

ENVIRONMENTAL PRODUCT DECLARATION

# HARDWOOD PLYWOOD

ROSEBURG FOREST PRODUCTS COMPANY



Founded in 1936, Roseburg is a privately-owned, vertically integrated company that owns and sustainably manages more than 600,000 acres of timberland in the U.S. The company converts those renewable resources into high quality, durable wood products including lumber, softwood and hardwood plywood panels, I-joists, laminated veneer lumber, and medium density fiberboard. Roseburg products are widely distributed throughout North America.



# ENVIRONMENTAL PRODUCT DECLARATION



Hardwood Plywood

According to ISO 14025,  
and ISO21930:2017

|  |   |
|--|---|
| EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE  | UL ENVIRONMENT, 333 PFINGSTEN RD., NORTHBROOK, IL 606011 <a href="https://www.ul.com">HTTPS://WWW.UL.COM</a>  |
| GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER  | UL Environment Environmental Product Declaration Program, GENERAL PROGRAM INSTRUCTIONS, VERSION 2.7, MARCH 2022   |
| MANUFACTURER NAME AND ADDRESS  | Roseburg Forest Products<br>3660 Gateway Street<br>Springfield, OR 97477  |
| DECLARATION NUMBER   | UL Provided   |
| DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT  | 1 cubic meter (m <sup>3</sup> ) of hardwood plywood   |
| REFERENCE PCR AND VERSION NUMBER   | ISO 21930:2017 – serves as the core PCR and:<br><br>UL Part A: Product Category Rules for Building-Related Products and Services - Part A: Life Cycle Assessment Calculation Rules and Report Requirements, v3.2.<br><br>UL Part B: Product Category Rule Guidance for Building-Related Products and Services, Part B: Structural and Architectural Wood Products, EPD Requirements UL 10010-9 v.1.0. |
| MARKETS OF APPLICABILITY   | North America   |
| DATE OF ISSUE  | UL Provided   |
| PERIOD OF VALIDITY   | UL Provided   |
| EPD TYPE   | Product specific  |
| EPD SCOPE  | Cradle-to-gate  |
| YEAR(S) OF REPORTED PRIMARY DATA   | 2022  |
| LCA SOFTWARE & VERSION NUMBER  | SimaPro V9  |
| LCI DATABASE(S) & VERSION NUMBER   | Ecoinvent 3.9.1, USLCI  |
| LCIA METHODOLOGY & VERSION NUMBER  | TRACI 2.1, IPCC AR5   |
| The UL Part A PCR review was conducted by:   | Lindita Bushi, PhD, Chair<br>Athena Sustainable Materials Institute<br><a href="mailto:Lindita.bushi@athenasmi.org">Lindita.bushi@athenasmi.org</a>   |
|  | Hughes Imbeault-Tetreault, Eng., M.A. Sc.<br>Groupe AGECO<br><a href="mailto:Hughes.i-tetreault@groupeageco.ca">Hughes.i-tetreault@groupeageco.ca</a>   |
|  | Jack Geibig<br>Ecoform<br><a href="mailto:jgeibig@ecoform.com">jgeibig@ecoform.com</a>  |
| The UL Part B PCR review was conducted by:   | Dr. Thomas Gloria, Chair<br>Industrial Ecology Consultants<br><a href="mailto:t.gloria@industrial-ecology.com">t.gloria@industrial-ecology.com</a>  |
|  | Dr. Indro Ganguly<br>University of Washington   |
|  | Dr. Sahoo<br>University of Georgia  |
| This declaration was independently verified in accordance with ISO 14025: 2006.<br><input type="checkbox"/> INTERNAL <input type="checkbox"/> EXTERNAL | Jack Geibig   |
| This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:  | Jack Geibig   |

# ENVIRONMENTAL PRODUCT DECLARATION



Hardwood Plywood

According to ISO 14025,  
and ISO 21930:2017

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:

Jack Geibig

#### 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, when they comply with all referenced standards, use the same sub-category PCR, and use equivalent scenarios with respect to construction works. 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. Comparison of the environmental performance of Structural and Architectural Wood 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 phase as instructed under this PCR.

## Foreword

This Type III environmental declaration is developed according to ISO 21930 and 14025 for hardwood plywood (HWPW). This EPD reports environmental impacts based on established life cycle impact assessment methods. The reported environmental impacts are estimates, and their level of accuracy may differ for a particular product line and reported impact. LCAs do not generally address site-specific environmental issues related to resource extraction or toxic effects of products on human health. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change and habitat destruction. Forest certification systems and government regulations address some of these issues. The product in this EPD conforms to ASTM D9-09ae1. EPDs do not report product environmental performance against any benchmark.

## Product System

### Product Description

Roseburg's HWPW is manufactured in a variety of dimensions, species, and grades. Roseburg HWPW is marketed and sold under the trademark name SkyPly®. The 2022 production data used in this EPD considers all HWPW produced during the year and is therefore weighted based on material output. The production data used in this EPD is presented in cubic meters, but includes the following possible dimensions:

- Lengths: 8', 10'
- Widths: 4'
- Thicknesses: 1/4" to 1-1/4"
- Number of plies: 3, 5, 7, 9, 11

A wide variety of face species are used in the manufacture of Roseburg's HWPW including walnut, alder, cherry, mahogany, oak, birch, and maple to name a few. In addition, there are variations on how the veneers are cut and matched that can provide hundreds of different decorative appearances in the finished panels. Roseburg also offers abundant choices in cores for these panels—from veneer core (predominately made from Douglas-fir and other western species) to composite wood cores such as medium density fiberboard (MDF) and particleboard (PB) and Combination Fiber Core (CFC). These variations in face, core, plies, and thicknesses provide myriad choices for end-use applications.

The possible core variations are presented below:

- Veneer
- MDF
- PB
- CF

Results are reported separately for each core variation, as well as for a production weighted average core.

### Application and Technical Data

Primary application categories of HWPW include architectural casework, furniture, and cabinetry. These applications span all types of building projects, from residential and commercial spaces, to hospitality and education.



According to ISO 14025,  
and ISO 21930:2017

## Production

The upstream forest operations include forest management, logging, planting, and loading the harvested roundwood onto a truck. The roundwood is then transported from the forest road. The logs are lathed with a rotating drive to the necessary dimensional specifications. Layers of dry veneer and cores are adhered together using a ULEF (ultra low emitting formaldehyde) urea formaldehyde resin. A hot press is used to cure the adhesive. Once the resin has set, the final assembly is trimmed. Depending on the final use of the HWPW, a UV-based lacquer may be applied. Finally, the product is packaged for shipping. All of these processes require electricity, fuels, and wood inputs as biomass fuel.

The raw materials for the product were obtained from various parts of the US depending on the location of the facility and the product type. In general, the product systems are built using wood and resin inputs. The materials are delivered to the manufacturing facility via truck. The distances were modeled by material and were calculated using the supplier location and the location of manufacturing. All products produced are packaged on-site on shipping crates using plastic, wood, and cardboard packaging.

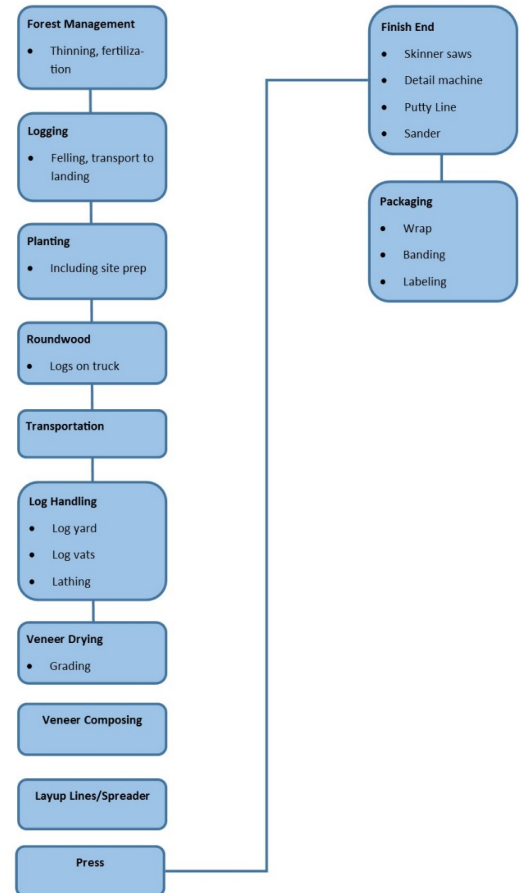


Figure 1: Cradle-to-gate product system for hardwood plywood



## Methodology of the Underlying LCA

### Declared Unit

The declared unit is one cubic meter (1 m<sup>3</sup>) of hardwood plywood. Table 1 shows additional details related to the functional unit.

**Table 1: Declared Unit Details (average HWPW product)**

|                                    | HARDWOOD PLYWOOD AVERAGE [%] | VENEER CORE [%] | MDF CORE [%] | PB CORE [%] | CF CORE [%] |
|------------------------------------|------------------------------|-----------------|--------------|-------------|-------------|
| Declared Unit [m <sup>3</sup> ]    | 1                            | 1               | 1            | 1           | 1           |
| Mass [dry kg]                      | 578                          | 551             | 725          | 644         | 597         |
| Density (dry) [kg/m <sup>3</sup> ] | 578                          | 551             | 725          | 644         | 597         |
| Moisture Content [%]               | 4                            | 4               | 4            | 4           | 4           |

The general composition of hardwood plywood produced at the facility is represented in Table 2.

**Table 2: Material Composition per Functional Unit**

|                 | HARDWOOD PLYWOOD AVERAGE [%] | VENEER CORE [%] | MDF CORE [%] | PB CORE [%] | CF CORE [%] |
|-----------------|------------------------------|-----------------|--------------|-------------|-------------|
| Hardwood Veneer | 8.43                         | 9.09            | 5.38         | 5.46        | 8.33        |
| Softwood Veneer | 74.2                         | 90.9            | 0            | 0           | 66.7        |
| MDF             | 11.7                         | 0               | 94.6         | 0           | 25.0        |
| Particleboard   | 5.67                         | 0               | 0            | 94.5        | 0           |

The average HWPW product represents a production-weighted average. The veneer core variation represented 75% of production in 2022, while the MDF, PB, and CFC cores represented 10%, 6%, and 9%, respectively.

The product is packaged with strapping made of plastic, cardboard packaging made of cardboard, and battens made of wood. It is recommended the packaging materials are reused where possible. The resin used is urea-formaldehyde resin.

This product fulfills the requirements of U.S. EPA TSCA Title VI (40 CFR Part 770) Formaldehyde Emission Standards for Composite Wood Products and is third-party certified for use of a ULEF resin system. Verification of third-party

certification can be downloaded from [www.roseburg.com](http://www.roseburg.com). Beyond formaldehyde, no hazardous materials are contained in, or result from the production of, any of the products assessed in this study.

Information pertaining to the classification of the substances used to manufacture any of Roseburg’s Hardwood Plywood products including composition information, first aid measures, fire fighting measures, accidental release measures, handling and storage, exposure controls/PPE, physical and chemical properties, stability and reactivity, toxicological information, ecological information, disposal considerations, transport information, and regulatory information are contained in the product Safety Data Sheet which is available to download from the Roseburg website at [www.roseburg.com](http://www.roseburg.com).

**System Boundaries**

As shown in Figure 2, the cradle-to-gate system boundary includes the extraction of raw materials and processing; the transportation of raw materials, secondary materials, and any fuels from the extraction site to the manufacturing site; and the manufacturing of the wood construction product, including any necessary packaging. All other life cycle stages are excluded from the analysis, denoted by MND or “module not declared.”

|          | PRODUCT STAGE       |           |               | CONSTRUCTION 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          |
| EPD Type | X                   | X         | X             | MND                         | MND              | MND       | MND         | MND    | MND         | MND           | MND  | MND   | MND               | MND       | MND              | MND      | MND   |

Figure 2: Life cycle stages of wood products (those included are marked with an ‘x’)

**Cut-off Rules**

Material and energy inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material or energy 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 and inputs, and environmental impacts are less than 5% based on total weight of the functional unit.

The list of excluded materials and energy inputs include:

- Some material inputs may have been excluded within the datasets used for this project. All datasets have been critically reviewed and conform to the exclusion requirement of the PCR.
- Capital material and infrastructure



Beyond this, no inputs or outputs were actively excluded.

## Background Data

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Background data for upstream and downstream data are representative for 2022 Ecoinvent 3.9.1, and USLCI.

## Data Quality

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Overall data quality is considered good. Improvements can be made through the modification of datasets to incorporate more regional specificity, both in terms of energy and technology. However, the data were considered appropriate in relation to the goal, scope, and budget of the project.

Primary data in the form of energy consumption and water consumption were normalized based on total mass of production during the same time frame. The resulting energy and water per unit were used for product manufactured at the facilities under study. Overall, primary energy and water data quality are considered good.

Primary data also includes the bills of materials used to formulate the products that are included in the study. Overall, this data is considered excellent. Upstream data quality can be increased through the use of supplier-specific secondary datasets.

## Period under Review

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This study is intended to represent production for the year 2022.

## Region under Review

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HWPW production occurs in Dillard, Oregon.

## Treatment of Biogenic Carbon

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The product system represented in this EPD includes the information modules A1, A2 and A3. According to ISO 21930 7.2.7, if a bio-based material containing biogenic carbon leaves the studied product system at the system boundary between product systems in information modules C1 to C4 (or any other information module), this export of bio-based material and associated flow of biogenic carbon is reported as an export of biogenic carbon expressed in CO<sub>2</sub> in the LCI and characterized with +1 kg CO<sub>2</sub>e/kg CO<sub>2</sub> of biogenic carbon in the calculation of the GWP in the respective information module C1 to C4 (or any other information module). The following results apply this methodology to the biogenic carbon present in the primary product as it leaves the manufacturer in module A3.

## Allocation

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Multi-output allocation generally follows the requirements of ISO 14044, Section 4.3.2.2. The method of multi-output allocation was determined based on the requirements and guidance of UL Part A, section 3.3 and additionally considers the following as per the PCR:

*“Mass should be used as the primary basis for co-product allocation in this Part B. Allocation methods deemed more appropriate than on the basis of mass may be used but only when justified.”*

This allocation method applies both to wood waste as an output and as an input (i.e. wood waste used in particleboard manufacturing). Co-product, ancillary material, and energy allocation were done using mass. This method aligns with



industry-average EPDs on the products under study.

## Comparability

This PCR allows EPD comparability only when the same functional requirements between products are ensured and the requirements of ISO 21930:2017 §5.5 are met. It should be noted that different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared. Comparison of the environmental performance using EPD information shall consider all relevant information modules over the full life cycle of the products within the building.

## Additional Statements

While this EPD does not address landscape level forest management impacts, potential impacts may be addressed through requirements put forth in regional regulatory frameworks, ASTM 7612-15 guidance, and ISO 21930 Section 7.2.11 including notes therein. These documents, combined with this EPD, may provide a more complete picture of environmental and social performance of wood products.

While this EPD does not address all forest management activities that influence forest carbon, wildlife habitat, endangered species, and soil and water quality, these potential impacts may be addressed through other mechanisms such as regulatory frameworks and/or forest certification systems which, combined with this EPD, will give a more complete picture of environmental and social performance of wood products.

EPDs can complement but cannot replace tools and certifications that are designed to address environmental impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, etc.

National or regional life cycle averaged data for raw material extraction does not distinguish between extraction practices at specific sites and can greatly affect the resulting impacts.

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 when averaging data. There was no method used to estimate variability in this EPD because no data averaging was used.

## Life Cycle Assessments Results

The impact categories presented represent impact potentials, i.e., they are approximations of environmental impacts that could occur if the emissions would (a) actually follow the underlying impact pathway and (b) meet certain conditions in the receiving environment while doing so. In addition, the inventory only captures that fraction of the total environmental load that corresponds to the functional unit (relative approach). LCIA results are therefore relative expressions only and do not predict actual impacts, exceeding thresholds, safety margins, or risks.

The LCIA results are presented for 1 m<sup>3</sup> of the weighted average hardwood plywood product in Table 3.

**Table 3: Weighted average LCIA Results for 1 m<sup>3</sup> of Hardwood Plywood produced by Roseburg**

| IMPACT CATEGORY  | TOTAL     | A1        | A2       | A3       |
|--|-----------|-----------|----------|----------|
| <b>LCIA Impact Indicators – TRACI 2.1 and IPCC AR5</b> |           |           |          |          |
| IPCC AR5 GWP incl. bio [kg CO <sub>2</sub> eq]         | -8.48E+02 | -9.78E+02 | 3.17E+01 | 9.82E+01 |
| IPCC AR5 GWP excl. bio [kg CO <sub>2</sub> eq]         | 2.50E+02  | 1.96E+02  | 3.16E+01 | 2.30E+01 |
| GWP TRACI excl. bio [kg CO <sub>2</sub> e]             | 2.47E+02  | 1.93E+02  | 3.13E+01 | 2.27E+01 |
| AP [kg SO <sub>2</sub> eq]                             | 2.18E+00  | 1.72E+00  | 1.77E-01 | 2.82E-01 |
| EP [kg N eq]   | 4.85E-01  | 4.52E-01  | 1.44E-02 | 1.93E-02 |
| ODP [kg CFC 11 eq]                                     | 4.21E-05  | 1.86E-05  | 1.79E-07 | 2.34E-05 |
| SFP [kg O <sub>3</sub> eq]                             | 1.50E+01  | 1.18E+01  | 1.28E+00 | 1.97E+00 |
| <b>Resource Use Parameters</b>                         |           |           |          |          |
| RPRE [MJ]  | 4.85E+01  | 3.65E+00  | 8.87E-01 | 4.39E+01 |
| RPRM [MJ]  | 1.28E+04  | 1.28E+04  | 0.00E+00 | 3.52E+01 |
| NRPRE [MJ]   | 3.10E+03  | 2.40E+03  | 3.98E+02 | 3.03E+02 |
| NRPRM [MJ]   | 6.35E+02  | 6.31E+02  | 0.00E+00 | 3.97E+00 |
| SM [kg]  | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00 |
| RSF [MJ]   | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00 |
| NRSF [MJ]  | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00 |
| RE [MJ]  | 4.32E+01  | 0.00E+00  | 0.00E+00 | 4.32E+01 |
| FW [m <sup>3</sup> ]                                   | 3.81E+01  | 2.77E+01  | 5.87E+00 | 4.54E+00 |
| ADPF [MJ]  | 3.52E+03  | 2.83E+03  | 3.92E+02 | 3.02E+02 |
| <b>Waste Parameters and Output Flows</b>               |           |           |          |          |
| HWD [kg]   | 2.85E+01  | 2.07E+01  | 4.40E+00 | 3.40E+00 |
| NHWD [kg]  | 1.52E+01  | 1.29E+01  | 1.54E-01 | 2.06E+00 |
| HLRW [kg]  | 1.61E+01  | 9.50E+00  | 4.54E-01 | 6.17E+00 |
| ILLRW [kg]   | 2.11E-08  | 1.01E-08  | 6.42E-09 | 4.65E-09 |



| IMPACT CATEGORY                   | TOTAL     | A1        | A2       | A3        |
|-----------------------------------|-----------|-----------|----------|-----------|
| CRU [kg]                          | 4.04E-08  | 1.97E-08  | 1.19E-08 | 8.76E-09  |
| MR [kg]                           | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| MER [kg]                          | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| EE [kg]                           | 3.62E-02  | 0.00E+00  | 0.00E+00 | 3.62E-02  |
| <b>Biogenic Carbon Indicators</b> |           |           |          |           |
| BCRP [kg CO2]                     | -1.08E+03 | -1.08E+03 | 0.00E+00 | 0.00E+00  |
| BCEP [kg CO2]                     | 1.04E+03  | 0.00E+00  | 0.00E+00 | 1.04E+03  |
| BCRK [kg CO2]                     | -3.62E+00 | 0.00E+00  | 0.00E+00 | -3.62E+00 |
| BCEK [kg CO2]                     | 3.62E+00  | 0.00E+00  | 0.00E+00 | 3.62E+00  |
| BCEW [kg CO2]                     | 2.10E+01  | 0.00E+00  | 0.00E+00 | 2.10E+01  |
| CCE [kg CO2]                      | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| CCR [kg CO2]                      | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| CWNR [kg CO2]                     | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |

Table 4: LCIA Results for 1 m<sup>3</sup> of Hardwood Plywood (Veneer Core) produced by Roseburg

| IMPACT CATEGORY  | TOTAL     | A1        | A2       | A3       |
|--|-----------|-----------|----------|----------|
| <b>LCIA Impact Indicators – TRACI 2.1 and IPCC AR5</b> |           |           |          |          |
| IPCC AR5 GWP incl. bio [kg CO <sub>2</sub> eq]         | -9.14E+02 | -1.04E+03 | 3.17E+01 | 9.82E+01 |
| IPCC AR5 GWP excl. bio [kg CO <sub>2</sub> eq]         | 1.80E+02  | 1.26E+02  | 3.16E+01 | 2.30E+01 |
| GWP TRACI excl. bio [kg CO <sub>2</sub> e]             | 1.78E+02  | 1.25E+02  | 3.13E+01 | 2.27E+01 |
| AP [kg SO <sub>2</sub> eq]                             | 1.53E+00  | 1.07E+00  | 1.77E-01 | 2.82E-01 |
| EP [kg N eq]   | 4.34E-01  | 4.00E-01  | 1.44E-02 | 1.93E-02 |
| ODP [kg CFC 11 eq]                                     | 3.01E-05  | 6.57E-06  | 1.79E-07 | 2.34E-05 |
| SFP [kg O <sub>3</sub> eq]                             | 3.01E-05  | 6.57E-06  | 1.79E-07 | 2.34E-05 |
| <b>Resource Use Parameters</b>                         |           |           |          |          |



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| IMPACT CATEGORY | TOTAL    | A1       | A2       | A3       |
|-----------------|----------|----------|----------|----------|
| RPRE [MJ]       | 4.85E+01 | 3.65E+00 | 8.87E-01 | 4.39E+01 |
| RPRM [MJ]       | 1.25E+04 | 1.25E+04 | 0.00E+00 | 3.52E+01 |
| NRPRE [MJ]      | 2.41E+03 | 1.70E+03 | 3.98E+02 | 3.03E+02 |
| NRPRM [MJ]      | 1.94E+02 | 1.90E+02 | 0.00E+00 | 3.97E+00 |
| SM [kg]         | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ]        | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ]       | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ]         | 4.32E+01 | 0.00E+00 | 0.00E+00 | 4.32E+01 |
| FW [m3]         | 3.80E+01 | 2.75E+01 | 5.87E+00 | 4.54E+00 |
| ADPF [MJ]       | 2.39E+03 | 1.70E+03 | 3.92E+02 | 3.02E+02 |

### Waste Parameters and Output Flows

|            |          |          |          |          |
|------------|----------|----------|----------|----------|
| HWD [kg]   | 3.80E+01 | 2.75E+01 | 5.87E+00 | 4.54E+00 |
| NHWD [kg]  | 2.31E-02 | 1.75E-02 | 3.98E-03 | 1.66E-03 |
| HLRW [kg]  | 2.15E+01 | 1.27E+01 | 6.06E-01 | 8.22E+00 |
| ILLRW [kg] | 1.02E-08 | 4.63E-09 | 3.29E-09 | 2.30E-09 |
| CRU [kg]   | 5.38E-08 | 2.63E-08 | 1.58E-08 | 1.17E-08 |
| MR [kg]    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MER [kg]   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| EE [kg]    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

### Biogenic Carbon Indicators

|               |           |           |          |           |
|---------------|-----------|-----------|----------|-----------|
| BCRP [kg CO2] | -1.08E+03 | -1.08E+03 | 0.00E+00 | 0.00E+00  |
| BCEP [kg CO2] | 1.04E+03  | 0.00E+00  | 0.00E+00 | 1.04E+03  |
| BCRK [kg CO2] | -3.62E+00 | 0.00E+00  | 0.00E+00 | -3.62E+00 |
| BCEK [kg CO2] | 3.62E+00  | 0.00E+00  | 0.00E+00 | 3.62E+00  |
| BCEW [kg CO2] | 2.10E+01  | 0.00E+00  | 0.00E+00 | 2.10E+01  |
| CCE [kg CO2]  | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |





| IMPACT CATEGORY            | TOTAL    | A1       | A2       | A3       |
|----------------------------|----------|----------|----------|----------|
| CCR [kg CO <sub>2</sub> ]  | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CWNR [kg CO <sub>2</sub> ] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

Table 5: LCIA Results for 1 m<sup>3</sup> of Hardwood Plywood (MDF Core) produced by Roseburg

| IMPACT CATEGORY  | TOTAL     | A1        | A2       | A3       |
|--|-----------|-----------|----------|----------|
| <b>LCIA Impact Indicators – TRACI 2.1 and IPCC AR5</b> |           |           |          |          |
| IPCC AR5 GWP incl. bio [kg CO <sub>2</sub> eq]         | -5.46E+02 | -6.76E+02 | 3.17E+01 | 9.82E+01 |
| IPCC AR5 GWP excl. bio [kg CO <sub>2</sub> eq]         | 6.41E+02  | 5.86E+02  | 3.16E+01 | 2.30E+01 |
| GWP TRACI excl. bio [kg CO <sub>2</sub> e]             | 6.31E+02  | 5.77E+02  | 3.13E+01 | 2.27E+01 |
| AP [kg SO <sub>2</sub> eq]                             | 5.95E+00  | 5.49E+00  | 1.77E-01 | 2.82E-01 |
| EP [kg N eq]   | 8.34E-01  | 8.00E-01  | 1.44E-02 | 1.93E-02 |
| ODP [kg CFC 11 eq]                                     | 1.28E-04  | 1.05E-04  | 1.79E-07 | 2.34E-05 |
| SFP [kg O <sub>3</sub> eq]                             | 8.37E+01  | 7.08E+01  | 5.11E+00 | 7.86E+00 |
| <b>Resource Use Parameters</b>                         |           |           |          |          |
| RPRE [MJ]  | 4.85E+01  | 3.65E+00  | 8.87E-01 | 4.39E+01 |
| RPRM [MJ]  | 1.48E+04  | 1.48E+04  | 0.00E+00 | 3.52E+01 |
| NRPRE [MJ]   | 7.06E+03  | 6.36E+03  | 3.98E+02 | 3.03E+02 |
| NRPRM [MJ]   | 2.90E+03  | 2.90E+03  | 0.00E+00 | 3.97E+00 |
| SM [kg]  | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00 |
| RSF [MJ]   | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00 |
| NRSF [MJ]  | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00 |
| RE [MJ]  | 4.32E+01  | 0.00E+00  | 0.00E+00 | 4.32E+01 |
| FW [m <sup>3</sup> ]                                   | 3.90E+01  | 2.86E+01  | 5.87E+00 | 4.54E+00 |
| ADPF [MJ]  | 9.72E+03  | 9.03E+03  | 3.92E+02 | 3.02E+02 |





| IMPACT CATEGORY                          | TOTAL     | A1        | A2       | A3        |
|--|-----------|-----------|----------|-----------|
| <b>Waste Parameters and Output Flows</b> |           |           |          |           |
| HWD [kg]                                 | 2.31E-02  | 1.75E-02  | 3.98E-03 | 1.66E-03  |
| NHWD [kg]                                | 9.23E+01  | 8.35E+01  | 6.06E-01 | 8.22E+00  |
| HLRW [kg]                                | 1.02E-08  | 4.63E-09  | 3.29E-09 | 2.30E-09  |
| ILLRW [kg]                               | 5.38E-08  | 2.63E-08  | 1.58E-08 | 1.17E-08  |
| CRU [kg]                                 | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| MR [kg]                                  | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| MER [kg]                                 | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| EE [kg]                                  | 1.45E-01  | 0.00E+00  | 0.00E+00 | 1.45E-01  |
| <b>Biogenic Carbon Indicators</b>        |           |           |          |           |
| BCRP [kg CO <sub>2</sub> ]               | -1.08E+03 | -1.08E+03 | 0.00E+00 | 0.00E+00  |
| BCEP [kg CO <sub>2</sub> ]               | 1.04E+03  | 0.00E+00  | 0.00E+00 | 1.04E+03  |
| BCRK [kg CO <sub>2</sub> ]               | -3.62E+00 | 0.00E+00  | 0.00E+00 | -3.62E+00 |
| BCEK [kg CO <sub>2</sub> ]               | 3.62E+00  | 0.00E+00  | 0.00E+00 | 3.62E+00  |
| BCEW [kg CO <sub>2</sub> ]               | 2.10E+01  | 0.00E+00  | 0.00E+00 | 2.10E+01  |
| CCE [kg CO <sub>2</sub> ]                | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| CCR [kg CO <sub>2</sub> ]                | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| CWNR [kg CO <sub>2</sub> ]               | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |

Table 6: LCIA Results for 1 m<sup>3</sup> of Hardwood Plywood (PB Core) produced by Roseburg

| IMPACT CATEGORY  | TOTAL     | A1        | A2       | A3       |
|--|-----------|-----------|----------|----------|
| <b>LCIA Impact Indicators – TRACI 2.1 and IPCC AR5</b> |           |           |          |          |
| IPCC AR5 GWP incl. bio [kg CO <sub>2</sub> eq]         | -5.65E+02 | -6.95E+02 | 3.17E+01 | 9.82E+01 |
| IPCC AR5 GWP excl. bio [kg CO <sub>2</sub> eq]         | 3.98E+02  | 3.43E+02  | 3.16E+01 | 2.30E+01 |
| GWP TRACI excl. bio [kg]                               | 3.91E+02  | 3.37E+02  | 3.13E+01 | 2.27E+01 |



# ENVIRONMENTAL PRODUCT DECLARATION



Hardwood Plywood

According to ISO 14025,  
and ISO 21930:2017

| IMPACT CATEGORY                          | TOTAL           | A1       | A2       | A3       |
|--|-----------------|----------|----------|----------|
| CO2e]                                    |                 |          |          |          |
| AP [kg SO <sub>2</sub> eq]               | <b>3.23E+00</b> | 2.77E+00 | 1.77E-01 | 2.82E-01 |
| EP [kg N eq]                             | <b>4.65E-01</b> | 4.32E-01 | 1.44E-02 | 1.93E-02 |
| ODP [kg CFC 11 eq]                       | <b>2.76E-05</b> | 4.04E-06 | 1.79E-07 | 2.34E-05 |
| SFP [kg O <sub>3</sub> eq]               | <b>4.25E+01</b> | 2.95E+01 | 5.12E+00 | 7.86E+00 |
| <b>Resource Use Parameters</b>           |                 |          |          |          |
| RPRE [MJ]                                | <b>4.85E+01</b> | 3.65E+00 | 8.87E-01 | 4.39E+01 |
| RPRM [MJ]                                | <b>1.35E+04</b> | 1.35E+04 | 0.00E+00 | 3.52E+01 |
| NRPRE [MJ]                               | <b>4.35E+03</b> | 3.65E+03 | 3.98E+02 | 3.03E+02 |
| NRPRM [MJ]                               | <b>1.96E+03</b> | 1.95E+03 | 0.00E+00 | 3.97E+00 |
| SM [kg]                                  | <b>0.00E+00</b> | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ]                                 | <b>0.00E+00</b> | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ]                                | <b>0.00E+00</b> | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ]                                  | <b>4.32E+01</b> | 0.00E+00 | 0.00E+00 | 4.32E+01 |
| FW [m <sup>3</sup> ]                     | <b>3.81E+01</b> | 2.77E+01 | 5.87E+00 | 4.54E+00 |
| ADPF [MJ]                                | <b>6.10E+03</b> | 5.40E+03 | 3.92E+02 | 3.02E+02 |
| <b>Waste Parameters and Output Flows</b> |                 |          |          |          |
| HWD [kg]                                 | <b>2.31E-02</b> | 1.75E-02 | 3.98E-03 | 1.66E-03 |
| NHWD [kg]                                | <b>3.81E+01</b> | 2.93E+01 | 6.06E-01 | 8.22E+00 |
| HLRW [kg]                                | <b>1.02E-08</b> | 4.63E-09 | 3.29E-09 | 2.30E-09 |
| ILLRW [kg]                               | <b>5.38E-08</b> | 2.63E-08 | 1.58E-08 | 1.17E-08 |
| CRU [kg]                                 | <b>0.00E+00</b> | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MR [kg]                                  | <b>0.00E+00</b> | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MER [kg]                                 | <b>0.00E+00</b> | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| EE [kg]                                  | <b>1.45E-01</b> | 0.00E+00 | 0.00E+00 | 1.45E-01 |
| <b>Biogenic Carbon Indicators</b>        |                 |          |          |          |



# ENVIRONMENTAL PRODUCT DECLARATION



Hardwood Plywood

According to ISO 14025,  
and ISO 21930:2017

| IMPACT CATEGORY            | TOTAL     | A1        | A2       | A3        |
|----------------------------|-----------|-----------|----------|-----------|
| BCRP [kg CO <sub>2</sub> ] | -1.08E+03 | -1.08E+03 | 0.00E+00 | 0.00E+00  |
| BCEP [kg CO <sub>2</sub> ] | 1.04E+03  | 0.00E+00  | 0.00E+00 | 1.04E+03  |
| BCRK [kg CO <sub>2</sub> ] | -3.62E+00 | 0.00E+00  | 0.00E+00 | -3.62E+00 |
| BCEK [kg CO <sub>2</sub> ] | 3.62E+00  | 0.00E+00  | 0.00E+00 | 3.62E+00  |
| BCEW [kg CO <sub>2</sub> ] | 2.10E+01  | 0.00E+00  | 0.00E+00 | 2.10E+01  |
| CCE [kg CO <sub>2</sub> ]  | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| CCR [kg CO <sub>2</sub> ]  | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| CWNR [kg CO <sub>2</sub> ] | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |

**Table 7: LCIA Results for 1 m<sup>3</sup> of Hardwood Plywood (CF Core) produced by Roseburg**

| IMPACT CATEGORY  | TOTAL     | A1        | A2       | A3       |
|--|-----------|-----------|----------|----------|
| <b>LCIA Impact Indicators – TRACI 2.1 and IPCC AR5</b> |           |           |          |          |
| IPCC AR5 GWP incl. bio [kg CO <sub>2</sub> eq]         | -8.17E+02 | -9.47E+02 | 3.17E+01 | 9.82E+01 |
| IPCC AR5 GWP excl. bio [kg CO <sub>2</sub> eq]         | 3.02E+02  | 2.48E+02  | 3.16E+01 | 2.30E+01 |
| GWP TRACI excl. bio [kg CO <sub>2</sub> e]             | 2.98E+02  | 2.44E+02  | 3.13E+01 | 2.27E+01 |
| AP [kg SO <sub>2</sub> eq]                             | 2.70E+00  | 2.24E+00  | 1.77E-01 | 2.82E-01 |
| EP [kg N eq]   | 5.40E-01  | 5.06E-01  | 1.44E-02 | 1.93E-02 |
| ODP [kg CFC 11 eq]                                     | 5.62E-05  | 3.26E-05  | 1.79E-07 | 2.34E-05 |
| SFP [kg O <sub>3</sub> eq]                             | 4.56E+01  | 3.26E+01  | 5.11E+00 | 7.86E+00 |
| <b>Resource Use Parameters</b>                         |           |           |          |          |
| RPRE [MJ]  | 4.85E+01  | 3.65E+00  | 8.87E-01 | 4.39E+01 |
| RPRM [MJ]  | 1.31E+04  | 1.31E+04  | 0.00E+00 | 3.52E+01 |
| NRPRE [MJ]   | 3.64E+03  | 2.94E+03  | 3.98E+02 | 3.03E+02 |
| NRPRM [MJ]   | 9.09E+02  | 9.05E+02  | 0.00E+00 | 3.97E+00 |





# ENVIRONMENTAL PRODUCT DECLARATION



Hardwood Plywood

According to ISO 14025,  
and ISO 21930:2017

| IMPACT CATEGORY | TOTAL    | A1       | A2       | A3       |
|-----------------|----------|----------|----------|----------|
| SM [kg]         | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ]        | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ]       | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ]         | 4.32E+01 | 0.00E+00 | 0.00E+00 | 4.32E+01 |
| FW [m3]         | 3.82E+01 | 2.78E+01 | 5.87E+00 | 4.54E+00 |
| ADPF [MJ]       | 4.33E+03 | 3.64E+03 | 3.92E+02 | 3.02E+02 |

### Waste Parameters and Output Flows

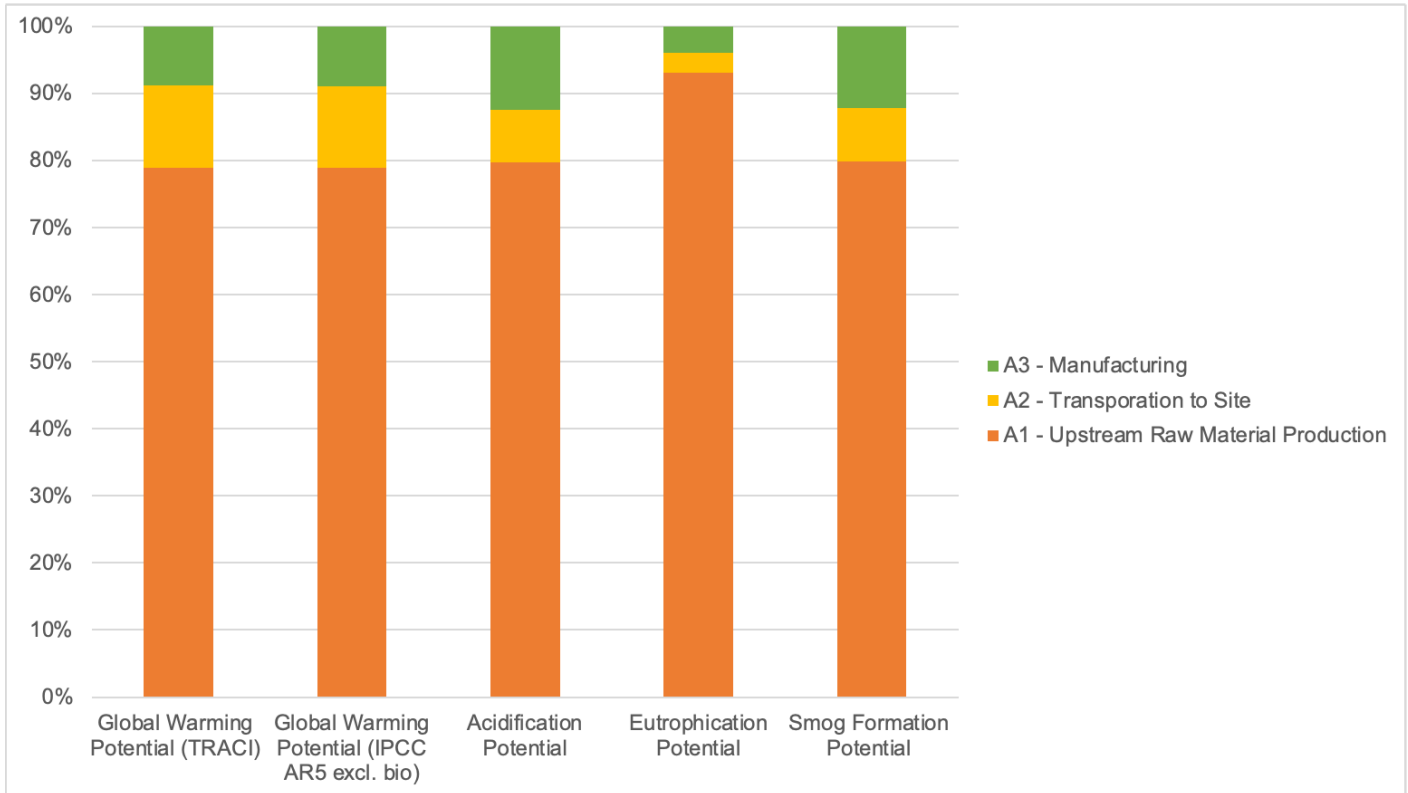
|            |          |          |          |          |
|------------|----------|----------|----------|----------|
| HWD [kg]   | 2.31E-02 | 1.75E-02 | 3.98E-03 | 1.66E-03 |
| NHWD [kg]  | 4.03E+01 | 3.15E+01 | 6.06E-01 | 8.22E+00 |
| HLRW [kg]  | 1.02E-08 | 4.63E-09 | 3.29E-09 | 2.30E-09 |
| ILLRW [kg] | 5.38E-08 | 2.63E-08 | 1.58E-08 | 1.17E-08 |
| CRU [kg]   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MR [kg]    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MER [kg]   | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| EE [kg]    | 1.45E-01 | 0.00E+00 | 0.00E+00 | 1.45E-01 |

### Biogenic Carbon Indicators

|               |           |           |          |           |
|---------------|-----------|-----------|----------|-----------|
| BCRP [kg CO2] | -1.08E+03 | -1.08E+03 | 0.00E+00 | 0.00E+00  |
| BCEP [kg CO2] | 1.04E+03  | 0.00E+00  | 0.00E+00 | 1.04E+03  |
| BCRK [kg CO2] | -3.62E+00 | 0.00E+00  | 0.00E+00 | -3.62E+00 |
| BCEK [kg CO2] | 3.62E+00  | 0.00E+00  | 0.00E+00 | 3.62E+00  |
| BCEW [kg CO2] | 2.10E+01  | 0.00E+00  | 0.00E+00 | 2.10E+01  |
| CCE [kg CO2]  | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| CCR [kg CO2]  | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |
| CWNR [kg CO2] | 0.00E+00  | 0.00E+00  | 0.00E+00 | 0.00E+00  |

A dominance analysis was performed to show which of the life cycle modules contributes to the majority of the impacts.





**Figure 3: Dominance analysis for 1 cubic meter of hardwood plywood produced by Roseburg (weighted average).**

The results are primarily driven by upstream raw material production (A1) followed by manufacturing (A3) at the facility across all indicators. For the weighted average product, the raw material production is driven by the upstream impacts of producing softwood veneer, hardwood veneer, particleboard, wheat flour, and MDF. Across all relevant impact categories the impacts of softwood veneer range from 3.4% (eutrophication potential) to 28.4% (smog formation potential). Similarly, the impacts for hardwood veneer range from 4.7% (eutrophication potential) to 10.2% (smog formation potential). The impacts for MDF range from 8.9% to 26.7% and for particleboard range from 0.7% to 6.9%. The key contributors to GWP are softwood veneer (28.2%), MDF (23.8%), Transport to site (13.2%), Manufacturing energy (9.0%), Hardwood veneer (8.0%), and Particleboard (6.6%). The manufacturing impacts are driven primarily by energy requirements. The results across the individual cores follow a similar trend to the weighted average. All key impact indicators are driven primarily by raw materials. Overall, the veneer core variation shows the lowest GWP followed by the CFC core, PB core, and finally the highest impact variation in terms of GWP is the MDF product.

Throughout this report, value choices and judgments that may have affected the LCA have been described. Additional decisions are summarized below:

- The inclusion of overhead energy data was determined appropriate due to the inability to sub-meter and isolate manufacturing energy from overhead energy.
- The use and selection of secondary datasets – The selection of which generic dataset to use to represent an aspect of a supply chain is a significant value choice. Collaboration between the LCA practitioner, the



Hardwood Plywood



According to ISO 14025,  
and ISO 21930:2017

manufacturer, and data experts was invaluable 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 also must be considered.

Some limitations to the study have been identified as follows:

- The 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.





## References

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