



Faculty of Design

2014

Generating the design process with GIGA-map: The development of the loop pavilion

Davidova, Marie

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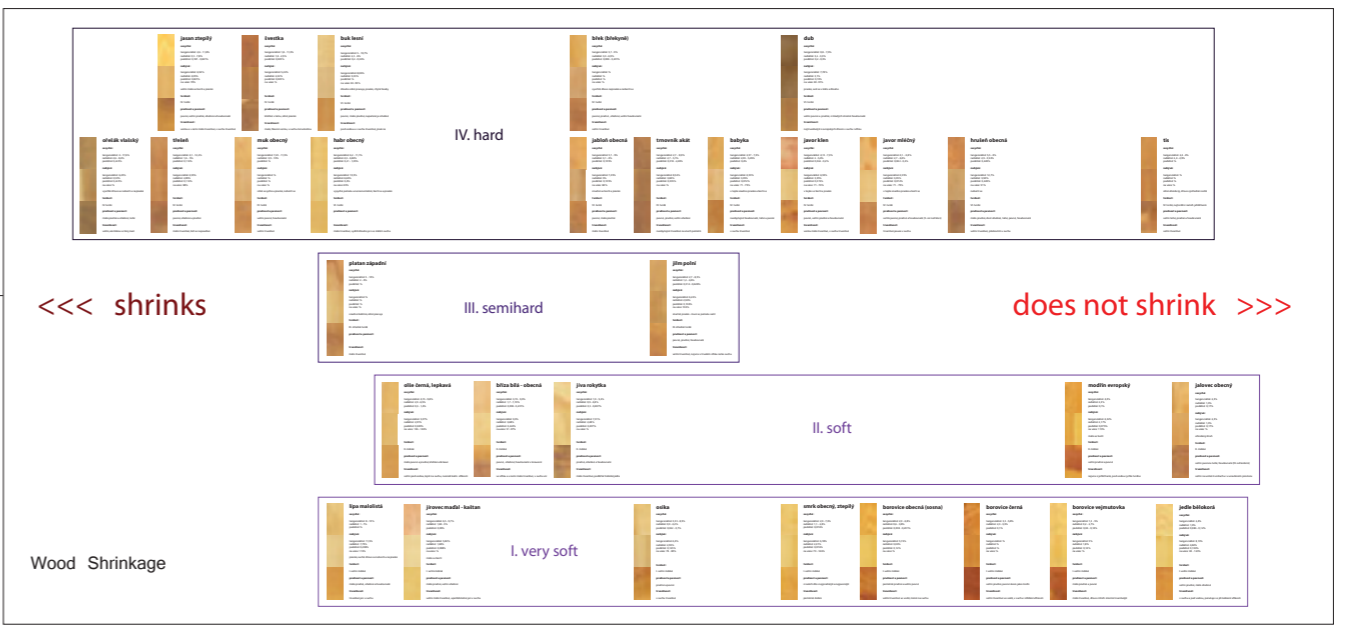
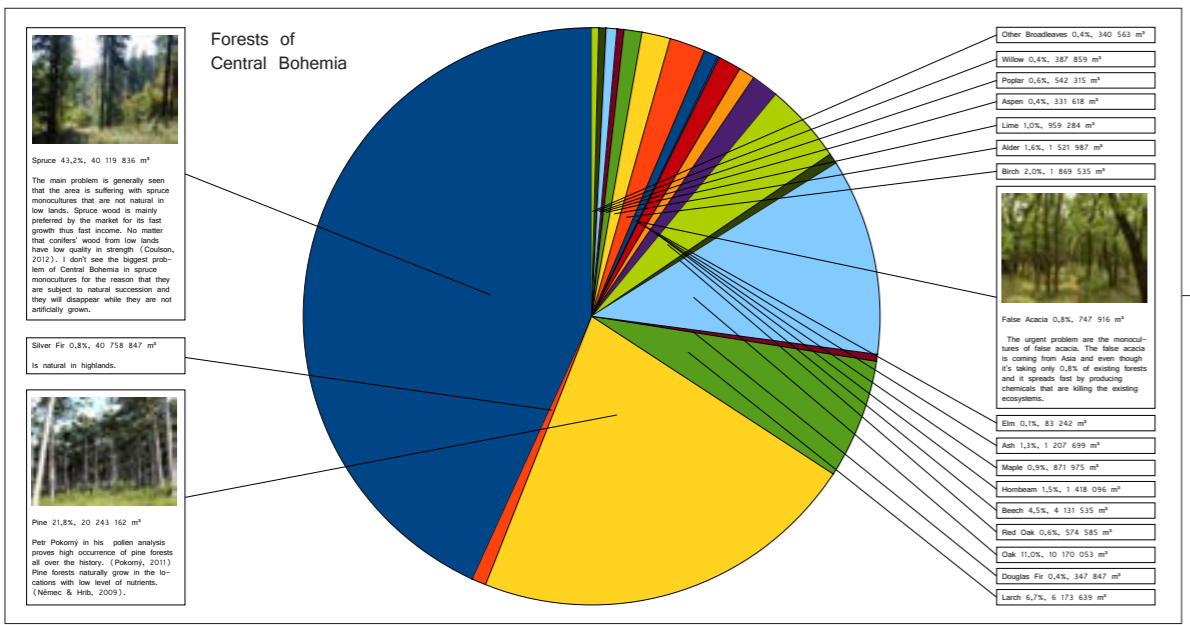


1. Systems Oriented Design

2. Research by Design - 1:1 Prototyping

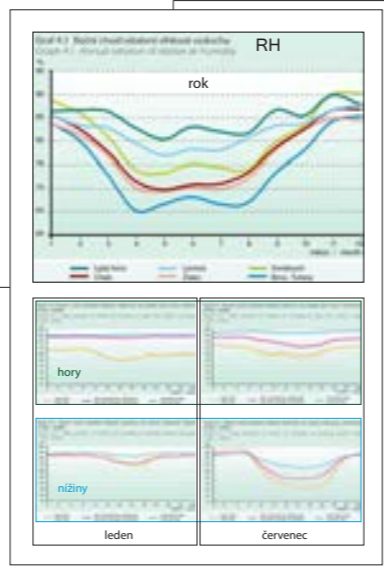
Wood in Relation to Environment

research - GIGAmap



Wood

Wood is a natural material with unique properties and characteristics. It is a complex material composed of cellulose, hemicellulose, and lignin. The structure of wood is highly organized, with fibers and vessels arranged in a specific pattern. This structure gives wood its strength and ability to absorb and release moisture. Wood is a renewable resource and is used in a wide range of applications, from construction to furniture. Understanding the properties and characteristics of wood is essential for its proper use and preservation.



Design Process

Reaction wood in tangential section warps in uniaxial direction within the same humidity conditions. More than half of the samples bend the opposite direction. The same occurrence has been observed in regular pine wood in one from ten samples. The behavior later disappeared.

Four types of samples were observed on regular green and dry wood: rectangular shape, parallelogram, rhombus and rectangle with notches. There was not so much difference between green and dry wood. The rhombus shape was bending the most, continued with parallelogram and after that rectangle. The rhombus bends into 20m difference, the rectangle tom on 30cm wide plate.

The rectangle with notches was at the beginning not warping at all and later on bended into a state where it stays not in dependency on relative humidity.

A fence coated by algae has approximately from two to four lower percentage of moisture content than the wood without it. This feature can be used in relation to wood warping.

Samples of Apocynaceae and Kibsonnium were grown on ash, false acacia and pine wood samples. While Apocynaceae is growing site well, Kibsonnium died after certain time. The last acacia was on ash wood followed by false acacia and then pine wood.

Design Process

System Ray2

Concept Sponge

Environmental Pavilion Concept

Concept Ray

The performative facade concept is generating 1 cm² fuel per 7,2 cm² area of the paneling. The panels are not interdependent.

The working prototype

Wood in Relation to Environment

forests in Central Bohemia



Spruce 43,2%, 40 119 836 m³

The main problem is generally seen that the area is suffering with spruce monocultures that are not natural in low lands. Spruce wood is mainly preferred by the market for its fast growth thus fast income. No matter that conifers' wood from low lands have low quality in strength (Coulson, 2012). I don't see the biggest problem of Central Bohemia in spruce monocultures for the reason that they are subject to natural succession and they will disappear while they are not artificially grown.

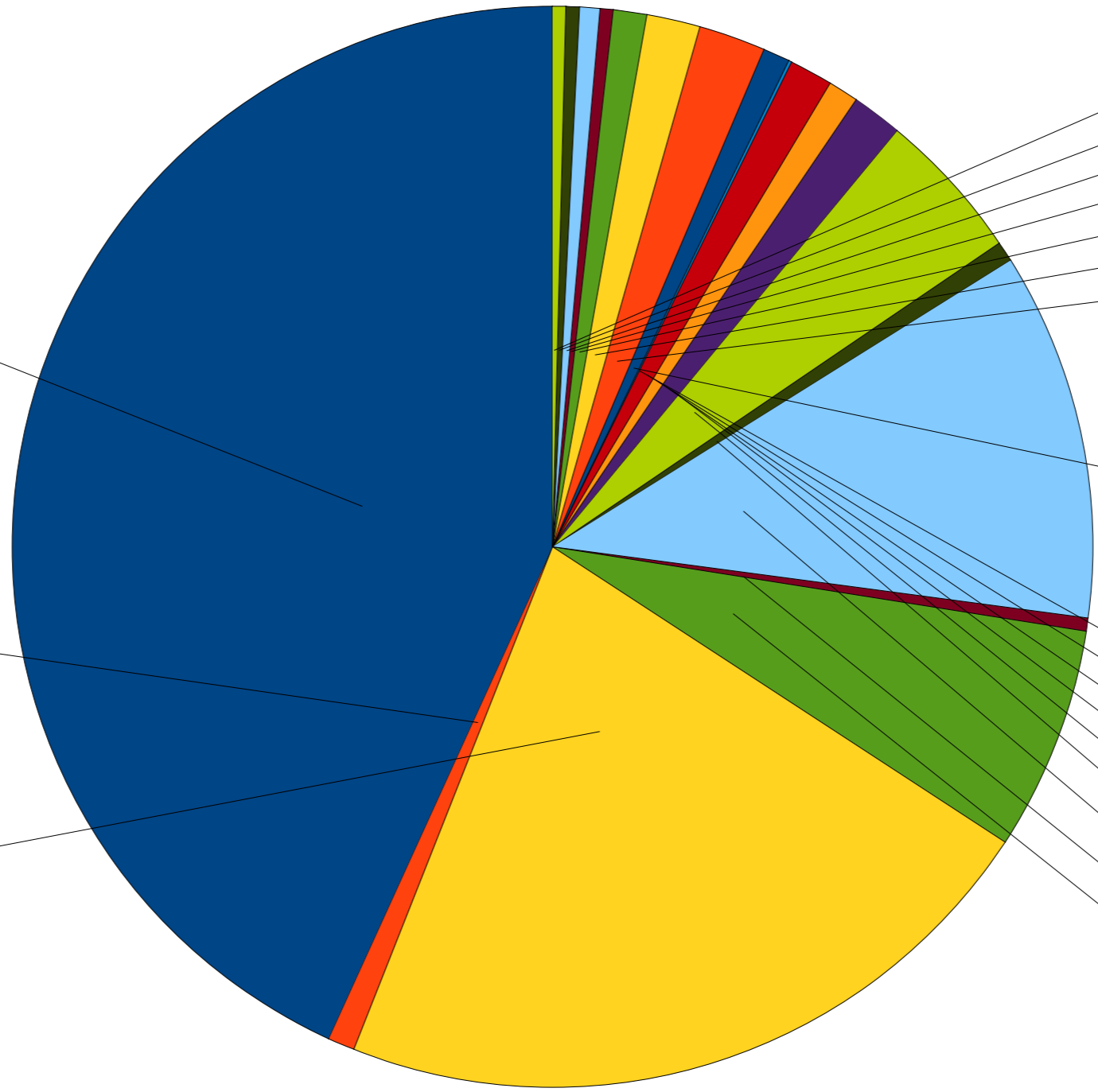
Silver Fir 0,8%, 40 758 847 m³

Is natural in highlands.



Pine 21,8%, 20 243 162 m³

Petr Pokorný in his pollen analysis proves high occurrence of pine forests all over the history. (Pokorný, 2011) Pine forests naturally grow in the locations with low level of nutrients. (Němec & Hrib, 2009).



- Other Broadleaves 0,4%, 340 563 m³
 - Willow 0,4%, 387 859 m³
 - Poplar 0,6%, 542 315 m³
 - Aspen 0,4%, 331 618 m³
 - Lime 1,0%, 959 284 m³
 - Alder 1,6%, 1 521 987 m³
 - Birch 2,0%, 1 869 535 m³
-
- False Acacia 0,8%, 747 916 m³
- The urgent problem are the monocultures of false acacia. The false acacia is coming from Asia and even though it's taking only 0,8% of existing forests and it spreads fast by producing chemicals that are killing the existing ecosystems.
- Elm 0,1%, 83 242 m³
 - Ash 1,3%, 1 207 699 m³
 - Maple 0,9%, 871 975 m³
 - Hornbeam 1,5%, 1 418 096 m³
 - Beech 4,5%, 4 131 535 m³
 - Red Oak 0,6%, 574 585 m³
 - Oak 11,0%, 10 170 053 m³
 - Douglas Fir 0,4%, 347 847 m³
 - Larch 6,7%, 6 173 639 m³

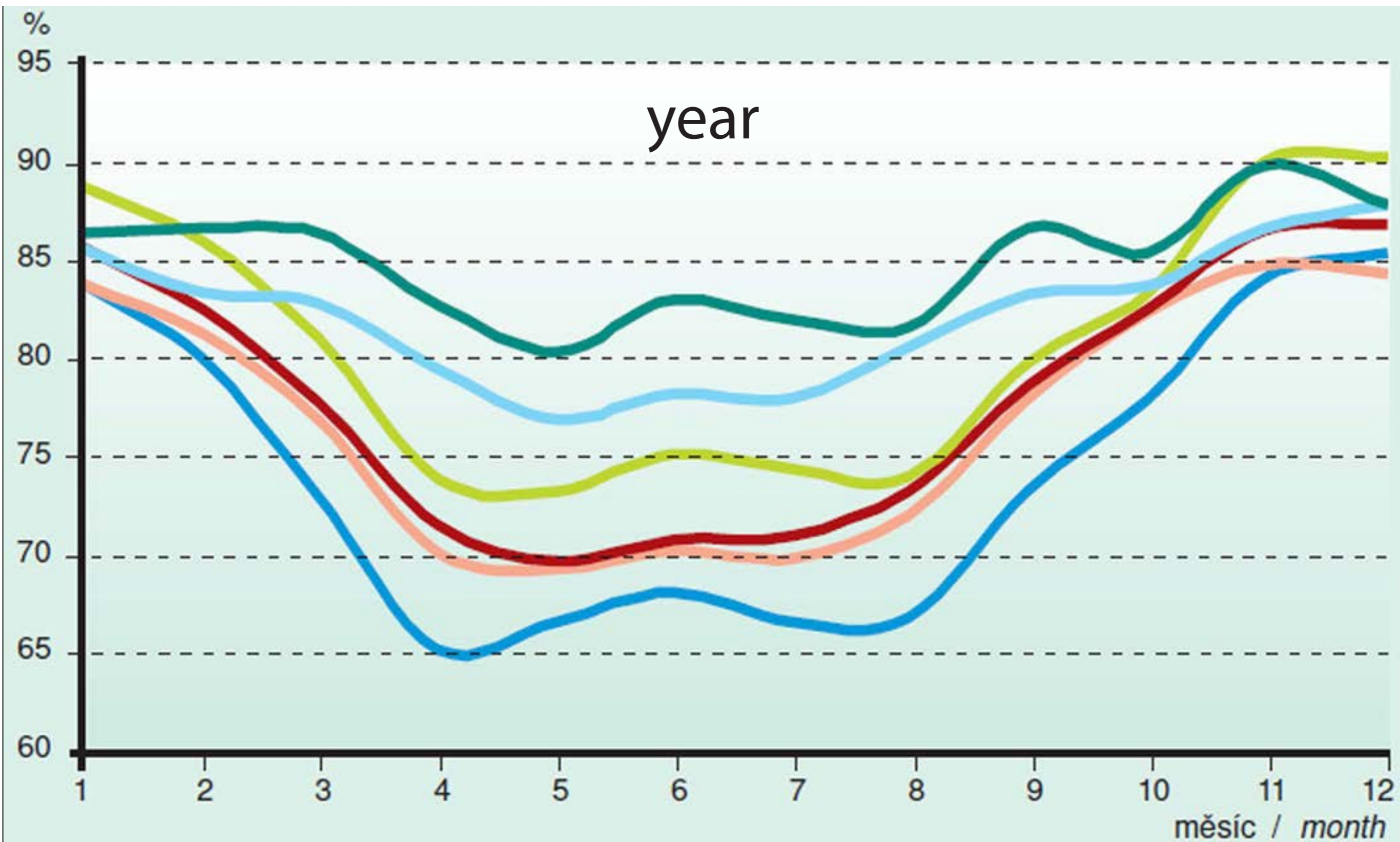
Wood in Relation to Environment

pine



Wood in Relation to Environment

annual variation of relative humidity



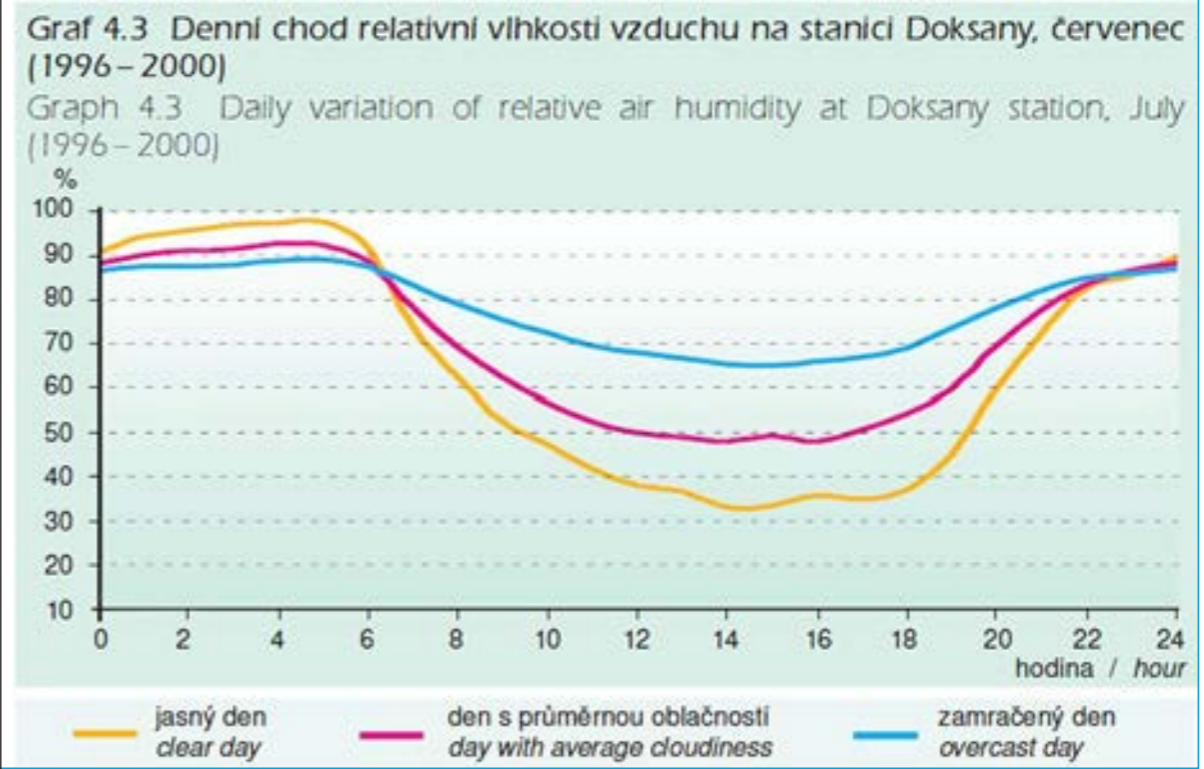
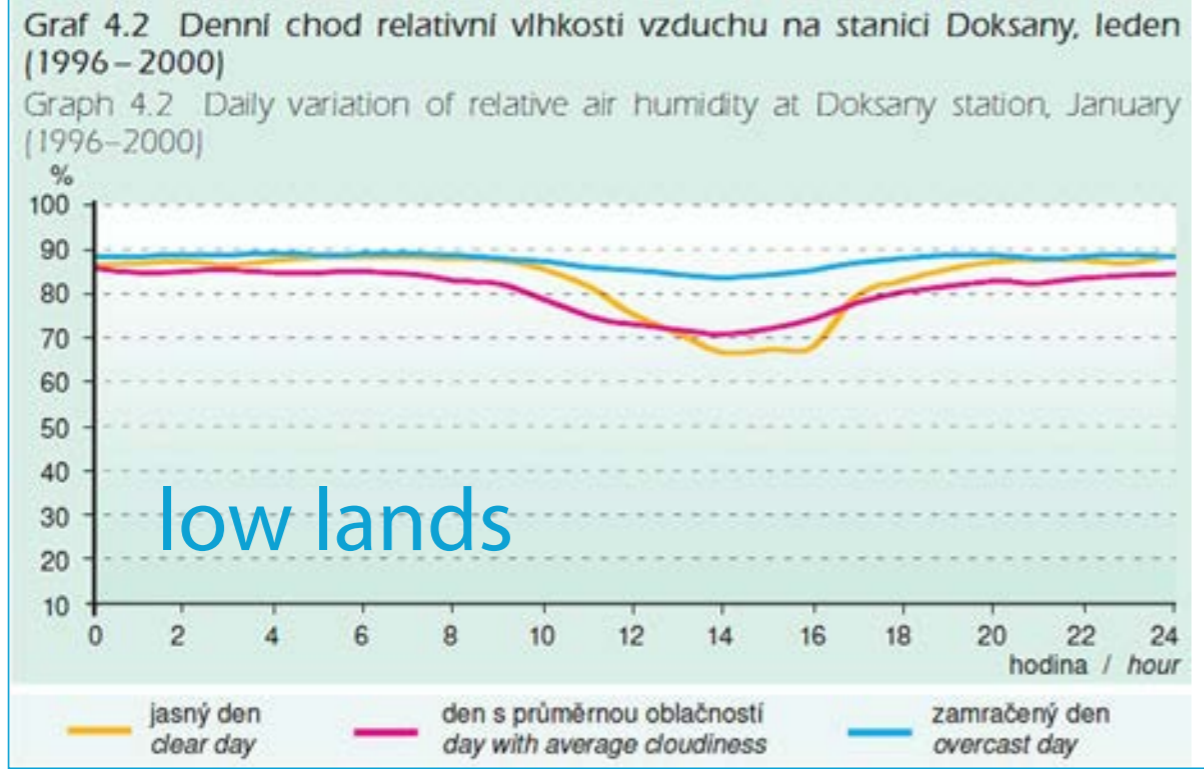
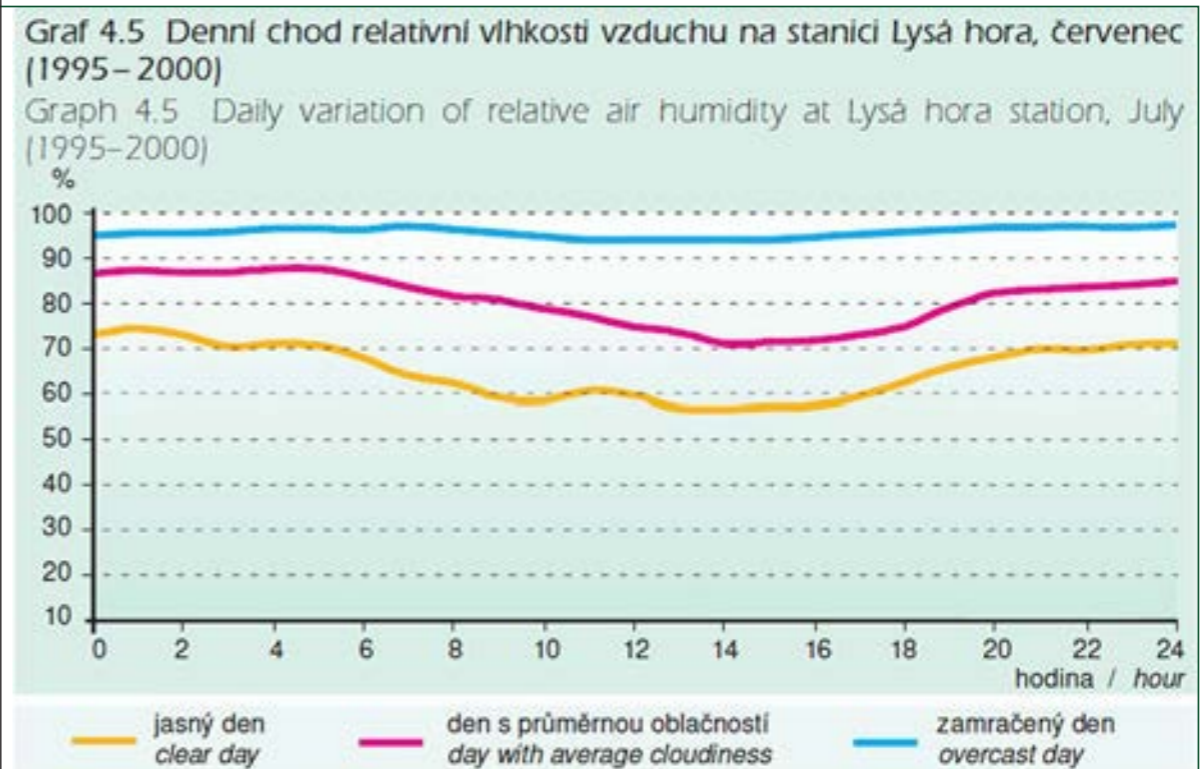
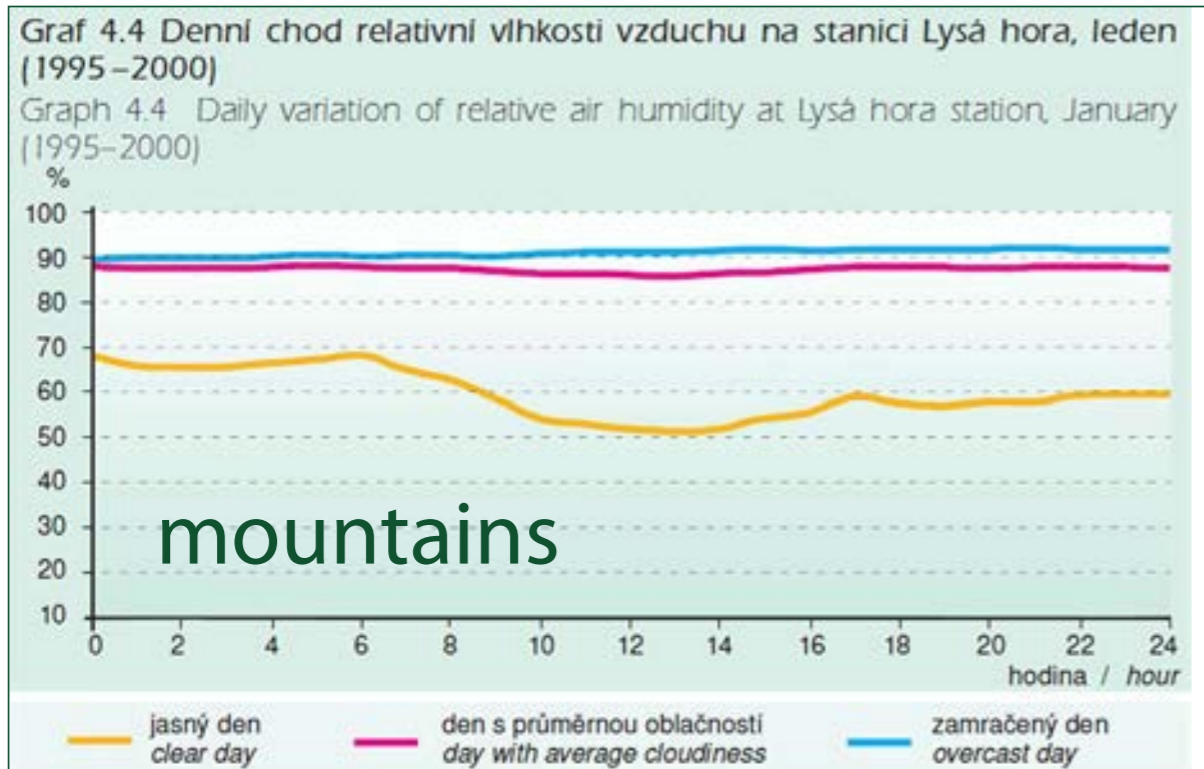
Lysá hora
Cheb

Lenora
Žatec

Svratouch
Brno, Tuřany

Wood in Relation to Environment

variation of relative humidity



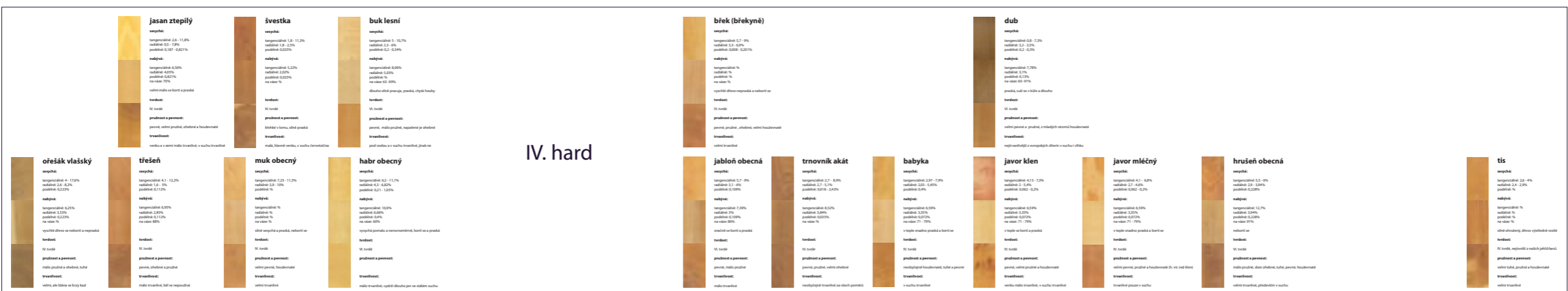
January

July

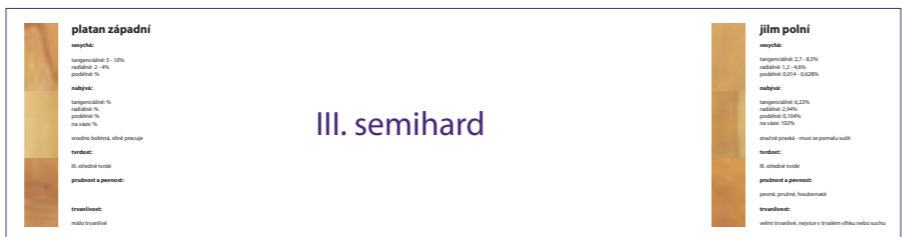
Wood in Relation to Environment

wood shrinkage

IV. hard



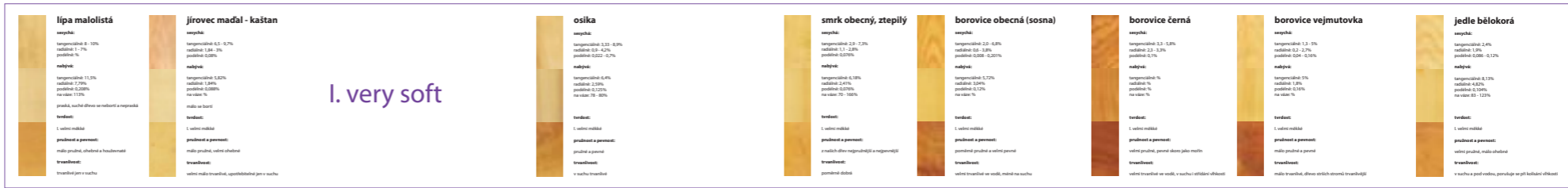
III. semihard



II. soft



I. very soft




<<< shrinks

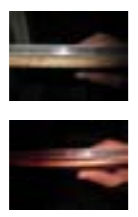
does not shrink >>>

Wood in Relation to Environment

research map




False acacia
reaction wood




1 cm

2 cm

Reaction wood in tangential section warps in unexpected directions within the same humidity conditions. More than half of the samples bends the opposite direction. The same occurrence has been observed in regular pine wood in one from ten samples. This behaviour latter disappeared.



Pine
regular wood




1 cm


2 cm

Four types of samples were observed on regular green and dry wood: rectangular shape, parallelogram, rhombus and rectangle with notches. There was not so much difference between green and dry wood. The rhombus shape was bending the most, continued with parallelogram and after that rectangle. The rhombus bends into 2cm difference, the rectangle 1cm on 30cm wide plate.

The rectangle with notches was at the beginning not warping at all and latter on bended into a state where it stays not in dependancy on relative humidity.



Fence with algae
Nové Město nad Metují



0%

1%

A fence covered by algae was observed. The wood with algae has approximately from two to four lower percentage of moisture content than the wood without it. This feature can be used in relation to wood warping.

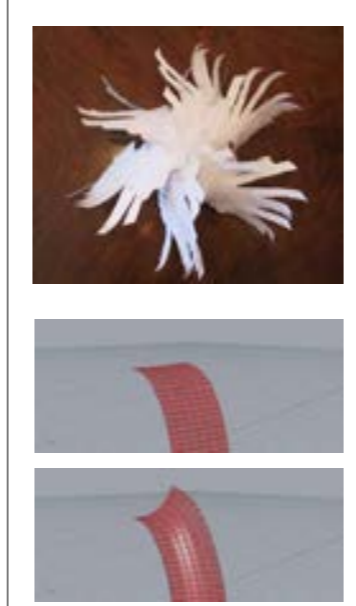


Apatococcus
Klebsormidium



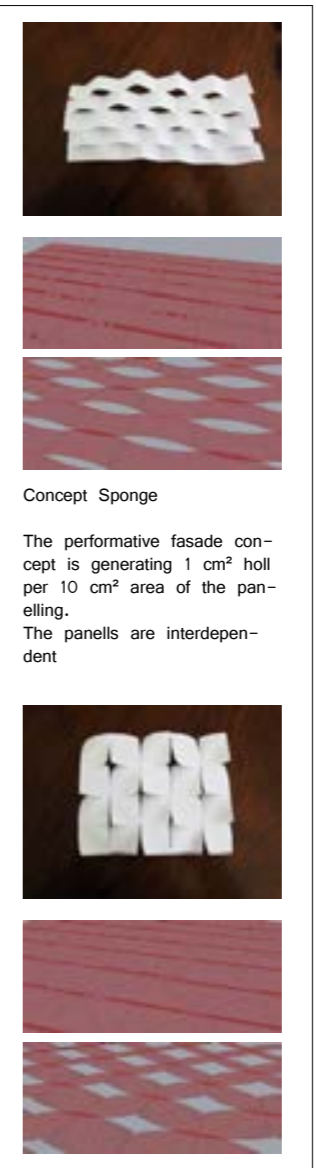
1 cm

Samples of Apatococcus and Klebsormidium were grown on ash, false acacia and pine wood samples. While Apatococcus is growing quite well, Klebsormidium died after certain time. The best succes was on ash wood followed by false acacia and than pine wood.



Environmental Pavilion Concept

The pavilion reacts to relative humidity by warping it's wings in the opposite direction. Thanks to that, the pavilion closes when it's humid and opens when dry weather. The concept of the opposite fibre orientation it tangential section was further developped into different performative systems proposals.




Concept Ray

The performative fasade concept is generating 1 cm² holl per 7,2 cm² area of the panelling. The panells are not interdependent.


System Ray2

Concept Ray was developed further for the protection from rain. It is based on the fact that the plates from the center of tree trunk warp more than the others. The system is generating 1 cm² holl per 7,8 cm² area of the panelling.




Concept Sponge


The performative fasade concept is generating 1 cm² holl per 10 cm² area of the panelling. The panells are interdependent



Based on the discussion with the producer a supportive system was developed so, taht its parts are difficult to produce and nor easy to copy.



Prototype model



The working prototype

Wood in Relation to Environment

wood warping - pine



Wood in Relation to Environment

wood warping - pine



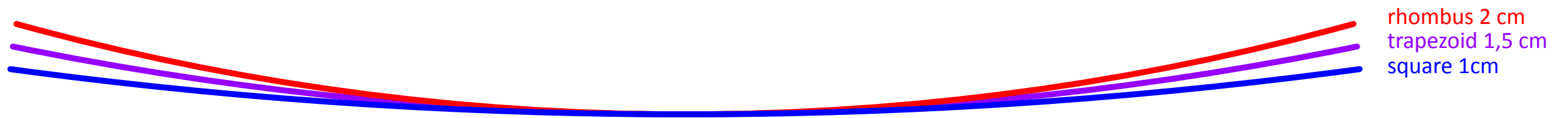
Wood in Relation to Environment

wood warping - pine



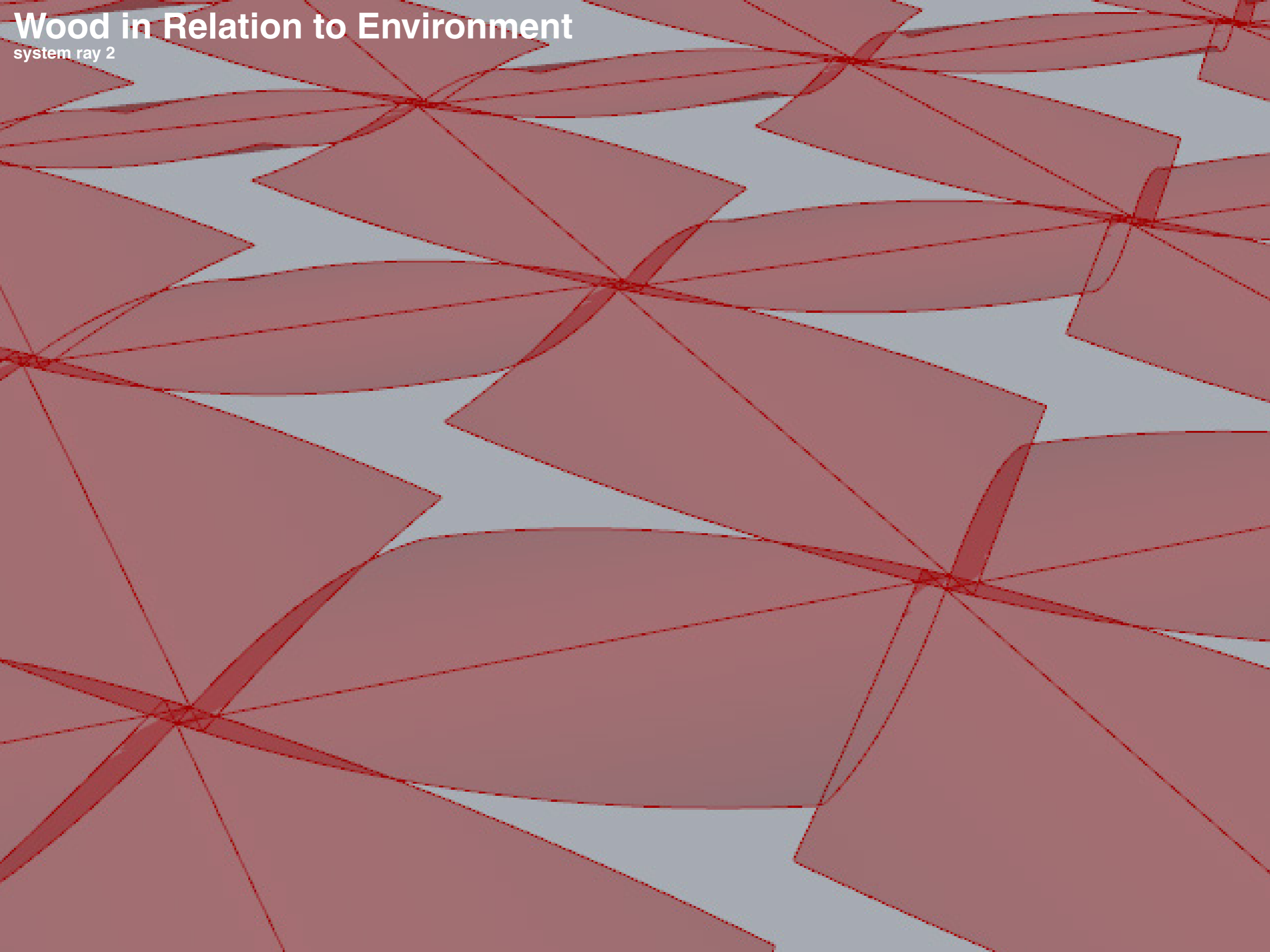
Wood in Relation to Environment

warping of shapes



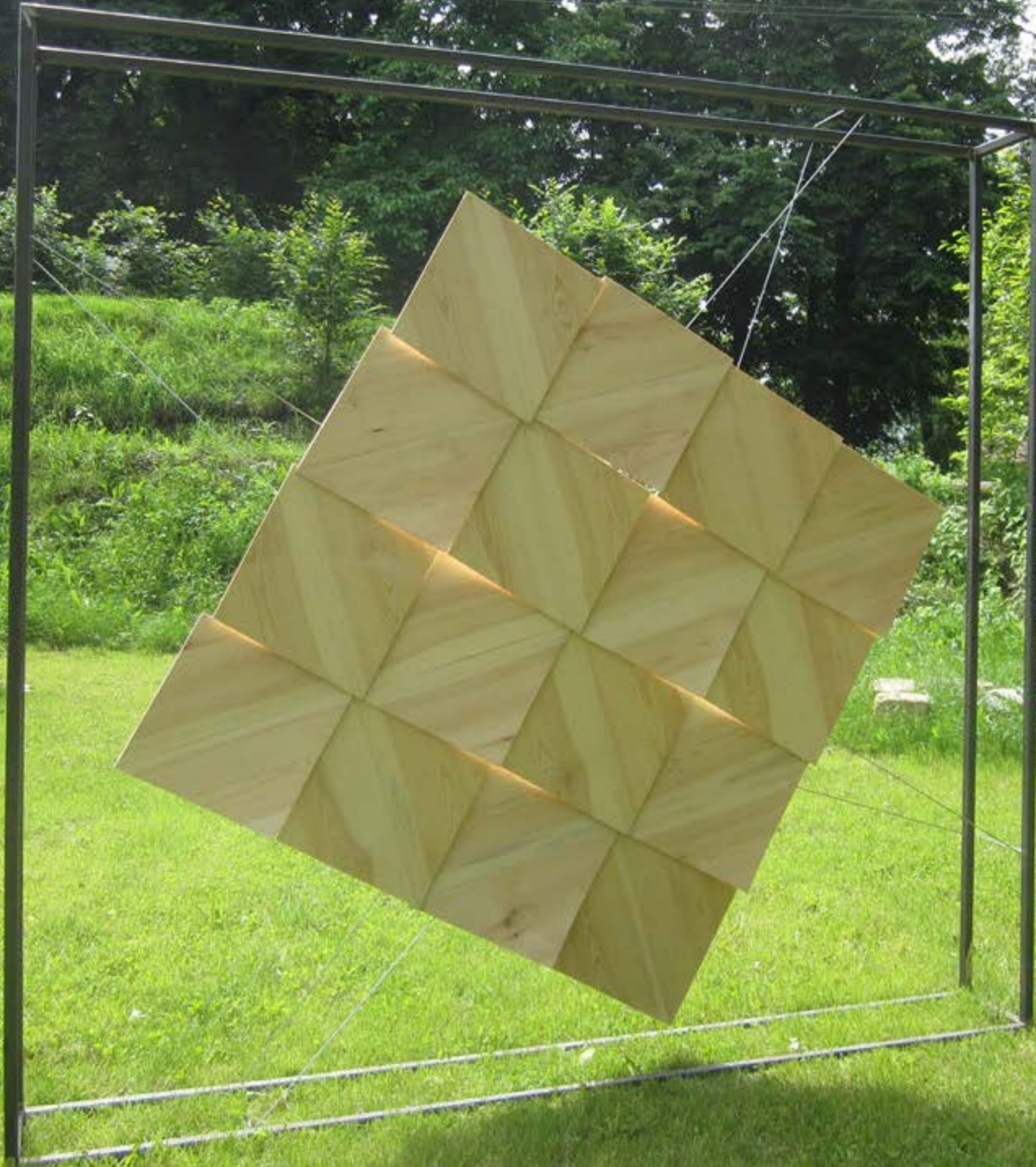
Wood in Relation to Environment

system ray 2



Wood in Relation to Environment

system ray 2 - prototype



Wood in Relation to Environment

system ray 2 - prototype



Wood in Relation to Environment

Mausoleum of Sultan Oljeitu, Sultaniyeh in Iran



Wood in Relation to Environment

environmental pavilion



Wood in Relation to Environment

environmental pavilion



Wood in Relation to Environment

environmental pavilion



Wood in Relation to Environment

copy file sharing

Marie Davidova > Personal Files > Environmental Pav... MENU

09_loop

03_GIGA_mapa

Sorted by Name ^	Sorted by Name ^	Name ^	Shared	Size	Modified
00_harmonogram 2014-02-25	01_WS_prezentace 2014-03-22	01_img	--	--	Apr. 12th, 2014
01_literatura 2014-02-14	02_GH_model 2014-03-22	02_FY_GIGA-map	--	--	Apr. 12th, 2014
02_prednasky 2014-02-19	03_GIGA_mapa 2014-03-22	03_DIGI_GIGA-map	--	--	Apr. 12th, 2014
03_foto 2014-02-24	04_konstrukce_detaily 2014-03-22	04_reference	--	--	Apr. 12th, 2014
04_software 2014-02-26	05_panelling 2014-03-22	support file for final GIGAmap	--	--	Apr. 5th, 2014
05_skicyPavilonu 2014-03-04	06_blog Public 2014-03-22				
06_workshop_grasshopper 2014-03-10	07_design 2014-03-23				
07_GIGA-mapy 2014-03-07	08_Mrsta Public 2014-03-27				
08_sponzoriLoga Public 2014-03-18	09_Vizošky Public 2014-03-30				
09_loop 2014-03-22	10_Křivky 2014-04-05				
10_EnviroCity 2014-05-08					

Start | Internet Explorer | File Explorer | Windows Media Center | HomeGroup | Task Scheduler | Chrome | Firefox | Skype | Adobe Illustrator | Microsoft Word | Adobe Photoshop

EN | 18:49 3. 10. 2014

Wood in Relation to Environment

first meeting

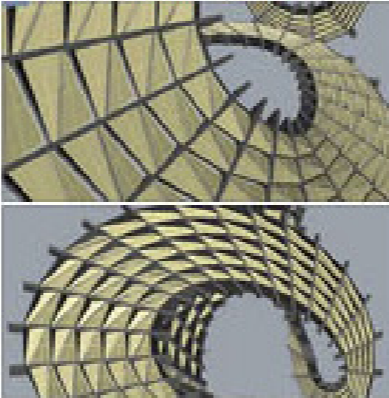


Wood in Relation to Environment

facebook group

Publ. Photo
22 Apr

Malý úspech: 3D model, ako nikdy predtým, ukazuje 3D model so postávkou rastlín, ktoré podporujú architektúru a vytvárajú estetický vzhľad stavby. Vďaka týmto 3D modelom sa môžete presvedčiť, že 3D model je oveľa lepšie, ako 2D model.



Write a Comment

Yes, Simon Pridley, Clara López Novales and 2 others like this · 2 Seen by everyone

Write a comment...

Ma In Confession
22 Apr

Ung... state sa mi... 3D model, ako nikdy predtým, ukazuje 3D model so postávkou rastlín, ktoré podporujú architektúru a vytvárajú estetický vzhľad stavby. Vďaka týmto 3D modelom sa môžete presvedčiť, že 3D model je oveľa lepšie, ako 2D model.

Write a Comment

Seen by everyone

Write a comment...

Ma In Confession
22 Apr

Ve... state sa mi... 3D model, ako nikdy predtým, ukazuje 3D model so postávkou rastlín, ktoré podporujú architektúru a vytvárajú estetický vzhľad stavby. Vďaka týmto 3D modelom sa môžete presvedčiť, že 3D model je oveľa lepšie, ako 2D model.

Write a Comment

Seen by everyone

Write a comment...

Simon Pridley
27 Apr

Paralel... state sa mi... 3D model, ako nikdy predtým, ukazuje 3D model so postávkou rastlín, ktoré podporujú architektúru a vytvárajú estetický vzhľad stavby. Vďaka týmto 3D modelom sa môžete presvedčiť, že 3D model je oveľa lepšie, ako 2D model.



Write a Comment

Yes, Clara López Novales and Ma In Confession like this · 2 Seen by everyone

Write 1 new comment

Simon Pridley deleted this

Copy Environment Perfor... 3D model, ako nikdy predtým, ukazuje 3D model so postávkou rastlín, ktoré podporujú architektúru a vytvárajú estetický vzhľad stavby. Vďaka týmto 3D modelom sa môžete presvedčiť, že 3D model je oveľa lepšie, ako 2D model.

Ma In Confession liked this · 27 Apr at 00:07 · Like

Ma In Confession liked this · 27 Apr at 00:07 · Like

Ma In Confession liked this · 27 Apr at 00:07 · Like

11 members

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SEARCH RESULTS 1 to 11

- Wood Clara López Novales · 11 likes · 1 photo
- Simon Pridley, Clara López Novales and 11 others like this · 1 photo
- Clara López Novales and 11 others like this · 1 photo
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- Clara López Novales and 11 others like this · 1 photo
- Simon Pridley, Clara López Novales and 11 others like this · 1 photo
- Clara López Novales and 11 others like this · 1 photo
- Simon Pridley, Clara López Novales and 11 others like this · 1 photo
- Clara López Novales and 11 others like this · 1 photo
- Simon Pridley, Clara López Novales and 11 others like this · 1 photo
- Clara López Novales and 11 others like this · 1 photo
- Simon Pridley, Clara López Novales and 11 others like this · 1 photo

Environmental Summer Pavilion 2



[ABOUT](#) [PARTICIPANTS](#) [DESIGNS](#) [GIGA MAPS](#) [GRASSHOPPER](#) [REFERENCES](#) [SPONSORS](#)

Wood as a primary medium to architectural performance is the topic for new Environmental Summer Pavilion. It will be a platform serving as a stage for cultural events led by Marek Prokůpek at the Institute of Planning and Development of Prague (IPR). The project is held in cooperation of Faculty of Art and Architecture of Technical University of Liberec (FUA TUL) and Faculty of Forestry and Wood Sciences of University of Life Sciences Prague (FLD CZU) under leadership of Marie Davidová, Martin Kloda and Šimon Prokop.

ABOUT

ABSTRACT

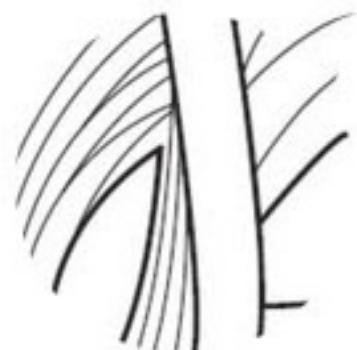
The project is led in cooperation of the Faculty of Art and Architecture of Technical University of Liberec (FUA TUL) and the University of Life Sciences Prague, Faculty of Forestry and Wood Sciences (FLD CZU). Its aim is to broaden the discussion on the wood's material properties in relation to environment and to gain the student's experience in production of their own design proposals. Pivilion will be used as a platform for cultural events led by Institute of Planning and Development of Prague, which doesn't communicate with public very well these days. Events are also connected with opening of the new information centre of IPR. It's actually some kind of unusual form of city furniture, which in significant way changes the public space by being space for meeting of neighbours, performers and as space for cultural living. It lives up the neighbourly integrity of Prague 2.

Tento projekt je veden ve spolupráci Fakulty umění a architektury Technické univerzity v Liberci (FUA TUL) a Lesnické a dřevařské fakulty České zemědělské univerzity (FLD CZU). Jeho cílem je prohloubit diskusi o materiálových vlastnostech dřeva v závislosti na prostředí a seznámit studenty s procesy zhotovování vlastních návrhů. Pavilon bude sloužit jako zázemí pro kulturní akce vedené Institutem plánování a rozvoje hl. m. Prahy (IPR), které v současné době k veřejnosti příliš nepromlouvá. Akce jsou také spojeny s plánovaným otevřením nového centra IPR. Je to v podstatě určitý nezvyklý typ městského mobiliáře, který ale zásadním způsobem mění veřejný prostor tím, že poskytuje sousedům a performerům možnost k setkávání a slouží také jako prostor ke kulturnímu vyžití. Tím oživuje sousedskou integritu Prahy 2.

GOALS OF THE PROJECT

- research of wood's material properties
- participating of students in production and cooperation with the industry
- living up of the public space
- inspiration for cities, new forms of city furniture

- výzkum materiálových vlastností dřeva
- účast studentů na výrobě a spolupráce s průmyslem



Wood in Relation to Environment

MINI-map Anna Hrušová



Atelier: Marie Davidová, Martin Kloda, Šimon Prokop
 Project: Summer pavilion 2
 Name: Anna Hrušová
 Drawing title: GIGA map

- REFERENCE //
- STRUCTURES //
- VARIABLES //
- ABSTRACT FORM //
- AIR MOVEMENT //
- LAYER //
- FINISH //
- POURNA //
- PROJECTION, SCREENING //
- LIGHT OBJECT //
- LIGHT TRANSPARENT //
- ORGAN //
- MOVEMENT IN NATURE // HUMIDITY //
- WOOD

PHOENIX Architecture / JMS and COL Tobi Loh

Shanghai Expo 2010 / The Spanish Pavilion / JMS

JMS, Creative Design / Digital Architectural Lab

WOOD / PROUDENI

WOOD

WOOD

WOOD

WOOD

WOOD

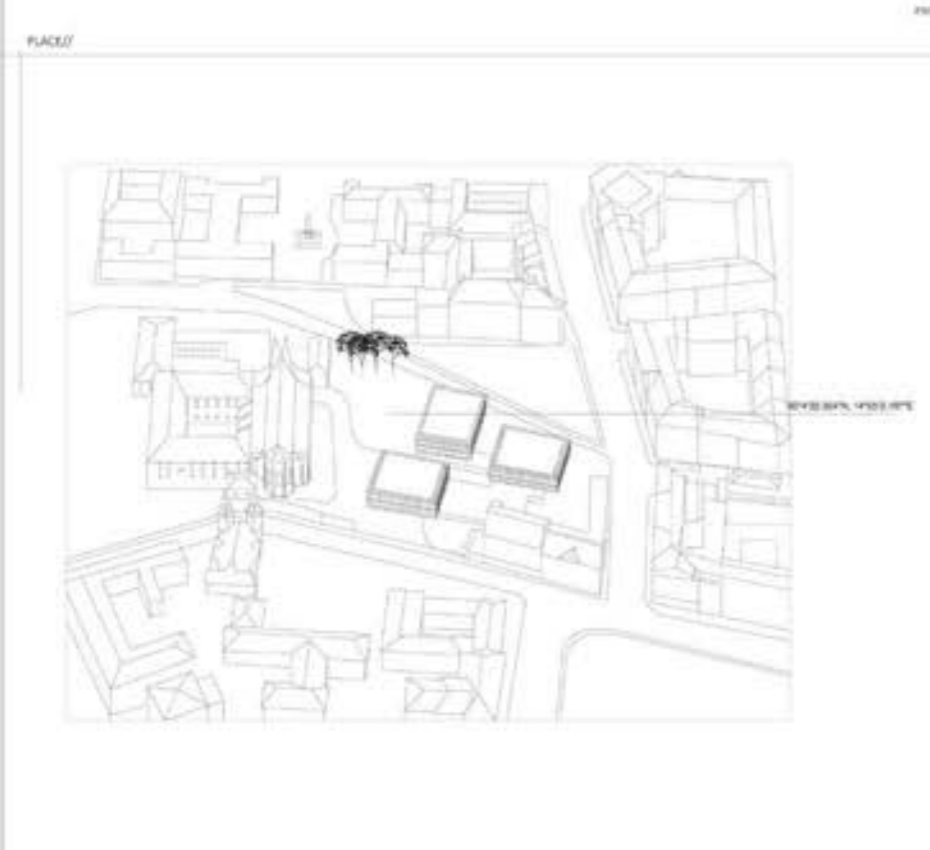
WOOD

WOOD

HUMIDITY // SHRINKAGE AND SWELLING // SHAPE

Rhombus 2 cm
 Stacking 1,5 cm
 toward 8cm

(characteristic shrinkage and distortion)



use of wood / properties in design
 využití vlastností dřeva v návrhu

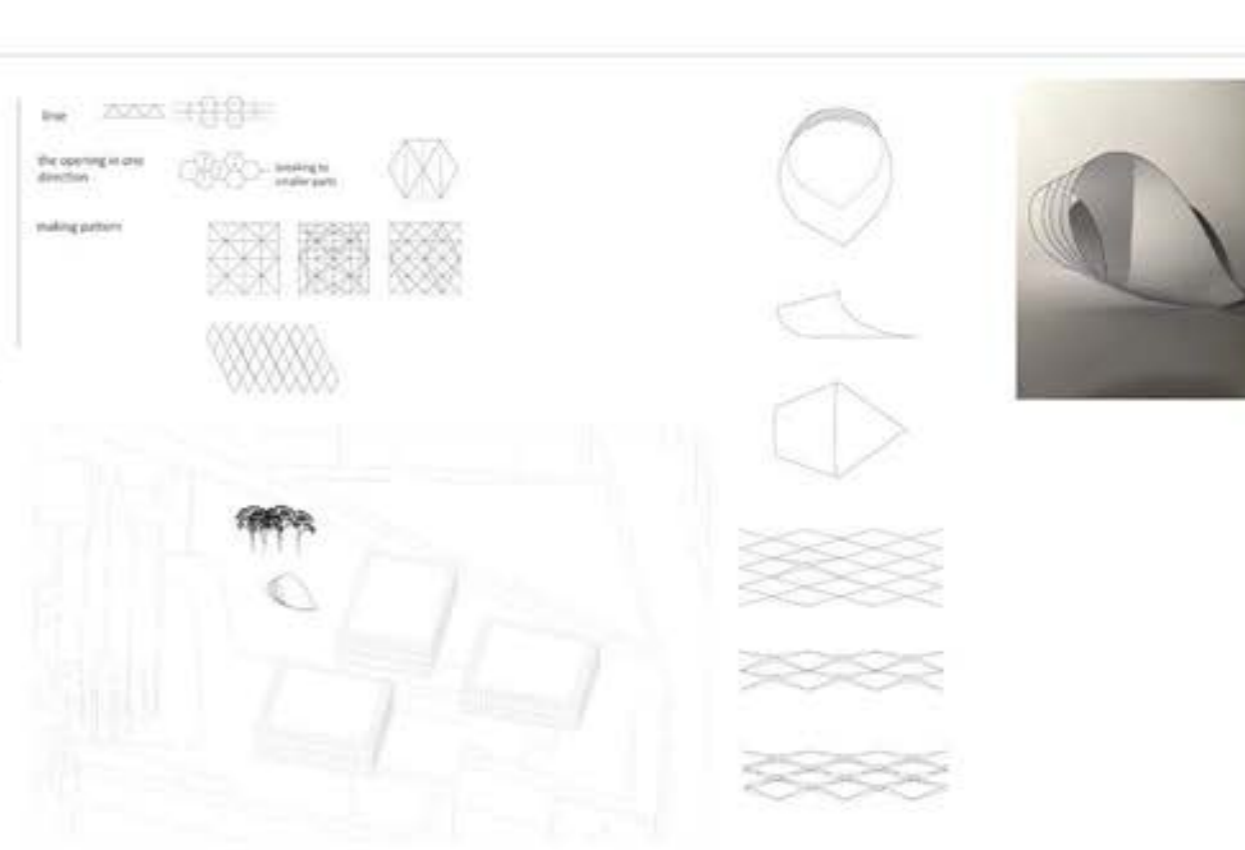
high humidity / smooth surface with minimal gaps
 v stavělosti na vlhkosti / během vysoké vlhkosti /
 hladké povrch s minimálními mezerami

flexibility / opening / creating relief
 flexibilita / otvírání průduchů / vzniká reliéf
 decreasing moisture / opening stomata / CREATED
 RELIEF

forming
 tvarování — podlům + something which gains
 make a space

changing surface

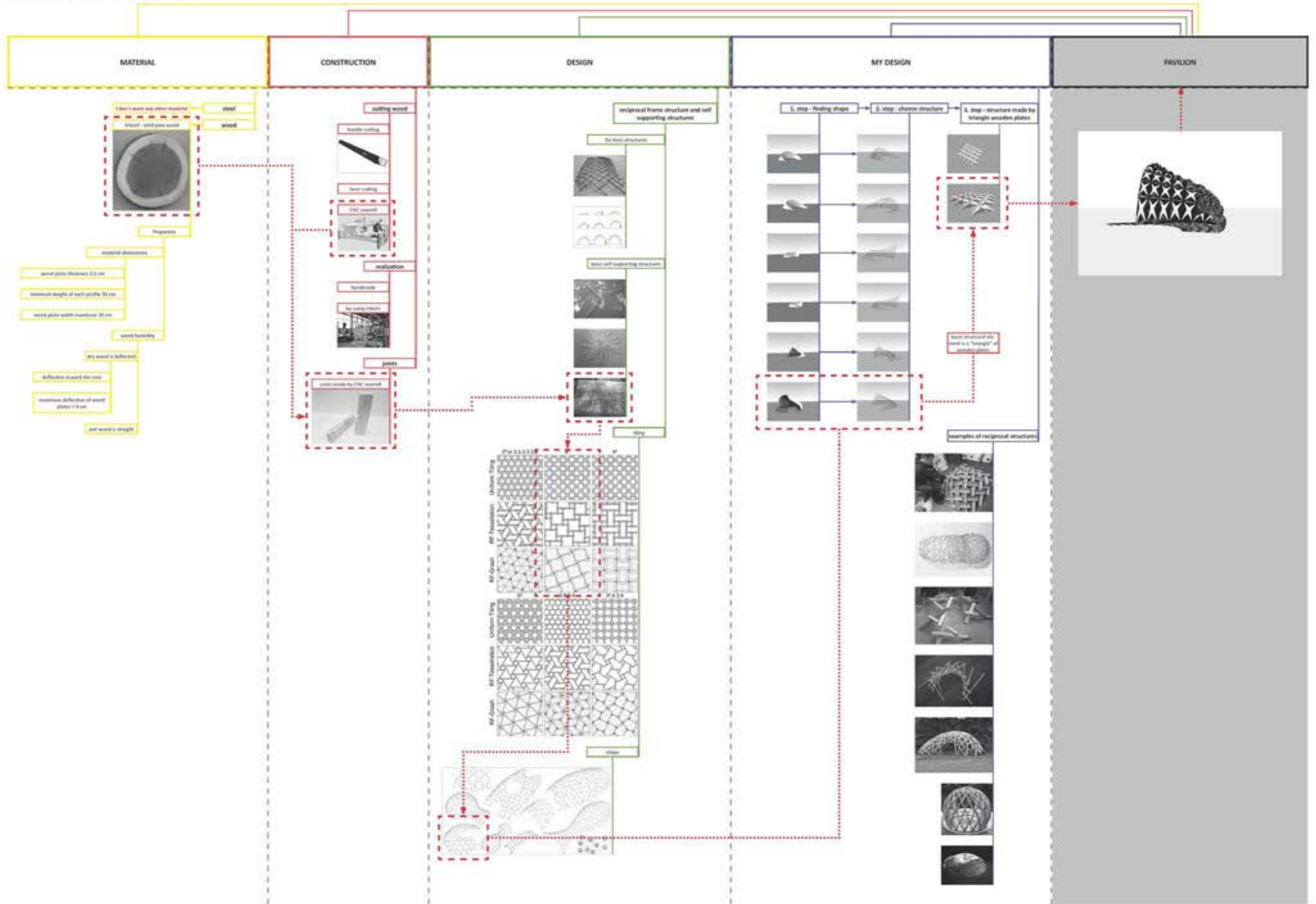
high humidity / smooth surface low humidity / shrinkage and distortion



Wood in Relation to Environment

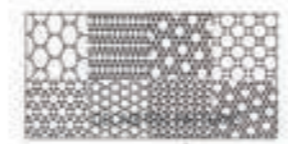
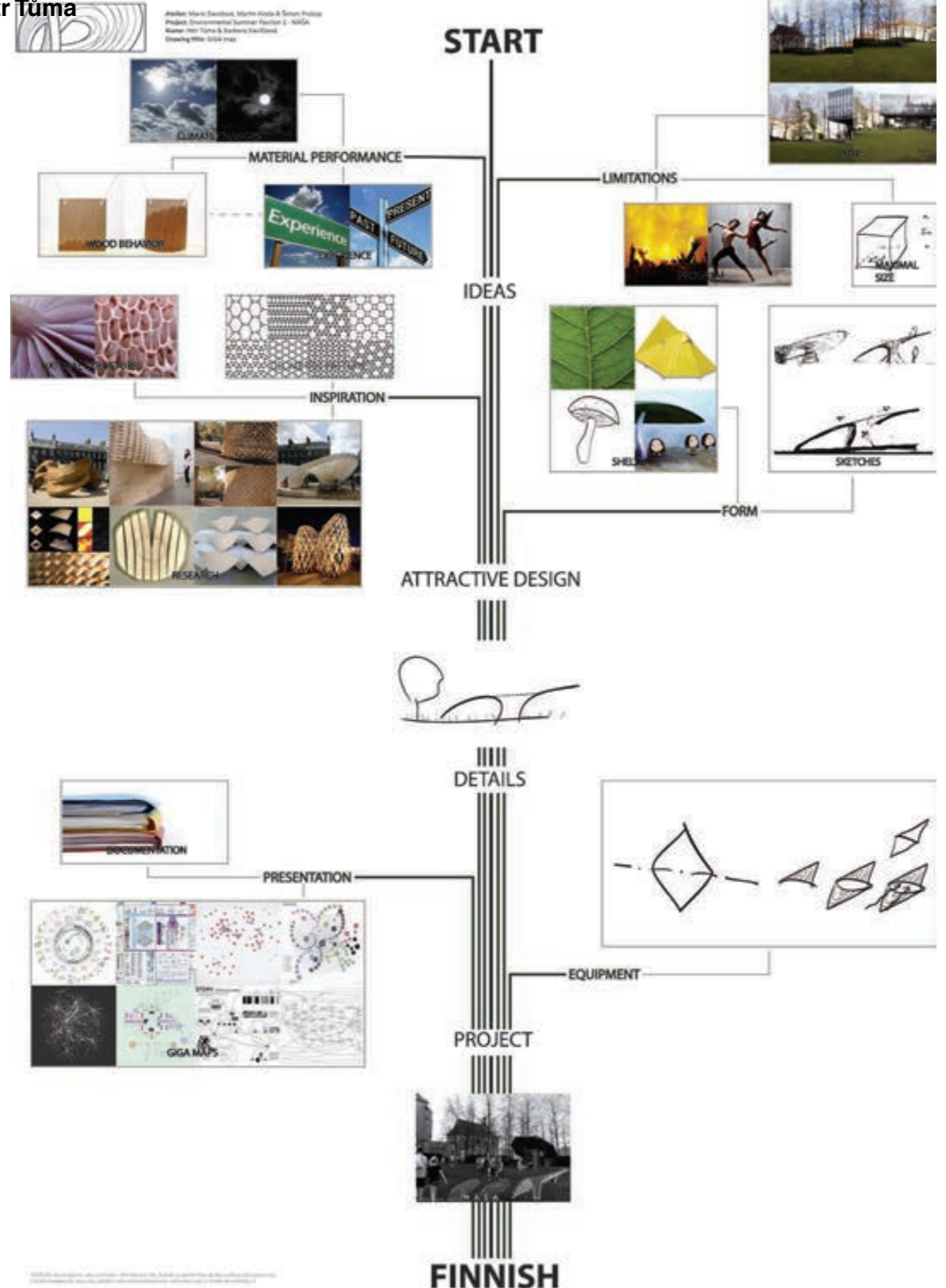
MINI-map Jakub Kopecký

Author: Marie Davidová, Simon Prohazk, Martin Kloda
Project: Self-supporting pavilion
Name: Jakub Kopecký
Drawing title: SIGA map



Wood in Relation to Environment

MINI-map Barbora Slvíčková and Petr Tůma



START

IDEAS

ATTRACTIVE DESIGN

DETAILS

PROJECT

FINNISH

MATERIAL PERFORMANCE

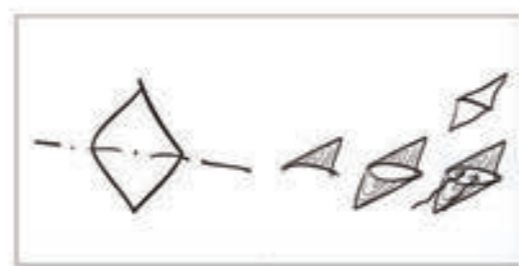
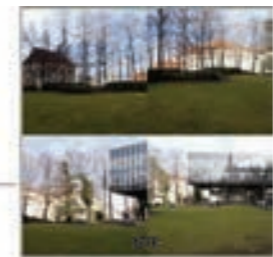
INSPIRATION

PRESENTATION

LIMITATIONS

FORM

EQUIPMENT

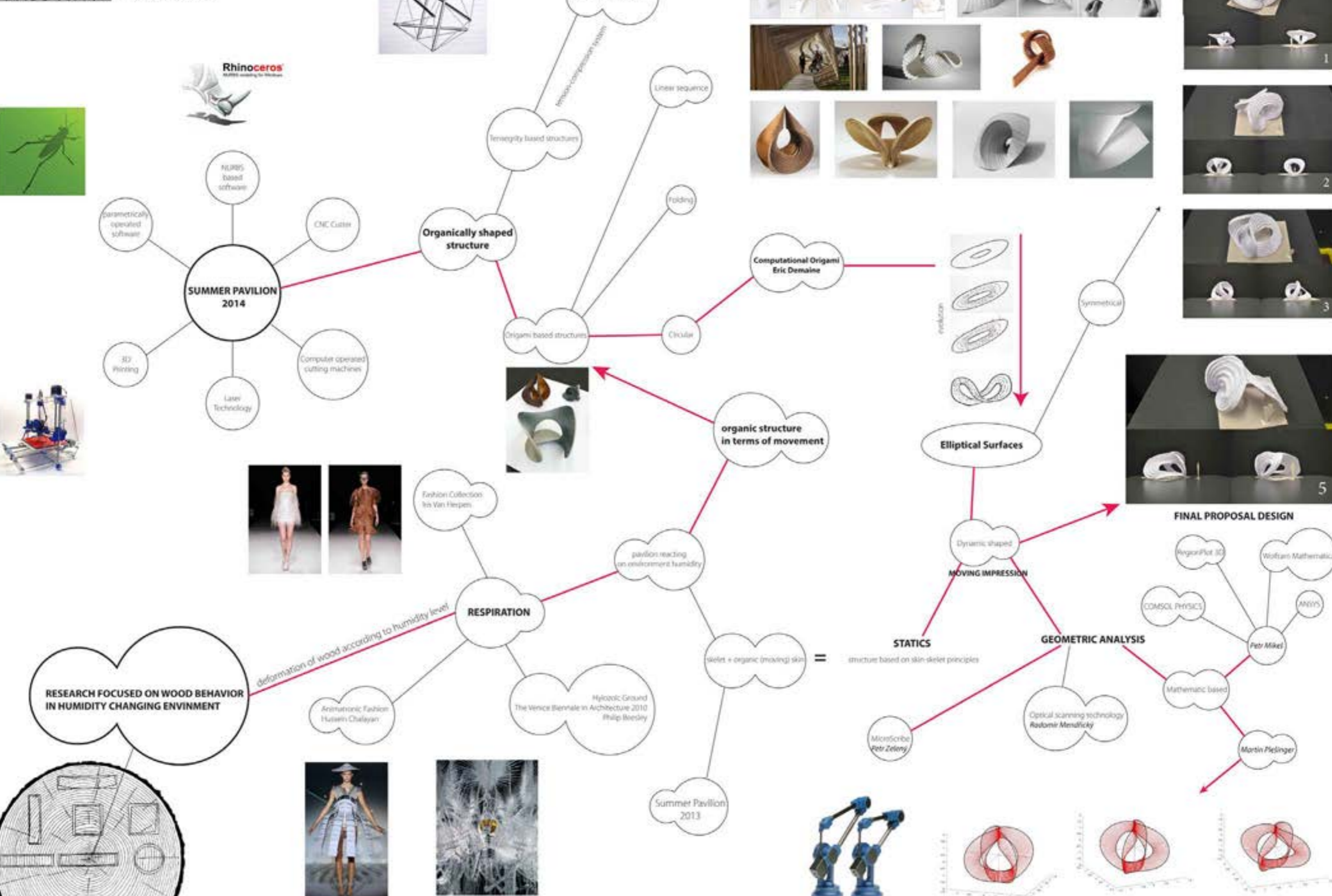


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Wood in Relation to Environment

MINI-map Antonín Hůla

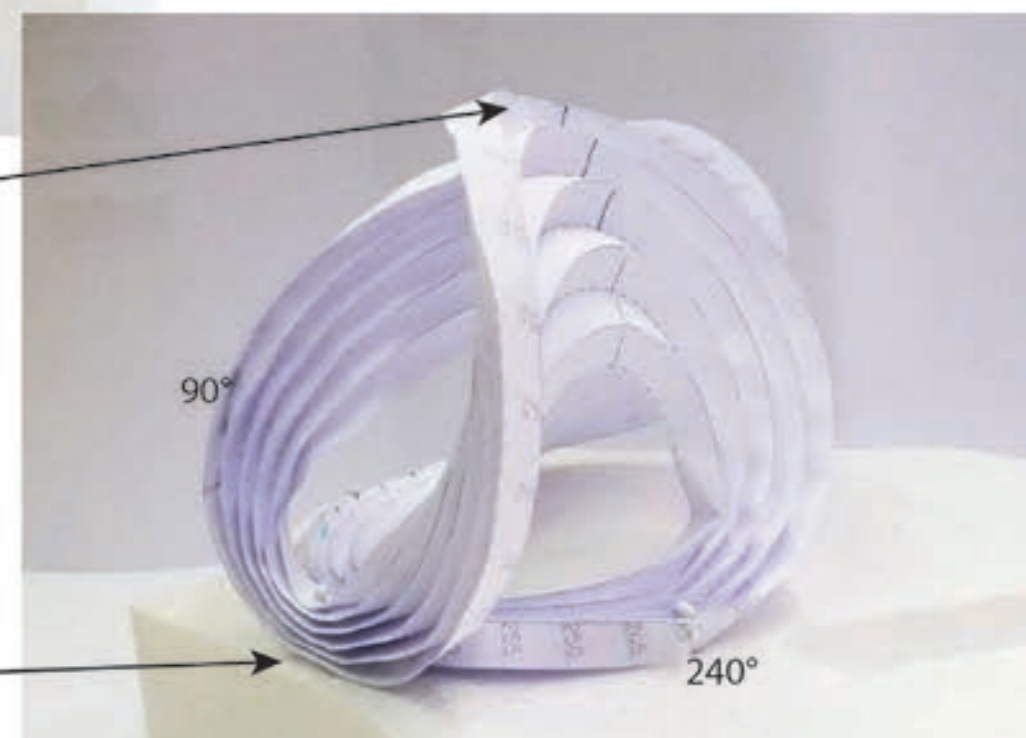
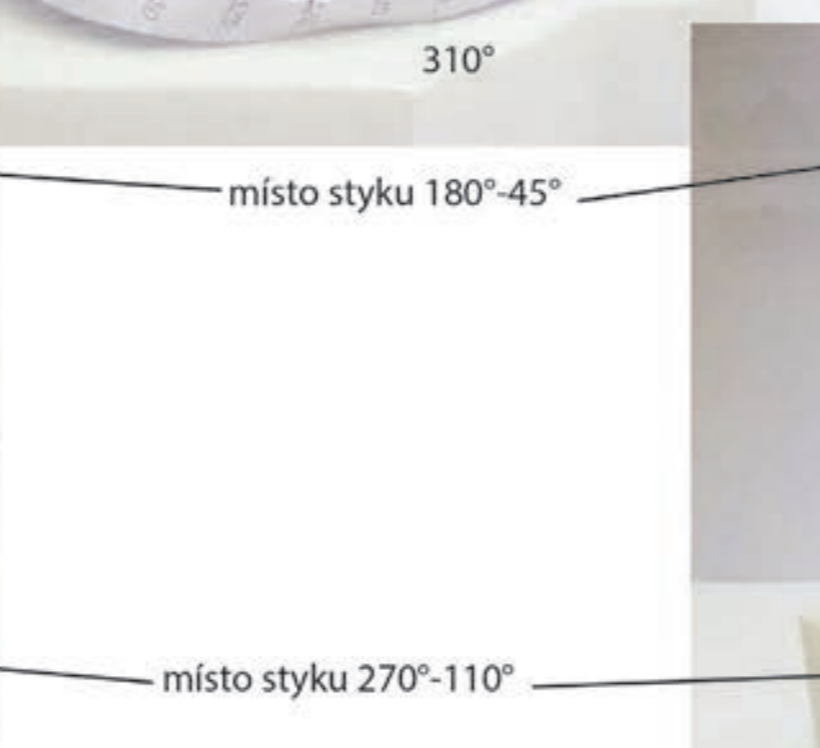
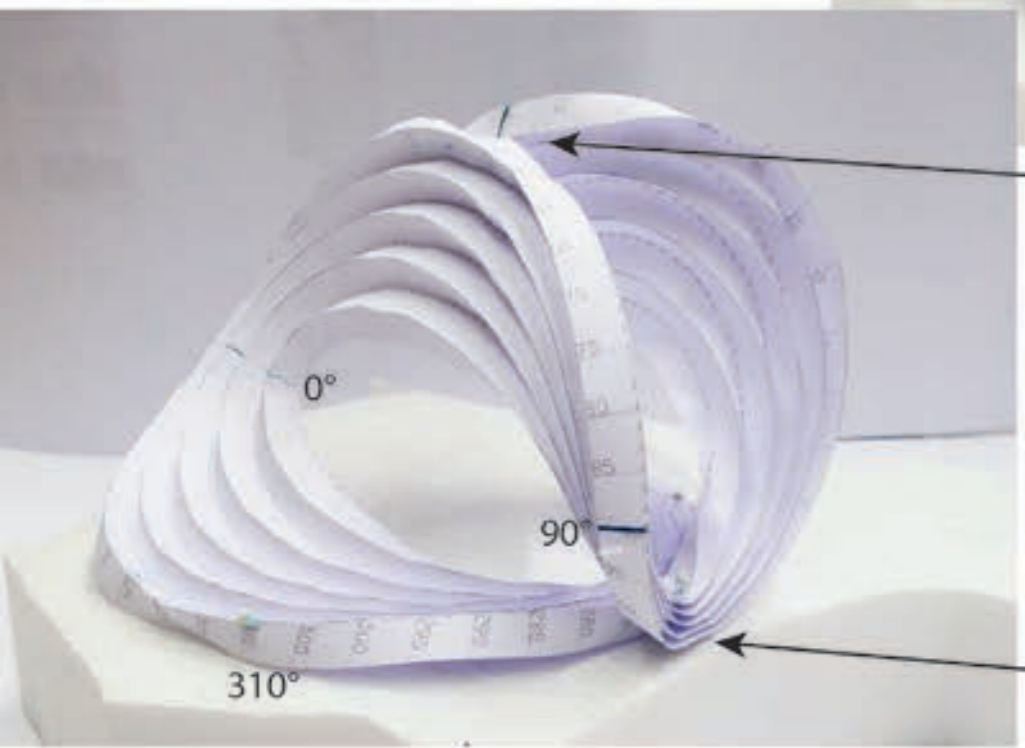
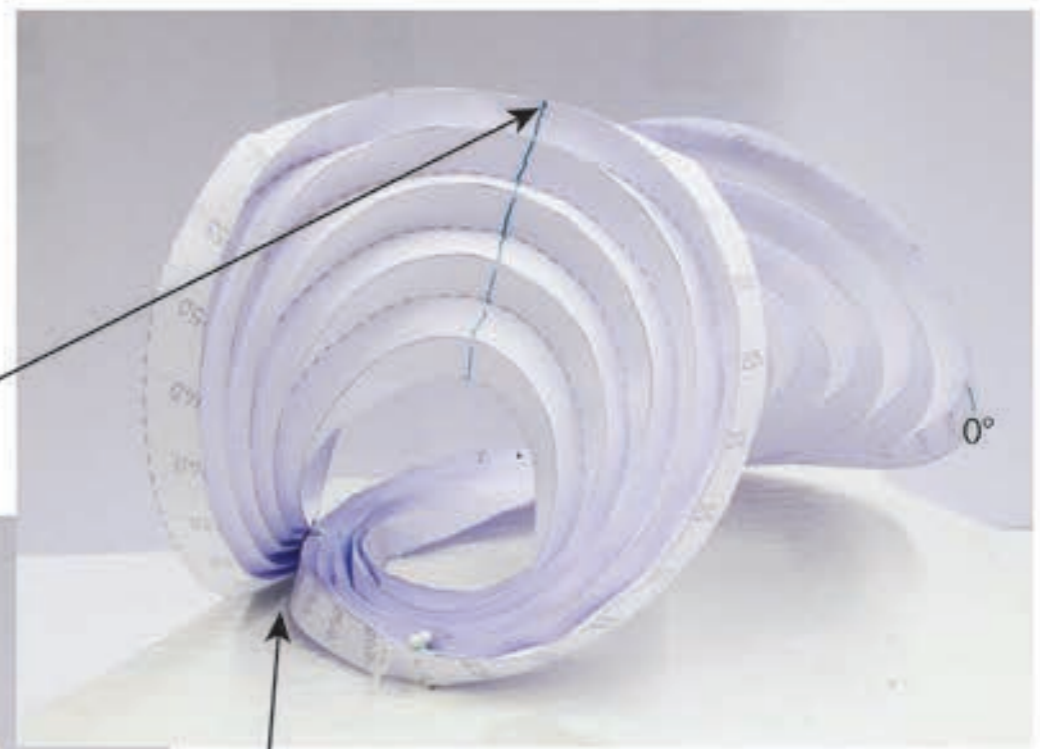
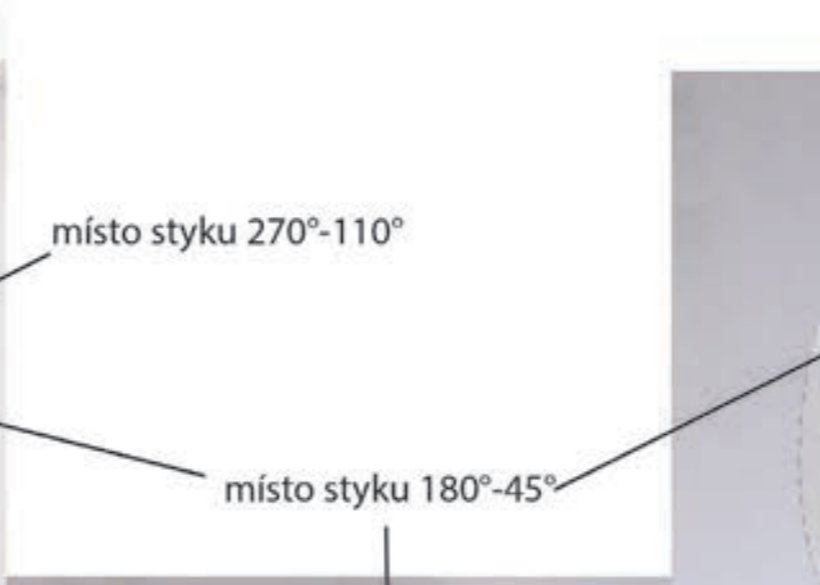
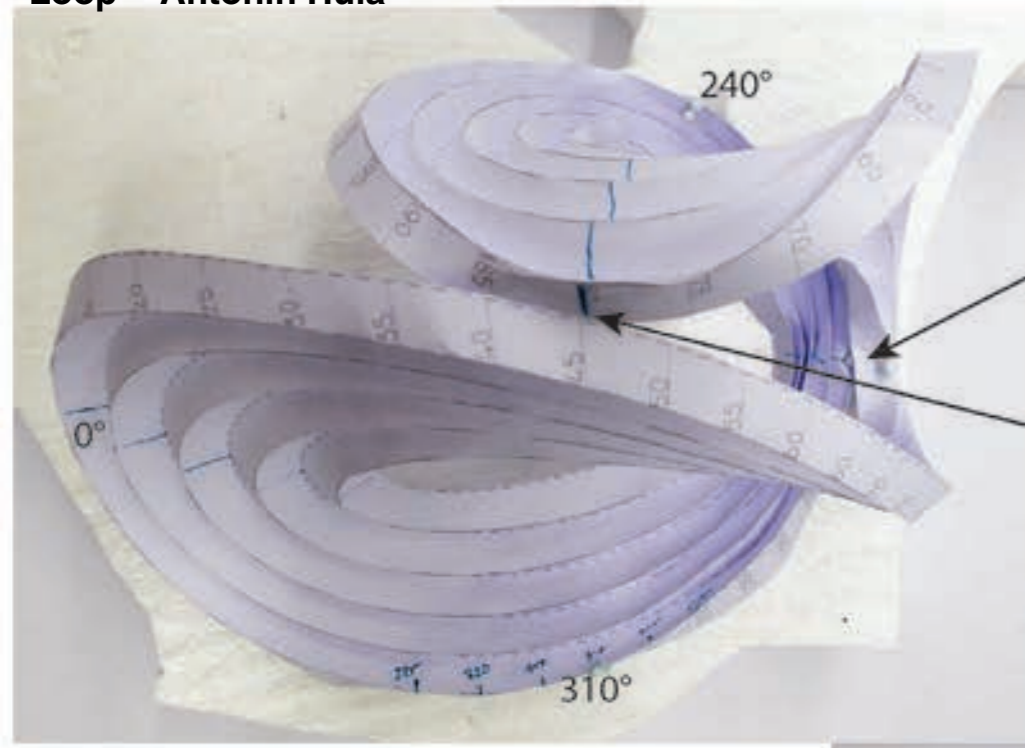
Atelier: Marie Davidová, Martin Kloda, Šimon Prokop
 Project: loop
 Name: Antonín Hůla
 Drawing title: GIGA map



Wood in Relation to Environment

Loop - Antonín Hůla

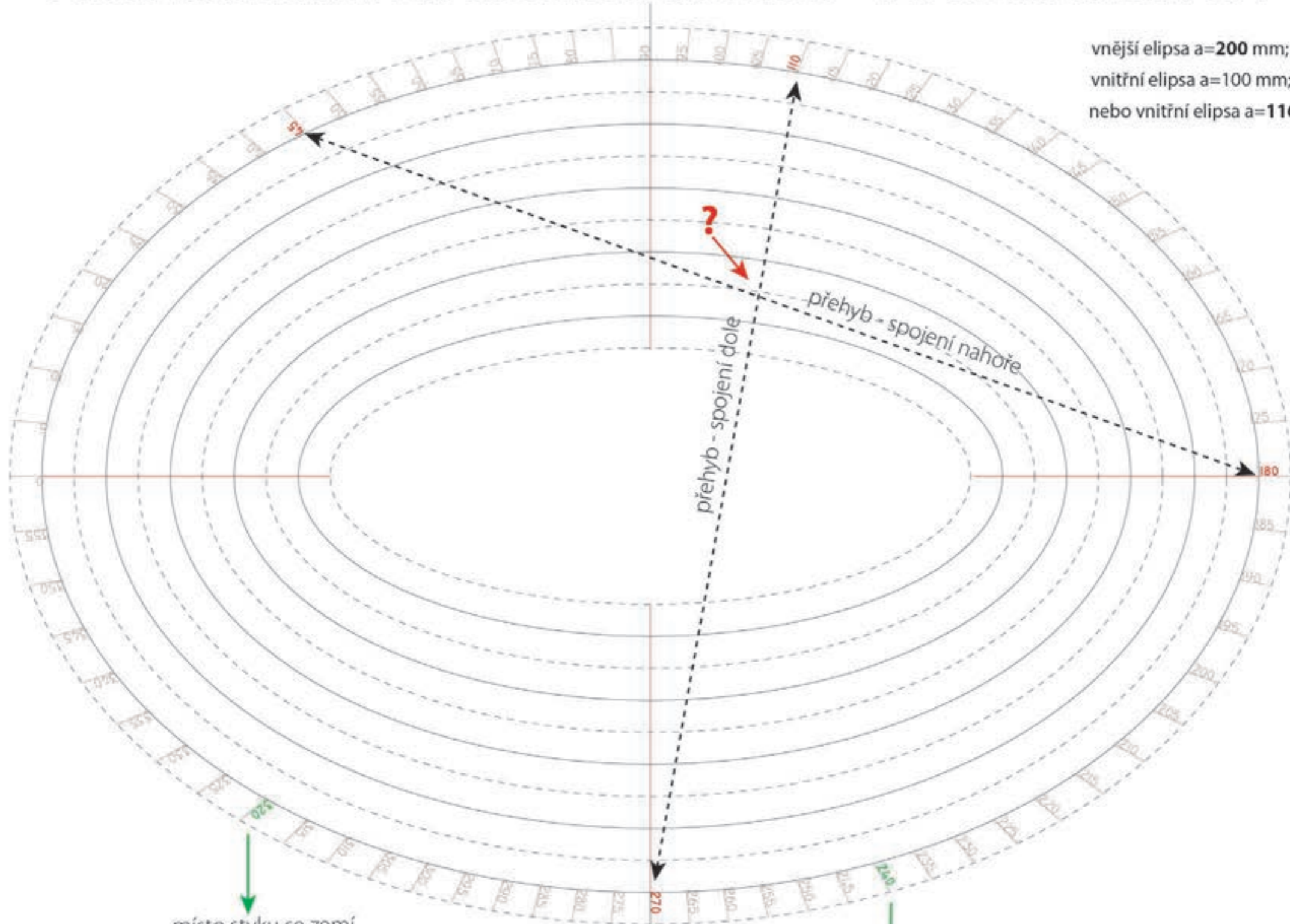
místo styku se zemí
resp. souřadnice z=0



Wood in Relation to Environment

Loop - Antonín Hůla

POPIS SKLÁDÁNÍ PAPIŘOVÉHO MODELU - ELIPSOVÁ VARIANTA



vnější elipsa a=200 mm; b=140 mm
vnitřní elipsa a=100 mm; b=40 mm
nebo vnitřní elipsa a=116 mm; b=56 mm

místo styku se zemí
resp. souřadnice z=0

místo styku se zemí
resp. souřadnice z=0

místo styku se zemí
resp. souřadnice z=0

1. design

2. GH model

3. GIGA - map

4. structure and joinery

5. panelling

6. blog

7. locations

Wood in Relation to Environment

Anna Hrušová - digital design draft

SUMMER PAVILION II

Marie Davidová
Martin Kloda
Šimon Prokop

STUDENTS
GRASSHOPPER
GIGA MAP
PROJECT / POSTER

SPONSORS

RESEARCH
REFERENCES
WOOD
HUMIDITY

BIDD

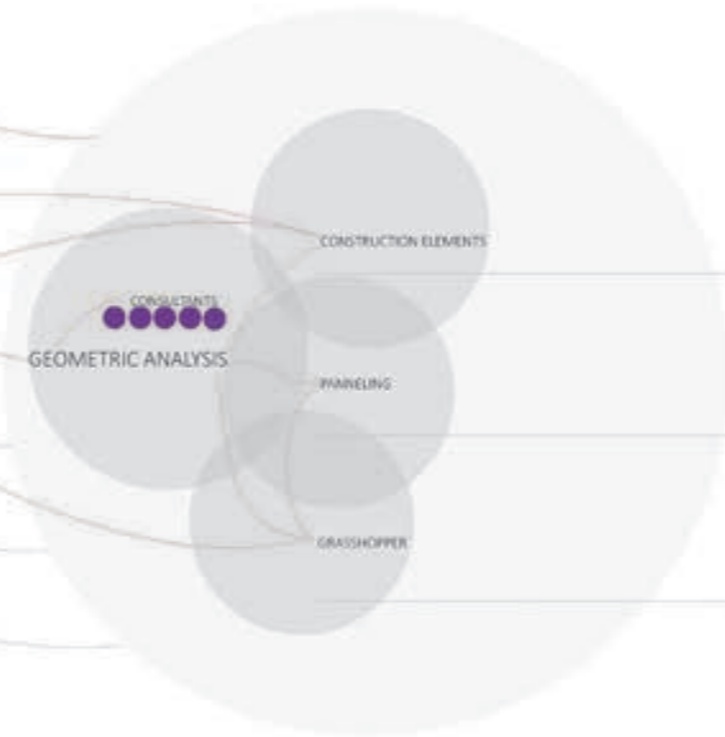
GIGA MAP

CONSULTANTS
GEOMETRIC ANALYSIS

CONSTRUCTION ELEMENTS

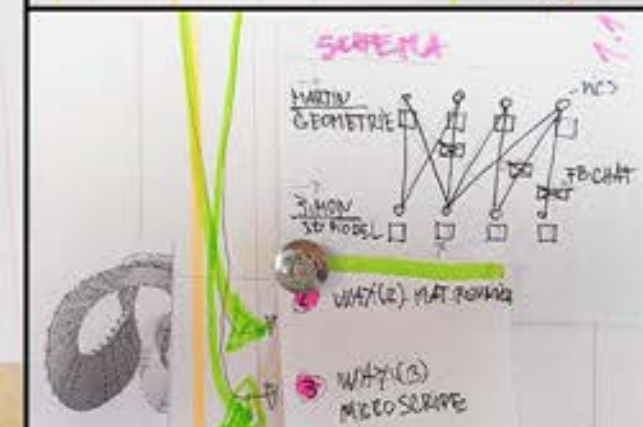
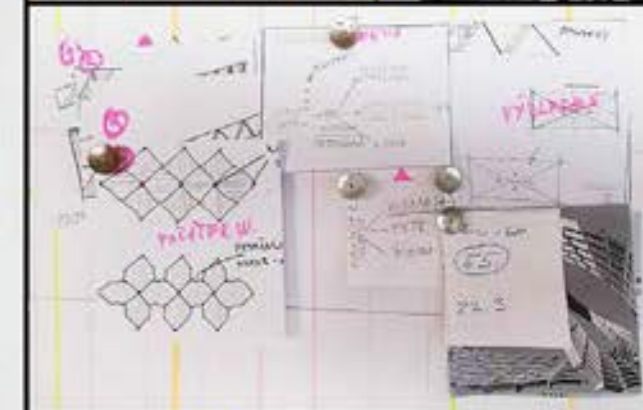
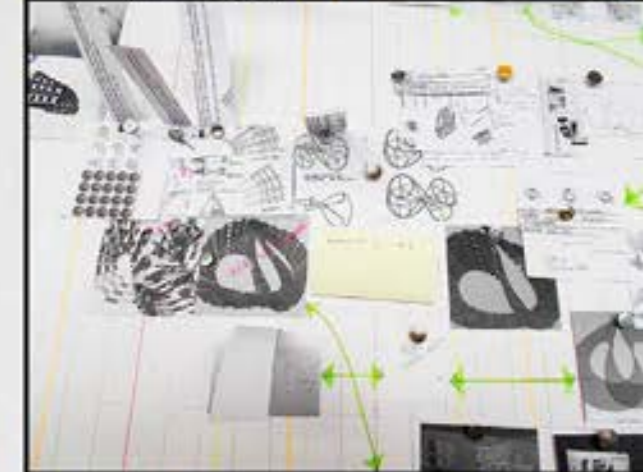
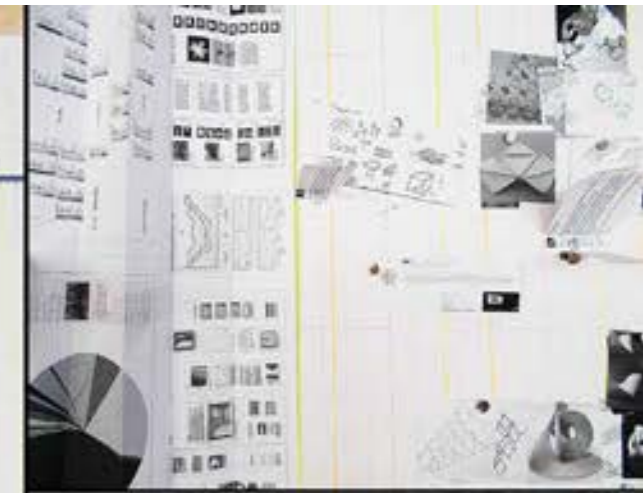
PANELING

GRASSHOPPER



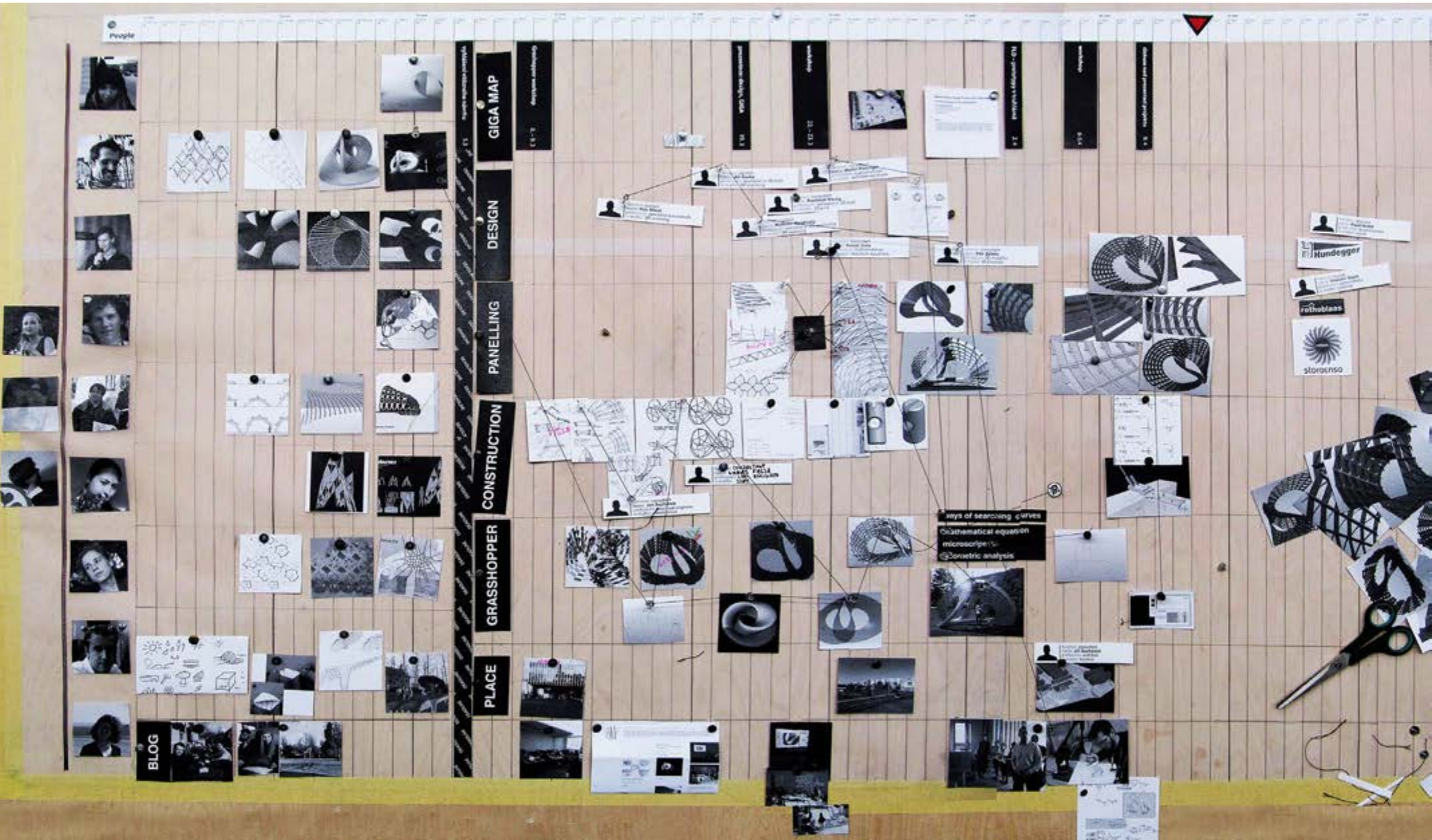
Wood in Relation to Environment

Anna Hrušová and Jiří Pokorný - physical design draft



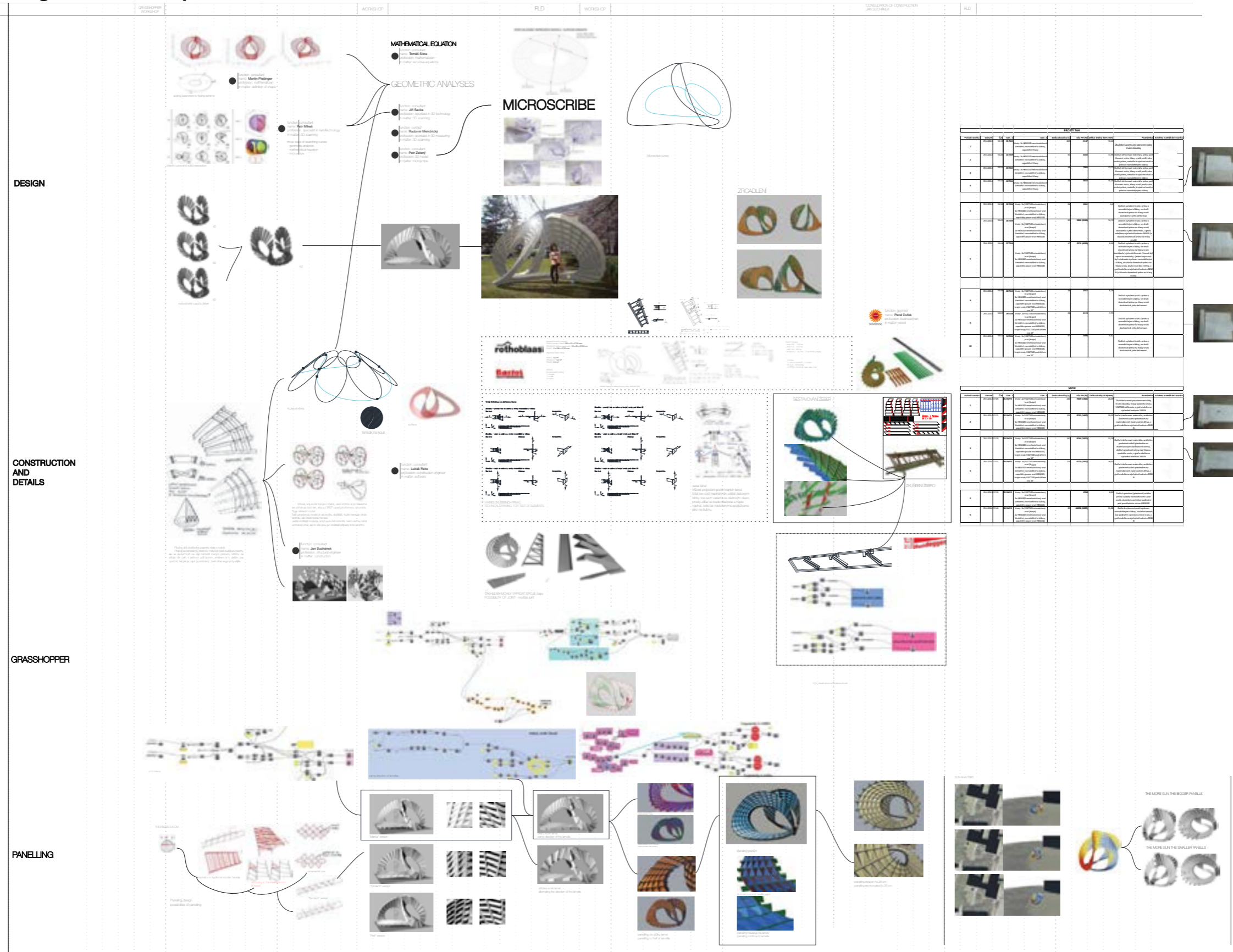
Wood in Relation to Environment

Jiří Pokorný - physical GIGA - map WIP redone



Wood in Relation to Environment

Hrůšová WIP - digital GIGA - map WIP redone



DESIGN

CONSTRUCTION AND DETAILS

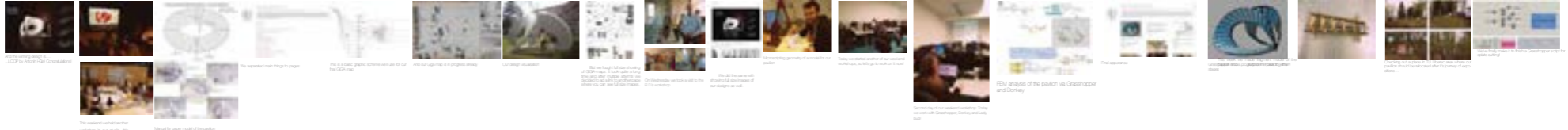
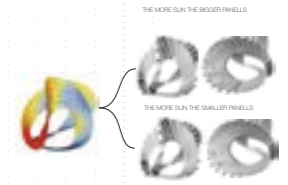
GRASSHOPPER

PANELLING

BLOG

MATERIALS									
Material	Quantity	Unit	Price	Total	Material	Quantity	Unit	Price	Total
...
...
...
...

COSTS									
Material	Quantity	Unit	Price	Total	Material	Quantity	Unit	Price	Total
...
...
...
...
...



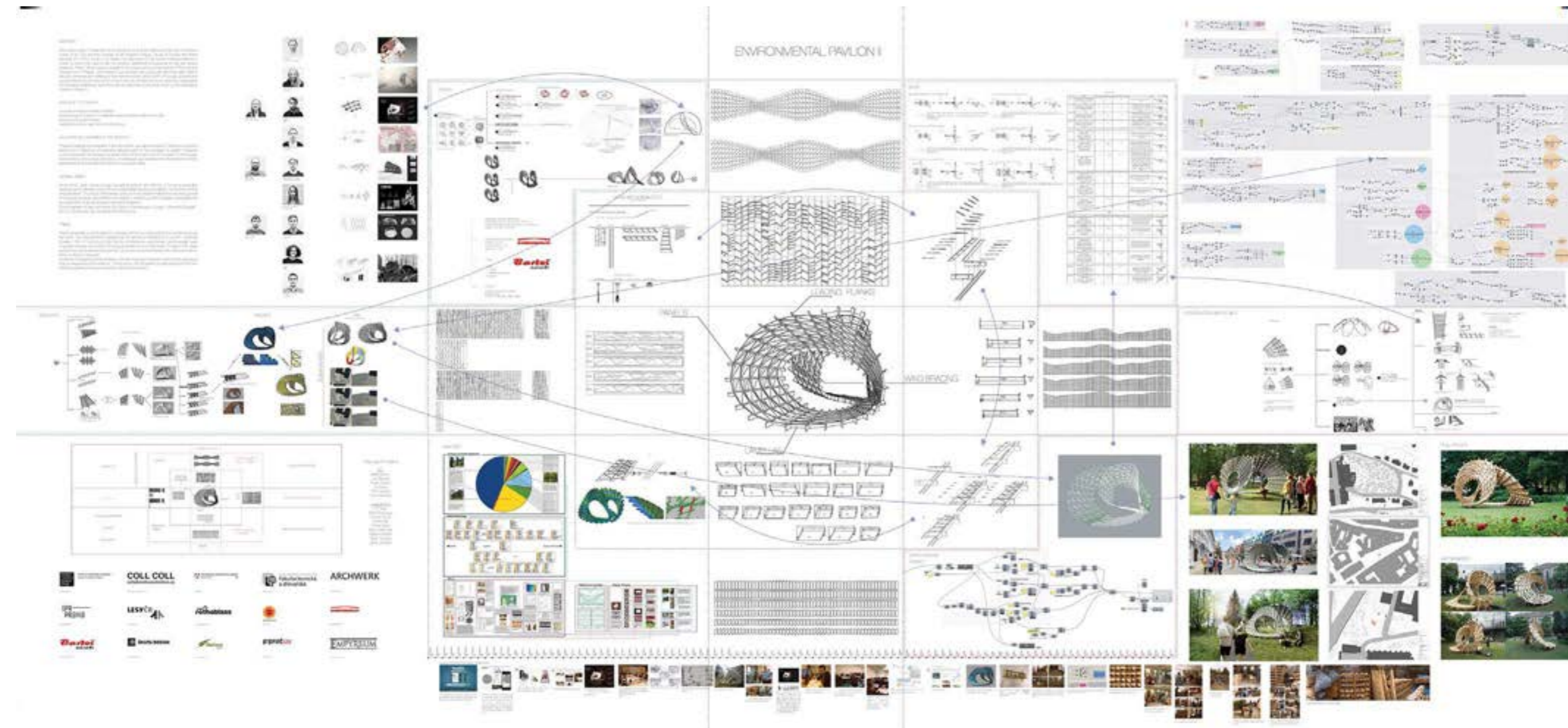
Wood in Relation to Environment

Jiří Pokorný - physical GIGA - map - Final



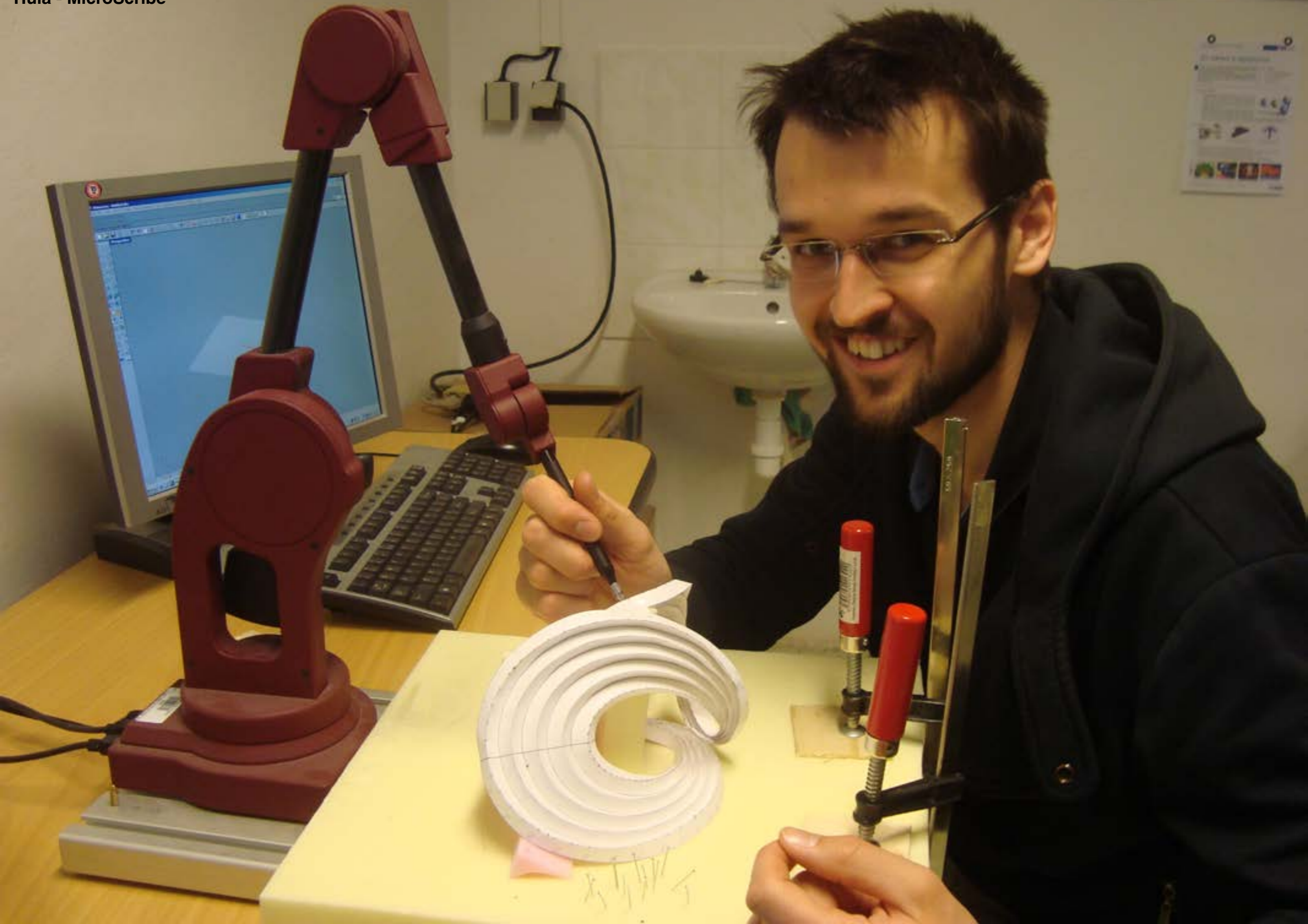
Wood in Relation to Environment

Hrůšová - digital GIGA - Final



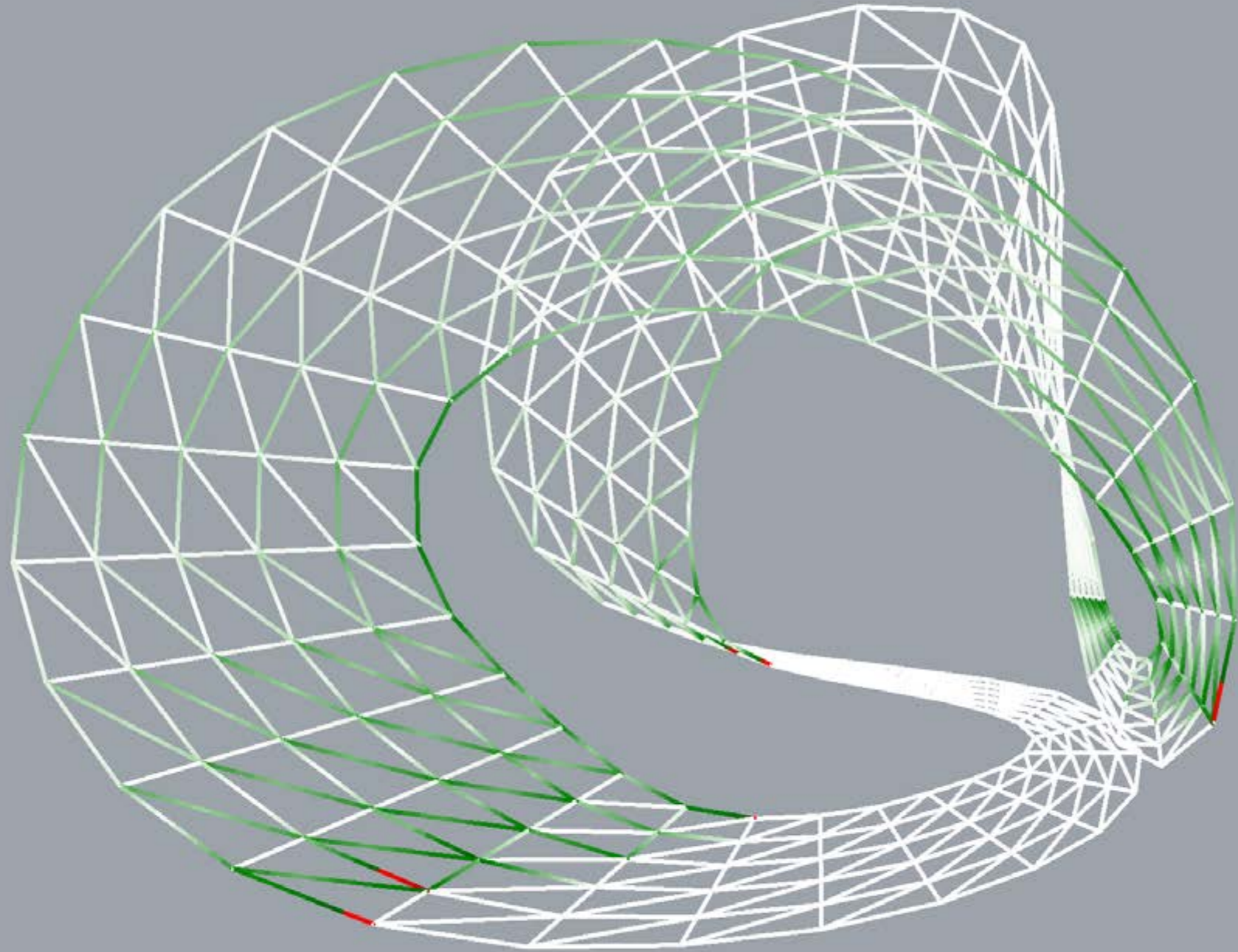
Wood in Relation to Environment

Håla - MicroScribe



Wood in Relation to Environment

structural analysis in Donkey



Wood in Relation to Environment

joins testing



Wood in Relation to Environment

environmental pavilion Loop



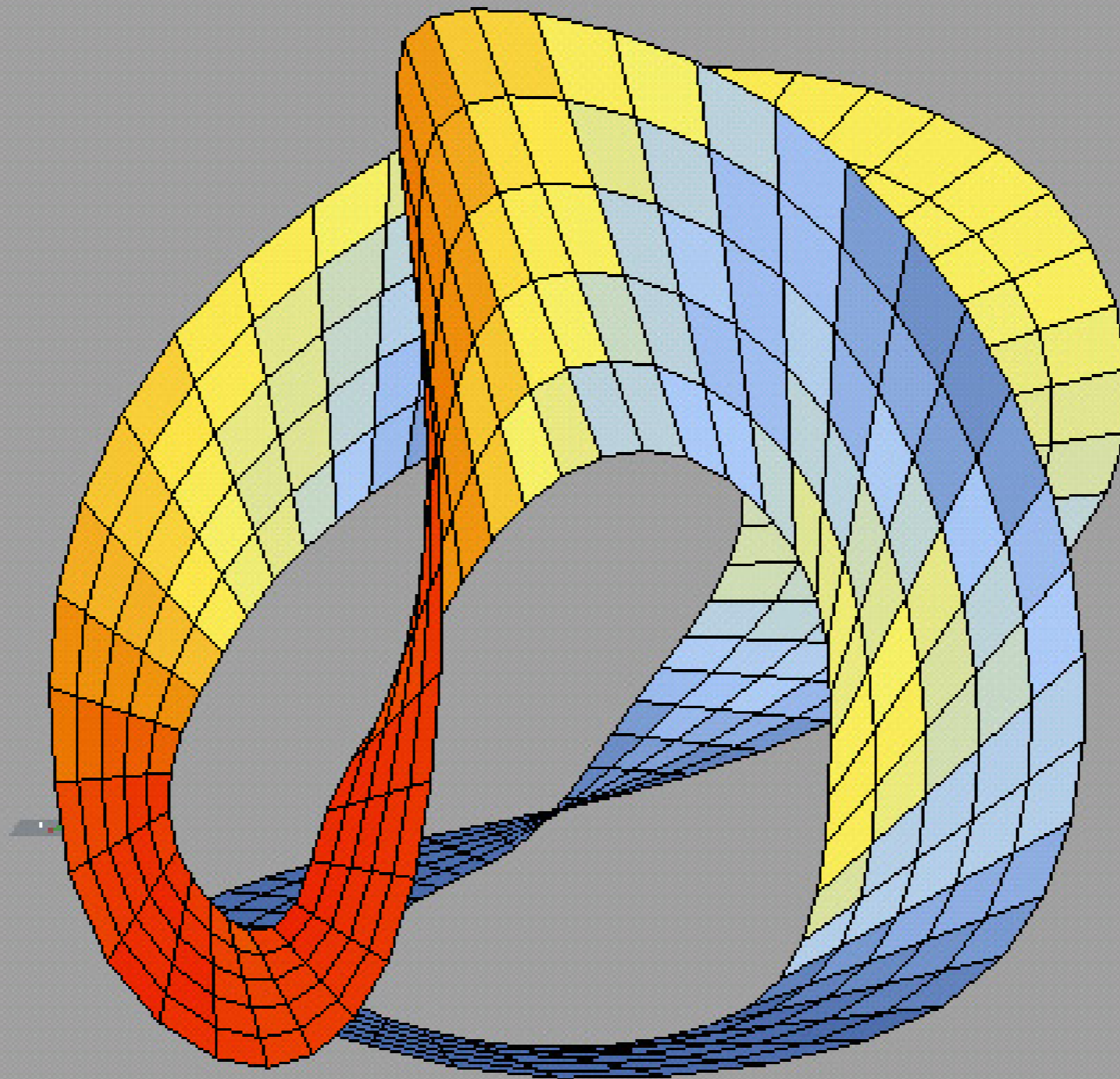
Wood in Relation to Environment

environmental pavilion Loop



Wood in Relation to Environment

solar analysis in Ladubug



Wood in Relation to Environment

opening of EnviroCity



Wood in Relation to Environment

opening of EnviroCity - Lunchmeat



Wood in Relation to Environment

opening of EnviroCity - Lunchmeat



Wood in Relation to Environment

discussion with Nadace Proměny



The GIGA-map is raising new questions in the design process and therefore generating it.

It's time basis creates an overview and control about the design stage and deadlines.

It is a great tool for the other professions to get overview of the project and involve themselves more, than to be just asked questions.

It is a good tool to draft the design concept of the paper based GIGA-map in the PC first.

Wood in Relation to Environment

conclusion

Creating a MINI-maps for each individual student/group was a good starting point that lead the students into the study.

The use of my own research GIGA-map gave a good study material for the students, who, thanks to the time schedule, couldn't go so deep into the wood research themselves.

The time-line GIGA-map is a good tool for the process but might not be working for the final representation.

The sticker method might work, but only in the very first stage of the GIGA-mapping.

Wood in Relation to Environment

conclusion

The complex overview helped us to develop the concept of performative wood!