The orientation of the model house

West

East

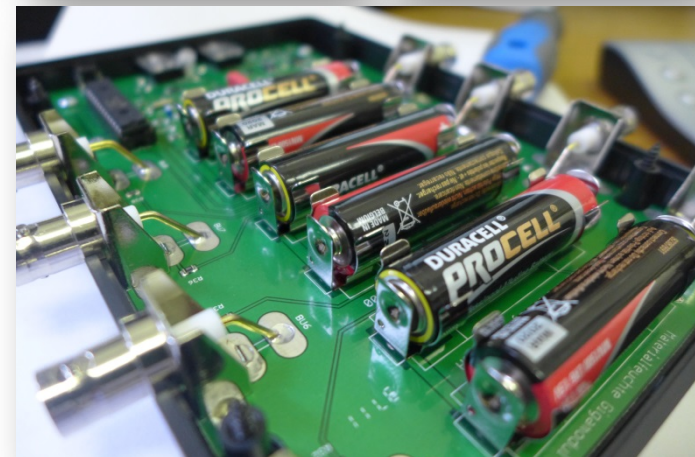


South

North

Parameters that are monitored

- Wood moisture
- Wood temperature
- Visual assessment of blue staining fungi
- Colour is recorded using the CIELab system
- Degradation and corrosion of fasteners
- Fungi degradation
- Temperature
- HCHO
- VOC
- RH



FIRST RESULTS

- Development of mould and blue staining fungi
- Wood Fungi and insects – no attack or softness
- Colour changes
- Wood moisture

Wood moisture and temperature



Measurements are performed and logged with
16 Scanntronik gigamodule (moisture) and
Thermofox universal (temperature) devices.





Colour changes



8.11.2013



8.10.2014



8.11.2013

Development of mould and blue staining fungi



8.10.2014

Visual assessment of blue staining

According to modified standard EN 152, except that we used different rating scale (from 0 to 4)



Rating	Classification	Definition
0	No disfigurement	No surface disfigurement can be detected visually on the surface.
1	Weak disfigurement	On the surface we can notice first small spots, which are not in the colonies.
2	Slight disfigurement	The surface exhibits only a few individual small colonies none larger than 1.5 mm in width and 4 mm in length.
3	Moderate disfigurement	The surface is colonized up to a maximum of one third of the total area.
4	Severe disfigurement	More than one third of the surface area is colonised.

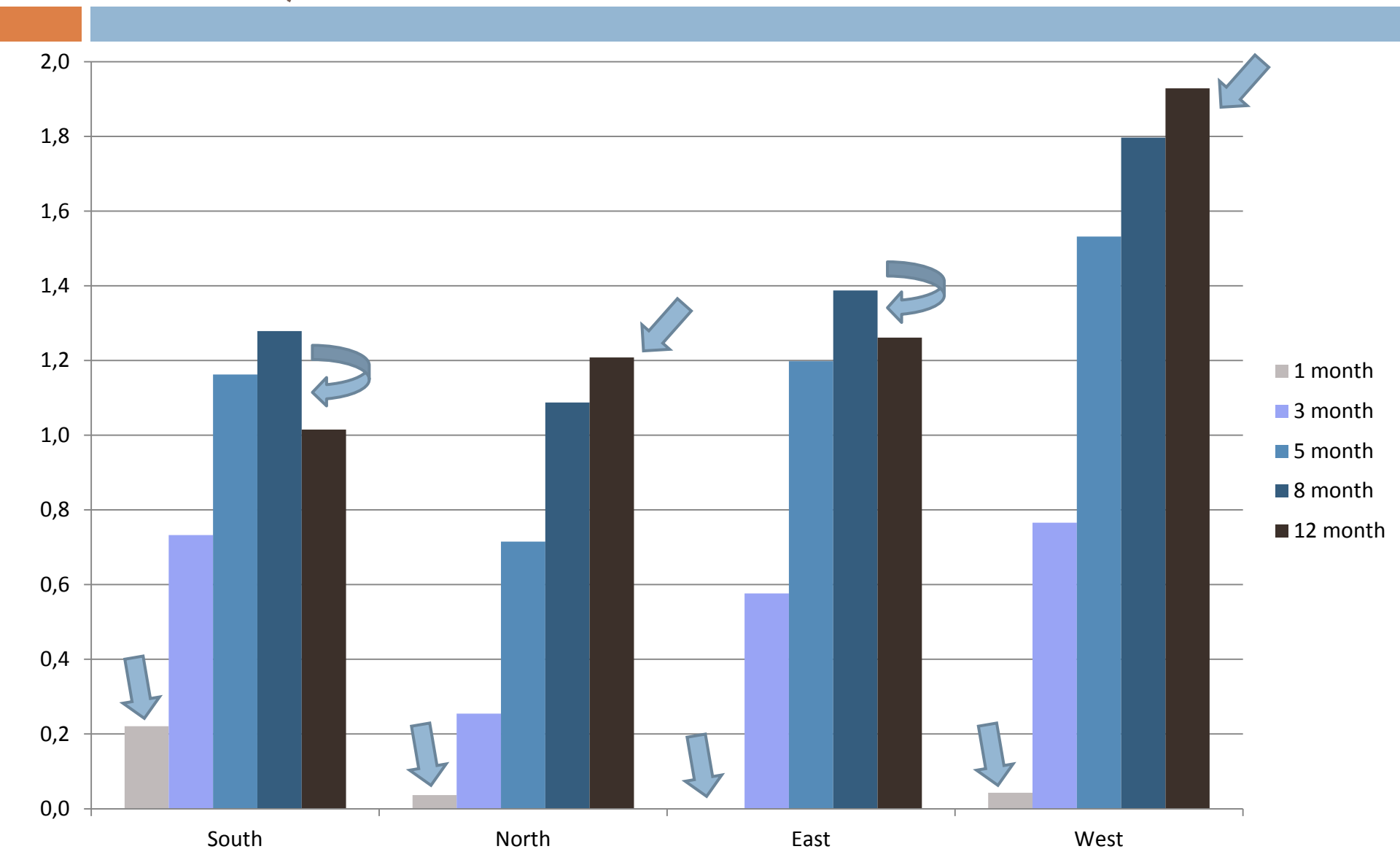
RESULTS

- Development of mould and blue staining fungi on some of the materials
 - ▣ First year of exposure
 - ▣ Influence of the:
 - Orientation
 - Wood species and treatment solution
 - Construction
 - Weathering and temperatures

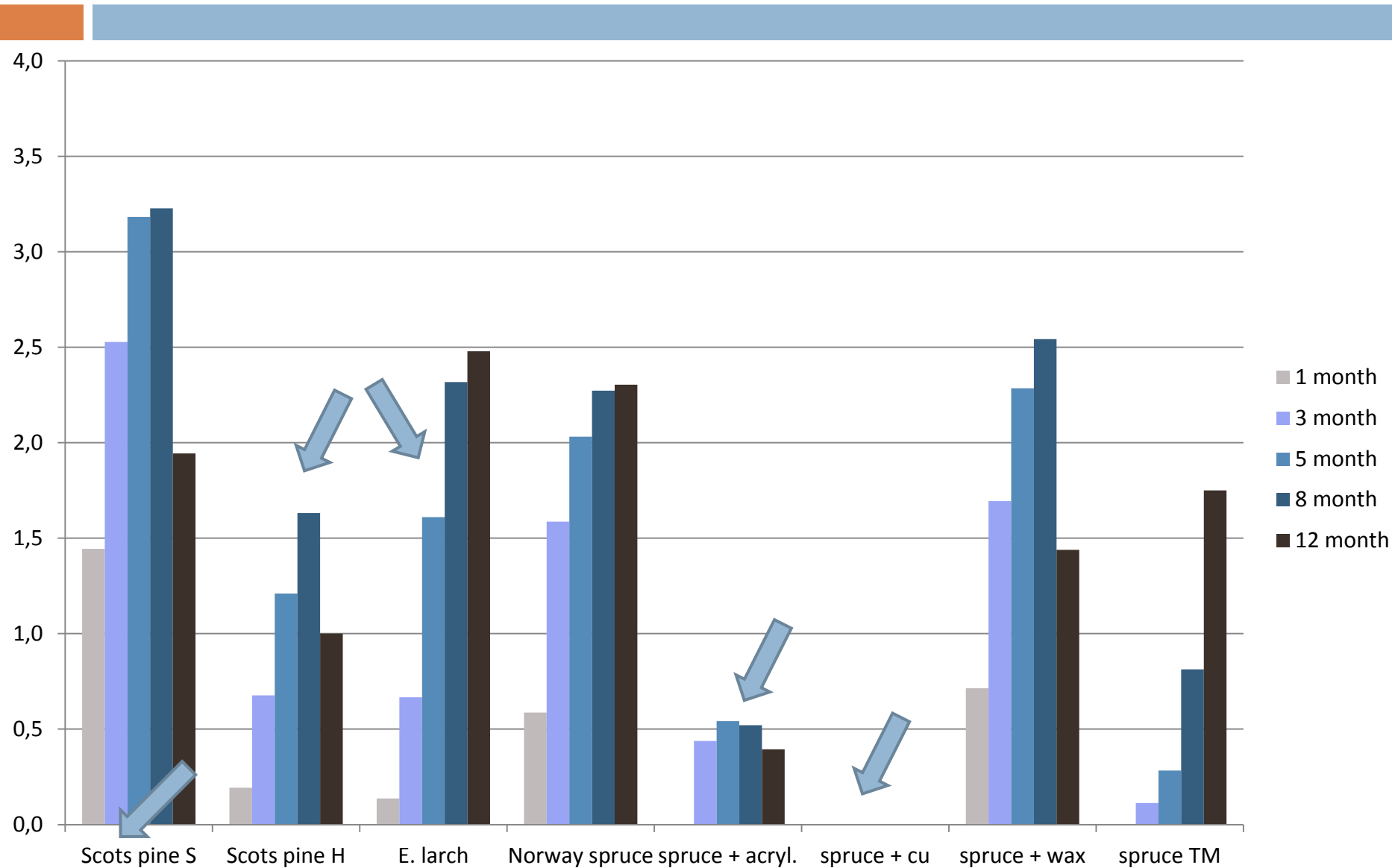
Materials

		Treatment solutions					
Wood specimens	Latin name of wood specimens	Non treated	Termally modified	vacuum pressure impregnation with copper-ethanolamine wood preservatives	vacuum pressure impregnation with emulsion of montan wax	acrylic coating	Acronyms
Norway spruce	<i>Picea abies</i> Karst.	X	X	X	X	X	Norway spruce spruce TM spruce + cu spruce + wax spruce + acryl.
European larch	<i>Larix decidua</i> Mill.	X					E. larch
Scots pine (softwood)	<i>Pinus sylvestris</i>	X					Scots pine S
Scots pine (hardwood)	<i>Pinus sylvestris</i>	X					Scots pine H

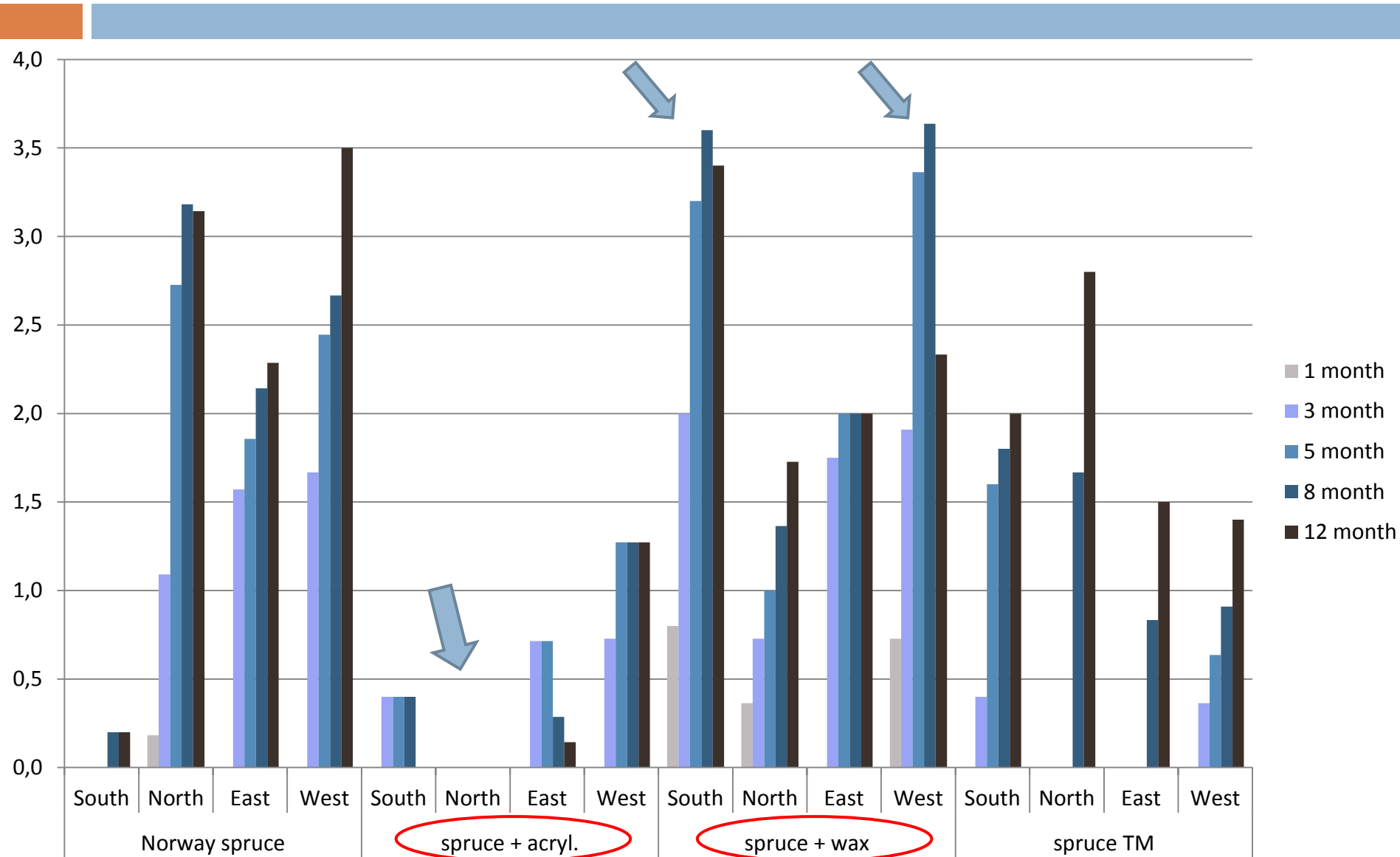
The influence of the orientation on the development of blue stain fungi during the first year of exposure (average result of visual assessment)



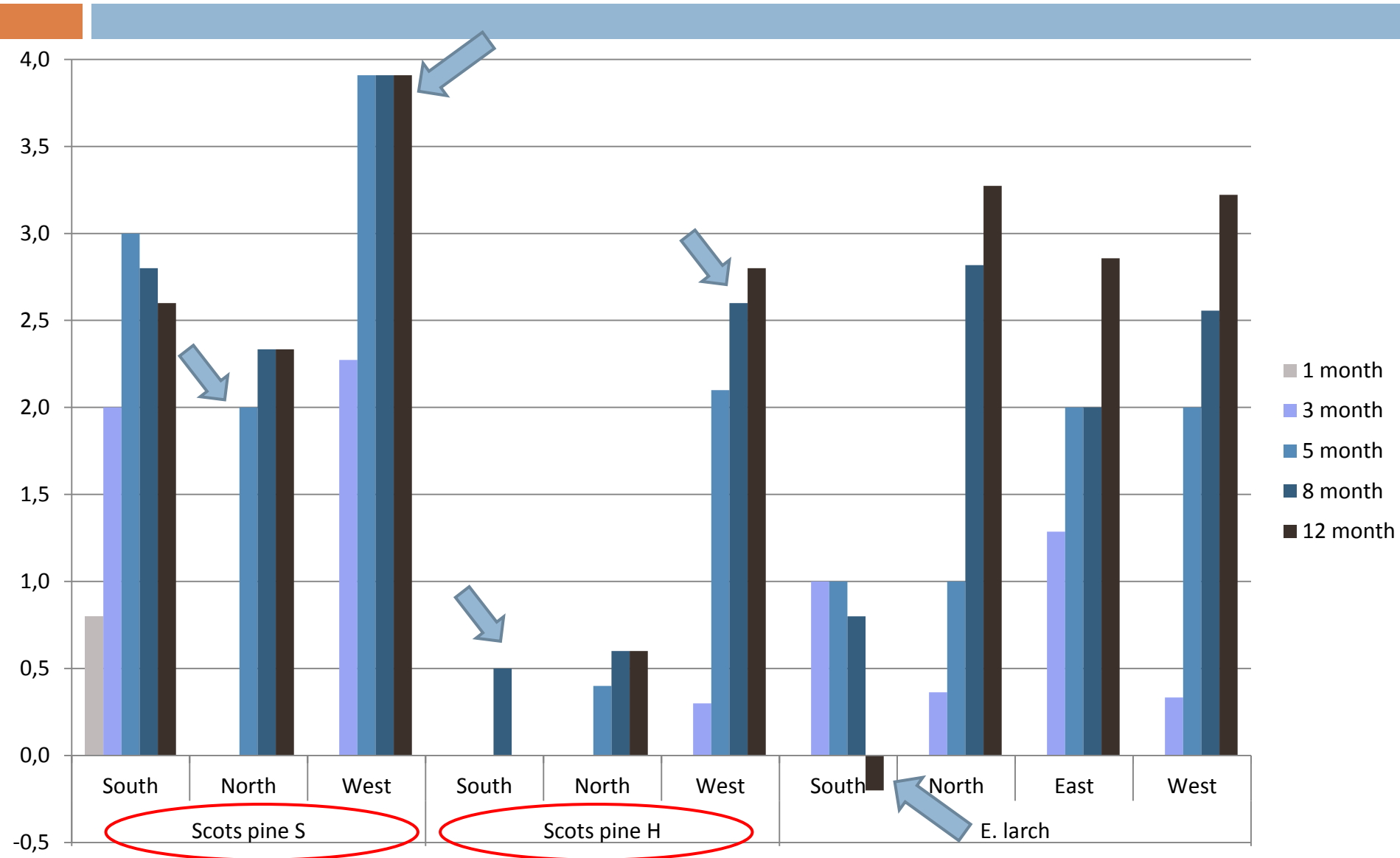
The influence of wood species and treatment solutions on the development of blue stain fungi during the first year of exposure



The influence of wood species, treatment solutions and orientation on the development of blue stain fungi during the first year of exposure



The influence of wood species, treatment solutions and orientation on the development of blue stain fungi during the first year of exposure



Conclusions

- The first blue staining fungi appear already after one month of exposure (the autumn 2013 was very warm and moist)
- The least prominent blue staining appears on the North side, where is the influence of weathering protection
- After one year of exposure the blue stain fungi did not appear on Norway spruce impregnated with copper-ethanolamine wood preservatives, only
- Norway spruce coated with acrylic coating was also very resistant to blue staining fungi
- The most prominent staining appears on Scots pine softwood
- Scots pine hardwood perform better than European larch
- On some parts of the façade we couldn't perform the rating, because of the photodegradation of wood (after one year of exposure)



Future work

- To investigate the correlation between:
 - ▣ Wood moisture
 - ▣ RH
 - ▣ Weathering
 - ▣ Temperature and formation of blue stain fungi
 - ▣ Test field and laboratory work (NMR, short term, long term water uptake)
- This data is compared and linked to laboratory results. Therefore this house represents an excellent platform for students, researchers, wood industry and end-users.

Acknowledgments



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THANK YOU FOR YOUR ATTENTION

