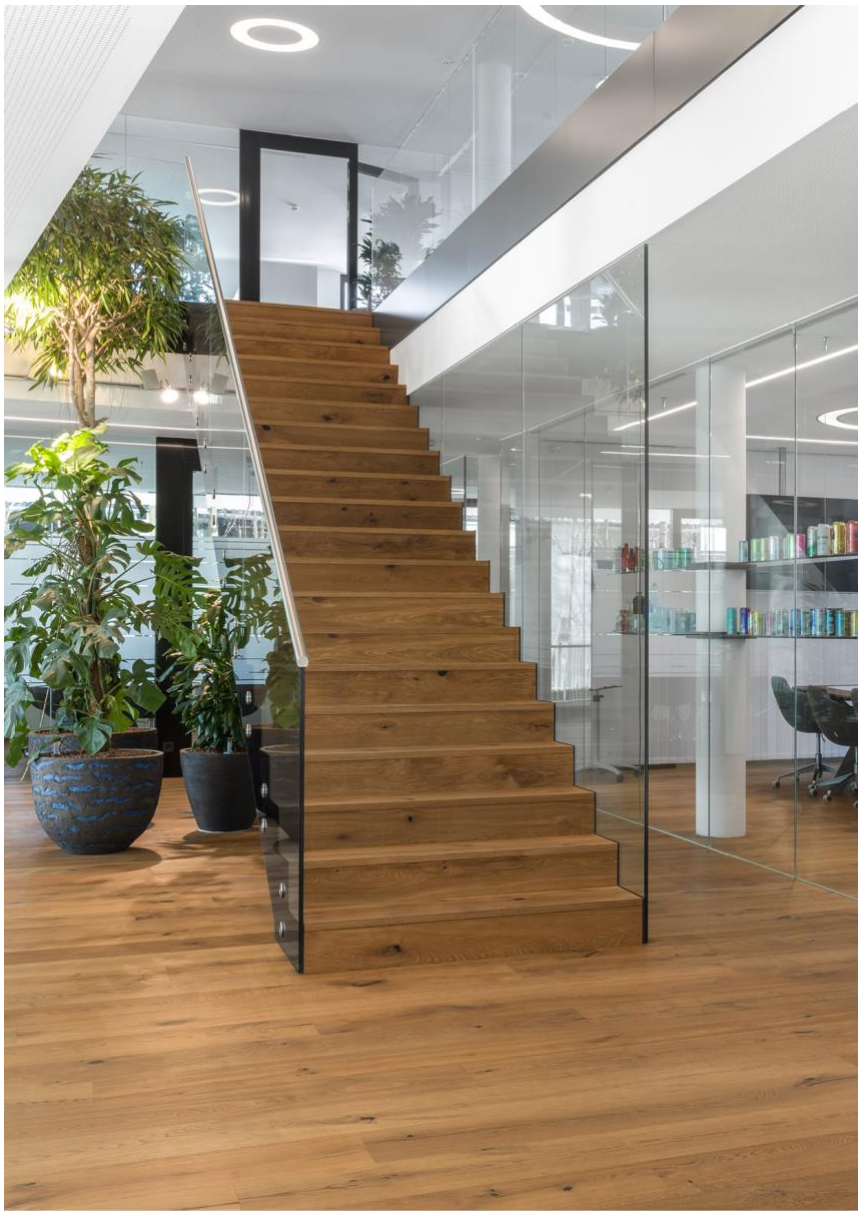
ENVIRONMENTAL PRODUCT DECLARATION

MAFI NATURAL WOOD PLANKS



mafi natural wood planks are free of harmful substances, stable, practical and authentic. We achieve these characteristics through important cornerstones such as our symmetrical 3-layer construction, the air-cured and oiled surface, and our chemical- free Vulcano thermo treatment along with the basic understanding that wood and plenty of time combines the best results.

mafi : walk on art

mafi is an Austrian family company that specializes in the production of high-quality and completely ecological natural wood planks.

At the core of mafi's philosophy is direct human contact with the natural material wood, because this contact has a positive effect on all our senses, whether we're at home, at work, or in a restaurant. We decided early on to go our own way with our production. We don't think in terms of how many board feet we can produce a minute. Instead, we invest more time to get an authentic wood product that people will appreciate and even cherish for decades to come.

Our product is essentially a plank that is manufactured in a symmetrical 3-layer structure. The symmetry offers maximum stability and makes optimal use of the precious resource that is wood. The three layers are glued with formaldehyde-free white glue; the wood is also finished with VOC-free, natural oils.

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

ENVIRONMENTAL PRODUCT DECLARATION

mafi : walk on art

CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION ULCOM/EPD

According to ISO 14025, EN 15804, and ISO 21930:2017

mafi Natural Wood Planks

EPD Program and Program Operator Name, Address, Logo, and Website	UL Environment 333 Pfingsten Road Northbrook, IL 60611 https://www.ul.com/ https://spot.ul.com
General Program Instructions and Version Number	General Program Instructions v.2.4 July 2018
Manufacturer Name and Address	mafi Naturholzboden GmbH Utzweihstraße 25 5212 Schneegattern, Austria
Declaration Number	4789456400.101.1
Declared Product & Functional Unit or Declared Unit	Natural Hardwood Planks 1 m_2 of finished floor covering for a period of 75 years
Reference PCR and Version Number	Part A: Life Cycle Assessment Calculation Rules and Report Requirements (UL Environment, V3.2, 2018) Part B: Flooring EPD Requirements (UL Environment V2.0, 2018)
Description of Product Application/Use	Hardwood planks are commonly used in a variety of applications, including commercial, light commercial, institutional, and residential interiors and flooring.
Product RSL Description (if Appl.)	75 years
Markets of Applicability	Americas, EMEA, APAC
Date of Issue	October 1, 2020
Period of Validity	5 Years
EPD Type	Product-Specific
Range of Dataset Variability	N/A
EPD Scope	Cradle-to-Grave
Year(s) of Reported Primary Data	2018
LCA Software & Version Number	GaBi v9.2.1.68
LCI Database(s) & Version Number	GaBi Service Pack 40
LCIA Methodology & Version Number	TRACI 2.1 and CML 2001-2016

This PCR review was conducted by:	UL Environment PCR Review Panel epd@ulenvironment.com
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒ EXTERNAL	Grant R. Martin Grant R. Martin, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria Thomas P. Gloria, Industrial Ecology Consultants

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

1. Product Definition and Information

1.1. Description of Company/Organization

mafi started as a small sawmill, which then evolved from a wood ceiling plank producer into the brand for naturally oiled and stable wood floors. In the course of the production line, mafi opts for regionality and is an important employer in the region. Short distances, established collaborations, familiar processes and fast response times are the advantages of this on-site network. In the end, exactly this holistic approach leads to a high product quality and family values such as trust and unfailing reliability.

1.2. Product Description

Product Identification

This EPD is for representative products derived from mafi's line of products produced at the facility located in Schneegattern, Austria. mafi's hardwood planks primarily consist of hardwood, plant oils, white glue, and fillers. There are several advantages to mafi hardwood planks. They have high stability, are ideal for installation on underfloor heating and other applications, and are available in a wide range of dimensions. The primary UNSPSC code for this flooring product is 30161702 and the CSI code is 09 64 00.

Flow Diagram

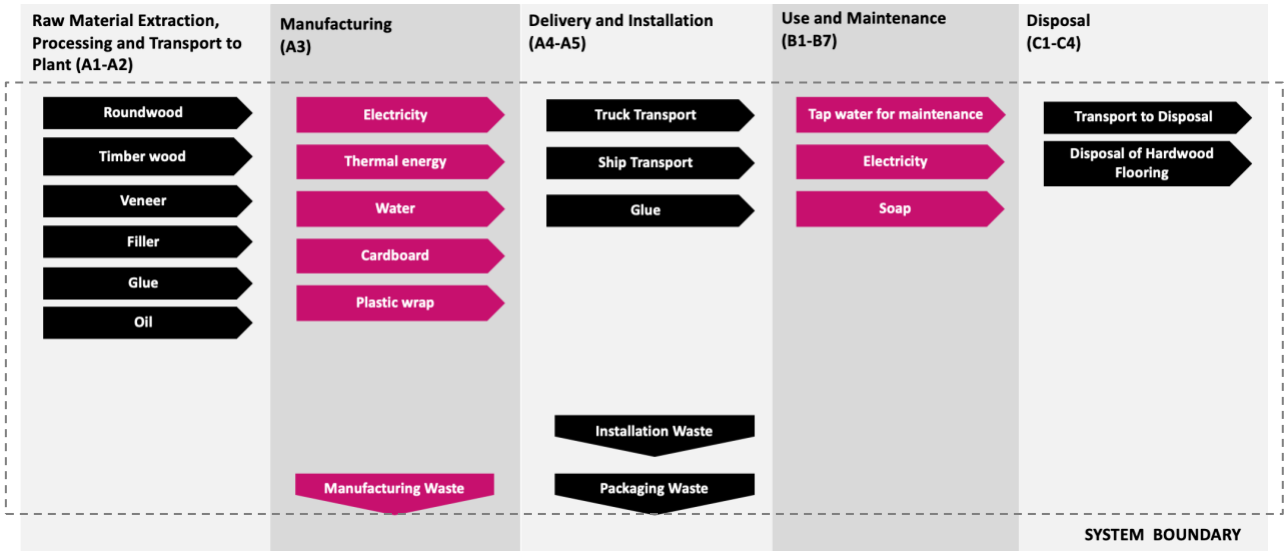


Figure 1: System Boundary

Product Average

Results in this LCA are presented based on a representative product that is calculated the total materials purchased during 2018 and annual production data.

1.3. Application

Wood plank products are commonly used in a variety of applications including commercial, light commercial, institutional, and residential interior applications.

1.4. Declaration of Methodological Framework

This LCA is considered a Cradle-to-Grave study. The LCA for this study follows an attributional approach. Infrastructure flows have been excluded.

A summary of the life cycle stages included in this EPD is presented in Table 7. The reference service life is outlined in Table 10 and is only applicable if all manufacturing guidelines are followed regarding site-selection and installation, found online. No known flows are deliberately excluded from this EPD. Third party verified ISO 14040/44 secondary LCI data sets contribute more than 67% of total impacts in all impact categories required by the PCR.

1.5. Technical Data

Table 1: Technical Details

PARAMETER	VALUE	UNIT
Density	0.33 - 0.96	g/cm^3
Thermal Resistance	0.07 - 0.21	m$_2$K/W
Hardness	12 - 48	N/mm$_2$
Lindane and Pentachlorophenol	<5	ppm
Fire certification	CFL-s1	
Emission Category	E1	
Thermal Resistance	0.07 - 0.21	m$_2$K/W

The prducts declared in this document comply with the following codes or regulations: ÖNORM EN 14342, DIN EN 13489, DIN 18356, and DIN 18202.

1.6. Properties of Declared Product as Delivered

mafi natural wood planks are delivered in cardboard packaging and plastic shrink wrap.

1.7. Material Composition

Table 2: Material Composition

COMPONENT	COMPOSITION
Core	80.21%
Top Layer	9.09%
Bottom Layer	9.09%
Filler	0.17%
Oil	0.13%
Glue	1.30%

1.8. Manufacturing

mafi sources wood in three different configurations – round wood, timber and solid thin planks. Round wood received is cut into planks for the core, top, and bottom layers of the product. Apart from this, mafi also receives timber wood and solid thin planks directly from suppliers. Some planks are thermally treated to intensify natural wood colors that create unique patterns and designs to enhance aesthetics of mafi's wood products. Fillers are also used to create unique design patterns. Next, the core layer is sandwiched between two layers using glue and then cut to size. Finally, they are finished with natural linseed oil which penetrates deep into the wood thus forming no film on its surface. Raw materials for the product were obtained from various parts of Austria, Bosnia, Czechia, Germany, Hungary, Italy, Russia, Switzerland, Ukraine, and the United States.

A portion of the offcuts from manufacturing are used to run a wood chip boiler in the facility that in turn is used for thermal treatment (torrefaction) of the wood planks. The remaining process waste is sent for pellet production for wood pellet stoves and burners in the region.

1.9. Packaging

Once the planks are manufactured, they are packaged in cardboard and plastic shrink wrap. The amount of packaging is detailed in Table 3.

Table 3: Packaging Inputs, per functional unit

INPUT	VALUES	UNIT
Cardboard	0.0907	kg/m2
Plastic Shrink Wrap	0.01	kg/m2

1.10. Transportation

mafi natural wood planks are delivered to the customer via truck and ocean freight depending on the location of the customer. An average distance based on sales records for 2018 was chosen to represent delivery to customer for this study.

1.11. Product Installation

Installation equipment is required though not included in the study as these are multi-use tools and the impacts per functional unit is considered negligible. Packaging and installation waste disposal have been modeled as per guidelines in section 2.8.5 of Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Additionally, for glue-down installations, adhesive is required to install wood flooring on the floor at the site.

Installation using adhesives must be compliant with the adhesive manufacturers' recommendations and the National Wood Flooring Association (NWFA) guidelines, and it is recommended to use a low- or no-VOC suitable parquet adhesive according to EN 14293. Specific adhesive manufacturer documentation should be referenced for information on VOC content and emission levels. It is the responsibility of the installer to perform adhesion tests and follow installation procedures for using adhesive over wood or concrete substrates. mafi planks are recommended for installation over under floor heating with exception to Larch Country Vulcano.

Table 4: Installation Inputs, per functional unit

INPUT	VALUES	UNIT
Adhesive	1.1	kg/m2
Finishing Oil	0.012	kg/m2

mafi floors need to be reoiled on site after installation. This allows the oil to penetrate the wood pores and fully harden before being used for heavy traffic. Wood planks can have a slight change in appearance based on the type of oil used for reoiling.

1.12. Use

As required in the PCR, the results are based on the estimated service life (ESL) of the building of 75 years. Since hardwood flooring usually last as long as the building itself, the RSL of the building is assumed to be 75 years. Hence, no replacements are necessary during the service life of the building. There are some impacts during the maintenance (B2) stage as the product uses hot water and soap for cleaning purposes.

The study does not include the impacts associated with repair, replacement, and refurbishment (B3-B5) as minimal resources are used in the rare occasion that repair, replacement, or refurbishment is necessary.

1.13. Reference Service Life and Estimated Building Service Life

According to Part A of the PCR, the Estimated Service Life (ESL) of the building is assumed to be 75 years. Since hardwood floors are expected to last as long as the building itself, the Reference Service Life (RSL) of hardwood floors is taken to be 75 years.

1.14. Reuse, Recycling, and Energy Recovery

A part of the offcuts from manufacturing are used in a wood chip boiler in the facility that in turn is used for the thermal treatment of wood products. The remaining process waste is sent for pellet production for wood pellet stoves and burners in the region.

1.15. Disposal

All waste has been classified according to regional-specific legislation as laid out in Section 2.8.6 in Part A: Life Cycle Assessment Calculation rules and Report Requirements from UL Environment. Waste has been classified according to REACH Substances of Very High Concern for the European region.

Table 5: End of Life Parameters, per functional unit

	Disposal Mechanism	Values	Unit
Collected as mixed construction waste	-	12.612	kg
Waste to be processed	50% recycled	6.30	kg
	37% landfilled	4.67	kg
	13% incinerated	1.64	kg

2. Life Cycle Assessment Background Information

2.1. Functional or Declared Unit

The functional unit according to the UL PCR is 1 m_2 of finished flooring.

Table 6 shows additional details related to the functional unit. The function of a floor covering is to cover and protect the flooring substrate.

Table 6: Functional Unit

	mafi
Functional Unit [m_2]	1
Average Weight [kg]	11.5

2.2. System Boundary

This EPD is considered a Cradle-to-Grave study. A summary of the life cycle modules included in this EPD is presented in Table 7. Infrastructure flows have been excluded.

Table 7: System Boundary

Module Name	Description	Analysis Period	Summary of Included Elements
A1	Product Stage: Raw Material Supply	2018	Raw Material sourcing and processing as defined by secondary data.
A2	Product Stage: Transport	2018	Shipping from supplier to manufacturing site. Fuel use requirements estimated based on product weights and measured and calculated distance.
A3	Product Stage: Manufacturing	2018	Energy, water and material inputs required for manufacturing products from raw materials. Packaging materials and manufacturing waste are included as well.
A4	Construction Process Stage: Transport	2018	Shipping from manufacturing site to project site. Fuel use requirements estimated based on assumed distance recommended by the PCR (Part B).
A5	Construction Process Stage: Installation	2018	Installation materials, installation waste and packaging material waste.
B1	Use Stage: Use	2018	Use of the product.
B2	Use Stage: Maintenance	2018	Water, electricity and soap used for cleaning.
B3	Use Stage: Repair	2018	No inputs required for repairs as minimal resources are used in the rare occasion that a repair is necessary.
B4	Use Stage: Replacement	2018	No inputs required for replacement manufacturing as minimal resources are used in the rare occasion that a replacement is necessary.
B5	Use Stage: Refurbishment	2018	As such, mafi floors last as long as the building and does not need refurbishment in general.
B6	Operational Energy Use	2018	No Operational Energy Use of Building Integrated System During Product Use
B7	Operational Water Use	2018	No Operational Water Use of Building Integrated System During Product Use
C1	EOL: Deconstruction	2018	No inputs required for deconstruction.
C2	EOL: Transport	2018	Shipping from project site to landfill, incineration or recycling center. Fuel use requirements estimated based on product weight and assumed distance recommended by the PCR (Part B).
C3	EOL: Waste Processing	2018	Waste processing included for incineration.
C4	EOL: Disposal	2018	Assumes all products are sent to landfill, incineration or recycling center. Assumptions from Part A PCR for Europe.
D	Benefits beyond system	MND	Module Not Declared

2.3. Estimates and Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44. The majority of the estimations are within the primary data. Some assumptions made in the study that may have affected the results are:

- The primary data was collected as annual totals including all utility usage and production information. For the LCA, the usage information was divided by the production to create an energy and water use per square meter.
- Installation tools are used enough times that the per square meter impacts are negligible.
- The disposal pathways and the corresponding transportation distances of unused product waste, packaging waste, and post-consumer product waste are assumed in accordance with the PCR.
- The use and selection of secondary datasets from GaBi – The selection of which generic dataset to use to represent an aspect of a supply chain is a significant value choice. Collaboration between LCA practitioner, mafi associates and GaBi data experts was valuable in determining best-case scenarios in the selection of data. However, no generic data can be a perfect fit. Improved supply chain specific data would improve the accuracy of results, however budgetary and time constraints have to be taken into account.

2.4. Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit. Materials excluded from the study are a few inks and proprietary additives (0.10% of final product) due to the unavailability of adequate datasets to represent the corresponding raw materials. No known flows are deliberately excluded from this EPD.

2.5. Data Sources

Primary data was collected by mafi associates for onsite energy, water and waste during the course of manufacturing. Whenever available, supplier data was used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production was used from GaBi Database Version 9.2, Service Pack 40. All calculation procedures adhere to ISO14044.

2.6. Data Quality

The geographical scope of the manufacturing portion of the life cycle is Austria. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent. Primary data were provided by the manufacturer and represent all information for calendar year 2018. Primary data provided by the manufacturer is specific to the technology that the company uses in manufacturing their product. It is site-specific and considered of good quality. Data used to allocate energy and water on a per unit of product produced includes overhead energy such as lighting, heating and sanitary use of water. Sub-metering was not available to extract process only energy and water use from the total energy use. Sub-metering would improve the technological coverage of data quality.

2.7. Period under Review

The period under review is calendar year 2018.

2.8. Allocation

General principles of allocation were based on ISO 14040/44. There are no products other than wood planks that are produced as part of the manufacturing processes studied in the LCA. Since there are no co-products, no allocation based on co-products is required. To derive a per unit value for manufacturing inputs such as electricity, thermal energy and water, allocation based on total production in square meters was adopted. Discussions with mafi staff divulged this was a more representative way than via mass to allocate the manufacturing inputs based on the manufacturing processes used and the types of products created. As a default, secondary GaBi datasets use a physical mass basis for allocation. Throughout the study recycled materials were accounted for via the cut-off method. Under this method, impacts and benefits associated with the previous life of a raw material from recycled stock are excluded from the system boundary. Additionally, impacts and benefits associated with secondary functions of materials at end of life are also excluded (i.e. production into a third life or energy generation from the incineration plant). The study does include the impacts associated with reprocessing and preparation of recycled materials that are part of the bill of materials of the products under study.

2.9. Comparability and Benchmarking

The user of the EPD should take care when comparing EPDs from different companies. Assumptions, data sources, and assessment tools may all impact the variability of the final results and make comparisons misleading. Without understanding the specific variability, the user is therefore, not encouraged to compare EPDs. Even for similar products, differences in use and end-of-life stage assumptions, and data quality may produce incomparable results. Comparison of the environmental performance of flooring products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR. Full conformance with the PCR for flooring products allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

3. Life Cycle Assessment Scenarios

Table 8. Transport to the building site (A4)

NAME	TRUCK	SHIP	UNIT
Fuel type	Diesel	Heavy Fuel Oil	
Liters of fuel	39.06	9,811.58	l/100km
Vehicle type	Truck-trailer, Euro 0 - 6 mix, 34 - 40t gross weight / 27t payload capacity	Container Ship 5000 to 200,000 dwt payload capacity, ocean going	
Transport distance	862.28	10,407.71	km
Capacity utilization (including empty runs, mass based	65	70	%
Weight of products transported (if gross density not reported)	14,741.75	140,000,000	kg
Capacity utilization volume factor (factor: =1 or <1 or ≥ 1 for compressed or nested packaging products)	1	1	-

Table 9. Installation into the building (A5)

NAME	VALUE	UNIT
Ancillary materials - Adhesive	1.1	kg/m2
Ancillary materials – Finishing oil	0.012	kg/m2
Net freshwater consumption	0	kg/m2
Product loss per functional unit	5	%
Waste materials at the construction site before waste processing, generated by product installation	0.675	kg/m2
Packaging waste, cardboard	0.090	kg/m2
Packaging waste, plastic shrink wrap	0.01	kg/m2
Biogenic carbon contained in packaging	0.322	kg/m2
VOC emissions	N/A	

Table 10. Reference Service Life

NAME	VALUE	UNIT
RSL	75	years
Declared product properties (at the gate) and finishes, etc.	See Table 1	Units as appropriate
Design application parameters (if instructed by the manufacturer), including references to the appropriate practices and application codes)	Installation per recommendation by manufacturer	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Accepted industry standard	-
Indoor environment, (if relevant for indoor applications), e.g. temperature, moisture, chemical exposure)	Normal building operating conditions	-
Use conditions, e.g. frequency of use, mechanical exposure.	Normal building operating conditions	-

Table 11. Maintenance (B2)

NAME	VALUE	UNIT
Maintenance process information	The floors should be wiped once per week for the three weeks following installation to eliminate build-up. After three weeks, it is recommended the floors are wiped once a month with warm water and mafi wood floor soap	
Maintenance cycle	904	cycles/ RSL
Maintenance cycle	904	cycles/ ESL
Net freshwater consumption	5.982, tap water, evaporated	kg/ m_2/year
Ancillary materials - Soap	0.078	kg/m_2/year
Energy input	0.165, water heating	kWh/m_2/year
Direct emissions to ambient air, soil and water	0	kg

The study does not include the impacts associated with repair, replacement, and refurbishment (B3-B5) as minimal resources are used in the rare occasion that repair, replacement, or refurbishment is necessary.

The product does not require operational energy or water use of the building integrated systems (B6-B7).

Table 12. End of life (C1-C4)

NAME		VALUE	UNIT
Assumptions for scenario development		Product is either disposed of with the underlying floor or manually removed via scraping	
Collection process	Collected separately	0	kg
	Collected with mixed construction waste	12.612	kg
Recovery	Reuse	0	kg
	Recycling	6.30	kg
	Landfill	4.67	kg
	Incineration	1.64	kg
	Incineration with energy recovery	0	kg
	Energy conversion efficiency rate	84-94	%
Disposal	Product or material for final deposition	12.612	kg
Removals of biogenic carbon (excluding packaging)		17.3	kg CO_2

4. Life Cycle Assessment Results

Table 13. Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
Cradle to Grave	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

An X in the table above signifies that a module was included in the life cycle assessment. MND stands for Module Not Declared and signifies that a life cycle stage was not evaluated in the life cycle assessment.

4.1. Life Cycle Impact Assessment Results[1]

Table 14. North American Impact Assessment Results

TRACI v2.1	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
GWP 100 [kg CO_2 eq]	-8.09E+00	2.06E+00	4.77E+00	0.00E+00	8.18E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-01	2.98E+00	7.72E+00
ODP [kg CFC-11 eq]	4.90E-11	3.92E-16	2.77E-12	0.00E+00	8.88E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E-17	4.84E-16	1.02E-15
AP [kg SO_2 eq]	8.81E-02	5.67E-02	1.42E-02	0.00E+00	3.20E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.71E-04	3.64E-04	2.22E-03
EP [kg N eq]	4.69E-03	2.01E-03	1.27E-03	0.00E+00	2.48E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.33E-05	2.43E-05	3.30E-04
POCP [kg O_3 eq]	2.58E+00	1.09E+00	3.23E-01	0.00E+00	4.62E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.73E-03	8.52E-03	5.10E-02
Resources [MJ, LHV]	9.84E+00	3.75E+00	1.39E+01	0.00E+00	1.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E-01	6.48E-02	6.19E-01

Table 15. EU Impact Assessment Results

CML v4.2	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
GWP 100 [kg CO_2 eq]	-8.09E+00	2.06E+00	4.77E+00	0.00E+00	8.18E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-01	2.98E+00	7.72E+00
ODP [kg CFC-11 eq]	4.87E-11	3.92E-16	2.75E-12	0.00E+00	8.88E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E-17	4.84E-16	1.02E-15
AP [kg SO_2 eq]	7.45E-02	5.27E-02	1.18E-02	0.00E+00	2.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E-04	2.82E-04	1.56E-03
EP [kg PO4-3 eq]	1.23E-02	5.85E-03	2.01E-03	0.00E+00	3.45E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.80E-05	6.07E-05	7.99E-04
POCP [kg ethene eq]	5.10E-02	1.90E-03	3.64E-03	0.00E+00	4.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-6.04E-05	2.35E-05	1.92E-03
$ADP_{element}$ [kg Sb-eq]	1.23E-06	3.51E-08	7.97E-07	0.00E+00	2.84E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.61E-09	6.00E-09	2.32E-08
ADP_{fossil} [MJ, LHV]	8.76E+01	2.61E+01	1.05E+02	0.00E+00	1.37E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E+00	5.48E-01	4.69E+00

1 $ADP_{elements}$ - Abiotic depletion potential for non-fossil resources; ADP_{fossil} - Abiotic depletion potential for fossil resources; AP - Acidification potential of soil and water; EP - Eutrophication potential; GWP - Global warming potential; OPD - Depletion of stratospheric ozone layer; POCP - Photochemical ozone creation potential; Resources - Depletion of non-renewable fossil fuels

4.2. Life Cycle Inventory Results[2]

Table 16. Resource Use

Parameter	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
RPR_E [MJ, LHV]	1.22E+02	2.39E-01	1.48E+01	0.00E+00	8.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.20E-02	1.19E-01	3.40E-01
RPR_M [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$ [MJ, LHV]	8.84E+01	2.62E+01	1.08E+02	0.00E+00	1.76E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E+00	6.40E-01	4.84E+00
$NRPR_M$ [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ, LHV]	9.38E-27	0.00E+00	1.09E-26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ, LHV]	1.10E-25	0.00E+00	1.28E-25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m_3]	5.45E-02	1.24E-04	2.76E-02	0.00E+00	5.35E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.55E-05	7.23E-03	1.03E-03

Table 17. Output Flows and Waste Categories

Parameter	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
HWD [kg]	2.82E-07	2.02E-09	1.02E-07	0.00E+00	8.18E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-08	4.46E-10	1.77E-08
NHWD [kg]	6.94E-01	8.17E-04	3.00E-01	0.00E+00	1.22E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E-04	2.13E-02	2.83E+00
HLRW [kg]	3.39E-07	3.37E-08	1.43E-06	0.00E+00	1.31E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.44E-09	3.01E-08	6.04E-08
ILLRW [kg]	2.97E-04	3.23E-05	1.27E-03	0.00E+00	1.54E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.62E-06	3.66E-05	5.84E-05
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
R [kg]	0.00E+00	0.00E+00	3.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.31E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	8.20E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E+00	0.00E+00
EE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 18. Carbon Emissions and Removals

Parameter	A1-C4
BCRP [kg CO_2]	17.3
BCEP [kg CO_2]	0.123
BCRK [kg CO_2]	0.322
BCEK [kg CO_2]	0.155

[2] RPR_E - Use of renewable primary energy excluding renewable primary energy resources used as raw materials; RPR_M - Use of renewable primary energy resources used as raw materials; $NRPR_E$ - Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; $NRPR_M$ - Use of non-renewable primary energy resources used as raw materials; SM - Use of secondary materials; RSF - Use of renewable secondary fuels; NRSF - Use of non-renewable secondary fuels; RE - Recovered Energy; FW - Net use of fresh water; HWD - Disposed-of-hazardous waste; NHWD - Disposed-of non-hazardous waste; HLRW - High-level radioactive waste, conditioned, to final repository; ILLRW - Intermediate- and low-level radioactive waste, conditioned, to final repository; CRU - Components for reuse; R - Materials for recycling; MER - Materials for energy recovery; EE - Exported energy

5. LCA Interpretation

Overall for mafi's wood plank products, Global Warming (GWP), POCP, and Abiotic Depletion of fossil fuels are the impact categories of most significance. In the sourcing and extraction stage, the largest contributors to the impacts in terms of raw materials are round wood (-47%) and timber wood (-57%). The negative value here is from trees inherently sequestering carbon in them. Within manufacturing, electricity contributes to 40% of overall GWP impacts while thermal energy contributes to 5%. Shipping to customer contributes around 8.2% of total GWP impacts, while installation contributes around 18% of GWP impacts. Use stage contributes to 33% of total GWP impacts mainly arising from use of electricity to heat water to clean the planks, followed by soap used to clean the products over 75 years of ESL. Finally, disposal of the product contributes 40% to total GWP impacts. This is due carbon dioxide and methane emissions from landfilling and incineration of wood.

A scenario analysis was conducted to understand the differences in impacts between installation methods other than fully glued installation:

- Nailed installation
- Partly glued installation
- Floated installation

It was found that the fully glued install method was the most impactful in terms of GWP impacts due to a large amount of adhesive being applied. On the other hand, for floated installation, the GWP is negative due to carbon being sequestered in the cork underlay. This is followed by impacts for nailed install and partly glued install, where GWP impacts arise from nails/electricity and adhesive, respectively.

Some limitations to the study have been identified as follows:

- Availability of geographically more accurate datasets would have improved the accuracy of the study.
- Only known and quantifiable environmental impacts are considered.
- Due to the assumptions and value choices listed above, these do not reflect real-life scenarios and hence they cannot assess actual and exact impacts, but only potential environmental impacts.

6. Additional Environmental Information

6.1. Environmental Activities and Certifications

More information on mafi's product, manufacturing operations, and company portfolio can be found at https://mafi.com/en. Additionally, the natural wooden flooring products have received Living Product Challege Imperative Certification and details can be found at https://mafi.com/en/why-mafi/sustainable-and-natural.

6.2. Extraordinary Effects

The natural wooden planks have a Class CFL-s1 fire rating. The product has no additional impact to the environment during unforeseeable extraordinary effects to include fire, flooding, or mechanical destruction.

7. References

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4. ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines.
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