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Environmental Product Declaration
White Cypress Timber

Environmental Product Declaration (EPD)
in accordance with ISO 14025 and EN 15804+A1

EPD Registration No. S-P-02327 | Version 1.0
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Geographical Scope: Australia

ECO PLATFORM EPD VERIFIED

AUSTRALASIA EPD®
ENVIRONMENTAL PRODUCT DECLARATION

Environmental Product Declarations

WoodSolutions has developed a suite of EPDs for industry-average, Australian-produced timber products.

These EPDs help to showcase the environmental credentials of Australian wood products. They also provide life cycle data for calculating the impacts of wood products at a building level.

EPDs include:

#01 Softwood Timber

#02 Hardwood Timber

#03 Particleboard

#04 Medium Density Fibreboard (MDF)

#05 Plywood

#06 Glued Laminated Timber (Glulam)

#07 White Cypress Timber

WoodSolutions is an industry initiative designed to provide independent, non-proprietary information about timber and wood products to professionals and companies involved in building design and construction.

WoodSolutions is resourced by Forest and Wood Products Australia (FWPA). It is a collaborative effort between FWPA members and levy payers, supported by industry peak bodies and technical associations.

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Version history

V1.0 Initial version based on 2019/20 production data from a new industry survey.

Produced: February 2022

EPD Details

An Environmental Product Declaration, or EPD, is a standardised and verified way of quantifying the environmental impacts of a product that is based on a consistent set of rules known as a PCR (Product Category Rules). EPDs within the same product category from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. Forest & Wood Products Australia has sole ownership, responsibility, and liability for this EPD.

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Independent verification of the declaration and data, according to ISO 14025:
☐ EPD process certification (Internal)
☑ EPD verification (External)

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Procedure for follow-up of data during EPD validity involves third-party verifier:

☑ Yes
☐ No
☑ Use Softwood EPD for guidance

Introduction

This Environmental Product Declaration (EPD) presents the average performance of sawn timber from Australian White Cypress grown in managed forests and processed in Australia. It provides information on the environmental impacts of raw materials, production, and end-of-life stages of the products life cycle.

This EPD has been prepared in accordance with ISO 14025:2006, EN 15804:2012+A1:2013, EN 16485:2014 PCR 2012:01 (EPD International). It covers Australian White Cypress sawn timber products.

The environmental data presented in this document were primarily derived from a survey of industry members covering the 2019 calendar year conducted by thinkstep-anz on behalf of FWPA. This current survey covers timber produced from approximately 64% of total sawn cypress logs harvested in Australia (ABARES, 2020).

About White Cypress

Australian cypress is a unique native softwood which provides timber with rich colour and characteristics that include natural termite resistance and high durability (AS 5604:2005). The genus is comprised of 15 species with the dominant commercial species being White Cypress (Callitris glaucophylla). It is commonly found throughout Victoria, western New South Wales, and central western Queensland growing on flat and sandy soils. White Cypress, often referred to as cypress pine due to the tree's conical growth habit, grows to a height of up to 25 metres and a stem diameter of 0.6 metres (WoodSolutions 2020).

Stand of White Cypress pines (Callitris glaucophylla) Photo: Michael Ryan

In contrast to a creamy-white band of sapwood, the heartwood ranges in colour from light yellow through orange to light brown, with occasional dark brown streaks. Grain is generally straight with a very fine and even texture. The presence of numerous tight knots is a distinctive feature that produces a strikingly decorative figure on exposed faces.

Natural resins in the wood impart a distinctive odour to White Cypress which contribute to the timber's impressive natural durability. Heartwood is naturally resistant to termites with a life expectancy for above ground exposed applications greater than 40 years (Class 1) and up to 25 years in-ground (Class 2) (AS 5604:2005). In protected above ground applications, including interior applications, life expectancy is indefinite.

In terms of hardness, White Cypress is a moderately hard timber – an appropriate hardness for most applications (ATFA 2010). It can be satisfactorily machined and turned to a smooth finish. Pre-drilling is recommended for hand nailing seasoned timber, although machine nailing with shear-point nails works well. White Cypress readily accepts most standard coatings, stains, and polishes. Special techniques, such as surface roughening, are required for gluing.

In its area of natural occurrence, White Cypress is commonly manufactured into sawn timber (usually unseasoned) and used in framework and other aspects of general building construction. More widely, it is used as flooring, cladding and fencing material. Decorative uses of White Cypress include quality indoor and outdoor furniture, turnery, joinery, carving, parquetry, and linings. Other common applications include oyster stakes and jetty piles in low-salinity environments, as well as beehives (WoodSolutions 2020).

Industry contributors

Production of this EPD has been facilitated by FWPA with the support of cypress processors who pay processor levies to FWPA and four processors contributing data from five sawmills (as shown in Table 1).

Table 1: White Cypress processors contributing to this EPD

Company	Town, State	Financial contributor	Data contributor
Grants Sawmilling Co.	Narrandera, NSW	X	X
Grants Sawmilling Co.	Condobolin, NSW	X	X
Hornick Cypress	Roma, QLD	X	
Hurfords Wholesale	Chinchilla, QLD	X	X
Inglewood Sawmill	Inglewood, QLD	X	
Injune Cypress	Injune, QLD	X	X
Queensland Cypress Supplies	Mungallala, QLD	X	
Vic's Timber & Dressing	Cecil, Plains, QLD	X	X
Walker Cypress Mills	Cecil, Plains, QLD	X	
Yuleba Cypress Sawmills	Miles, QLD	X	

Description of the Australian Sawn Softwood Industry

The Australian sawn cypress manufacturing industry is an important contributor to the regional economies of Queensland and New South Wales where producers are based. In 2016-17 it was estimated that there were 17 cypress sawmills in Australia - 13 in Queensland and 4 in New South Wales - all located near cypress managed forest resource (Downham et. al. 2019). In 2018-19 these sawmills processed an estimated 149,000 m3 of cypress logs (ABARES 2020).

Almost all the cypress pine sawlogs were sourced from public forests (99 per cent) and only 1 per cent was sourced from private forests. (Downham et. al. 2019).

Table 2: Softwood sawmills by Australian state

NSW[a]	Qld	Aust.
4	13	17

a Includes ACT

How this EPD can be used in the Green Star and Infrastructure rating systems

This EPD and the information and transparency it provides means it can be used to obtain credit points under the Green Building Council of Australia (GBCA) Green Star sustainable building rating system. This EPD complies with the requirements for an industry or sector wide EPD given that:

1. It conforms with ISO 14025 and EN 15804+A1.
2. It has been verified by an independent third party.
3. It has at least a cradle-to-gate scope.
4. The participants in the EPD are listed (see Table 1).

It may be used by project teams using the Design & As Built and Interiors rating tools to obtain Green Star points under the following credits:

- Credit 19 Life Cycle Impacts
- Credit 21 Sustainable Products (Australian White Cypress Timber EPD contributes with a Sustainability Factor of 0.5.)

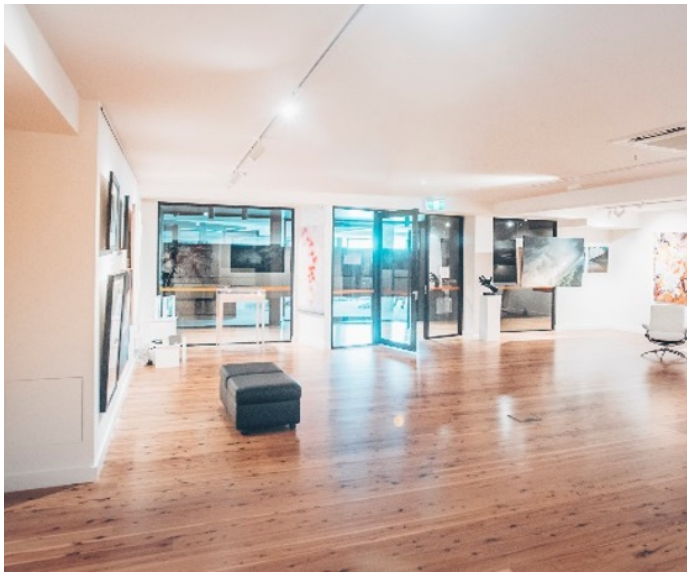
For projects using any of the above Green Star rating tools, up to an additional 3 points are available if Credit 19 is extended to reduce the embodied carbon through the Responsible Carbon Impact innovation challenge.

It may be used by project teams using the new Green Star rating tools released from 2020 to obtain points under the Responsible Products Framework in the following criteria:

- Life-cycle basis
- Environmental impact disclosure
- Carbon emissions disclosure
- Ingredient disclosure
- 3rd Party verification.

Additional point(s) are also available if White Cypress is supplied as PEFC/Responsible Wood certified by a chain of custody certified supplier. Ask your cypress supplier for details.

This EPD is also recognised for credits in the Infrastructure Sustainability (IS) rating scheme of the Infrastructure Sustainability Council of Australia (ISCA).



Scope

Products

This Sector EPD describes the following average products (declared units) manufactured in Australia by the contributors listed in Table 1:

- *1 m^3 of rough-sawn, green (unseasoned) White Cypress*
  30% moisture content (dry basis), density of 830 kg/m^3
- *1 m^3 of dressed, green (unseasoned) White Cypress*
  30% moisture content (dry basis), density of 830 kg/m^3

The declared units above represent an entire product category rather than a specific product from a specific manufacturer. The values represent a production volume weighted average. As such, a specific product purchased on the market may have a lesser or greater environmental impact than the average presented in this EPD. Some products may also undergo further processing (e.g. kiln-drying, seasoning, glue lamination, coating) before being used in a building. These processes have not been included in this EPD.

All products consist of 100% Australian White Cypress grown in managed native forests. No preservative chemicals are applied to increase durability and/or termite or other insect resistance.

Packaging

The producers surveyed for this analysis used a variety of packaging for their cypress timber products. The LCA took an average of all packaging used. In general, cypress timber is covered with a low density polyethylene wrap, with either steel or polypropylene strapping used to keep the product and wrap in place.

End Uses

Rough-sawn, green cypress
Structural framing, fencing, and landscape timbers.

Dressed, green cypress
Flooring, decking, cladding, panelling, furniture, stair treads, structural timber, feature fencing and commercial decking.

Representativeness

Market coverage: The data in this EPD are from detailed surveys of 5 of the 17 cypress sawmills in Australia. These 5 mills collectively processed 95,864 m^3 of harvested White Cypress logs in 2019 (reference year for the study), equating to approximately 64% of the total Australian processing of White Cypress logs (149,028 m^3) (based on the 2018/19 total from ABARES, 2020).

Temporal representativeness: Primary data were collected from participating sites for the 2019 calendar year. Following EN 15804, producer specific data are required to have been updated within the last 5 years to be used in an EPD, meaning that these datasets are valid.

Geographical and technological representativeness: The data are representative of the 5 sites surveyed, which collectively produce approximately 64% of all Australian-produced sawn cypress. More detailed information can be found in the Variation in Results section later in this EPD.

Industry Classifications

Product	Classification	Code	Category
All	UN CPC Ver.2	31100	Wood, sawn or chipped lengthwise, sliced or peeled, of a thickness exceeding 6 mm
Some rough-sawn, green cypress	UN CPC Ver.2	31330	Other wood in the rough (including split poles and pickets)
Rough-sawn green, cypress timber	ANZSIC 2006	1411	Log sawmilling
Dressed green, cypress timber	ANZSIC 2006	1413	Timber resawing and dressing

Content declaration

White Cypress sawn timber contains no added substances that are on the REACH Candidate List of Substances of Very High Concern for Authorisation (ECHA 2021).

White Cypress sawn timber contains no added substances that are on the Living Building Challenge Red List or the Watch List Priority for Red List Inclusion (LBC 2021).

LCA Calculation Rules

System Boundary

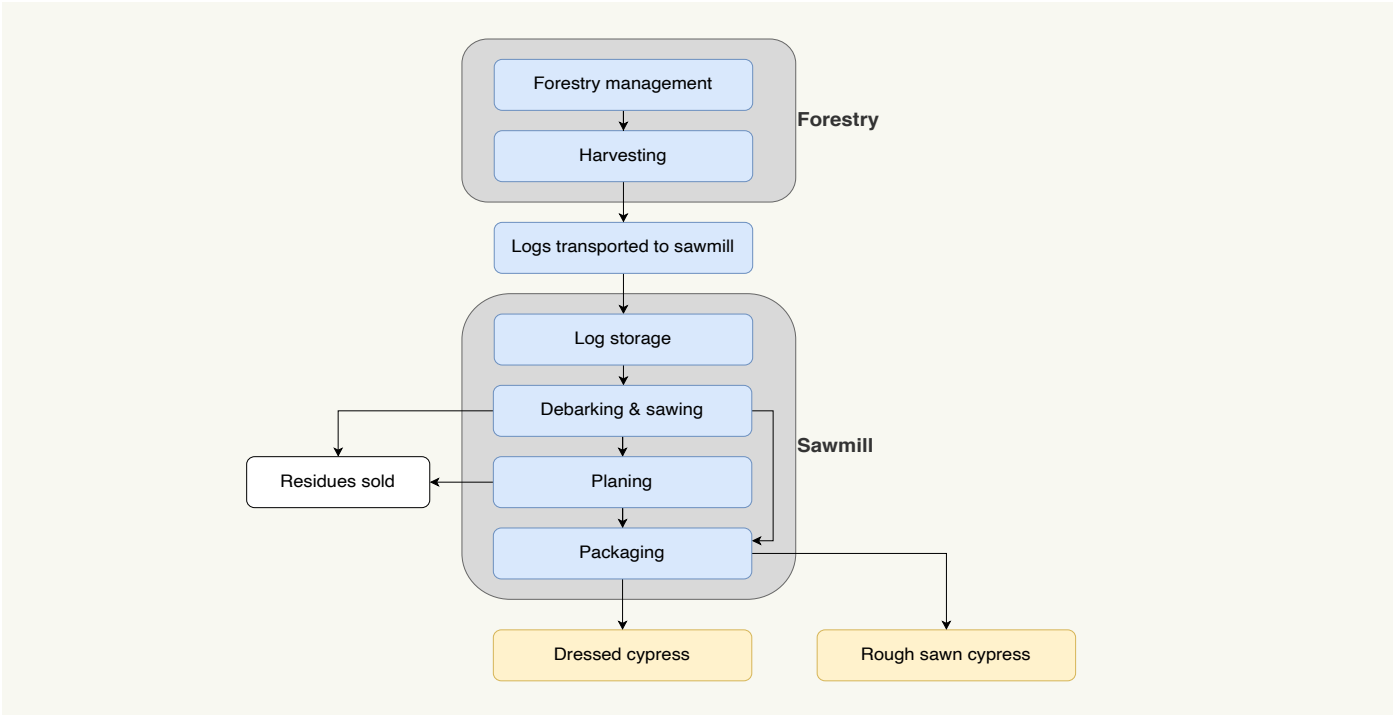
This EPD is of the 'cradle-to-gate' type with options. The options include two modules in module C - the end-of-life stage, which is modelled using scenarios, and module D - benefits and loads beyond the system boundary.

Product stage			**Construc-tion stage**		**Use stage**							**End-of-life stage**				**Benefits and loads beyond the system boundary**
Raw material supply	Transport of raw materials	Manufacturing	Transport to customer	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to waste processing	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X

Key: X = included in the EPD
MND = module not declared (such a declaration shall not be regarded as an indicator result of zero)

Production (Module A)

The production stage includes the environmental impacts associated with forestry and processing of inputs, transport to, between and within the sawmills, manufacturing of green sawn cypress and planing for dressed cypress.



End-of-Life (Module C)

When a wood product such as cypress pine reaches the end of its useful life it may either be reused, recycled, combusted to produce energy, or landfilled. All scenarios are in use in certain regions (Forsythe Consultants 2007; National Timber Product Stewardship Group 2015) and have been included within this EPD.

Each scenario assumes that 100% of the wood is sent to that scenario. To create an end-of-life mix for a given region or end use, the reader should take a weighted sum of these scenarios. Where no data are available, the 'landfill (typical)' scenario should be used for 100% of the waste as landfill is currently the most common end-of-life route for timber and wood products in Australia.

Reuse

The cypress product is assumed to be removed from a building manually and reused with no further processing (i.e. direct reuse). Transport and wastage are excluded and only one reuse cycle is considered. The second life is assumed to be the same (or very similar) to the first, meaning that a credit is given for production of 1 m^3 of primary sawn cypress in module D. The sequestered CO_2 and the energy content of the wood are assumed to leave the system boundary at C3 so that future product systems can also claim these without double-counting (EN 16485:2014 Section 6.3.4.2). Any further processing, waste or transport would need to be modelled and included separately, e.g. transporting old, large dimension cypress beams offsite for sawing to make furniture.

Recycling

Cypress may be recycled in many ways. This scenario considers recycling of smaller dimension cypress that is shredded into wood chips. Wood waste is chipped (module C3) and assigned credits relative to the avoided production of woodchips from virgin cypress (module D). The sequestered CO_2 and the energy content of the wood are assumed to leave the system boundary at C3 so that future product systems can also claim these without double-counting (EN 16485:2014 Section 6.3.4.2).

Energy recovery

This scenario includes shredding (module C3) and combustion with recovered energy offset against average thermal energy from natural gas (module D) in line with EN 16485:2014 (Section 6.3.4.5). Note that other options are also in use within Australia, including replacement of coal, replacement of electricity, and replacement of both electricity and thermal energy (via co-generation).

Landfill

This EPD includes two scenarios for landfill, each with a different value for the degradable organic carbon fraction (DOC_F) of wood. The two values are based on bioreactor laboratory research. This experimental work involves the testing of a range of waste types in reactors operated to obtain maximum methane yields. As the laboratory work optimises the conditions for anaerobic decay, the results can be considered as estimates of the DOC_F value that would apply over very long time horizons.

- Landfill (typical): DOC_F = 0.1%. This is based on bioreactor laboratory research by Wang et al. (2011) on pinus radiata, one of the dominant softwood species in Australia.
- Landfill (NGA): DOC_F = 10%. This is the value chosen for Australia's National Greenhouse Accounts (NGA) (Australian Government 2020). This is a reduction from the previous value of 23% (Australian Government 2014) that was derived from early bioreactor laboratory research from the 1990s (e.g. Barlaz 1998) that investigated the degradability of wood tree branches ground to a fine powder under anaerobic conditions. This DOC_F value can be considered extremely conservative when compared to values from later research (as used in the typical scenario above) and effectively assumes that at least part of the wood waste is ground into a powder to accelerate degradation.

The impacts associated with the landfill are declared in module C4. All landfill gas that is combusted for energy recovery (module C4) is assumed to occur in a power plant with an electrical conversion efficiency of 36% (Australian Government 2014b, p. 189) and the resulting electricity receives a credit for offsetting average electricity from the Australian grid (module D) in line with EN 16485:2014 (Section 6.3.4.5).

Both landfill scenarios assume the following for carbon emissions:

- Of the gases formed from any degradation of wood in landfill, 50% is methane and 50% is carbon dioxide (Australian Government 2020, Table 46).
- All carbon dioxide is released directly to the atmosphere.
- 43% of the methane is captured, based on weighted average methane captured in Australian landfills (Australian Government 2021, section 7.3.1).
- Of this 43% captured, one-quarter (10.8% of the total) is flared and three-quarters (32.3% of the total) are used for energy recovery (Carre 2011).
- Of the 57% of methane that is not captured, 10% (5.7% of the total) is oxidised (Australian Government 2016, Table 43) and 90% (51.3%) is released to the atmosphere.
- In summary, for every kilogram of carbon converted to landfill gas, 74.4% is released as carbon dioxide and 25.7% is released as methane.

Key Assumptions

Energy: Thermal energy and transport fuels have been modelled as the Australian average (see (Sphera, 2020) for documentation). Electricity for production (modules A1-A3) has been modelled as a state-specific split based upon the volume of production in each state. Electricity at end-of-life (module C) has been modelled using an average Australian electricity mix as the location where the product reaches end-of-life is unknown.

Forestry: All breakdown of forest matter after harvest is modelled as aerobic and therefore carbon neutral as carbon sequestered is released as carbon dioxide. Any burning of forestry material left behind after logging is modelled as being carbon neutral, aside from the trace emissions of various organic gases (Commonwealth of Australia, 2016). All forestry certified to PEFC/Responsible Wood sustainable forest management standards and/or the Code of practice for native forest timber production on Queensland's State forest estate (State of Queensland 2020) is assumed to be sustainably managed and as such there are no carbon emissions associated with land use change. Loss of carbon from the soil is assumed to be zero (i.e., no significant erosion).

Following section 6.3.4.2 of EN 16485 (PCR for wood products used in construction (EN 16485:2014), Australian white cypress forests are considered to be a natural system, with timber production being one of several functions. Natural processes like wildfires are not attributable to the timber production function and so are not considered in the LCA of these timber products. It is assumed that all native white cypress forest will regrow after bushfires.

Cut-off Criteria

Environmental impacts relating to personnel, infrastructure, and production equipment not directly consumed in the process are excluded from the system boundary as per the PCR (EPD International, 2020, Section 7.5.4). All other reported data were incorporated and modelled using the best available life cycle inventory data.

Allocation

Upstream data: For refinery products, allocation is done by mass and net calorific value. Inventories for electricity and thermal energy generation include allocation by economic value for some by-products (e.g., gypsum, boiler ash and fly ash). Allocation by energy is applied for co-generation of heat and power. For materials and chemicals, the allocation rule most suitable for the product is applied (see Sphera, 2020).

Co-products (e.g. sawn wood and sawdust from milling): As the difference in economic value of the co-products is high (>25% as per EN 15804, Section 6.4.3.2), allocation has been done by economic value.

Background Data

Data for all energy inputs, transport processes and raw materials are from GaBi Databases 2020 (Sphera, 2020). Most datasets have a reference year between 2016 and 2019 and all fall within the 10-year limit allowable for generic data under EN 15804 (Section 6.3.7).

Electricity

The electricity supply grid mixes were based on GaBi state and country-specific grid mix datasets for Queensland, New South Wales for the sawmills and Australia for the end of life (Sphera, 2020).
The emission factor for Queensland is 1,056 g CO_2/kWh, New South Wales is 1,020 g CO_2/kWh and Australia is 891 g CO_2/kWh.

EPD Results

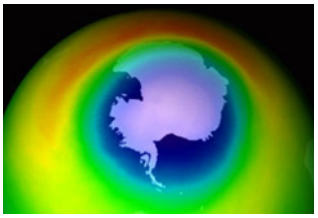
Note: these tables show the impacts associated with production and end-of-life. Any potential credits to future products from recycling or energy recovery are presented in the Other Environmental Information section.

Environmental Impact Indicators

An introduction to each environmental impact indicator is provided below. The best-known effect of each indicator is listed to the right of its name.

Global Warming Potential (GWP) → Climate Change
A measure of greenhouse gas emissions, such as carbon dioxide and methane. These emissions increase absorption of radiation emitted by the earth, intensifying the natural greenhouse effect. Contributions to GWP can come from either fossil or biogenic sources, e.g. burning fossil fuels or burning wood. GWP is reported as a total as well as being separated into biogenic carbon (GWPB) and fossil carbon (GWPF).

Ozone Depletion Potential (ODP) → Ozone Hole
A measure of air emissions that contribute to the depletion of the stratospheric ozone layer, causing higher levels of ultraviolet B (UVB) to reach the earth's surface with detrimental effects on humans, animals and plants.



Acidification Potential (AP) → Acid Rain
A measure of emissions that cause acidifying effects to the environment. Acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H+) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline and the deterioration of building materials.

Eutrophication Potential (EP) → Algal Blooms
A measure of nutrient enrichment that may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. It includes potential impacts of excessively high levels of macronutrients, the most important of which are nitrogen (N) and phosphorus (P).

Photochemical Ozone Creation Potential (POCP) → Smog
A measure of emissions of precursors that contribute to ground level smog formation (mainly ozone O_3), produced by the reaction of VOCs and carbon monoxide in the presence of nitrogen oxides under the influence of UV light. Ground level ozone may be harmful to human and ecosystem health and may also damage crops.

Abiotic Depletion Potential (ADP)→ Resource Consumption
The consumption of non-renewable resources leads to a decrease in the future availability of the functions supplied by these resources. Depletion of mineral resource elements (ADPE) and non-renewable fossil energy resources (ADPF) are reported separately.

Table 3: Environmental impacts, 1 m³ of rough-sawn, green (unseasoned) White Cypress

	Production	Landfill (typical)	Landfill (NGA)	Energy recovery	Recycling
Parameter [Unit]	**A1-A3**	**C4**	**C4**	**C3**	**C3**
GWP [kg CO_2-eq.]	-1,070	61.0	543	1,230	1,230
GWPF [kg CO_2-eq.]	130	58.0	58.2	8.40	8.40
GWPB [kg CO_2-eq.]	-1,200	3.05	484	1,220	1,220
ODP [kg CFC11-eq.]	2.22E-13	1.77E-13	1.77E-13	1.49E-15	1.49E-15
AP [kg SO_2-eq.]	0.825	0.185	0.226	0.0531	0.0531
EP [kg PO_4^3-eq.]	0.160	0.0226	0.0326	0.0123	0.0123
POCP [kg C_2H_4-eq.]	0.581	0.0120	0.103	0.00461	0.00461
ADPE [kg Sb-eq.]	3.13E-06	4.55E-06	4.55E-06	1.03E-07	1.03E-07
ADPF [MJ]	1,630	829	829	111	111

Table 4: Environmental impacts, 1 m³ of dressed, green (unseasoned) White Cypress

	Production	Landfill (typical)	Landfill (NGA)	Energy recovery	Recycling
Parameter [Unit]	**A1-A3**	**C4**	**C4**	**C3**	**C3**
GWP [kg CO_2-eq.]	-1,010	61.1	543	1,230	1,230
GWPF [kg CO_2-eq.]	184	58.0	58.3	8.40	8.40
GWPB [kg CO_2-eq.]	-1,190	3.05	484	1,220	1,220
ODP [kg CFC11-eq.]	2.35E-13	1.74E-13	1.74E-13	1.49E-15	1.49E-15
AP [kg SO_2-eq.]	1.14	0.186	0.226	0.0531	0.0531
EP [kg PO_4^3--eq.]	0.209	0.0227	0.0327	0.0123	0.0123
POCP [kg C_2H_4-eq.]	0.730	0.0120	0.103	0.00461	0.00461
ADPE [kg Sb-eq.]	3.71E-06	4.53E-06	4.53E-06	1.03E-07	1.03E-07
ADPF [MJ]	2,250	830	830	111	111

Resource Use

Table 5: Resource use, 1 m³ of rough-sawn, green (unseasoned) White Cypress

	Production	Landfill (typical)	Landfill (NGA)	Energy recovery	Recycling
Parameter [Unit]	**A1-A3**	**C4**	**C4**	**C3**	**C3**
PERE [MJ]	44.6	52.3	52.3	0.735	0.735
PERM [MJ]	13,400	0	0	-13,400	-13,400
PERT [MJ]	13,400	52.3	52.3	-13,400	-13,400
PENRE [MJ]	1,600	841	841	111	111
PENRM [MJ]	34.6	0	0	0	0
PENRT [MJ]	1,630	841	841	111	111
SM [kg]	0	0	0	0	0
RSF [MJ]	0	0	0	0	0
NRSF [MJ]	0	0	0	0	0
FW [m³]	0.216	0.00609	0.0754	0.00105	0.00105

***PERE** = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; **PERM** = Use of renewable primary energy resources used as raw materials; **PERT** = Total use of renewable primary energy resources; **PENRE** = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; **PENRM** = Use of non-renewable primary energy resources used as raw materials; **PENRT** = Total use of non-renewable primary energy resources; **SM** = Use of secondary material; **RSF** = Use of renewable secondary fuels; **NRSF** = Use of non-renewable secondary fuels; **FW** = Net use of fresh water*

Table 6: Resource use, 1 m³ of dressed, green (unseasoned) White Cypress

	Production	Landfill (typical)	Landfill (NGA)	Energy recovery	Recycling
Parameter [Unit]	**A1-A3**	**C4**	**C4**	**C3**	**C3**
PERE [MJ]	43.3	51.3	51.3	0.735	0.735
PERM [MJ]	13,400	0	0	-13,400	-13,400
PERT [MJ]	13,400	51.3	51.3	-13,400	-13,400
PENRE [MJ]	2,220	842	842	111	111
PENRM [MJ]	34.6	0	0	0	0
PENRT [MJ]	2,255	842	842	111	111
SM [kg]	0	0	0	0	0
RSF [MJ]	0	0	0	0	0
NRSF [MJ]	0	0	0	0	0
FW [m³]	0.297	0.00400	0.0733	0.00105	0.00105

Waste and Output Flows

Table 7: Waste categories, 1 m³ of rough-sawn, green (unseasoned) White Cypress

	Production	Landfill (typical)	Landfill (NGA)	Energy recovery	Recycling
Parameter [Unit]	**A1-A3**	**C4**	**C4**	**C3**	**C3**
HWD [kg]	5.33E-05	2.91E-06	2.91E-06	1.61E-07	1.61E-07
NHWD [kg]	3.06	830	677	0.00259	0.00259
RWD [kg]	0.00191	0.00459	0.00459	1.18E-05	1.18E-05
CRU [kg]	0	0	0	0	0
MFR [kg]	0	0	0	0	830
MER [kg]	0	0	0	830	0
EEE [MJ]	0	1.68	168	0	0
EET [MJ]	0	0	0	0	0

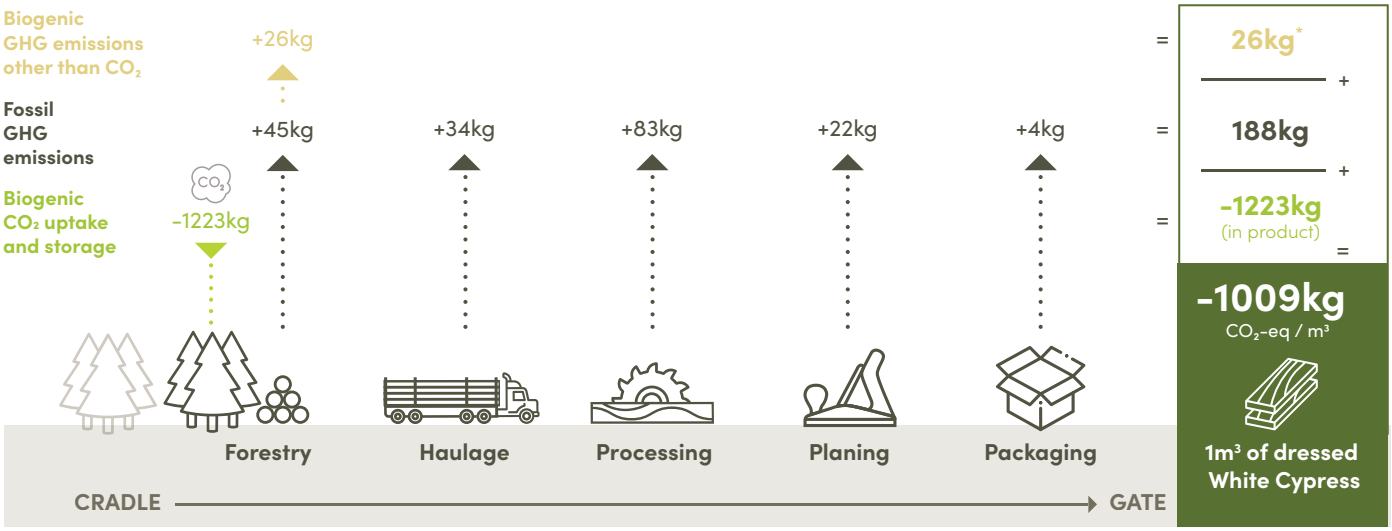
***HWD** = Hazardous waste disposed; **NHWD** = Non-hazardous waste disposed; **RWD** = Radioactive waste disposed;*
***CRU** = Components for reuse; **MFR** = Materials for recycling; **MER** = Materials for energy recovery;*
***EEE** = Exported electrical energy; **EET** = Exported thermal energy*

Table 8: Waste categories, 1 m³ of dressed, green (unseasoned) White Cypress

	Production	Landfill (typical)	Landfill (NGA)	Energy recovery	Recycling
Parameter [Unit]	**A1-A3**	**C4**	**C4**	**C3**	**C3**
HWD [kg]	6.65E-05	2.91E-06	2.91E-06	1.61E-07	1.61E-07
NHWD [kg]	3.87	830	677	0.00259	0.00259
RWD [kg]	0.00200	0.00459	0.00459	1.18E-05	1.18E-05
CRU [kg]	0	0	0	0	0
MFR [kg]	0	0	0	0	830
MER [kg]	0	0	0	830	0
EEE [MJ]	0	1.68	168	0	0
EET [MJ]	0	0	0	0	0

Interpretation

Understanding the Carbon Life Cycle of White Cypress Timber



Carbon footprint 1m³ of dressed White Cypress
Cradle to Gate A1 - A3

*CO_2 biogenic emissions from production (e.g. from combustion and degradation of residues) are excluded as they are balanced by uptake during tree growth (i.e., balance to zero)

Variation in Results

The variation between sites used to create the average shown in this EPD are given in Table 9 below for the environmental impact indicators in modules A1-A3.

Table 9: Inter-site variability for White Cypress (modules A1-A3).

	Rough-sawn, green (unseasoned) White Cypress			Dressed, green (unseasoned) White Cypress		
Parameter [Unit]	**Min**	**Max**	**CV**	**Min**	**Max**	**CV**
GWP [kg CO_2-eq.]	-5.5%	+6.5%	±4.0%	-0.9%	+5.8%	±2.8%
GWPF [kg CO_2-eq.]	-19.8%	+22.8%	±14.4%	-1.2%	+24.1%	±10.5%
GWPB [kg CO_2-eq.]	-3.7%	+8.0%	±4.3%	-2.8%	+3.7%	±2.7%
ODP [kg CFC11-eq.]	-89.8%	+142.6%	±83.3%	-59.3%	+180.6%	±103.4%
AP [kg SO_2-eq.]	-19.3%	+22.6%	±13.9%	-3.2%	+23.8%	±11.1%
EP [kg PO_4^3-eq.]	-23.5%	+23.1%	±15.1%	-3.2%	+23.0%	±10.9%
POCP [kg C_2H_4-eq.]	-17.2%	+31.1%	±18.6%	-16.7%	+30.4%	±19.9%
ADPE [kg Sb-eq.]	-44.5%	+78.7%	±45.6%	-17.6%	+88.9%	±47.0%
ADPF [MJ]	-22.6%	+24.7%	±16.3%	-1.7%	+24.9%	±10.3%

Min *= (minimum - average) / average;* ***Max*** *= (maximum - average) / average;*
CV *= coefficient of variation = standard deviation / average*

Carbon Dioxide Sequestration

During growth, trees absorb carbon dioxide (CO_2) from the atmosphere through the process of photosynthesis and convert this into carbon-based compounds that constitute various components of a tree, including wood. For cypress (Callitris spp.) 52.5% of the dry weight of wood is made up of the element carbon (Gifford 2000).

All state-owned Australian cypress production forests are independently certified to the internationally recognised forest management certification system: the Australian Standard for Sustainable Forest Management (AS 4708) produced by Responsible Wood, which is recognised under the Programme for the Endorsement of Forest Certification (PEFC). It is therefore appropriate to include biogenic CO_2 sequestration in this EPD in line with EN 16485 (Section 6.3.4.2).

Module D: Recycling, Reuse and Recovery Potentials

Table 10: Module D, 1 m³ of rough-sawn, green (unseasoned) White Cypress

Parameter [Unit]	Landfill (typical)	Landfill (NGA)	Energy recovery	Recycling
Environmental Impact				
Parameter [Unit]	**C4**	**C4**	**C3**	**C3**
GWP [kg CO_2-eq.]	-0.416	-41.6	-886	-190
GWPF [kg CO_2-eq.]	-0.416	-41.6	-888	-158
GWPB [kg CO_2-eq.]	-2.21E-04	-0.0221	1.67	-31.9
ODP [kg CFC11-eq.]	-2.57E-15	-2.57E-13	-1.87E-14	-3.57E-13
AP [kg SO_2-eq.]	-0.00166	-0.166	-0.154	-0.910
EP [kg PO_4^3-eq.]	-1.49E-04	-0.0149	-0.0866	-0.205
POCP [kg C_2H_4-eq.]	-8.93E-05	-0.00893	0.117	-0.392
ADPE [kg Sb-eq.]	-2.83E-08	-2.83E-06	-7.48E-05	-5.04E-06
ADPF [MJ]	-4.67	-467	-15,100	-2,030
Resource Use				
PERE [MJ]	-0.711	-71.1	-5.27	-96.8
PERM [MJ]	0	0	0	0
PERT [MJ]	-0.711	-71.1	-5.27	-96.8
PENRE [MJ]	-4.67	-467	-15,100	-2,030
PENRM [MJ]	0	0	0	0
PENRT [MJ]	-4.67	-467	-15,050	-2,033
SM [kg]	0	0	0	830
RSF [MJ]	0	0	13,400	0
NRSF [MJ]	0	0	0	0
FW [m^3]	-0.00225	-0.225	-0.0143	-0.490
Wastes and Outputs				
HWD [kg]	-7.56E-10	-7.56E-08	-3.50E-06	-4.80E-07
NHWD [kg]	-0.00120	-0.120	33.4	-25.1
RWD [kg]	-7.99E-07	-7.99E-05	-0.00104	-9.74E-04
CRU [kg]	0	0	0	0
MFR [kg]	0	0	0	0
MER [kg]	0	0	0	0
EEE [MJ]	0	0	0	0
EET [MJ]	0	0	0	0

Table 11: Module D, 1 m³ of dressed, green (unseasoned) White Cypress

Parameter [Unit]	Landfill (typical)	Landfill (NGA)	Energy recovery	Recycling
Environmental Impact				
Parameter [Unit]	**C4**	**C4**	**C3**	**C3**
GWP [kg CO_2-eq.]	-0.416	-41.6	-886	-190
GWPF [kg CO_2-eq.]	-0.416	-41.6	-888	-158
GWPB [kg CO_2-eq.]	-2.21E-04	-0.0221	1.67	-31.9
ODP [kg CFC11-eq.]	-2.57E-15	-2.57E-13	-1.87E-14	-3.57E-13
AP [kg SO_2-eq.]	-0.00166	-0.166	-0.154	-0.910
EP [kg PO_4^3-eq.]	-1.49E-04	-0.0149	-0.0866	-0.205
POCP [kg C_2H_4-eq.]	-8.93E-05	-0.00893	0.117	-0.392
ADPE [kg Sb-eq.]	-2.83E-08	-2.83E-06	-7.48E-05	-5.04E-06
ADPF [MJ]	-4.67	-467	-15,100	-2,030
Resource Use				
PERE [MJ]	-0.711	-71.1	-5.27	-96.8
PERM [MJ]	0	0	0	0
PERT [MJ]	-0.711	-71.1	-5.27	-96.8
PENRE [MJ]	-4.67	-467	-15,100	-2,030
PENRM [MJ]	0	0	0	0
PENRT [MJ]	-4.67	-467	-15,050	-2,033
SM [kg]	0	0	0	830
RSF [MJ]	0	0	13,400	0
NRSF [MJ]	0	0	0	0
FW [m^3]	-0.00225	-0.225	-0.0143	-0.490
Wastes and Outputs				
HWD [kg]	-7.56E-10	-7.56E-08	-3.50E-06	-4.80E-07
NHWD [kg]	-0.00120	-0.120	33.4	-25.1
RWD [kg]	-7.99E-07	-7.99E-05	-0.00104	-9.74E-04
CRU [kg]	0	0	0	0
MFR [kg]	0	0	0	0
MER [kg]	0	0	0	0
EEE [MJ]	0	0	0	0
EET [MJ]	0	0	0	0

Natural Durability

As described in the Scope section, this EPD covers untreated sawn cypress products. Natural resins in White Cypress impart a distinctive odour and contribute to the timber's impressive natural durability. According to Australian Standard AS 5604:2005 Timber - natural durability ratings (AS 5604:2005), heartwood is naturally resistant to termites; life expectancy for inner heartwood for above ground applications is greater than 40 years and up to 25 years in-ground; sapwood is not susceptible to lyctus borer.

Sustainable Forest Management and COC Certification

Many Australian production forests harvested for timber are certified to a sustainable forest management certification scheme. This certification is an independent auditing process that provides:

- Assurance that the timber is from well-managed forests certified to internationally and nationally accepted forest management standards.
- Assurance that the timber is from legally harvested sources.
- Chain of custody (CoC) certification extending from the forest to the end user, which is traceable throughout the supply chain.

Publicly managed Callitris forests are the source of 99% of white cypress logs processed into timber products (Downhan et. al 2019). Public cypress forests are certified with the Responsible Wood Certification Scheme against the Sustainable Forest Management (AS 4708). Timber production in Queensland cypress forests must comply with the Code of practice for native forest timber production on Queensland's State forest estate (State of Queensland 2020). The following forest managers are certified:

- Forest Products-DAF (Certificate No. AFS 603520)
- Forestry Corporation of NSW-Hardwood Forests Division (Certificate No. AFS 604224)

If a Green Star project elects to use the Responsible Timber credit as part of their Green Star submission, the Green Building Council of Australia recognises PEFC-endorsed forest certification schemes (such as the Responsible Wood Certification Scheme).

Some Australian cypress suppliers are listed in this EPD are CoC certified and can therefore supply certified products. Visit https://www.responsiblewood.org.au/search-database/ and search for "cypress pine" "White Cypress pine" and "cypress" under species.

Harvesting and biodiversity

White Cypress is an important species in eastern Australia for conservation as well as for the commercial forestry industry (Thompson & Eldridge 2005). Australia has over two million hectares of native cypress forest (ABARES 2018) and the entire White Cypress woodland habitat (from soil surface to canopy) is utilised by mammals, reptiles, birds and invertebrates, including many threatened and rare species (Thompson & Eldridge 2005).

Unlike other softwoods harvested in Australia, White Cypress performs poorly as a plantation species. Commercial cypress is therefore sourced from natural stands. It was recognised early in the 1900s, that dense native cypress woodlands benefit greatly from thinning practices. Dense stands of White Cypress reveal very little evidence for self-thinning (Law et al 2018). Thinning forest regrowth is known to accelerate tree growth and can increase structural complexity. Thinning products, such as sawlogs, can then be recovered for commercial benefit. Regrowth forest commonly offers a more suitable habitat for animals and plants than non-native plantations (Dwyer et al 2009 after Bowen et al., 2007; Fensham & Guymer, 2009).

Cypress forestry management practices have come a long way and current research now highlights the potential benefits of thinning regrowth for biodiversity. In 2018 the NSW Department of Primary Industries performed a comprehensive study on the effects of thinning cypress forests on biodiversity. The outcome revealed that biodiversity responded mostly positive or neutral. The recommendation was made that under proper management, such as mosaic or patchwork thinning including un-thinned areas, and retention of dead trees, a majority of species responds positively (NSW DPI 2018, Gonsalves et al 2018).

Regrowth woodlands of White Cypress are rather stable, provide habitat and biodiversity benefits and aid in carbon sequestration (Thompson & Eldridge 2005). They also improve soil conditions and the mitigation of salinity, therefore, under effectively managed commercially viable stands, multiple benefits can be achieved (Elridge et al 2003). Although the science of thinning for biodiversity is still evolving, it is no less essential to recognise the environmental benefits of cypress, to forward progress within the industry.

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