



Hickory, White Oak, Black Walnut and Heart Pine Engineered Wood Flooring



CRAFT Artisan Wood Floors

ENVIRONMENTAL PRODUCT DECLARATION

ISO 14025:2006



ASTM INTERNATIONAL

CRAFT Artisan Wood Floors is pleased to present this environmental product declaration (EPD) for its Hickory, White Oak, Black Walnut and Heart Pine flooring. This EPD was developed in compliance with CAN/CSA-ISO 14025 and has been verified by Lindita Bushi, Athena Sustainable Materials Institute.

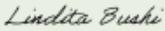
The LCA and the EPD were prepared by Vertima Inc. The EPD includes cradle-to-grave life cycle assessment (LCA) results.

For more information about CRAFT Artisan Wood Floors, visit www.craftfloor.com

For any explanatory material regarding this EPD, please contact the program operator.

1 GENERAL INFORMATION

PCR GENERAL INFORMATION			
Reference PCR	ULE General Program Instructions v2.3, February 2018 PCR for Building-Related Products and Services in: Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2 and Part B: Flooring EPD Requirements. Version 2.0. (UL Environment, September 2018 to September 2023).		
The PCR review was conducted by:	<i>Jack Geibig, Chair</i> Ecoform jgeibig@ecoform.com	<i>Thomas Gloria, PhD</i> Industrial Ecology Consultants t.gloria@industrial-ecology.com	<i>Thaddeus Owen</i> hiper4m@gmail.com

EPD GENERAL INFORMATION			
Program Operator	ASTM International 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA www.astm.org		
Declared Product	Hickory Flooring White Oak Flooring Black Walnut Flooring Heart Pine Flooring		
EPD Registration Number #234	EPD Date of Issue July 2021	EPD Period of Validity¹ July 2021 - July 2026	
EPD Recipient Organization The EPD owner has the sole ownership, liability and responsibility of the EPD.	Creative At Home Entreprises Inc. CRAFT Artisan Wood Floors Brand Head Office – Warehouse Location 8028 Enterprise Street, Burnaby, British Columbia, V5A 1V7, CANADA.		
EPD Type/Scope and Declared Unit Product specific type III, Cradle-to-Grave EPD with functional unit of 1 m ² of floor covering for a period of 75 years.		Year of Reported Manufacturer Primary Data 2019	
LCA Software Open LCA v.1.10.3	LCI Databases ecoinvent 3.7, US LCI	LCI Methodology TRACI 2.1	
This LCA and EPD were prepared by:		Gatien Geraud Essoua Ph.D., Eng. Forestry. Vertima Inc. www.vertima.ca	
This declaration was independently verified in accordance with ISO 14025:2006. The UL Environment “Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report,” v3.2 (September 2018), based on ISO 21930:2017 and CEN Norm EN 15804 (2012), serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017)		 _____ Lindita Bushi, Ph.D. Athena Sustainable Materials Institute	
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2 PRODUCT DEFINITION AND INFORMATION

2.1 DESCRIPTION OF THE COMPANY

CRAFT Artisan Wood Floors is the flagship brand manufactured and distributed by Creative At Home Enterprises Inc., a Canadian corporation that manufactures Engineered Wood Flooring products.

CRAFT is a leader in the manufacture of certified sustainable and healthy engineered wood floors. CRAFT embraces the principles of artisanal wood crafting, and is dedicated to creating uncommonly stunning wood floors that are as kind to the planet as they are beautiful.

2.2 PRODUCT DESCRIPTION

2.2.1 Product Identification

Products assessed in this report are Engineered Wood Flooring; more specifically, Hickory, White Oak, Black Walnut and Heart Pine Engineered Wood Flooring. CRAFT's flooring is 5/8" in thickness, and available in widths of either 7 inches or 8 inches. It comes in a mixture of fixed lengths, with a maximum plank length of 10 feet. It is used for both residential and commercial applications, and is commonly installed over wood or concrete subfloors. The products are increasingly being used for wall and ceiling applications. The construction and finish are both durable and beautiful, and come with a lifetime structural warranty and 30-year finish warranty. Figure 1 is a room scene of CRAFT's popular Black Walnut flooring. The primary United Nations Standard Products and Services Code (UNSPSC) code for this wood flooring product is 30161702 and the Construction Specifications Institute (CSI) code is 09 64 00.



Figure 1: Representation of Black Walnut flooring.

2.2.2 Product Average

The weighted average profile of each product is calculated based on 2019 annual production data (on mass) of the four (4) flooring products.

2.2.2.1 Product-Specific EPD

In the context of growing popularity of LEED certifications, developing Type III EPDs would allow CRAFT Artisan Wood Floors to increase the visibility of its products. This EPD is specific to CRAFT Artisan Wood Floors. It has been developed according to ISO 21930 - 2017 and ISO 14025 for four engineered wood flooring products, including Hickory, White Oak, Black Walnut and Heart Pine.

2.3 APPLICATION

All of CRAFT's Engineered Wood Flooring can be used in residential and commercial applications, and installed over wood or concrete subfloors as well as wall and ceiling applications.

2.4 DECLARATION OF METHODOLOGICAL FRAMEWORK

This LCA is a cradle-to-grave study. For this analysis, the attributional approach was followed and impacts of infrastructure have been excluded.

Life cycle stages included in the analysis are presented in Table 6. In accordance with the PCR, the reference service life (RSL) is 75 years. The study was verified by a third party. According to the UL Environment PCR – Part A [1], if a mass flow or energy flow represents less than 1% of the cumulative mass or energy flow of the system, it may be excluded from system boundaries. No known flows are deliberately excluded from this EPD. According to PCR section 3.10 allocation rules, mass should be used as the primary basis co-product allocation. OpenLCA software v1.10.2 [2], an open-source software, was used to calculate the inventory and to assess potential environmental impacts associated with the inventoried emissions.

2.5 TECHNICAL DATA

For specific properties and performance data of all of CRAFT's products, please consult the following link: <https://craftfloor.com/>

The construction and finish are both durable and beautiful, and CRAFT provides a lifetime structural warranty and a 30-year finish warranty. Table 1 presents the technical data details.

Table 1: Technical Details

CRAFT's Products	Name	Standards/Certifications	Values	Unit
Hickory	Thickness	-	15.875	mm
White Oak	Width	-	177.8 - 203.2	mm
Black Walnut	Weight	-	8.24 – 8.44	kg/m ²
Heart Pine	VOC Emissions	GREENGUARD GOLD	<0.026	mg/m ³
	Formaldehyde Emissions	GREENGUARD GOLD	<0.002	ppm

2.6 MATERIAL COMPOSITION

A summary of the values compiled are presented in Table 2.

Table 2: Material Composition

Material	Amount per One Functional Unit of CRAFT's Product			
	Hickory	White Oak	Black Walnut	Heart Pine
	%	%	%	%
Softwood	65.76%	66.15%	67.35%	65.97%
Hardwood	27.25%	26.82%	25.48%	26.51%
Adhesive	4.76%	4.79%	4.88%	4.78%
Wood Filler	0.83%	0.83%	0.85%	1.33%
Stain	0.41%	0.41%	0.42%	0.41%
UV Finish	0.99%	1.00%	1.02%	1.00%
Total	100.00%	100.00%	100.00%	100.00%

2.7 MANUFACTURING

The manufacture of CRAFT's Engineered Wood Flooring is a four-step process: drying, gluing, milling and finishing. Drying starts with rough lumber received at the flooring manufacturing plant gate. The softwood used is Spruce – Pine – Fir (SPF) while the hardwoods used are Hickory, White Oak and Black Walnut. Dried lumber then undergoes the ripping, chopping, resawing, sanding, gluing and moulding processes in order to produce unfinished wood flooring planks. Once assembled, unfinished wood flooring planks are comprised of two different layers: the bottom (structural) layer which is comprised of softwood (SPF), and the surface hardwood layer (lamella). The exception is for Reclaimed Heart Pine planks where the surface layer is technically a softwood (Heart Pine). At the end of the manufacturing process, flooring planks are finished through the application of a stain and protective coating.

CRAFT Engineered Wood Flooring planks are then packaged and delivered in closed cardboard boxes. Packaging materials used are presented in section 2.8 below. Figure 2 presents the flow diagram.

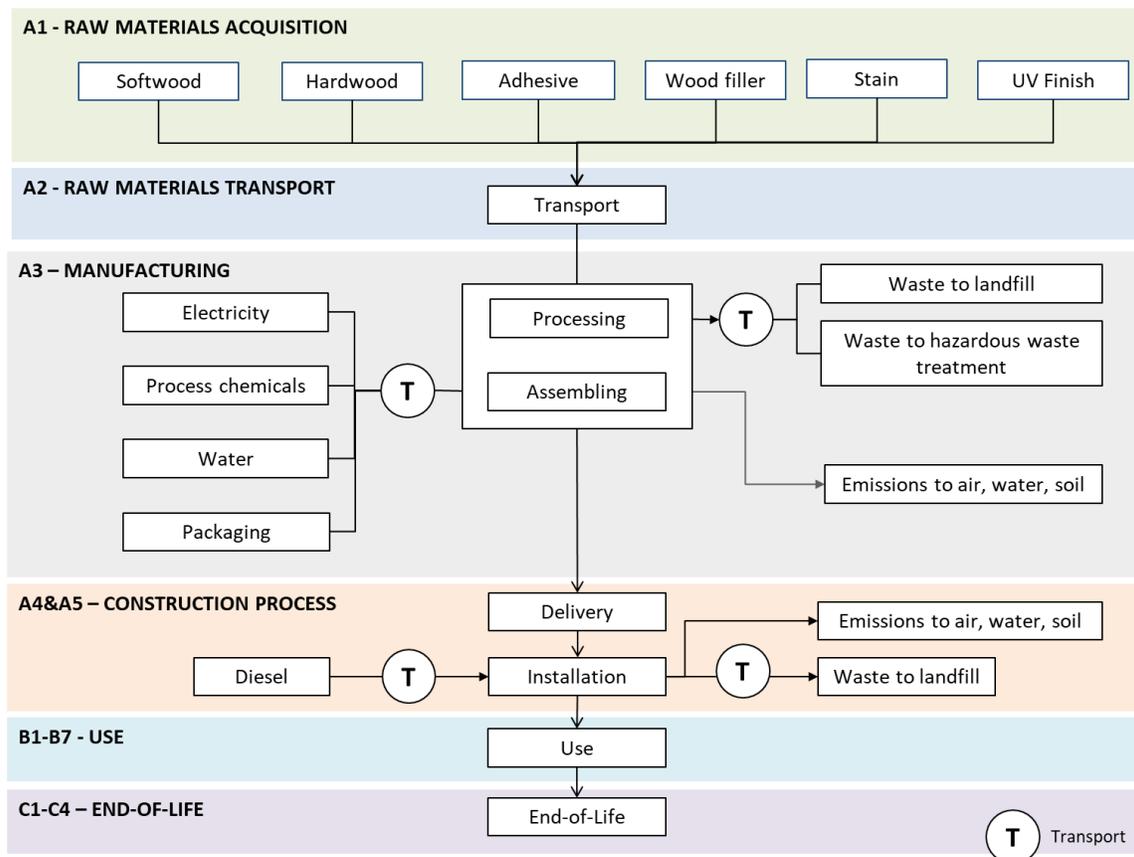


Figure 2: Flow Diagram

2.8 PACKAGING

All of CRAFT’s Engineered Wood Flooring is packaged using the materials presented in Table 3.

Table 3: Amount of packaging materials per 1m² of CRAFT Engineered Wood Flooring

Materials	Unit	Hickory	White Oak	Black Walnut	Heart Pine
Wood Pallets	kg	1.36E-01	1.35E-01	1.33E-01	1.36E-01
Cardboard Boxes	kg	2.28E-01	2.27E-01	2.23E-01	2.27E-01
Cardboard Hard Corner	kg	8.00E-03	7.95E-03	7.81E-03	7.97E-03
EPE Foam	kg	7.00E-03	6.96E-03	6.83E-03	6.98E-03
Plastic Pallet Straps - White	kg	1.00E-02	9.94E-03	9.76E-03	9.96E-03
Plastic Pallet Straps - Green	kg	2.00E-03	1.99E-03	1.95E-03	1.99E-03

All of CRAFT's flooring is packaged in cardboard boxes with plastic straps that make the boxes easy to carry.

2.9 TRANSPORTATION

CRAFT's products are transported by truck and boat from the factory to the warehouse. Transportation to CRAFT's customers is provided primarily via trucking to North American locations.

2.10 PRODUCT INSTALLATION

The manufacturer has created detailed installation instructions (available at: <https://craftfloor.com/install.pdf>) and they should be followed at all times. Electric saws are required for installation, and the electricity consumption by the equipment is included in the analysis. Packaging and installation waste disposal input and output have been modelled in accordance with the section 2.8.5 of Par A: Life Cycle Assessment Calculation Rules and Report Requirements.

Installation instructions follow the manufacturer's recommendations in accordance with the National Wood Flooring Association (NWFA) guidelines. Installation inputs per functional unit are provided in Table 4. During installation, personal protective equipment (dust masks or respirators, ear plugs and safety glasses) should be worn to protect the installer's respiratory system, ears and eyes from excessive exposure to sawdust. In addition, the use of knee pads and rubber gloves is recommended.

Table 4: Installation inputs per FU

Materials	Unit	Quantity
Electricity	kWh/m ²	2.00E-02
Adhesive	Kg/m ²	7.00E-02

2.11 USE CONDITIONS

Every CRAFT floor is a premium quality, prefinished wood product that is built to exhibit superior stability and longevity - but it is not indestructible. Wood is a natural and organic material and can undergo irreparable damage if not treated properly and given periodic care and maintenance. Once a CRAFT floor has been installed and started to be lived on by its new occupants, there are three very important considerations that must be observed: proper cleaning, protection and humidity control. To get the most enjoyment out of a CRAFT floor, proper care and maintenance guidelines should be followed at all times [3]. Maintenance does not require the use of special products. Use of common wood floor cleaning products are recommended.

Creative At Home and the CRAFT brand are committed to making products that contribute to a healthy living environment. This is evidenced by the fact that all of CRAFT's products have been third-party certified by Underwriters Laboratories to the level of GREENGUARD® Gold, demonstrating the most stringent level of low VOC emissions available.

2.12 REFERENCE SERVICE LIFE AND ESTIMATED BUILDING SERVICE LIFE

As required in the PCR, the estimated service life (ESL) of the building is 75 years. Since the hardwood flooring is used for as long as the building's ESL, the reference service life (RSL) is assumed to be 75 years. No replacements are therefore necessary during the building's service life.

2.13 REUSE, RECYCLING, AND ENERGY RECOVERY

During the life cycle stages of CRAFT Engineered Wood Flooring, there is no re-use, recycling, or energy recovery.

2.14 DISPOSAL

This LCA study assumes that flooring disposal at the end of the service life occurs along with the construction, renovation and demolition (CRD) waste disposal practice commonly occurring in Canada. According to recent estimates, a major portion of CRD waste ends up in specifically designated landfills. For this analysis, it was assumed that 100% of the waste generated was landfilled [1].

2.15 FURTHER INFORMATION

Further information about CRAFT's Engineered Wood Flooring products is available at <https://craftfloor.com/>

3 LIFE CYCLE ASSESSMENT CALCULATION RULES

3.1 FUNCTIONAL UNIT

The functional unit (FU) for this study according to the UL PCR is 1 m² of floor covering by CRAFT Engineered Wood Flooring. Table 5 presents the functional unit of each product under study.

Table 5: Functional Unit of assessed products.

Item	Unit	Hickory	White Oak	Black Walnut	Heart Pine
Functional Unit	m ²	1	1	1	1
Weight	kg	8.44E+00	8.39E+00	8.24E+00	8.41E+00

3.2 SYSTEM BOUNDARIES

According to UL Environment's PCR [4], the LCA modelling covers cradle-to-grave stages. All life cycle stages are included in the analysis; Production, Construction, Use, and End-of-life. The Production stage included A1) Extraction and upstream production, A2) Raw materials transportation to the manufacturing plant and A3) Manufacturing of CRAFT's products. The Construction stage included A4) Transportation of flooring product from factory to building site and A5) Installation. The Use stage included modules B1 to B7. The End-of-life (EoL) stage included modules C1 to C4. Table 6 presents the life cycle stages and their modules included in the system boundaries analysed in accordance with ISO 21930 [5].

Table 6: Description of the system boundary modules

PRODUCT STAGE			CONSTRUCTION STAGE		USE STAGE							END-OF-LIFE STAGE				BENEFITS BEYOND THE SYSTEM
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Extraction and upstream production	Transport	Manufacturing	Transport from gate to site	Assembly/Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction	Transport	Waste Processing	Disposal	Reuse – Recycling
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

Legend: X = Included; MND = Module not declared (Excluded)

Extraction and upstream production (module A1): This stage includes the extraction and transformation of raw materials needed to produce CRAFT's flooring products (Hickory, White Oak, Black Walnut, Heart Pine). All chemicals used in the process have been taken into account in the inventory.

Raw materials transportation to flooring factory (module A2): This stage includes the transportation of raw materials from suppliers to CRAFT's factory in Jiashan, Zhejiang, China.

Manufacturing of flooring (module A3): This stage includes water and energy (electricity, heat) consumption for manufacturing processes (drying, resawing, planing, gluing, sanding, and finishing). Chemicals used in the wood bleaching process have been considered here, as well as their transport to the plant. Hazardous waste treatment has been accounted for as well.

The manufacturing processes for CRAFT's flooring products generates 3% in losses. These losses have been determined by weight and are considered as waste. Finally, packaging materials to make products ready for shipment are covered by this stage.

Transport to installation site (module A4): Products are transported by truck and boat from the factory to installation sites in North American locations.

Product installation (module A5): To install CRAFT flooring, glue, nails and energy are used depending to the type of sub-flooring. In this module, the waste generated includes wood product and packaging.

Maintenance (module B2): The products need to be maintained. A common and periodical maintenance schedule should be followed during the use stage. Manufacturer recommendations correspond to the standard of the wood flooring industry.

Transport to waste processing and/or disposal (module C2): Transport from the installation site to landfill site is considered in this module.

Disposal of waste (module C4): A large majority of CRAFT's flooring is distributed in North America (81%); hence, end-of-life scenarios are modeled according to the North American context.

3.3 ESTIMATION AND ASSUMPTIONS

During the use stage, the resources used on rare occasions are negligible for modules B1, B3 and B5. Since hardwood flooring lasts as long as the building itself, the RSL of the product is equal to ESL of the building. As required in the PCR, the ESL of the building is 75 years. Based on this, no replacements are necessary during the service life of the building. During the service life of the building, the product doesn't require operational energy (B6) and water use (B7). Based on this information, the environmental impacts of modules B1, B3, B4, B5, B6 and B7 are therefore considered as nil. For cleaning purposes, the energy, wood flooring cleaner product and finish used in module B2 are included as inputs in the analysis.

For the EoL stage, there is no energy consumption for the demolition module (C1) because it is generally a manual operation. In the case of C3, the waste goes directly from the building site to the landfill site without energy consumption at sorting plan. Module D is excluded to the system boundaries [1].

The average transportation distance for delivery of CRAFT's products in North America area was assumed to be 800 km according to the PCR. The transportation distance from the building demolition site to the landfill site was assumed to be 161 km according to the PCR [1].

3.4 CUT-OFF CRITERIA

According to the PCR, which follows ISO 21930:217 directives, cut-off rules shall not be applied in order to hide data. Any application of the criteria for the exclusion of inputs and outputs shall be documented.

In this EPD, any material input less than 1% of the total mass of the final product, with no significant environmental impact, is not included in the scope of the study. However, material inputs greater than 1% of the total mass of the final product are included within the scope of the study. The cumulative material inputs and environmental impacts less than 5% of the total weight of the FU are excluded. No known flows are deliberately excluded from this EPD.

3.5 DATA SOURCES

Inventory data was collected from Creative At Home's manufacturing plant located in Jiashan, Zhejiang, China, using a life cycle inventory (LCI) questionnaire. All data collected from Creative At Home (primary data) was used in the analysis.

When primary data was not available, unit processes were selected from the ecoinvent database v3.7 or from the US LCI database, the most comprehensive LCI databases currently available [6], [7].

When ecoinvent unit processes were not available specifically for North America or Canada, they were adapted by replacing their electricity grid by the ecoinvent process "Market for Electricity, medium or high voltage – CA ON," or by "Market group for Electricity, medium or high voltage - RNA".

3.6 DATA QUALITY

The primary data obtained from the manufacturer is representative of the current technologies and materials used by this company. As primary data was collected directly from the plant where CRAFT Engineered Wood Flooring products are manufactured, it is 100% representative of the technologies in use and of the geographical areas. The primary data was collected so as to be representative of the full year of 2019. The geographic area coverage of primary data was considered to be excellent. Representativeness and completeness of the data collected was very

good quality. Secondary data was used only for upstream processes. For some processes, the ecoinvent v3.7 database provided representative data for a North American, Canadian and Chinese context. These processes were used in priority. When necessary, the grid mix was changed to the grid mix of the province where the production took place.

3.7 PERIOD UNDER REVIEW

The period under review is the year 2019.

3.8 ALLOCATION

The ISO 14040 allocation procedure states that whenever possible, allocation should be avoided by collecting data related to the process under study or by expanding the product system [8].

According to PCR section 3.10 allocation rules, mass should be used as the primary basis co-product allocation. In this study, mass allocation was used for input and output flows [1]. Allocation was performed on the basis of the yearly production mass of each product under study. CRAFT provided all data relative to energy consumption (electricity, heat) for all products.

Material flows undergoing recycling/reuse processes are excluded from the system boundary. A cut-off approach was used because recycled/reused material is part of raw material preparation of another product system.

3.9 COMPARABILITY AND BENCHMARKING

PCRs for flooring allow EPD comparability only when all life cycle stages are considered. However, the comparison of specific EPDs from different manufacturers should be undertaken with caution, because assumptions, considerations, data sources, databases used, non-life cycle inventory data such as transportation distance and mode, and assessment tools and methods used, impact the final results. In the absence of knowledge of these specific variabilities, comparison of EPDs is not encouraged.

4 LIFE CYCLE ASSESSMENT SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

Table 7: Transport from gate to site (A4)

Name	Truck	Ship	Unit
Fuel type	Diesel	Heavy Fuel Oil	
Litres of fuel	-	-	l/100 km
Vehicle type	Transport truck,	Transoceanic container ship, 50,000 dwt	-
Transport distance	949	12,002	Km
Capacity utilization (including empty runs, mass-based)	-	-	%
Weight of products transported (if gross density not reported)	-	-	kg
Capacity utilization volume factor (factor=1 or <1 or ≥1 for compressed or nested packaging products)	1	1	-

Table 8: Installation (A5)

Name	Hickory	White Oak	Black Walnut	Heart Pine	Unit
Ancillary materials – Adhesive	0.07	0.07	0.07	0.07	Kg/m ²
Net freshwater consumption	0	0	0	0	Kg/m ²
Product loss per functional unit	5	5	5	5	%
Waste materials at the construction site before waste processing, generated by product installation	0.44	0.44	0.43	0.44	Kg/m ²
Packaging waste	0.41	0.41	0.40	0.41	Kg/m ²
Biogenic carbon contained in packaging	0.34	0.34	0.34	0.34	Kg CO ₂
VOC emissions	NB	NB	NB	NB	µg/m ³

Table 9: Reference Service Life (RSL)

Name	Value	Unit
RSL	75	Years
Declared product properties (at the gate) and finishes, etc.	-	Units as appropriate
Design application parameters (if instructed by the manufacturer), including references to the appropriate practices and application codes	Installation as per manufacturer's recommendations	-
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	-
Maintenance, e.g. required frequency, type and quality of replacement components	Maintenance based on manufacturer's recommendations	-

Table 10: Maintenance (B2)

Name	Value	Unit
Maintenance process information	Maintenance based on manufacturer's recommendations	
Maintenance cycle	900	Cycles/RSL
Maintenance cycle	900	Cycles/ESL
Net freshwater consumption specified by water source and fate (e.g., X m3 river water evaporated, X m3 city water disposed to sewer)	0.18	Litre/ Year/m2
Ancillary materials specified by type (e.g. cleaning agent)	0.03	kg/Year/m2
Energy input, specified by activity, type and amount	0.03	kWh/Year/m2
Direct emissions to ambient air, soil and water	0	kg

Table 11: End of Life (C1-C4)

Name		Hickory	White Oak	Black Walnut	Heart Pine	Unit
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)		CRAFT’s product is manually removed				
Collection process (specified by type)	Collected separately	0	0	0	0	Kg
	Collected with mixed construction waste	8.44	8.39	8.24	8.41	kg
Recovery (specified by type)	Reuse	0	0	0	0	kg
	Recycling	0	0	0	0	kg
	Landfill	0	0	0	0	kg
	Incineration	0	0	0	0	kg
	Incineration with energy recovery	0	0	0	0	kg
	Energy conversion (specify efficiency rate)	0	0	0	0	%
Disposal (specified by type)	Product or material for final deposition	8.44	8.39	8.24	8.41	kg
Biogenic carbon removals (excluding packaging)		-15.6	-15.5	-15.2	-15.5	Kg CO2

The values indicated in Table 11 represent the average values of CRAFT’s products.

5 LIFE CYCLE ASSESSMENT RESULTS

5.1 RESULTS TABLES

According to the PCR, life cycle assessment results must be presented per FU. It should be noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds safety margins, or risks.



Environmental Product Declaration (EPD) #

Table 12: Hickory Life Cycle Impact Assessment Results

Indicator	Description	Units	Production Stage			Construction Stage			Use Stage							End-of-Life Stage				Total
			A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4				
GWP-100 ⁽²⁾	Global Warming Potential-100 years	kg CO2 eq	1.55E+01	1.72E+00	1.00E+00	0.00E+00	9.41E+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	1.24E-01	0.00E+00	3.90E-02	2.78E+01
BCR ⁽³⁾	Biogenic Carbon Removals	kg CO2	-1.51E+01	0.00E+00	-7.41E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.59E+01
BCE	Biogenic Carbon Emissions	kg CO2	5.80E-02	0.00E+00	1.31E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.80E+00	1.99E+00
ODP ⁽¹⁾	Ozone Depletion Potential	kg CFC-11 e	1.37E-06	2.23E-07	8.40E-08	0.00E+00	1.37E-06	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	4.02E-09	0.00E+00	9.57E-09	3.06E-06
AP ⁽¹⁾	Acidification of soil and water Potential	kg SO2 eq	1.13E-01	2.39E-02	6.20E-03	0.00E+00	5.25E-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	6.41E-04	0.00E+00	3.64E-04	1.96E-01
EP ⁽¹⁾	Eutrophication Potential	kg N eq	2.28E-02	1.91E-03	3.35E-03	0.00E+00	3.72E-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	3.14E-05	0.00E+00	5.57E-05	6.53E-02
SFP ⁽¹⁾	Smog Formation Potential	kg O3 eq	1.89E+00	4.26E-01	1.02E-01	0.00E+00	4.93E-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	2.06E-02	0.00E+00	1.07E-02	2.94E+00
ADPFossil ⁽¹⁾	Depletion of abiotic resources - fossil fuels	MJ	1.75E+02	2.32E+01	1.47E+01	0.00E+00	1.47E+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	1.66E+00	0.00E+00	5.60E-01	3.62E+02

Table 13: White Oak Life Cycle Impact Assessment Results

Indicator	Description	Units	Production Stage			Construction Stage			Use Stage							End-of-Life Stage				Total
			A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4				
GWP-100 ⁽²⁾	Global Warming Potential-100 years	kg CO2 eq	1.54E+01	1.71E+00	1.00E+00	0.00E+00	9.41E+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	1.24E-01	0.00E+00	3.88E-02	2.77E+01
BCR ⁽³⁾	Biogenic Carbon Removals	kg CO2	-1.50E+01	0.00E+00	-7.37E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.58E+01
BCE	Biogenic Carbon Emissions	kg CO2	5.77E-02	0.00E+00	1.65E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E+00	2.01E+00
ODP ⁽¹⁾	Ozone Depletion Potential	kg CFC-11 e	1.37E-06	2.23E-07	8.41E-08	0.00E+00	1.37E-06	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	4.00E-09	0.00E+00	9.51E-09	3.06E-06
AP ⁽¹⁾	Acidification of soil and water Potential	kg SO2 eq	1.12E-01	2.39E-02	6.20E-03	0.00E+00	5.25E-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	6.37E-04	0.00E+00	3.62E-04	1.96E-01
EP ⁽¹⁾	Eutrophication Potential	kg N eq	2.27E-02	1.91E-03	3.35E-03	0.00E+00	3.72E-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	3.12E-05	0.00E+00	5.54E-05	6.52E-02
SFP ⁽¹⁾	Smog Formation Potential	kg O3 eq	1.89E+00	4.25E-01	1.02E-01	0.00E+00	4.93E-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	2.05E-02	0.00E+00	1.07E-02	2.94E+00
ADPFossil ⁽¹⁾	Depletion of abiotic resources - fossil fuels	MJ	1.74E+02	2.32E+01	1.47E+01	0.00E+00	1.47E+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	1.65E+00	0.00E+00	5.56E-01	3.61E+02

Table 14: Black Walnut Life Cycle Impact Assessment Results

Indicator	Description	Units	Production Stage			Construction Stage			Use Stage							End-of-Life Stage				Total
			A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4				
GWP-100 ⁽²⁾	Global Warming Potential-100 years	kg CO2 eq	1.53E+01	1.70E+00	1.00E+00	0.00E+00	9.41E+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	1.21E-01	0.00E+00	3.81E-02	2.76E+01
BCR ⁽³⁾	Biogenic Carbon Removals	kg CO2	-1.48E+01	0.00E+00	-7.24E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.55E+01
BCE	Biogenic Carbon Emissions	kg CO2	5.67E-02	0.00E+00	1.63E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E+00	1.98E+00
ODP ⁽¹⁾	Ozone Depletion Potential	kg CFC-11 e	1.36E-06	2.23E-07	8.43E-08	0.00E+00	1.37E-06	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	3.92E-09	0.00E+00	9.34E-09	3.05E-06
AP ⁽¹⁾	Acidification of soil and water Potential	kg SO2 eq	1.11E-01	2.39E-02	6.19E-03	0.00E+00	5.25E-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	6.26E-04	0.00E+00	3.56E-04	1.95E-01
EP ⁽¹⁾	Eutrophication Potential	kg N eq	2.25E-02	1.90E-03	3.35E-03	0.00E+00	3.72E-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	3.07E-05	0.00E+00	5.44E-05	6.50E-02
SFP ⁽¹⁾	Smog Formation Potential	kg O3 eq	1.87E+00	4.23E-01	1.02E-01	0.00E+00	4.93E-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	2.02E-02	0.00E+00	1.05E-02	2.92E+00
ADPFossil ⁽¹⁾	Depletion of abiotic resources - fossil fuels	MJ	1.73E+02	2.30E+01	1.47E+01	0.00E+00	1.47E+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	1.62E+00	0.00E+00	5.47E-01	3.60E+02

Table 15: Heart Pine Life Cycle Impact Assessment Results

Indicator	Description	Units	Production Stage			Construction Stage			Use Stage							End-of-Life Stage				Total
			A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4				
GWP-100 ⁽²⁾	Global Warming Potential-100 years	kg CO2 eq	1.50E+01	1.71E+00	9.51E-01	0.00E+00	9.41E+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	1.24E-01	0.00E+00	3.89E-02	2.72E+01
BCR ⁽³⁾	Biogenic Carbon Removals	kg CO2	-1.51E+01	0.00E+00	-7.39E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.59E+01
BCE	Biogenic Carbon Emissions	kg CO2	1.33E-02	0.00E+00	1.65E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E+00	1.99E+00
ODP ⁽¹⁾	Ozone Depletion Potential	kg CFC-11 e	1.29E-06	2.23E-07	7.51E-08	0.00E+00	1.37E-06	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	4.01E-09	0.00E+00	9.54E-09	2.97E-06
AP ⁽¹⁾	Acidification of soil and water Potential	kg SO2 eq	1.08E-01	2.39E-02	5.98E-03	0.00E+00	5.25E-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	6.39E-04	0.00E+00	3.63E-04	1.91E-01
EP ⁽¹⁾	Eutrophication Potential	kg N eq	2.17E-02	1.91E-03	1.49E-03	0.00E+00	3.72E-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	3.13E-05	0.00E+00	5.55E-05	6.24E-02
SFP ⁽¹⁾	Smog Formation Potential	kg O3 eq	1.76E+00	4.25E-01	1.01E-01	0.00E+00	4.93E-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	2.06E-02	0.00E+00	1.07E-02	2.81E+00
ADPFossil ⁽¹⁾	Depletion of abiotic resources - fossil fuels	MJ	1.69E+02	2.32E+01	1.42E+01	0.00E+00	1.47E+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	1.65E+00	0.00E+00	5.58E-01	3.55E+02





Environmental Product Declaration (EPD) #

(1): Calculated as per U.S EPA TRACI 2.1 [1], OpenLCA v 1.10.2

(2): GWP 100, excludes biogenic CO2 removals and emissions associated with biobased products and packaging; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5).

(3): A negative represents a biogenic carbon removal to the atmosphere.

Table 16: Hickory Life Cycle Inventory Results

Resource use																
Parameter	Unit	Production stage	Construction stage		Use stage							End-of-life stage				Total
		A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	
RPR _E ⁽⁴⁾	MJ, LHV	4.54E+02	3.24E-01	2.19E+01	0.00E+00	2.81E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.64E-03	0.00E+00	3.05E-02	5.05E+02
RPR _M ^{(5)*}	MJ, LHV	1.02E+02	0.00E+00	4.95E+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	1.07E+02
NRPR _E ⁽⁶⁾	MJ, LHV	2.14E+02	2.35E+01	1.87E+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	3.27E+00	0.00E+00	6.16E-01	2.60E+02
NRPR _M ^{(7)*}	MJ, LHV	4.88E-01	0.00E+00	2.44E-02	0.00E+00	6.25E+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	6.76E+00
SM ⁽⁸⁾	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	0.00E+00
RSF ⁽⁹⁾	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	0.00E+00
NRSF ⁽¹⁰⁾	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	0.00E+00
RE ⁽¹¹⁾	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	0.00E+00
FW ⁽¹²⁾	m ³	8.66E-02	1.65E-03	1.36E-02	0.00E+00	3.84E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.44E-07	0.00E+00	6.86E-05	4.86E-01
Output Flows and Waste																
HWD ⁽¹³⁾	kg	1.64E-02	0.00E+00	8.21E-04	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	1.72E-02
NHWD ⁽¹⁴⁾	kg	2.53E-01	0.00E+00	1.27E-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	0.00E+00	8.44E+00	8.71E+00
HLRW ⁽¹⁵⁾	m ³	1.81E-13	4.02E-13	2.80E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E-14	0.00E+00	0.00E+00	6.76E-13
ILLRW ⁽¹⁶⁾	m ³	4.56E-13	1.14E-12	7.93E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-13	0.00E+00	0.00E+00	1.86E-12
CRU ⁽¹⁷⁾	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	0.00E+00
MR ⁽¹⁷⁾	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	0.00E+00
MER ⁽¹⁷⁾	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	0.00E+00
EE ⁽¹⁷⁾	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	0.00E+00

*In the calculation of RPR_M and NRPR_M, packaging materials were included





Table 17: White Oak Life Cycle Inventory Results

Resource use																
Parameter	Unit	Production stage	Construction stage			Use stage						End-of-life stage				Total
		A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	
RPR _ℓ ⁽⁴⁾	MJ, LHV	4.53E+02	3.24E-01	2.20E+01	0.00E+00	2.81E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.62E-03	0.00E+00	3.03E-02	5.04E+02
RPR _M ^{(5)*}	MJ, LHV	1.02E+02	0.00E+00	4.95E+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	1.07E+02
NRPR _ℓ ⁽⁶⁾	MJ, LHV	2.14E+02	2.34E+01	1.87E+01	0.00E+00	1.76E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.25E+00	0.00E+00	6.12E-01	4.36E+02
NRPR _M ^{(7)*}	MJ, LHV	4.88E-01	0.00E+00	2.44E-02	0.00E+00	6.25E+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	6.76E+00
SM ⁽⁸⁾	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	0.00E+00
RSF ⁽⁹⁾	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	0.00E+00
NRSF ⁽¹⁰⁾	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	0.00E+00
RE ⁽¹¹⁾	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	0.00E+00
FW ⁽¹²⁾	m ³	8.66E-02	1.65E-03	1.36E-02	0.00E+00	3.84E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.44E-07	0.00E+00	6.86E-05	4.86E-01
Output Flows and Waste																
HWD ⁽¹³⁾	kg	1.63E-02	0.00E+00	8.16E-04	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	1.71E-02
NHWD ⁽¹⁴⁾	kg	2.52E-01	0.00E+00	1.26E-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	0.00E+00	8.39E+00	8.65E+00
HLRW ⁽¹⁵⁾	m ³	1.80E-13	4.00E-13	2.79E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.49E-14	0.00E+00	0.00E+00	6.73E-13
ILLRW ⁽¹⁶⁾	m ³	4.54E-13	1.13E-12	7.90E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.84E-13	0.00E+00	0.00E+00	1.85E-12
CRU ⁽¹⁷⁾	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	0.00E+00
MR ⁽¹⁷⁾	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	0.00E+00
MER ⁽¹⁷⁾	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	0.00E+00
EE ⁽¹⁷⁾	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	0.00E+00

*In the calculation of RPR_M and NRPR_M, packaging materials were included.





Table 18: Black Walnut Life Cycle Inventory Results

Resource use																
Parameter	Unit	Production stage	Construction stage		Use stage							End-of-life stage				Total
		A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	
RPR _ℓ ⁽⁴⁾	MJ, LHV	4.52E+02	3.24E-01	2.23E+01	0.00E+00	2.81E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.56E-03	0.00E+00	2.98E-02	5.02E+02
RPR _M ^{(5)*}	MJ, LHV	1.02E+02	0.00E+00	4.95E+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	1.07E+02
NRPR _ℓ ⁽⁶⁾	MJ, LHV	2.13E+02	2.33E+01	1.87E+01	0.00E+00	1.76E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E+00	0.00E+00	6.01E-01	4.35E+02
NRPR _M ^{(7)*}	MJ, LHV	4.88E-01	0.00E+00	2.44E-02	0.00E+00	6.25E+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	6.76E+00
SM ⁽⁸⁾	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	0.00E+00
RSF ⁽⁹⁾	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	0.00E+00
NRSF ⁽¹⁰⁾	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	0.00E+00
RE ⁽¹¹⁾	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	0.00E+00
FW ⁽¹²⁾	m ³	8.65E-02	1.65E-03	1.36E-02	0.00E+00	3.84E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.41E-07	0.00E+00	6.81E-05	4.86E-01
Output Flows and Waste																
HWD ⁽¹³⁾	kg	1.60E-02	0.00E+00	8.02E-04	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	1.68E-02
NHWD ⁽¹⁴⁾	kg	2.47E-01	0.00E+00	1.24E-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	0.00E+00	8.24E+00	8.50E+00
HLRW ⁽¹⁵⁾	m ³	1.77E-13	3.94E-13	2.74E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.39E-14	0.00E+00	0.00E+00	6.62E-13
ILLRW ⁽¹⁶⁾	m ³	4.46E-13	1.12E-12	7.76E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-13	0.00E+00	0.00E+00	1.82E-12
CRU ⁽¹⁷⁾	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	0.00E+00
MR ⁽¹⁷⁾	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	0.00E+00
MER ⁽¹⁷⁾	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	0.00E+00
EE ⁽¹⁷⁾	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	0.00E+00

*In the calculation of RPR_M and NRPR_M, packaging materials were included





Table 19: Heart Pine Life Cycle Inventory Results

Resource use																
Parameter	Unit	Production stage	Construction stage		Use stage							End-of-life stage				Total
		A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	
RPR _E ⁽⁴⁾	MJ, LHV	4.54E+02	3.24E-01	2.20E+01	0.00E+00	2.81E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.63E-03	0.00E+00	3.04E-02	5.04E+02
RPR _M ^{(5)*}	MJ, LHV	1.02E+02	0.00E+00	4.95E+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	1.07E+02
NRPR _E ⁽⁶⁾	MJ, LHV	2.14E+02	2.34E+01	1.87E+01	0.00E+00	1.76E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.26E+00	0.00E+00	6.14E-01	4.36E+02
NRPR _M ^{(7)*}	MJ, LHV	4.88E-01	0.00E+00	2.44E-02	0.00E+00	6.25E+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	6.76E+00
SM ⁽⁸⁾	kg	2.23E+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	2.23E+00
RSF ⁽⁹⁾	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	0.00E+00
NRSF ⁽¹⁰⁾	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	0.00E+00
RE ⁽¹¹⁾	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	0.00E+00
FW ⁽¹²⁾	m ³	8.25E-02	1.65E-03	1.36E-02	0.00E+00	3.84E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.42E-07	0.00E+00	6.83E-05	4.82E-01
Output Flows and Waste																
HWD ⁽¹³⁾	kg	1.64E-02	0.00E+00	8.18E-04	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	1.72E-02
NHWD ⁽¹⁴⁾	kg	2.52E-01	0.00E+00	1.26E-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	0.00E+00	8.41E+00	8.67E+00
HLRW ⁽¹⁵⁾	m ³	1.80E-13	4.01E-13	2.78E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.51E-14	0.00E+00	0.00E+00	6.73E-13
ILLRW ⁽¹⁶⁾	m ³	4.53E-13	1.13E-12	7.87E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.84E-13	0.00E+00	0.00E+00	1.85E-12
CRU ⁽¹⁷⁾	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	0.00E+00
MR ⁽¹⁷⁾	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	0.00E+00
MER ⁽¹⁷⁾	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	0.00E+00
EE ⁽¹⁷⁾	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	0.00E+00

*In the calculation of RPR_M and NRPR_M, packaging materials were included.

(4): RPR_E = RPRT - RPR_M, where RPRT is equal to the value for renewable energy obtained using the CED LHV.

(5): RPR_M is calculated by multiplying the mass (kg) of the material input (or its components) by the net calorific value (lower heating value) (MJ/kg) of this input as per ACLCA ISO 21930 Guidance [1]. In the calculation of RPR_M, packaging materials were included.

(6): NRPR_E = NRPR_T - NRPR_M, where NRPR_T is equal to the value for non-renewable energy obtained using the CED LHV methodology (for non-renewable fossil fuels and nuclear energy).

(7): NRPR_M is calculated by multiplying the mass (kg) of the material input (or its components) by the net calorific value (lower heating value) (MJ/kg) of this input as per ACLCA ISO 21930 Guidance [1]. In the calculation of NRPR_M, packaging materials were included.





Environmental Product Declaration (EPD)

- (8): Calculated as per ACLCA ISO 21930 Guidance [6], 6.5 Secondary material, SM: An SM is involved in the manufacturing of CRAFT's Heart Pine Floor.
- (9): Calculated as per ACLCA ISO 21930 Guidance [6], 6.6 Renewable secondary fuels, RSF: There is no RSF involved in the CRAFT's floor manufacturing process.
- (10): Calculated as per ACLCA ISO 21930 Guidance [6], 6.7 Non-renewable secondary fuels, NRSF: There is no NRSF involved in the CRAFT's floor manufacturing process.
- (11): Calculated as per ACLCA ISO 21930 Guidance [6], 6.8.1 Recovery Energy, RE: There is no RE involved in the CRAFT's floor manufacturing process
- (12): Represents the use of net fresh water considering upstream processes that are part of the life cycle inventory.
- (13): Calculated from life cycle inventory results, based on "hazardous."
- (14): Calculated from life cycle inventory results, based on "non-hazardous" waste.
- (15): Calculated as per ACLCA ISO 21930 Guidance [1], 10.3 High-level radioactive waste, conditioned, to final repository. It should be noted that CRAFT's floor manufacturing process does not generate any HLRW. High-level radioactive waste, e.g., when generated by electricity production, consists mostly of spent fuel from reactors (ISO 21930:2017, clause 7.2.14).
- (16): Calculated as per ACLCA ISO 21930 Guidance [1], 10.4 Intermediate- and low-level radioactive waste, conditioned, to final repository. It should be noted that CRAFT's floor manufacturing process does not generate any ILLRW. Low- and intermediate-level radioactive wastes, e.g., when generated by electricity production, arise mainly from routine facility maintenance and operations (ISO 21930:2017, clause 7.2.14).
- (17): Reused components (CRU), materials for recycling (MR), materials for energy recovery (MER) and exported energy (EE) are not applicable for this project.



Table 20: Biogenic Carbon Removal and Emission

Parameter	Description	Unit	CRAFT's Product			
			Hickory	White Oak	Black Walnut	Heart Pine
BCRP	Biogenic carbon removal from product	kg CO2 eq	-1.56E+01	-1.55E+01	-1.52E+01	-1.55E+01
BCEP	Biogenic carbon emission from product	kg CO2 eq	1.95E+00	1.98E+00	1.94E+00	1.94E+00
BCRK	Biogenic carbon removal from packaging	kg CO2 eq	-2.92E-01	-2.92E-01	-2.92E-01	-2.92E-01
BCEK	Biogenic carbon emission from packaging	kg CO2 eq	3.44E-02	3.44E-02	3.44E-02	3.44E-02

6 LCA: INTERPRETATION

The contribution analysis of the Hickory product life cycle modules shows the major contribution of modules A1 to A3 and B2 for all impact categories. For the Global Warming Potential impact category, without the effect of biogenic carbon, the production stage represents 56% while module B2 represents 34% of the total environmental impact. In the production life cycle stage, the A3 module is the major contributor due to the high voltage energy grid mix produced in China. Its impact represents 51% of the production stage impact. Module B2 represents the maintenance operations of the functional unit for a period of 75 years (building ESL). Its highest impact is due to the materials used (detergent and UV finish) for 75 years of the building's life.

When including biogenic carbon in the calculation, the environmental impacts of CRAFT's product for the Global Warming Potential impact category decreases. The production stage impact of the Hickory flooring represents -0.45% of the total life cycle stage impact. For the same impact category, the modules A5 and C4 represent 0.39% and 1.84% of the total life cycle stages impact, respectively.

The analysis of the production stage of White Oak, Black Walnut and Heart Pine products represents 0.48%, 0.59% and -0.04%, respectively, for the GWP impact categories. The environmental impacts of other life cycle stages are similar to the Hickory product.

Limitation to this study is:

- Comparability limitation: Environmental declarations from different programs based upon differing PCRs may not be comparable. Furthermore, Cradle-to-Grave EPDs based on the same PCR and reference standards may be comparable; however, care should be taken when doing so.

7 ADDITIONAL ENVIRONMENTAL INFORMATION

7.1 ENVIRONMENTAL ACTIVITIES AND CERTIFICATION

In addition, Creative At Home and the CRAFT Artisan Wood Flooring brand is part of a third-party verification process with Vertima Inc. where their flooring products and environmental documents have been assessed. At the end of the process, they received a Validated Eco-Declaration® (EDS-Environmental Data Sheet) summarizing verified environmental claims.

CRAFT have also a chemical ingredients declaration (DECLARE®) for Hickory, White Oak, Black Walnut and Heart Pine flooring products.

7.2 EXTRAORDINARY EFFECTS

CRAFT's floors have a class C surface burning/flame spread rating, for the standard ASTM E84 and 150 FSR (Flame Spread Rating) for walls and ceilings for the standard CAN/ULC S102.



8 REFERENCES

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- [9] American Center for Life Cycle Assessment (ACLCA), "ACLCA Guidance to Calculating Non-LCIA Inventory metrics in Accordance with ISO 21930;2017," American Center for Life Cycle Assessment, 2019.
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