



# Eberswalde University for Sustainable Development

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## DMP: Predictability of color changes of wood used indoor - A new approach to evaluate the colour change as a function of the radiation dose. Research Data Management Questionnaire

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# **DMP: Predictability of color changes of wood used indoor - A new approach to evaluate the color change as a function of the radiation dose.**

## **Research Data Management Questionnaire**

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This data management plan (DMP) applies to the Research Data Management Organizer (RDMO) questionnaire and was operated with the RDMO software.  
<https://rdmorganiser.github.io/en/>

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# 1. General

## 1.1 Topic

### What is the main research question of the project?

The optical properties of wood show a high variety and depend on the chromophoric functional groups and chromophore systems present in the wood. Noticeable colour variations are found both between different species as well as within a wood species. During natural aging, wood undergoes a colour change, which is mainly caused by radiation of ultraviolet and visible light and the hereby induced photo-oxidation. The aim of this project is to convert key figures into a databased modelling in order to be able to evaluate the chemical and colour changes of wood based on the radiation dose. This includes the evaluation of the changes via depth profiles. Overall, research problems are dealt with on the basis of the following hypotheses:

- Colour and chemical changes in wood during natural sunlight exposure indoors ( $t_n$ ) and during artificially simulated ultraviolet and visible (UV/Vis) light exposure indoors ( $t_a$ ) are known:
  - a) If there are species-specific relationships between the two exposures, these can be described mathematically using a compensation curve. The parameters can be calculated using the generalized least squares estimation method. For the assumed relationship  $t_n = z * t_a$ , the shift factors ( $z$ ) can then be determined.
  - b) When light-induced colour and chemical changes occur, these can be checked for correlations using a structure-discovering method from explorative data analysis and multivariate statistics (Principal Component Analysis, PCA).
  - c) If the irradiation exposures have short-term colour and chemical effects, then long-term changes can be deduced via linear regressions.
- If the sunlight exposure can be specified as a function of time, then it can also be specified as a function of radiation dose (accumulated area-based power density).
- UV/Vis light filtered through window glass penetrates various types of wood at different depths: The further away the effect of surface-based radiation is from the wood surface, the lower the colour and chemical changes. If the changes are attenuated with increasing penetration depth, this results in depth profiles in the wood substance that can be measured colour-wise and chemically.
- If the evaluation of the planned measurements as a function of radiation dose, rather than as a function of time, produces revealing findings, then changes can be predicted.

### Please give some keywords describing the research question.

- wood

- radiation dose
- photo-induced colour change
- chromophore
- natural and artificial irradiation
- European wood species
- interior
- sunlight exposure

## 1.2 Research field

**Which research field(s) does this project belong to?**

- Engineering Sciences / Materials Science
- Natural Sciences / Polymer Research

## 1.3 Project schedule

**When does the project start?**

March 1, 2021

**When does the project end?**

Feb. 29, 2024

## 1.4 Project coordination

**Which persons or institutions are responsible for the project coordination?**

- Prof. Dr.-Ing. Alexander Pfriem - as responsible; Eberswalde University for Sustainable Development (HNEE)  
(HNEE is the German abbreviation for Hochschule für nachhaltige Entwicklung Eberswalde)
- PD Dr. habil. Gerald Koch - as co-responsible; Thünen Institute, Institute of Wood Research, Hamburg-Bergedorf (TI-HF)  
(TI-HF is the German abbreviation for Thünen Institut für Holzforschung)

## 1.5 Project partners

**Project partner**

*Project Partner "PD Dr. habil. Koch - TI-HF, Hamburg":* PD Dr. habil. Gerald Koch; Thünen Institute of Wood Reserch Hamburg-Bergedorf (TI-HF)

*Project Partner "Prof. Dr. habil. Beyer - IHD, Dresden":* Prof. Dr. habil. Mario Beyer; Institute for Wood Technology Dresden gGmbH (IHD)  
(IHD is the German abbreviation for Institut für Holztechnologie Dresden)

(gGmbH is a non-profit limited company, German abbreviation for gemeinnützige Gesellschaft mit beschränkter Haftung)

**Does your institution have rules or guidelines for the handling of research data? If yes, please briefly outline them and refer to more detailed sources of information if necessary. Please also indicate, if the rules / guidelines are mandatory or optional.**

*Project Partner "PD Dr. habil. Koch - TI-HF, Hamburg":* On 13.12.2019, the Thünen Institute adopted the "Guidelines for Handling Research Data at the Thünen Institute (Thünen Data Policy)"<sup>1</sup>. The Thünen Institute supports open access to research data and works with a structured research data management to ensure traceability, verifiability and, above all, further use. This guideline came into force on 01.01.2020. It will be reviewed at least every 2 years and updated as necessary.

*Project Partner "Prof. Dr. habil. Beyer - IHD, Dresden":* DFG - German research Foundation - funding, policies; Data storage and possible publication is carried out along the guideline for handling research data at the HNEE. HNEE - Eberswalde University for Sustainable Development - Guideline on handling research data at HNEE 09/22). The publication of the data will then follow the **F**indability, **A**ccessibility, **I**nteroperability, and **R**euse (FAIR)-principles<sup>2</sup> in order to enable the highest possible re-usability of the data.

**Who is/are the contact person(s) for data management questions?**

*Eberswalde University for Sustainable Development:*

- Prof. Dr.-Ing. Alexander Pfriem - Vice president for research and transfer; Head of this project
- Ian Wolff M.A. - Data Stuart, Research data management (RDM)
- Claudia Lenz M.Sc. - Research assistant, Project employee

*Project Partner "PD Dr. habil. Koch - TI-HF, Hamburg":*

- Prof. Dr. Folkhard Isermeyer - President, Overall responsibility
- Prof. Dr. Andreas Krause - Director, Compliance with the data policy
- PD Dr. habil. Gerald Koch - as co-head of project

*Project Partner "Prof. Dr. habil. Beyer - IHD, Dresden":*

- Prof. Dr. habil. Mario Beyer
- Dr. Almut Wiltner

## **1.6 Funding**

**Who is funding the project?**

*Funder "DFG":* German Research Foundation

(DFG is the German abbreviation for Deutsche Forschungsgemeinschaft e.V.)

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<sup>1</sup> <https://www.thuenen.de/de/data-policy> (retrieved on 23.06.2023)

<sup>2</sup> <https://www.go-fair.org/fair-principles/> (retrieved on 23.06.2023)



## Is the project within a special funding programme?

Funder "DFG": Individual Research Grants, Project number: 442135169<sup>3</sup>

**Does the funder have rules or recommendations for data management? If yes, please briefly outline them and refer to more detailed sources of information if necessary. Please also indicate if the rules / guidelines are mandatory or optional.**

Funder "DFG": Handling of Research Data - mandatory Specification of Requirements Relating to the Handling of Research Data in Funding Proposals - mandatory for proposals to include details<sup>4</sup>.

Checklist for the appropriate handling of research data in connection with DFG projects - Handling of research data<sup>5</sup>.

## 1.7 Other requirements I

**Are there requirements regarding the data management from other parties (e.g. the scholarly/scientific community)?**

No.

## 2. Content classification

### 2.1 Datasets

**What kind of dataset is it?**

Dataset "*specimen preparation*": There are 8 measurement series with 7 different wood species (2 softwoods and 5 hardwoods):

1. *Abies alba* MILL.  
Silver fir - sapwood, early wood
2. *Pinus sylvestris* L.  
Scots pine - sapwood, early wood
3. *Pinus sylvestris* L.  
Scots pine - heartwood, early wood
4. *Acer* spp.  
Maple - sapwood, early wood
5. *Fagus sylvatica* L.  
European beech - sapwood, early wood
6. *Juglans regia* L.  
European walnut - heartwood, early wood
7. *Quercus robur* L. or *Quercus petraea* (MATT.) LIEBL.

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<sup>3</sup> <https://gepris.dfg.de/gepris/projekt/442135169?language=en> (retrieved on 23.06.2023)

<sup>4</sup> [https://www.dfg.de/en/research\\_funding/announcements\\_proposals/2022/info\\_wissenschaft\\_22\\_25/index.html](https://www.dfg.de/en/research_funding/announcements_proposals/2022/info_wissenschaft_22_25/index.html) (retrieved on 23.06.2023)

<sup>5</sup> [https://www.dfg.de/download/pdf/foerderung/grundlagen\\_dfg\\_foerderung/forschungsdaten/forschungsdaten\\_checkliste\\_en.pdf](https://www.dfg.de/download/pdf/foerderung/grundlagen_dfg_foerderung/forschungsdaten/forschungsdaten_checkliste_en.pdf) (retrieved on 23.06.2023)

European oak, Pedunculate/grape oak - heartwood, late wood  
8. *Robinia pseudoacacia* L.  
Robinia - heartwood, late wood

- Wood blocks - 75 mm height, 20 mm width, 10 mm thick
- Wood veneers - 75 mm height, 20 mm width, depth 50 µm and 100 µm thick, tangential section
- For the Setups with extracted specimens: Standard TAPPI T 204 cm-07.

*Dataset "colour changes"*: Measurement data; Colour measurement values in the CIE L\*a\*b\* colour space; DIN EN ISO/CIE 11664-4:2020-03.

*Dataset "sample scans"*: Image scans of the samples; Scans of solid wood blocks and wood veneers; Veneers 1 to 4 are each 50 µm thick and veneers 5 to 10 are each 100 µm thick.

*Dataset "ATR FT-IR"*: Measurement data (spectra); ATR FT-IR, Attenuated Total Reflection Fourier-Transform Infrared spectroscopy.

*Dataset "UV-Vis"*: Measurement data (spectra); UV-Vis, Ultraviolet - Visible spectrophotometry.

*Dataset "UMSP"*: Topochemical investigations; UMSP, UV-Microspectrophotometry.

*Dataset "GC-MS"*: Chemical investigations; GC-MS, Gas Chromatography - Mass Spectrometry.

*Dataset "artificial irradiance"*: Artificial irradiation - constant irradiation; Sunlight simulation device with integrated control of ambient conditions and filter system for indoor sunlight simulation; DIN EN ISO 16474-2:2022-11, (DIN EN ISO 4892-2:2021-11), CIE 241:2020, DIN 50014:2018-08.

*Dataset "natural irradiance"*: Measurement and recording of natural irradiance in W/m<sup>2</sup>; ISO 9060:2018-11.

*Dataset "electromagnetic irradiance"*: Measurement data (spectra); Electromagnetic radiation (UV, VIS, IR).

*Dataset "climate data"*: Measurement data; climate data in the room - data logger; Temperature (°C) and relative humidity (%).

*Dataset "wood moisture"*: Wood blocks - 75 mm height, 30 mm width, and 30 mm thick, DIN 50014:2018-08.

## 2.2 Data origin

### Is the dataset being created or re-used?

*For all data sets applies:* Created.

## 2.3 Reuse

**Which individuals, groups or institutions could be interested in re-using this dataset? What are possible scenarios?**

*Dataset "specimen preparation":* Scientists in wood research.

*Dataset "colour changes":* Scientists in wood research; Industry: e.g. architects, furniture manufacturers, software developers, companies and enterprises dealing with surface treatment of wood.

*Dataset "sample scans":* Scientists in wood research; Industry: e.g. architects, furniture manufacturers, software developers, companies and enterprises dealing with surface treatment of wood.

*Dataset "ATR FT-IR":* Scientists in wood research; Industry: Companies and enterprises dealing with surface treatment of wood. The choice of the optimal surface treatment for parquet floors, floorboards and patio decks depends primarily on the type of wood, the technical requirements, i.e. the type of object.

- a) Impregnation (hard oils, alkyd oils, high solid oils, 2-component oils, glazes)
- b) Film-forming impregnation (hard wax oil, thick layer glazes);
- c) Sealing (water-based varnish, oil-based synthetic resin varnish, DD varnish, acid-curing varnish, epoxy resin coatings, cellulose varnishes, primers, joint filler solutions/binders);
- d) Lyes and soaps;
- e) Colouring of wood (colour oils, stains, colour glazes, active lyes, ammonia/smoking, thermal treatment);
- f) Industrial surfaces (UV oils, LED oils, UV varnishes).

*Dataset "UV-Vis":* Scientists in wood research.

*Dataset "UMSP":* Scientists in wood research.

*Dataset "GC-MS":* Scientists in wood research; Industry: chemical enterprises and companies in chemical industry, particularly working on light stabilisers for wood as well as for wood paints and lacquers.

*Dataset "artificial irradiance":* Scientists in wood research; Industry: e.g. architects, furniture manufacturers, companies and enterprises dealing with surface treatment of wood.

*Dataset "natural irradiance":* Scientists in wood research; Industry: e.g. architects, furniture manufacturers, companies and enterprises dealing with surface treatment of wood.

*Dataset "electromagnetic irradiance":* Scientists in wood research.

*Dataset "climate data":* Scientists in wood research. Industry: e.g. architects, furniture manufacturers, companies and enterprises dealing with surface treatment of wood.

*Dataset "wood moisture":* Scientists in wood research.

## 2.4 Reproducibility

**Is the dataset reproducible in the sense that it could be created / collected new in case it got lost?**

*For all data sets (except "climate data" and "wood moisture") applies:* No or only with disproportionate cost or effort.

*Datasets "climate data" and "wood moisture":* Yes, with little effort. Technically, data collection is simple, but historically, these data are unique because they are climate-dependent.

## 3. Technical classification

### 3.1 Date collection

**When does data collection or creation start?**

*Dataset "specimen preparation":* March 16, 2022

*Dataset "colour changes":* July 28, 2021

*Dataset "sample scans":* July 28, 2021

*Dataset "ATR FT-IR":* July 28, 2021

*Dataset "UV-Vis":* July 28, 2021

*Dataset "UMSP":* July 28, 2021

*Dataset "GC-MS":* May 1, 2023

*Dataset "artificial irradiance":* July 28, 2021

*Dataset "natural irradiance":* July 28, 2021

*Dataset "electromagnetic irradiance":* June 19, 2022

*Dataset "climate data":* July 28, 2021

*Dataset "wood moisture":* July 28, 2021

**When does data collection or creation end?**

*Dataset "specimen preparation":* May 31, 2023

*Dataset "colour changes":* Dec. 22, 2023

*Dataset "sample scans":* Dec. 22, 2023

*Dataset "ATR FT-IR":* Dec. 22, 2023

*Dataset "UV-Vis":* Dec. 22, 2023

*Dataset "UMSP": Dec. 22, 2023*

*Dataset "GC-MS": Jan. 31, 2024*

*Dataset "artificial irradiance": Dec. 22, 2023*

*Dataset "natural irradiance": Jan. 31, 2024*

*Dataset "electromagnetic irradiance": Dec. 23, 2022*

*Dataset "climate data": Jan. 31, 2024*

*Dataset "wood moisture": Jan. 31, 2024*

**When does data cleansing / data preparation start?**

*Dataset "specimen preparation": March 16, 2022*

*Dataset "colour changes": Sept. 1, 2021*

*Dataset "sample scans": Sept. 1, 2021*

*Dataset "ATR FT-IR": Sept. 1, 2021*

*Dataset "UV-Vis": Sept. 1, 2021*

*Dataset "UMSP": Aug. 22, 2022*

*Dataset "GC-MS": June 27, 2022*

*Dataset "artificial irradiance": Sept. 1, 2021*

*Dataset "natural irradiance": July 3, 2023*

*Dataset "electromagnetic irradiance": April 3, 2023*

*Dataset "climate data": July 3, 2023*

*Dataset "wood moisture": Sept. 1, 2021*

**When does data cleansing / data preparation end?**

*Dataset "specimen preparation": May 31, 2023*

*Dataset "colour changes": Dec. 22, 2023*

*Dataset "sample scans": Dec. 22, 2023*

*Dataset "ATR FT-IR": Dec. 22, 2023*

*Dataset "UV-Vis": Dec. 22, 2023*

*Dataset "UMSP": Dec. 22, 2023*

*Dataset "GC-MS": Jan. 31, 2024*

*Dataset "artificial irradiance": Dec. 22, 2023*

*Dataset "natural irradiance": Dec. 22, 2023*

*Dataset "electromagnetic irradiance": June 30, 2023*

*Dataset "climate data": Dec. 22, 2023*

*Dataset "wood moisture": Jan. 31, 2024*

### **When does data analysis start?**

*Dataset "specimen preparation": March 16, 2022*

*Dataset "colour changes": Sept. 1, 2021*

*Dataset "ATR FT-IR": Sept. 1, 2021*

*Dataset "sample scans": Sept. 1, 2021*

*Dataset "UV-Vis": Sept. 1, 2021*

*Dataset "UMSP": Aug. 22, 2022*

*Dataset "GC-MS": June 27, 2022*

*Dataset "artificial irradiance": Sept. 1, 2021*

*Dataset "natural irradiance": July 3, 2023*

*Dataset "electromagnetic irradiance": April 3, 2023*

*Dataset "climate data": July 3, 2023*

*Dataset "wood moisture": Sept. 1, 2021*

### **When does data analysis end?**

*Dataset "specimen preparation": May 31, 2023*

*Dataset "colour changes": Feb. 29, 2024*

*Dataset "sample scans": Feb. 29, 2024*

*Dataset "ATR FT-IR": Feb. 29, 2024*

*Dataset "UV-Vis": Feb. 29, 2024*

*Dataset "UMSP": Feb. 29, 2024*

*Dataset "GC-MS": Feb. 29, 2024*

*Dataset "artificial irradiance": Feb. 29, 2024*

*Dataset "natural irradiance": Feb. 29, 2024*

*Dataset "electromagnetic irradiance":* June 30, 2023

*Dataset "climate data":* Feb. 29, 2024

*Dataset "wood moisture":* Feb. 29, 2024

### **3.2 Data size**

#### **What is the actual or expected size of the dataset?**

*For all data sets (except "sample scans" and "UMSP") applies:* Less than 1 GB.

*Datasets "sample scans" and "UMSP":* 1 GB to 1 TB.

### **3.3 Formats**

#### **Which file formats are used?**

*Dataset "specimen preparation":*

- No file formats, as they are the samples to be measured.

*Dataset "colour changes":*

- Text file, Comma-Separated Values (.csv)
- Raster image file, Portable Network Graphic (.png)

*Dataset "sample scans":*

- Raster image file, Portable Network Graphic (.png)
- Text-only document, Hypertext Markup Language (.html)

*Dataset "ATR FT-IR":*

- Text file, Comma-Separated Values (.csv)
- Spectroscopy file format (.spa), SPA files mostly belong to OMNIC by ThermoFisher. These SPA textures contain raster graphics saved in BMP (bitmap) format.
- Raster image file, Portable Network Graphic (.png)

*Dataset "UV-Vis":*

- Text file, Comma-Separated Values (.csv)
- Spectroscopy file format (.vspd), Shimadzu UV 1800, 2500, 3600, 3600i (.spc .vspd)
  - In-company formats
- Raster image file, Portable Network Graphic (.png)

*Dataset "UMSP":*

- Raster image file, Portable Network Graphic (.png)
- Special file formats
  - .APM - vector image file saved in the Aldus Placeable Metafile format;
  - .DBS - DBS files are the saved project files of DBSchema, an embedded database system solution;

- .IM1 - Files with -.IM1 extension were used as a bitmap image file format,
- .AP1 - AP1 files are associated with other file types. Overall, this format is associated with a variety of software applications. They are usually in the following file format: Binary Data.
- Text file, Comma-Separated Values (.csv)

*Dataset "GC-MS":*

- Text file, Comma-Separated Values (.csv)

*Dataset "artificial irradiance":*

- Text file, Comma-Separated Values (.csv)

*Dataset "natural irradiance":*

- Text file, Comma-Separated Values (.csv)
- Raster image file, Portable Network Graphic (.png)

*Dataset "electromagnetic irradiance":*

- Text file, Comma-Separated Values (.csv)
- Spectroscopy file format (.spc),
  - The SPC file format is a file format in which all kinds of spectroscopic data, including among others infrared spectra, Raman spectra and UV/VIS spectra. The format can be regarded as a database with records of variable length and each record stores a different kind of data (instrumental information, information on one spectrum of a dataset, the spectrum itself or extra logs)
- Raster image file, Portable Network Graphic (.png)

*Dataset "climate data":*

- Text file, Comma-Separated Values (.csv)
- Special file format (.record)
- Raster image file, Portable Network Graphic (.png)

*Dataset "wood moisture":*

- Text file, Comma-Separated Values (.csv)

### 3.4 Tools

**Which tools, software, technologies or processes are used to generate or collect the data?**

*Dataset "specimen preparation":*

- Purchase of sample material:
  - Lehmann e.K. (Domestic and foreign veneers and woods), Berlin, Germany  
→ *Abies alba* MILL., *Pinus sylvestris* L., *Acer* spp., *Fagus sylvatica* L., *Quercus robur* L. or *Quercus petraea* (MATT.) LIEBL., and *Robinia pseudoacacia* L.
  - deutsches-tonholz, Dresden, Germany  
→ *Juglans regia* L.



- Preparing specimens:
  - Device: Sled microtome for the production of thin films for microscopy "Leica SM2010 R", S/N: 10759  
Narrow band disposable blades (microtome blades) from Leica:
    - Surgipath® DB80 LX (Cat.-No.: 631-1082) and
    - Surgipath® DB80 LS (Cat.-No.: 631-1082) microtome blades from Leica, Avantor® VWR International GmbH, Darmstadt, Germany
  - Company: Leica Biosystems Nussloch GmbH, Nussloch, Germany
  - Software: not necessary
- Soxhlet-Extraction - Devices and chemicals
  - Devices:
    - Soxhlet extractor: Extractor head according to Soxhlet, Capacity 30 ml, cone NS 29/32, DIN 12602, Cat.-No.: 05 3951 25  
Lenz Laborglas GmbH & Co. KG, Wertheim, Germany
    - Extraction thimbles: Cellulose, MN 645, Height: 80 mm, Outer diameter: 25 mm, Inner diameter: 22 mm  
Macherey-Nagel GmbH & Co. KG, Düren, Germany
    - Magnetic stirrer with heating plate made of glass ceramic and (IKA C-MAG HS 7) DIN 12878 socket for connecting the electronic contact thermometer (temperature controller IKA ETS-D5)  
IKA GmbH & Co. KG, Staufen im Breisgau, Germany
    - Two laboratory cylinder magnetic stir bars for stirring the silicone oil in the beaker and the extraction solution in the round-bottom flask.  
Carl Roth GmbH + Co. KG, Karlsruhe, Germany
    - Laboratory lifting platform (Lab-Jack), DIN 12897, Aluminium, green, Floor area: 240x240 mm (Typ 1), Height min: 60 mm, Height max: 275 mm, Maximum dynamic operating load (kg max dyn): 7kg, Maximum static operating load (kg max stat): 30 kg, Cat.-No.: 11040  
Bochem Instrumente GmbH (Bochem Lab Supply), Weilburg, Germany
    - Reflux condenser: Condensers with glass connectors Dimroth-condenser, 400 mm, 29/32, Cat.-No.: TK40.1  
Carl Roth GmbH + Co. KG, Karlsruhe, Germany
    - Tube: ROTILABO® silicone standard design, 10.0 mm, 14,0 mm, 10 m  
Carl Roth GmbH + Co. KG, Karlsruhe, Germany
    - Tripod plate stainless steel, 300 x 150 x 3 mm, M10 thread, 1 foot, adjustable, with non-slip rubber coating with  
Tripod rod stainless steel, with M10 thread, Length: 1250 x 13 mm diameter  
Laborshop24 GmbH, Gross-Zimmern, Germany
    - Reagent bottles with thread, material: borosilicate glass 3.3, according to ISO 4796, content: 100 ml, graduated, sterilisable up to 140°C; Cat.-No.: 215-1592  
Avantor® VWR International GmbH, Darmstadt, Germany
  - Chemicals:
    - Toluene: Toluene, 2.5 l, glass, ROTIPURAN® ≥99.5 %, p.a., ACS, ISO, Cat.-No.: 7115.2  
Carl Roth GmbH + Co. KG, Karlsruhe, Germany
    - Ethanol: Ethanol, 2.5 l, plastic, ≥99.8 %, denatured, Cat.-No.: K928.3

- Carl Roth GmbH + Co. KG, Karlsruhe, Germany
  - Silicone oil (Medium to be heated during Soxhlet extraction): Silicone oil M 100, 5 l, medium viscous, stabilised, Cat.-No.: A528.2  
Carl Roth GmbH + Co. KG, Karlsruhe, Germany
- Due to the work with toluene, the chemical resistance of plastics must be considered. Therefore, special caps and pouring rings must be used:
  - Screw caps made of PBT with PTFE-coated silicone seal, red, GL 45, diameter 54 mm, Height: 28 mm; Cat.-No.: TX94.1  
Carl Roth GmbH + Co. KG, Karlsruhe, Germany
  - Pouring rings ETFE, red, GL 45, Cat.-No.: N543.1  
Carl Roth GmbH + Co. KG, Karlsruhe, Germany
- The stacks of veneers, each with 10 veneers per type of wood and setup, are placed one on top of the other on a magnetic plate and fixed on the long sides to the right and left respectively with a glass slide (for the microscopy) and a cone-shaped neodymium magnet above it. Between the individual irradiation times, the veneers are completely fixed under the glass slides with cone magnets and packed light-proof in boxes and cooled.
  - Neodymium steel cone magnets Ø15x21 mm, chrome-plated, adhesive force approx. 5.5 kg, Cat.-No.: 3712  
EarthMag GmbH, Dortmund, Germany
  - Magnetic wall - galvanised coated sheet 600 x 600 x 1 mm, RAL 9007 - grey aluminium, cut to many sheets: 120 x 60 mm, Cat.-No.: : 002-1091-4  
Bauflaschnerei Winter GmbH, Essingen, Germany
  - Storage boxes with hinged lids, PP, 136x87x35 mm, Cat.-No.: SEMA0342  
Avantor® VWR International GmbH, Darmstadt, Germany

*Dataset "colour changes":*

- Device: Spectrophotometer „spectro-guide sphere gloss“, Cat.-No.: 6834
- Company: BYK-Gardner GmbH, BYK - a member of Atlanta, Geretsried, Germany
- Software: BYKWARE easy-link for spectro-guide, Version V2.09.1 (Add-ins, Excel-Macros)
- Copyright: © 1999 BYK-Gardner

*Dataset "sample scans":*

- Device: Laser printer - WLAN 4-in-1, Colour laser multifunction device „Brother MFC-L8690CDW“
- Company: Brother International GmbH, Bad Vilbel, Germany
- Scans: Scans of solid wood blocks and wood veneers. For each type of wood species, one block and ten veneers are prepared and measured. The ten veneers are packed on top of each other to form a stack. The first (upper) four veneers are each 50 µm thick and the last (lower) six veneers are each 100 µm thick. The veneers from the veneer stacks are separated during the scanning process and placed next to each other on the scanner.

*Dataset "ATR FT-IR":*

- Device: FT-IR spectrometer with ATR and transmission measurement „Nicolet™ iS™ 5“, Cat.-No.: IQLAADGAAGFAHDMAZA
- Company: Thermo Fisher Scientific Inc., Waltham, Massachusetts, USA
- Software: OMNIC Software Suite 9.8.286, Driver version: 9.8, Firmware version: 1.08; Cat.-No.: 4500573209
- Copyright: © 1992-2017 Thermo Fisher Scientific Inc.

*Dataset "UV-Vis":*

- Device: UV/Vis spectrometer incl. integrating sphere for measurement on solids „UV-2600 with ISR2600Plus“
- Company: Shimadzu Corp. Kyōto, Japan
- Software: LabSolutions UV-Vis, Version 1.10, Cat.-No.: 207-24525-92, S/N: A11664900364
- Copyright: © 2019 Shimadzu Corporation

*Dataset "UMSP":*

- Device: UV-Microspectrophotometer „UMSP 80“ equipped with a scanning stage
- Company: Carl Zeiss AG, Oberkochen, Germany
- Software: APAMOS Zeiss West Germany, (Automatic Photometric Analysis of Microscopic Objects by Scanning), Zeiss, Version 1.00; 31.01.1991
- Copyright: © 1990 Zeiss Germany

*Dataset "GC-MS":*

- Device: Gas chromatograph equipped with a split/split less injection port and an MSD
- Company: Agilent Technologies, Inc., Santa Clara, California, USA
- Software: Agilent Data Analysis MSD ChemStation F.01.03.2365
- Copyright: © 1989-2015 Agilent Technologies, Inc.

*Dataset "artificial irradiance":*

- Device: Sunlight simulation device with integrated control of ambient conditions and filter system for indoor sunlight simulation „Q-SUN Xe-3 w / RH Control“, S/N: 20-26006-78-X3H
- Company: Q-Lab GmbH, Saarbrücken, Germany
- Software: VSC\_Q-SUN.xlsm (Add-ins, Excel-Macros)
- Copyright: © 2019 Q-Lab

*Dataset "natural irradiance":*

- Device: Pyranometer „Kipp & Zonen SMP11“, Secondary standard; S/N: 212370, Cat.-No.: 0374910; Recording Device: Data logger, „Kipp & Zonen METEON 2.0 Smart Irradiance Meter“, S/N: MT1837064, Ca.-No.: 0388900
- Company: both OTT HydroMet GmbH, Kempten, Germany
- Software: METEON 2.0, Version V1.1.0.0, Firmware Version: 2.01
- Copyright: © 2018 Kipp & Zonen

*Dataset "electromagnetic irradiance":*

- Device: Spectro-radiometer „TRISTAN 4“ with cosine light guide  
On loan from the University of Leipzig, Germany, Faculty of Life Sciences, Institute of Biology, Plant Physiology
- Company: m.u.t GmbH, Wedel, Germany
- Software: TriWin 2.0, Version 2.00.05
- Copyright: © m.u.t. GmbH

*Dataset "climate data":*

- Device: Climate data logger „BL30“
- Company: Trotec GmbH, Heinsberg, Germany
- Software: BL-30, RH and Temp Data logger Version 1.7
- Copyright: © 2021 Trotec

*Dataset "wood moisture":*

Laboratory scale:

- Device: VWR Classic LPW, precision scale with LCD "LPW 732i", max. 720g, S/N: IT1303666
- Company: VWR International GmbH, Darmstadt, Germany
- Software: not necessary

Constant-climate chamber:

- Device: Memmert "HPP 110", 0-70 °C, IP protection classes according to DIN EN 60529-IP20
- Company: Memmert GmbH + Co. KG, Schwabach, Germany
- Software: not necessary

**Which software, processes or technologies are necessary to use the data?**

*Dataset "specimen preparation":*

There are 8 measurement series with 7 different wood species (2 softwood and 5 hardwood):

1. *Abies alba* MILL.
  2. *Pinus sylvestris* L. - sapwood
  3. *Pinus sylvestris* L. - heartwood
  4. *Acer* spp.
  5. *Fagus sylvatica* L.
  6. *Juglans regia* L.
  7. *Quercus robur* L. or *Quercus petraea* (MATT.) LIEBL.
  8. *Robinia pseudoacacia* L.
- Wood blocks - 75 mm height, 20 mm width, 10 mm thick
  - Wood veneers - 75 mm height, 20 mm width, depth 50 µm and 100 µm thick, tangential section
  - For each type of wood species, one block and ten veneers are prepared and measured. The ten veneers are packed on top of each other to form a stack. The first (upper) four veneers are each 50 µm thick and the last (lower) six veneers are each

100 µm thick. Due to the resulting stack-wise measuring procedure, depth profiles are obtained.

- Dataset “*colour changes*”:
  - Measurement of all veneers and the blocks.
  - Measurements after 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 25, 30, 35, 40, 50, 60, 70, 80, 90 and 100 hours of irradiation.
- Dataset “*sample scans*”:
  - Scans of all veneers and the blocks.
  - Scans after 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 50, 60, 70, 80, 90, and 100 hours of irradiation.
- Dataset “*ATR FT-IR*”:
  - Measurement of all veneers and the blocks.
  - Measurements after 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 50, 60, 70, 80, 90, and 100 hours of irradiation.
- Dataset “*UV-Vis*”:
  - Measurement of the first (upper) three veneers and the blocks.
  - Measurements after 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 50, 60, 70, 80, 90, and 100 hours of irradiation.
- Dataset “*UMSP*”:
  - Measurement of the surface and in deeper regions of blocks irradiated at the radial surface. The thin sections are then prepared from the blocks at the TI-HF in Hamburg.
  - Measurements after 1 hour, 10 hours, one-month of irradiation.
- Dataset “*GC-MS*”:
  - Measurement of the first (upper) two veneers.
  - Measurements after 1 hour, 10 hours, one-month of irradiation.
- For the Setups with extracted specimens: Standard TAPPI T 204 cm-07.

There are 6 main measurement series in the project (6 experimental setups), see Fig. 1:

A_artificial_sunlight_exposure_indoor_untreated	Xenon
B1_natural_sunlight_exposure_indoor_untreated	Summer sun
B2_natural_sunlight_exposure_indoor_untreated	Winter sun
C_artificial_sunlight_exposure_indoor_extracted	Xenon
D1_natural_sunlight_exposure_indoor_extracted	Summer sun
D2_natural_sunlight_exposure_indoor_extracted	Winter sun

For the experimental setups C, D1, and D2, ethanol-toluene (ratio 1:1) extraction was performed following the TAPPI-T-204-cm-97 (1997) standard. The extraction of the veneers was carried out by Soxhlet extraction in extraction thimbles at 130°C for 24 hours. The external surface temperature of the Soxhlet extractor had a surface temperature of 60 °C. The blocks were extracted at 60 °C for three weeks an ethanol-toluene solution.

		Irradiation		
		Artificial	Natural	
		Xenon	Summer	Winter
Specimens	Untreated	A	B1	B2
	Extracted	C	D1	D2

**Figure 1:** Experimental setups

*Dataset "colour changes":*

The specific instrument settings selected during the measurements are listed hereafter.

- Scale: CieLAB
- Index: delta E\*
- Gloss: on
- Type of light: D65/10°

The same 2 points are always measured per veneer and per block and the average value is then calculated from this. The veneers are always placed on a white cellulose sheet to ensure the same background influence of the semi-hyaline veneers for each measurement.

*Dataset "sample scans":*

The following software is used to create colour plates for visual demonstration of the scanned samples:

- Software: GIMP (GNU Image Manipulation Programm), Version 2.10.34;
- Copyright: © 1995-2023 Spencer Kimball, Peter Mattis and the GIMP Development Team.

*Dataset "ATR FT-IR":*

Attenuated total reflection (ATR) has become a standard technique for measuring FT-IR spectra. In this technique, infrared light is transmitted through a crystal made of an IR-transparent material (diamond, ZnSe or germanium, in our case ZnSe - zinc selenide) and then interacts with a sample that has previously been pressed onto the crystal. The close contact is particularly important to obtain high-quality IR spectra. The specific instrument settings selected during the measurements are listed hereafter:

- [DATA COLLECTION INFORMATION]:
  - Number of sample scans: 32
  - Collection length: ~ 51.17 sec
  - Resolution: 4.000
  - Levels of zero filling: 2
  - Number of scan points: 12415
  - Number of FFT points: 65536

- Laser frequency: 15798,00 cm-1
- Interferogram peak position: 6100
- Apodization: N-B strong
- Phase correction: Mertz
- Number of background scans: 32
- Background gain: 1.0
- [DATA DESCRIPTION]:
  - Number of points: 7053
  - X-axis: Wavenumbers (cm-1)
  - Y-axis: Absorbance
- [SPECTROMETER DESCRIPTION]:
  - Spectrometer: Nicolet iS5
  - Source: IR
  - Detector: DTGS KBr
  - Smart Accessory ID: 098-2337718
  - Beam splitter: KBr
  - Sample spacing: 1.0000
  - Digitizer bits: 24
  - Optical velocity: 0.4747
  - Aperture: 100.00
  - Sample gain: 1.0
  - High pass filter: 1.0000
  - Low pass filter: 11000.0000

The veneers between the Zn-Se crystal and the pressure arm are always covered with a white cellulose sheet. This minimises the risk of damage to the thin veneers.

*Dataset "UV-Vis":*

Measuring diffuse reflectance with baseline measurement on barium sulphate (BaSO<sub>4</sub>) - Standard white plate. The specific instrument settings selected during the measurements are listed hereafter:

- [MEASUREMENT]:
  - Start: 800 nm
  - End: 200 nm
  - Data Interval: 0.5 nm
  - Scan Speed: Medium speed
  - Spectrum Type: Reflectance
- [ACCESSOIRES]:
  - Accessories: None
- [ADVANCED]:
  - Slit Width: 5.0 nm
  - Detector Unit: External (1 Detector)
  - Light Source Switch Wavelength: 323 nm
  - S/R Switch: Standard
  - Stair Correction: ON
- [REPEAT]:
  - Repeat Measurement: OFF

- [POST-PROCESSING]:
  - Spectrum Transformation: OFF
  - Data Processing Table: ON
  - Type: Peak Table
  - Number of Points: 4
  - Threshold Value: 0,001 nm
  - Print: OFF

*Dataset "UMSP":*

Software: DOSBox, Version v0.74-3

Copyright: © 2021 DOSBox.

Starting APAMOS under DOSBOX (in Windows 10 Education, Version 21H2)

1. Open DOSBOX (on desktop or under C: Programs)
2. Command inputs (#Comments)
  - mount c c:/ (#Ignore error message)
  - C: (#C drive is recognized)
  - cd apamos (#Enter twice)
  - apamos.exe (#Program starts)
3. Increase CPU power with Ctrl and F12 to approx. 40.000 (do not open Snap before)
4. The APAMOS data must be in the same folder level as the DOSBOX. The folder for the data is called ADATA.

The specific instrument settings selected during the measurements are listed hereafter:

The samples were embedded in epoxy resin according to Spurr 1969<sup>A</sup>, trimmed with a razor blade and sectioned with a rotary microtome (Leica, RM2265) equipped with a diamond knife (DiATOME, ultra 45° 2,5mm) of a defined thickness of 1µm. The scan program APAMOS digitises square fields of a local geometrical resolution of 0.25 µm × 0.25 µm and a photometrical resolution of 4096 greyscale levels. To visualize the absorbance intensities, the greyscale levels were converted into 14 basic colours (Koch and Kleist 2001<sup>B</sup>). The principle of UMSP investigation is based on the typical UV absorbance of lignin displaying a characteristic absorbance maximum in the range of λ270 - 280nm (Musha and Goring 1975<sup>C</sup>); λ280nm - absorbance for softwood lignin; λ278nm - absorbance for hardwood lignin. The default threshold is between 10 (min.) and 80 (max.). For large overflow between 5 and 80, but must be evaluated within a measurement series with equal threshold values.

*Dataset "GC-MS":*

For a qualitatively reliable measurement, at least 5 grams of the specific wood material are required per measurement.

Extraction was done using methanol, ethanol, or toluene. Methanol or ethanol are the solvents of choice for GC/MS analysis. Therefore, toluene must be removed before analysis and the residue must be solved in methanol before GC/MS analysis. The following parameters were used:

- Initial temperature: 40°C
- Maximum temperature: 330°C
- Initial time: 1 min



- Equilibration time: 0.50 min
- Run time: 37 min
- Mode: split
- Split ratio: 10:1
- Split flow: 26.8 ml/min
- Total flow: 32.2 ml/min
- Gas type: helium
- Column: capillary column,  
Agilent 1909S-416 HP-5MS
- Length: 60 m
- Diameter: 320  $\mu\text{m}$
- Film thickness: 0.25  $\mu\text{m}$
- Inlet: back inlet
- Outlet: MSD
- Outlet pressure: vacuum

*Dataset "artificial irradiance":*

The specific instrument settings selected during the measurements are listed hereafter:

- Irradiance of each of three Xenon Arc Lamps, Xe-1/Xe-3: 50 W/m<sup>2</sup>;
- Chamber temperature: 38 °C
- Relative humidity: 65 %
- Black panel temperature: 65 °C

Filter: Special 3 mm glass filters (Window-Q filters from Q-Lab) are installed in front of the xenon lamps to simulate the irradiation in the interior. For runs with less than 100 hours of irradiation, 15 minutes of dark phase are included before the specific exposure to stabilize the chamber climate to constant conditions (38 °C, 65 % RH). For the operation of the sunlight simulation device under defined climatic conditions for irradiation behind window glass, various additional tools are necessary. An ion exchanger with conductivity meter (Display 0 to 50 Micro-Siemens per centimetre [ $\mu\text{S}/\text{cm}$ ]; Range from 0 to 10  $\mu\text{S}/\text{cm}$  is ok, respectively green display range) is necessary for the supply with deionized water. Ion exchanger cartridges made of stainless steel, maximum pressure 10 bar, and capacity at 10° total salinity 2800 l, pure water quality 0.1-20  $\mu\text{S}/\text{cm}$ , capacity at least 800 l/h.

*Dataset "natural irradiance":*

The specific instrument settings selected during the measurements are listed hereafter:

- Measurement and recording of natural irradiance in watts per square meter [W/m<sup>2</sup>]
- Interval: 30 s.

The pyranometer used has the following technical characteristics:

- Spectral range (50% points): 285 to 2800 nm;
- Field of view: 180°
- Response time (63%): < 0.7 s
- Response time (95%): < 2 s
- Zero offset A: thermal radiation (at 200 W/m<sup>2</sup>): < 7 W/m<sup>2</sup>
- Zero offset B: < 2 W/m<sup>2</sup>

- Directional error (up to 80° at 1000 W/m<sup>2</sup> beam): < 10 W/m<sup>2</sup>
- Temperature response (-20°C - +50°C): < 1 %
- Temperature response (-40°C - +70°C): < 2 %
- Analogue output: 0-1 V or 4-20 mA
- Digital output: 2-wire RS-485
- Connection cable: 10 m

*Dataset "electromagnetic irradiance":*

The specific instrument settings selected during the measurements are listed hereafter:

- [MEASURE-Type]:
  - Type: Absolute
- [MEASURE-Parameter]:
  - Add cycles: 5
  - Iterations: 5
  - Auto exposure: yes
  - Max cycle time: 100 ms
- [MEASURE-Filter]:
  - Steps: 5 nm
  - Ampl. correction: 0 - respectively no  
(must be switched off when (also) measuring in the UV range)
  - Dark. correction: 1 - respectively yes
  - Filter: 0 - respectively no  
(Gauss Filter 0 nm, Bandwidth 0nm -> OFF)
  - Noise Filter: 1 - respectively yes
- [GRAPH]:
  - X-axis: 250 nm (min) - 850 nm (max.)
  - Y-axis: 0 (min) - 1500 (max)
  - X-Dimension [unit]: wavelength [nm]
  - Auto: X (yes), Y (yes)
- [IO]:
  - Baud: 115 K
  - Data bits: 8
  - Stop bits: 1
  - Parity: none

A baseline correction is available via settings of the amplitude correction as well as dark current measurement and finally the reference measurement.

*Dataset "climate data":*

The specific instrument settings selected during the measurements are listed hereafter:

- Sampling rate: 1800 s

*Dataset "wood moisture":*

For each wood species, the same three samples per measured climate are always used and the mean value is calculated from them.

**Is documentation about relevant software needed to use the data?**

*For all data sets applies:* No.

### **3.5 Versioning**

**Are different versions of the dataset created?**

*For all data sets applies:* No.

## **4. Data usage**

### **4.1 Usage scenarios**

**How / for what purpose will this dataset be used during the project?**

*Dataset "specimen preparation":*

The data set is the basis for all other measurements and setups.

*Dataset "colour changes":*

The data set is used to capture the objective colour change in a defined three-dimensional colour space.

- L\* coordinate: L\* Luminance [L\*=0 corresponds to white; L\*=100 corresponds to black];
- a\*-coordinate: +red/-green;
- b\*-coordinate: +yellow/-blue.

The a\*-coordinate and the b\*-coordinate can be combined as chromaticity  $C^*_{a,b}$ . All three coordinates together result in the Euclidean colour distance  $\Delta E^*$ . The CIE Lab system is a colour space defined by the international lighting commission (French: Commission Internationale de l'Éclairage (CIE)) in 1976. The official homepage of the CIE can be found here: <http://www.cie.co.at/>. It was further developed from the CIE colour system and is based on the CIE standard valence system introduced in 1931. CIE Lab system is probably the most common colour system today. Using the device-independent 3D colour model, colour differences are to be determined numerically. The model is objective and at the same time almost does justice to human perception by attempting to adapt the geometric distance between two colours in the colour space to human perception.

DIN EN ISO/CIE 11664-4:2020-03 - Colorimetry - Part 4: CIE 1976 L\*a\*b\* colour space.

*Dataset "sample scans":*

The data set is used for the realistic visual recording of the colour changes of the test specimens over the entire measurement period. The resulting overview colour charts serve as a visual supplement to the numerical values of the CIE Lab colour space.

*Dataset "ATR FT-IR":*

The data set is used to detect chemical changes and basic chemical compositions during the irradiation scenarios. Based on the position and intensity of characteristic absorption bands, conclusions can be drawn about the chemical composition (functional

groups of the lignin and extractives - untreated and extracted samples). The peaks can be related by the semi-quantitative method of area integration of the individual peaks. Based on the experimental design, information is then obtained on changes as a function of exposure dose and duration on the one hand and on the depth profile in the wood on the other. The different bands are already known in the literature and summarised in tabular form for the main components by Ganne-Chédeville et al. 2012<sup>D</sup>. In addition, influences of extractives are described in Pandey 2005<sup>E</sup>, among others. With the available equipment, measurements in the near infrared (NIR) range are also possible. Due to the better penetration depth into the veneers, NIR measurements are a good supplement to ATR-FTIR measurements in the future.

#### *Dataset "UV-Vis":*

The data set is used to identify spectral changes in UV light and Vis light and the basic diffuse reflectance behaviour in the irradiation scenarios. The analyses with the integration sphere measurement setup are relative measurements. A sample spectrum is always measured in relation to a reference material (barium sulphate, Al-Au mirror, D65/10° standard plate, etc.). The sample light falls on the integrating sphere at an angle of 0° (normal incidence) and the reference light at an angle of 8°. Using the S/R exchange function of the software parameters for the spectral method, the diffuse reflectance can be measured in the reflectance measurement position on the sample side or a specular reflectance of 8 degrees can be measured in the reflectance measurement position on the reference side. In our case, we measure the sample side (diffuse reflectance).

#### *Dataset "UMSP":*

The data set is used to detect aromatic compounds (lignin, phenolic extractives). They can be localised in individual cell wall layers at a resolution of 0.25 µm x 0.25 µm. The qualitative determination of ingredients is carried out by recording UV/Vis spectra in the wavelength range from 240 to 700 nm. The results can be presented topochemically by spectroscopic surface scanning (Koch et al., 2003<sup>F</sup>, Koch & Kleist, 2001<sup>B</sup>). These analyses are not carried out on a regularly recurring basis, but only at four different times for each setup. Above all, the precise visualisation of the colouring components in the different cell types and cell wall layers as well as their change due to sunlight exposure provides further fundamental insights into the photochemical reactions in the wood tissue. For the chemical characterisation of the substances, point measurements with a resolution of 1 µm<sup>2</sup> can also be carried out. These UV/Vis absorbance spectra are recorded in a wavelength range from 240 to 580 nm. An absorbance maximum in the wavelength range of 276 to 280 nm is typical for aromatic and conjugated compounds, e.g. lignin and phenolic extractives. According to Koch 2004<sup>G</sup>, higher condensed compounds are formed with increasing drying temperature, which are characterised by a strong shift of the absorbance maxima into the longer wavelength spectral range and overall higher absorbance values. These reaction mechanisms also explain the colour behaviour of the wood during prolonged exposure to light, which causes an intensive darkening (light ageing). Due to the considerable data sets of up to 60,000 measuring points for each scanning field (size approx. 50 µm x 50 µm), the evaluation is focussed on three wood species (*Pinus sylvestris* heartwood, *Quercus* spp. and *Juglans regia* and

two cutting depths with four measuring points per setup and treatment (untreated/extracted)).

*Dataset "GC-MS":*

Gas chromatography (GC), after prior derivatisation, can be used in organic analysis to determine individual substances in complex mixtures of substances. Mass spectrometry (MS) can be used to measure the mass-to-charge ratio of charged particles. The material composition of a sample or a molecule can thus be determined. When both methods are used in combination, the molecules of individual substances can be determined precisely. This allows precise conclusions to be drawn about the degradation of concrete extract substances and thus supports FTIR evaluations. As described in Beyer et al. (2018)<sup>H</sup>, conclusions about high and low molecular substances can be drawn during the evaluation via the retention time and via the peaks present. An exact quantitative analysis is difficult, but a comparison of the relative amounts is possible. Due to the considerable costs of this method, the evaluation is limited to three wood species and two cutting depths with four measuring times per setup and treatment (untreated/extracted).

*Dataset "artificial irradiance":*

The data set is used to record the objective artificial irradiation with xenon arc lamps. (more information at: <https://www.q-lab.com/documents/public/41b5935b-d41d-4368-a53e-98a3d528baf1.pdf>). The xenon arc lamps of the Q-SUN Xe-3 test chamber provide the simulation of the entire spectrum of sunlight. The near-horizontal specimen orientation and optional water and back-spray features provide a realistic moisture simulation available in a xenon test chamber. Q-SUN Xe-3-H: full spectrum sunlight, humidity control The Q-SUN-Xe-3 test chamber's xenon arc lamps produce realistic reproduction of the full spectrum of sunlight, including ultraviolet light, visible light and infrared radiation. Optional window glass filters produce spectra that correspond to sunlight entering through window glass. This spectrum can also simulate other indoor lighting such as the typical harsh lighting of commercial and office spaces. Window glass filters are used for interior materials such as textiles or printed materials. The following window glass filter is used in the project: Window-Q. This filter is equivalent to direct sunlight coming through a piece of single-strength, single-pane glass of the type most widely used in North America. This filter meets the requirements for window glass filters in ASTM and most ISO test methods. Window-Q has a nominal cut-on of 310 nm. (more information at: <https://www.q-lab.com/documents/public/40a33eb5-8bf9-4501-85d9-10f0b66aa254.pdf>).

*Dataset "natural irradiance":*

The data set is used to record the actual incident natural sunlight behind window glass (in this case a box double window, roller glass) on the wood samples. A pyranometer is used to measure the incoming short-wave solar radiation. A pyranometer is a sensor for measuring the irradiance of the sun (in watts per square metre) with a field of view of 180 degrees. Pyranometers are widely used in meteorology, climatology, building physics and solar energy research. They are used in meteorological stations, usually mounted horizontally and placed next to solar cells, usually parallel to the surface of the

solar cell. The ISO 9060 standard exists for pyranometers and is also recognised by the World Meteorological Organization. This standard distinguishes between three classes. The best class is called secondary standard, the second best first class and the last second class. In the project, a pyranometer of the "secondary standard" class is used.

*Dataset "electromagnetic irradiance":*

The data set is used to record the actual incident UV-VIS-IR spectrum of natural sunlight behind window glass. The spectroradiometer used is a versatile spectrometer that measures and displays the spectral distribution of the incident light in different modes. It is a compact and fully self-sufficient spectrometer, a portable turnkey instrument for stationary data acquisition applications.

*Dataset "climate data":*

The data set is used to record the climatic conditions in rooms where the wood samples are located. Many properties of wood are dependent on the wood moisture content. The wood moisture in turn depends on temperature and humidity.

*Dataset "wood moisture":*

The data set is used to record the wood moisture content. The measurement of wood moisture is a fundamental method in wood research, as many properties are dependent on wood moisture.

**How often will this dataset be used?**

*Dataset "specimen preparation":* Permanent. This data set is the basis for all other measurements and setups.

*Dataset "colour changes":* Permanent.

*Dataset "sample scans":* Often.

*Dataset "ATR FT-IR":* Permanent.

*Dataset "UV-Vis":* Permanent.

*Dataset "UMSP":* Often.

*Dataset "GC-MS":* Often.

*Dataset "artificial irradiance":* Permanent.

*Dataset "natural irradiance":* Permanent.

*Dataset "electromagnetic irradiance":* Seldom.

**To what extent will infrastructure resources be required (e.g. CPU hours, bandwidth, storage space... etc.).**

*For all data sets (except "UMSP" and "GC-MS") applies:*

- Infrastructure resources of the usual workplace equipment are sufficient.

*Dataset "UMSP":* The following infrastructure resources is needed:

- UV-Microspectralphotometry (UMSP) at the Thünen Institute for Wood Research

*Dataset "GC-MS":* The following infrastructure resources are needed:

- GC-MS analyses at the Institute for Wood Technology Dresden gGmbH

**Are there actual or potential usage scenarios that could benefit from support by a data management or IT expert, or that even require such support?**

*For all data sets applies:* No.

## **4.2 Data organisation**

**Where is the dataset stored during the project?**

*For all data sets (except "UMSP" and "GC-MS") applies:*

- Synology  
Synology Disk Station DS212, separate server of the research group "Chemistry and Physics of Wood".
- Nextcloud  
The data will be stored in the Nextcloud (backed up cloud-storage) of the university computer centre during the project period.
- External hard drive

*Dataset "UMSP":*

- Synology (detailed information see above)
- Nextcloud (detailed information see above)
- External hard drive
- In the project partner's storage media (Thünen Institute of Wood Research, Hamburg);  
Data-Server infrastructure of the Thünen Institute (Federal Research Institute)

*Dataset "GC-MS":*

- Synology (detailed information see above)
- Nextcloud (detailed information see above)
- External hard drive
- In the project partner's Data-Surfer Infrastructure (Institute for Wood Technology Dresden gemeinnützige GmbH)

**Are there internal project guidelines for a consistent organisation of the data? If so, where they are documented?**

*For all data sets applies:*

Yes: See point: 5.2 Structure, granularity, and referencing

**Is there an internal project guideline for naming the data? If so, please briefly outline the naming conventions and, if necessary, link to the documentation.**

*For all data sets applies:*

Yes: See point: 5.2 Structure, granularity, and referencing

### **4.3 Data storage and security**

#### **Who is allowed to access the dataset?**

*For all data sets (except "UMSP" and "GC-MS") applies:*

The record can only be accessed internally (research group chemistry and physics of wood).

*Dataset "UMSP":*

The record can only be accessed internally (research group chemistry and physics of wood) and in the project partner's storage media (Thünen Institute of Wood Research, Hamburg) from the project Partner in Hamburg.

*Dataset "GC-MS":*

The record can only be accessed internally (research group chemistry and physics of wood) and in the project partner's storage media (Institute for Wood Technology Dresden gGmbH) from the project Partner in Dresden.

#### **How and how often will backups of the data be created?**

*For all data sets (except "UMSP" and "GC-MS") applies:*

- SYNOLOGY is backed up at 8:30 p.m. every weekday; the backup is performed according to the Smart Recycle routine set in the Hyper Backup system utility: in this process, the system "keeps each backup version until the specified number of versions is exceeded. When the rotation is triggered, the system first rotates the versions that do not meet any of the conditions; if all the existing versions meet the conditions below, the system rotates the earliest version.
  - Hourly versions created in the last 24 hours: The earliest version created in each hour is kept.
  - Daily versions from the past 1 day up to 1 month: the earliest version created in each day is kept.
  - Weekly versions older than 1 month: The earliest version created in each week is kept." The backup is stored on 10.1.1.133 according to the system information, HNE- internal additional server.
- NEXTCLOUD The following things should be noted:
  - the use of the cloud storage can only be used during your studies or time as an employee;
  - you are responsible for backing up your data;
  - Access to Nextcloud is encrypted (via https).
  - During maintenance work, the service may be down for a short time.
  - The maintenance window is on Fridays from 16-17 o'clock and daily from 23:00-23:30 o'clock.
- EXTERNAL HARD DRIVE is backed up manually every 3 month.



*Dataset "UMSP":*

- SYNOLOGY (detailed information see above)
- NEXTCLOUD (detailed information see above)
- EXTERNAL HARD DRIVE (detailed information see above)
- DATA-SERVER infrastructure of the Thünen Institute (Federal Research Institute).

*Dataset "GC-MS":*

- SYNOLOGY (detailed information see above)
- NEXTCLOUD (detailed information see above)
- EXTERNAL HARD DRIVE (detailed information see above)
- In the DATA-SERVER infrastructure of the Institute for Wood Technology Dresden gemeinnützige GmbH

**Who is responsible for the backups?**

*For all data sets (except "UMSP" and "GC-MS") applies:*

- Synology - HNEE, IT Service Centre
- Nextcloud - HNEE, IT Service Centre
- External hard drive - Project employee

*Dataset "UMSP":*

- Synology - HNEE, IT Service Centre
- Nextcloud - HNEE, IT Service Centre
- External hard drive - Project employee
- Data-Server infrastructure of the Thünen Institute

*Dataset "GC-MS":*

- Synology - HNEE, IT Service Centre
- Nextcloud - HNEE, IT Service Centre
- External hard drive - Project employee
- Data-Server infrastructure of the Institute for Wood Technology Dresden gemeinnützige GmbH – IT administrator

**Which measures or provisions are in place to ensure data security (e.g. protection against unauthorized access, data recovery, transfer of sensitive data)?**

*For all data sets applies:*

In the unlikely event that sensitive data arises, it can also be stored and backed up on Synology and Nextcloud (special Backup folders). Before the project begins, the group of people with access rights is defined, who are then given the right to use the folders. The access rights to the folders are managed by a central administrator in the project.

## **4.4 Interoperability**

**Is this dataset interoperable, i.e. allowing data exchange and re-use between researchers, institutions, organisations, countries etc.?**

*Dataset "specimen preparation":*

- The dataset is not interoperable as it is the samples from which the data to be published is derived. The samples are physical sources from which the digital data are derived.
- No file formats, as they are the samples to be measured.

*Dataset "colour changes":*

- The dataset adheres to standardised formats: .csv
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: all common spreadsheet programs
- The dataset can easily be re-combined with different datasets from different origins: .txt, etc.

*Dataset "sample scans":*

- The dataset adheres to standardised formats: .png
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: lossless bitmap graphics format
- The dataset can easily be re-combined with different datasets from different origins: .tiff, etc.

*Dataset "ATR FT-IR":*

- The dataset adheres to standardised formats: .csv
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: all common spreadsheet programs
- The dataset can easily be re-combined with different datasets from different origins: .txt, etc.

*Dataset "UV-Vis":*

- The dataset adheres to standardised formats: .csv
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: all common spreadsheet programs
- The dataset can easily be re-combined with different datasets from different origins: .txt, etc.

*Dataset "UMSP":*

- The dataset adheres to standardised formats: .csv and .png
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: all common spreadsheet programs (.csv) and lossless bitmap graphics format (.png)
- The dataset can easily be re-combined with different datasets from different origins: .txt and .tiff, etc.

*Dataset "GC-MS":*

- The dataset adheres to standardised formats: .csv
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: all common spreadsheet programs
- The dataset can easily be re-combined with different datasets from different origins: .txt, etc.

*Dataset "artificial irradiance":*

- The dataset adheres to standardised formats: .csv
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: all common spreadsheet programs
- The dataset can easily be re-combined with different datasets from different origins: .txt, etc.

*Dataset "natural irradiance":*

- The dataset adheres to standardised formats: .csv
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: all common spreadsheet programs
- The dataset can easily be re-combined with different datasets from different origins: .txt, etc.

*Dataset "electromagnetic irradiance":*

- The dataset adheres to standardised formats: .csv
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: all common spreadsheet programs
- The dataset can easily be re-combined with different datasets from different origins: .txt, etc.

*Dataset "climate data":*

- The dataset adheres to standardised formats: .csv
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: all common spreadsheet programs
- The dataset can easily be re-combined with different datasets from different origins: .txt, etc.

*Dataset "wood moisture":*

- The dataset adheres to standardised formats: .csv
- The dataset is usable with available (open) software applications or software applications that are established and widely used in the respective community: all common spreadsheet programs

- The dataset can easily be re-combined with different datasets from different origins: .txt, etc.

## 4.5 Data sharing and re-use

### Will this dataset be published or shared?

*For all data sets (except "specimen preparation") applies:* Yes, externally for everyone.

*Dataset "specimen preparation":* No.

### If no, please explain why not. Please differentiate between legal and contractual reasons and voluntary restrictions.

*Dataset "specimen preparation":* It is not possible to publish the samples themselves, since it is the samples from which the data to be published are derived. However, the information about the instrument and the sample size and the "cutting parameters" are publicly available through this publication.

### If yes, under which terms of use or license will the dataset be published or shared?

*For all data sets applies:* CC BY: Attribution

### When will the data be published (if they are)?

*For all data sets applies:* Jan. 30, 2026

## 4.6 Collaborative work

### Will the data be collaboratively used?

*For all data sets (except "UMSP" and "GC-MS") applies:* No.

*Datasets "UMSP" and "GC-MS":* Yes, by several persons at various institutions.

### Which platform / tools is / are used for collaboratively working on data and publications?

*Datasets "UMSP" and "GC-MS":* E-Mail attachment.

### How is the collaborative work on the same files organised?

*Dataset "UMSP":* Generated raw data from Thünen Institute for Wood Research (TI-HF) are sent via zip-file as e-mail attachment to HNEE.

*Dataset "GC-MS":* Generated raw data from Institute for Wood Technology Dresden gGmbH (IHD) are sent via .csv-file as e-mail attachment to HNEE.

## 4.7 Quality assurance

### Which measures of quality assurance are taken for this dataset?

- Quality assurance, data curation

Quality assurance is based on the DFG's "Guideline 7: Cross-Phase Quality Assurance" and the "Guidelines for Safeguarding Good Research Practice". Quality assurance is carried out along the technical conditions. This means, technical equipment is calibrated to have the same conditions across the survey phase. See "Quality assurance, technical." The data generation and deviations are documented. Results from measurements are recorded in a structured manner. Data cleaning and analysis of the data is also documented. This makes the data provenance comprehensible. The storage and publication of the data will be done according to the FAIR principles.

- Quality assurance, technical

#### *Dataset "specimen preparation":*

- Regularly change the Surgipath® DB80 LX and Surgipath® DB80 LS microtome blades from Leica.
- The sharp blades ensure consistently precise sections from the 1<sup>st</sup> to the 25<sup>th</sup> cut.
- Depending on the type of wood, the blade needs to be changed more or less often. In addition, both the inclination and declination angles must be constantly adjusted.
- All cut samples are checked by digital thickness gauge (Hilitand); measuring range 0-12.7mm, accuracy 0.001 mm for actual veneer thickness at several places of each veneer.

#### *Dataset "colour changes":*

- Regular calibration of the spectrophotometer every 3 months.
- Checks for completeness, data reconciliation, sampling procedures.

#### *Dataset "sample scans":*

- Checks for completeness, data reconciliation, sampling procedures.

#### *Dataset "ATR FT-IR":*

- Recording of the background before each individual measurement. Cleaning of the ZnSe crystal after each individual measurement with Isopropanol (2-Propanol).  
2-Propanol: 2-Propanol, 2.5 l, ≥99.9 %, VLSI Grade, Cat.-No.: 9781.1, Carl Roth GmbH + Co. KG, Karlsruhe, Germany
- Checks for completeness, data reconciliation, sampling procedures.

#### *Dataset "UV-Vis":*

- Regular baseline determination prior to each use of the integrating sphere for diffuse reflectance.
- The lamps have a guaranteed service life of 2000 operating hours. The readout of the operating hours is possible via the control software (LabSolutions). Set the switching wavelength for the D2 (deuterium) and W1 (halogen) lamps from 290 nm to 370 nm in 0.1 nm increments.

- Checks for completeness, data reconciliation, sampling procedures.

*Dataset "UMSP":*

- Preparation of semi-thin sections with defined thicknesses of 1µm; calibrating the extinctions by transmission measurements of the monochromatic UV wavelengths.

*Dataset "GC-MS":*

- A reference data bibliography (NIST, e.g.) is used for identification of each substance. For a number of substances, own calibrations are available. Moreover, the quality of the identification is given. The most crucial point is the sample weight and the signal intensity, respectively.

*Dataset "artificial irradiance":*

- Every 500 light hours: Calibration of the light sensors.
- Every 1500 light hours: Renewing the xenon arc lamps, cleaning the lamp trigger fingers with fine-grained sandpaper, Removal of dust from the glass filters and from the reflector surfaces of the lamp housing with a cloth moistened with alcohol.
- Monthly: Cleaning of the air filter with a vacuum cleaner or compressed air. The measures are carried out according to the maintenance instructions of the Q-Lab company. Regular replacement of the ion exchanger cartridges by a specialist company when the conductivity meter is close to the red range (from 10 µS/cm upwards). - Constant checks for completeness, system function, etc.

*Dataset "natural irradiance":*

- Regular dusting of the glass dome of the pyranometer.
- Regular reading of the data logger before the memory is full.
- Permanent control of the pyranometer that it is not in the shade when the samples are in the sun.
- Checks for completeness, data reconciliation, sampling procedures.

*Dataset "electromagnetic irradiance":*

- Cosine correction; Cosine correction is a method for correcting the radiance LT registered over a pixel, which is based on the cosine law as its physical foundation. It describes the intensity of direct irradiance as a function of the angle between solar irradiance and the surface normal of an image element.

*Dataset "climate data":*

- Regular reading of the data logger before the memory is full.
- Checks for completeness, data reconciliation, sampling procedures.

*Dataset "wood moisture":*

- Regular calibration of the laboratory balance.
- Checks for completeness, data reconciliation, sampling procedures.

## 4.8 Data integration

**Is the integration between the re-used and newly created data ensured? If yes, by which means?**

Not necessary, as no re-used data is used.

## 5. Metadata and referencing

### 5.1 Metadata

**Which information is necessary for other parties to understand the data (that is, to understand their collection or creation, analysis, and research results obtained on its basis) and to re-use it?**

*For all data sets (except "specimen preparation", "sample scans" and "wood moisture") applies:*

- Location
- Content
- Methodology
- Creation process
- Technology
- Documentation of the software necessary to use the data
- Time

*Datasets "specimen preparation" and "wood moisture":*

- Methodology
- Creation process

*Dataset "sample scans":*

- Methodology
- Creation process
- Documentation of the software necessary to use the data

**Which standards, ontologies, classifications etc. are used to describe the data and context information?**

*For all data sets (except "specimen preparation", "colour changes", "artificial irradiance", "natural irradiance" and "wood moisture") applies:*

- A custom description system is used (please briefly outline and, if necessary, indicate where it is documented in more detail): See point: 3.4 Tools, specimen preparation

*Dataset "specimen preparation":*

- Discipline-specific standards, classifications etc. are used:
  - DIN 50014:2018-08;

- TAPPI T 204 cm-07 is used for the following three of six setups:
  - C\_artificial\_sunlight\_exposure\_indoor\_extracted,
  - D1\_natural\_sunlight\_exposure\_indoor\_extracted,
  - D2\_natural\_sunlight\_exposure\_indoor\_extracted
- A custom description system is used (please briefly outline and, if necessary, indicate where it is documented in more detail): See point: 3.4 Tools, specimen preparation

*Dataset "colour changes":*

- Discipline-specific standards, classifications etc. are used:
  - DIN EN ISO/CIE 11664-4:2020-03
- A custom description system is used (please briefly outline and, if necessary, indicate where it is documented in more detail): See point: 3.4 Tools, specimen preparation

*Dataset "artificial irradiance":*

- Discipline-specific standards, classifications etc. are used:
  - DIN EN ISO 16474-2:2022-11; (DIN EN ISO 4892-2:2021-11);
  - CIE 241:2020
- A custom description system is used (please briefly outline and, if necessary, indicate where it is documented in more detail): See point: 3.4 Tools, specimen preparation

*Dataset "natural irradiance":*

- Discipline-specific standards, classifications etc. are used:
  - ISO 9060:2018-11
- A custom description system is used (please briefly outline and, if necessary, indicate where it is documented in more detail): See point: 3.4 Tools, specimen preparation

*Dataset "wood moisture":*

- Discipline-specific standards, classifications etc. are used:
  - DIN 50014:2018-08
- A custom description system is used (please briefly outline and, if necessary, indicate where it is documented in more detail): See point: 3.4 Tools, specimen preparation

**In case it is unavoidable that you use uncommon or generate project-specific ontologies or vocabularies, will you provide mappings to more commonly used ontologies?**

*For all data sets applies:* No.

**Which metadata are collected automatically?**

*Dataset "colour changes":*

- Sample no.



- Date
- Time
- N
- Colour scale (L\*, a\*, b\*)
- Gloss
- I II/Obs
- Measuring points in the visible light spectrum from 400 to 700 nm; resolution in 10 nm steps.

*Dataset "sample scans":*

- Date
- Time
- Size [kB]
- Dimensions: 4816 x 6876 pixels
- Horizontal resolution: 600 dpi
- Vertical resolution: 600 dpi
- Bit depth: 24

*Dataset "ATR FT-IR":*

- Date
- Time
- Size [kB]
- For
  - [DATA COLLECTION INFORMATION],
  - [DATA DESCRIPTION] and
  - [SPECTROMETER DESCRIPTION]:
 See point: 3.4 Tools - Which software, processes or technologies are necessary to use the data?

*Dataset "UV-Vis":*

- Date
- Time
- Size [kB]
- For
  - [MEASUREMENT]:
  - [ACCESSOIRES]:
  - [ADVANCED]:
  - [REPEAT]:
  - [POST-PROCESSING]:
 See point: 3.4 Tools - Which software, processes or technologies are necessary to use the data?

*Dataset "UMSP":*

UV scanning absorbance values with a resolution of 0.25  $\mu\text{m}$  x 0.25  $\mu\text{m}$  (up to 60.000 measuring points of one scanning field with individual cell wall layers).

*Dataset "GC-MS":*

- Date
- Time
- Operator
- Library research report (.txt)
- Acquisition method file (.txt)
- MS-file
- Results (.csv) with date and time, header "PK", "RT", "Area Pct", "Library/ID", "Ref", "CAS", "Qual" separated by comma.

*Dataset "artificial irradiance":*

- Date
- Time
- Irradiance [W/m<sup>2</sup>/nm]
- Temperature [° C]

*Dataset "natural irradiance":*

Natural irradiance in watts per square meter [W/m<sup>2</sup>] (Minimum, Average; Maximum);  
Intervall: 30 s. The pyranometer used has the following technical characteristics:  
Spectral range (50% points): 285 to 2800 nm.

*Dataset "electromagnetic irradiance":*

- X-Axis: nm
- Y-Axis: Value
- Date
- Time

*Dataset "climate data":*

- No. - Number
- Temp - Temperature in °C
- % RH - relative humidity in %
- WB - Thermal load in °C
- DP - Dew point temperature in °C
- Time; Start time; End time
- Sampling rate
- Temp Alarm HI: 40 °C, Temp Alarm Low: 0 °C
- RH Alarm HI: 90 %RH, RH Alarm Low: 0 %RH
- Temp MAX: in °C @Time 00:00:00, Date 00/00/00
- Temp MIN: in °C @Time 00:00:00, Date 00/00/00
- Temp DUR: in °C
- RH MAX: in %RH @Time 00:00:00, Date 00/00/00
- RH MIN: in %RH @Time 00:00:00, Date 00/00/00
- RH DUR: in %RH
- Temperature Unit: Celsius

## **Which metadata are collected semi-automatically?**

*Dataset "colour changes":*

- dL\* (delta luminance)
- da\* (delta +red/-green - coordinate)
- db\* (delta +yellow/-blue - coordinate)
- dE\* (euclidean colour distance)
- dC\* (delta chromaticity)
- dG (delta gloss)

*Dataset "UV-Vis":*

- [Sample Information]:
  - Type of Data
  - Data Set Name
  - Sample Name
  - Sample ID
  - Option
  - Analyst
  - Date of Creation
  - Comments

*Dataset "UMSP":*

- Microscopic images (overview photographs) of the analysed wooden tissues (semi-thin sections).

*Dataset "GC-MS":*

- Integration range

*Dataset "electromagnetic irradiance":*

- See point: 3.4 Tools - Which software, processes or technologies are necessary to use the data?

## **Which metadata are collected manually?**

*For all data sets applies:*

- Correct specimen name,
- Irradiation time,
- Irradiation setup.

## **Are metadata and context information being checked for correctness and completeness?**

*For all data sets applies:*

- Manual check for correctness
- Manual check for completeness

## Who is responsible for documenting the metadata and context information and for checking if they are correct and complete?

For all data sets (except "UMSP" and "GC-MS") applies:

- Project employee

Dataset "UMSP":

- Project employee
- Technical assistant

Dataset "GC-MS":

- Project employee
- Technical assistant

## 5.2 Structure, granularity, and referencing

What is the structure of the data? How are the individual components of the dataset related to each other? How is the dataset related to other datasets used in the project?

For all data sets applies:

There are 8 measurement series with 7 different wood species (2 softwood and 5 hardwood):

1. *Abies alba* MILL.
2. *Pinus sylvestris* L.
3. *Pinus sylvestris* L.
4. *Acer* spp.
5. *Fagus sylvatica* L.
6. *Juglans regia* L.
7. *Quercus robur* L. or *Quercus petraea* (MATT.) LIEBL.
8. *Robinia pseudoacacia* L.

There are 6 main measurement series in the project (6 setups):

A\_artificial\_sunlight\_exposure\_indoor\_untreated,  
B1\_natural\_sunlight\_exposure\_indoor\_untreated,  
B2\_natural\_sunlight\_exposure\_indoor\_untreated,  
C\_artificial\_sunlight\_exposure\_indoor\_extracted,  
D1\_natural\_sunlight\_exposure\_indoor\_extracted,  
D2\_natural\_sunlight\_exposure\_indoor\_extracted

There are 6 standard measurement methods (Datasets) in each of the 6 setups:

A\_colour changes,  
B\_sample scans  
C\_ATR FT-IR,  
D\_UV-Vis,  
E\_UMSP\_TI-HF-Hamburg (*Pinus* heartwood, *Juglans* and *Quercus* only), F\_GC-MS\_IHD-Dresden, (*Pinus* heartwood, *Juglans* and *Quercus* only),

- The datasets "artificial irradiance", "natural irradiance", "electromagnetic irradiance", "climate data" and "wood moisture" are important information that is mandatory for the evaluation of the overall data set in the project.
- For more information, see point "Tools", Part: "Which software, processes or technologies are necessary to use the data?"

### **5.3 Persistent Identifiers (PIDs)**

**Will persistent identifiers (PIDs) be used for this data set?**

*For the data sets "colour changes", "sample scans", "ATR FT-IR" and "UV-Vis" applies:* Yes.

*For all other data sets applies:* No.

**Which system of persistent identifiers shall be used?**

*For the data sets "colour changes", "sample scans", "ATR FT-IR" and "UV-Vis" applies:*  
A common data set with a Digital Object Identifier (DOI) is deposited with several data packages (datasets).

**Which (sub-) entities / sub units should be referenced using identifiers? Which of those identifiers should be persistent and citable?**

Not necessary.

**Who is responsible for the maintenance of the PIDs and the object maintenance (i.e. who is responsible notifying the PID-Service about object relocation and the new address)?**

Owner of repository: Institutional repository (in development).

## **6. Legal and ethics**

### **6.1 General legal issues**

**Does the legal situation of different countries have to be considered?**

No.

### **6.2 Personal data**

**Does this dataset contain personal data?**

*For all data sets applies:* No.

### **6.3 Sensitive data**

**Does the dataset contain information on racial and ethnic origin, political opinions, religious or philosophical beliefs, trade union membership, health or sex life?**

*For all data sets applies:* No.

**Will the data be anonymised or pseudonymised?**

*For all data sets applies:* No.

### **6.4 Other sensitive data**

**Does this dataset contain sensitive data other than personal data?**

*For all data sets applies:* No.

### **6.5 Official approval**

**Has the project been approved by a research ethics committee?**

No, a review is not necessary, because: Recommendations on topics according to § 64 (3) Brandenburg Higher Education Act (Brandenburgisches Hochschulgesetz - BbgHG):  
- possible use of research results for non-peaceful purposes, - Research projects on humans and animals are not necessary

**Is a statutory approval / permit needed for the research?**

No.

**Is a data access committee needed to handle access requests to the published data of the project?**

No.

### **6.6 Intellectual property rights I**

**Does the project use and/or produce data that is protected by intellectual or industrial property rights?**

No.

### **6.7 Intellectual property rights II**

**Does copyright law apply to this dataset?**

No.

**Do other intellectual property rights apply to this dataset?**

No.

## 7. Storage and long-term preservation

### 7.1 Selection

**What are the criteria / rules for the selection of the data to be archived (after the end of the project)?**

The responsibility for data storage after the end of the project lies with the repositories or data centres designated for storage. Storage in sustainable structures is planned, implementing the FAIR principles to the greatest extent possible.

**Who selects the data to be archived?**

Head of project

### 7.2 Long-term preservation

**Does this dataset have to be preserved for the long-term?**

*For all data sets applies:* Yes.

**What are the reasons this dataset has to be preserved for the long-term?**

*For all data sets applies:*

- Re-use in subsequent projects or by others
- Documentation, because it is relevant to society
- Self-commitment

**How long will the data be stored?**

*For all data sets applies:* The data is stored for at least 10 years.

**How long is it intended that the data remains re-usable.**

*For all data sets applies:* The data should be reusable for several decades.

**Where will the data (including metadata, documentation and, if applicable, relevant code) be stored or archived after the end of the project?**

*For all data sets (except "UMSP" and "GC-MS") applies:*

- Own institutional repository (in development)

*Dataset "UMSP":*

- Own institutional repository (in development)
- Other: Data archiving at the Thünen Institute for Wood Research (TI-HF)

*Dataset "GC-MS":*

- Own institutional repository (in development)
- Other: Data archiving at the Institute for Wood Technology Dresden gGmbH (IHD)

**Is the repository or data centre chosen certified (e.g. Data Seal of Approval, nestor Seal or ISO 16363)? (If the dataset is archived at several places, you may answer this question with yes, if this applies to at least one of these.)**

For the time being is no certification planned, but the FAIR principles are considered as best as possible.

**Have you explored appropriate arrangements with the identified repository?**

Contact is made with the developers of the institutional repository.

**Shall there be an embargo period before the data are made available?**

*For all data sets applies:* There is no blocking period or embargo on the publication of the data.

**How will the identity of the person accessing the data will be ascertained?**

*For all data sets applies:* Authorised server access.

**By when will the data be archived?**

*For all data sets applies:* Feb. 29, 2036

## 8. Additional Information

**Competing interests:** The authors declare no competing financial interests.

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