Amorim Wise Cork Pure Environmental footprint

Amorim Cork Flooring

Executive summary

October 2021

Building a better working world

Disclaimer

EY carbon footprint analysis follows a life-cycle approach based on ISO Standard 14040 on Amorim Cork Flooring data and business assumptions. These results are not third-party verified.

EY LCA analysis is based on ISO Standard 14040 and EN 15804, and on Amorim Cork Flooring data and business assumptions. The results presented are not third-party verified.

Executive summaries

The present document presents the executive summaries, which include the products' information, methodology and the main results for carbon footprint and environmental footprint of the following products:

- A – Amorim Wise Cork Pure PU PF
- B – Amorim Wise Cork Pure UV

A

Amorim Wise Cork Pure PU PF

Agenda - Amorim Wise Cork Pure PU PF

1. About the study

2. Carbon footprint

   Cradle-to-grave

   Sensitivity analysis

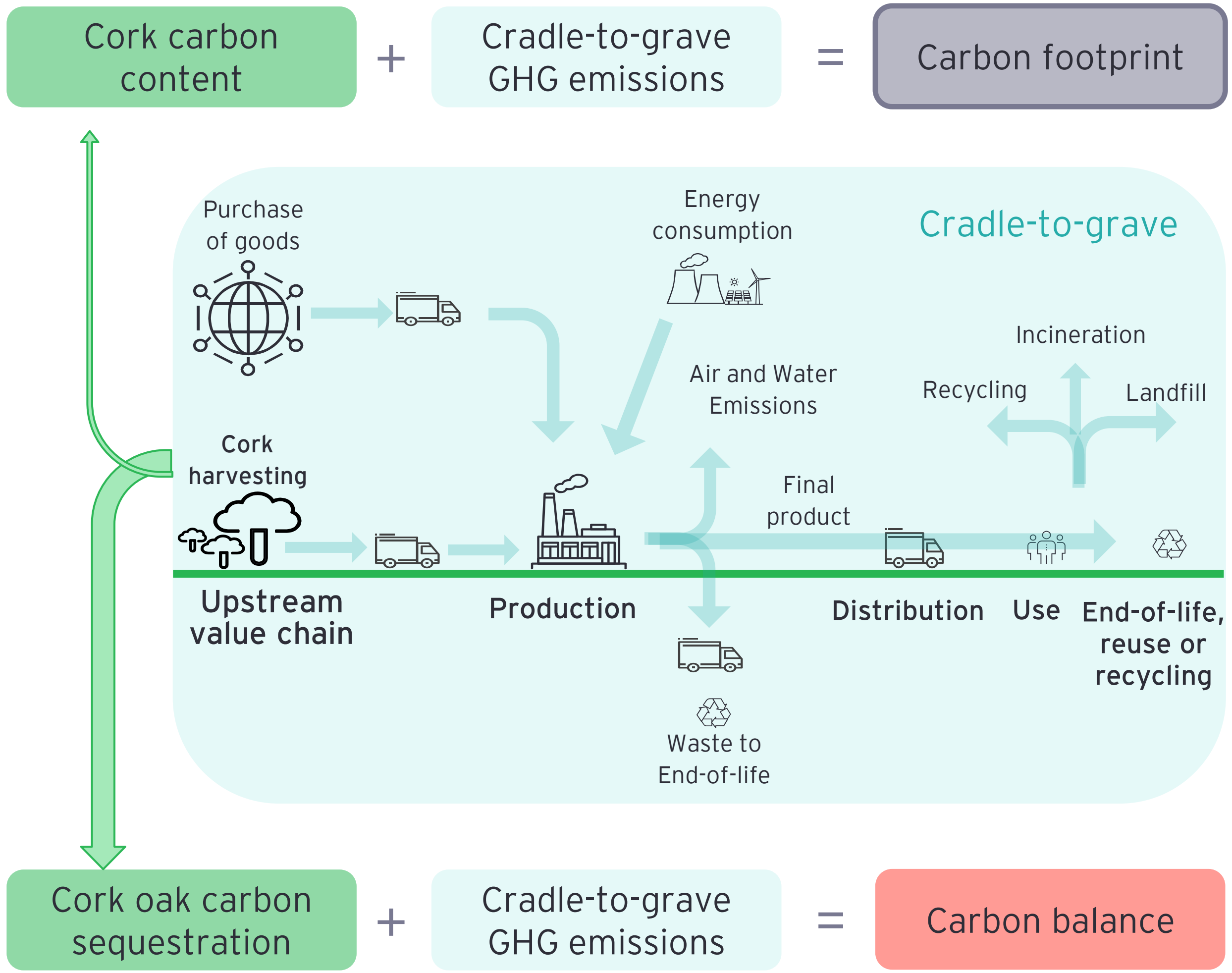
3. Carbon balance

   Scenario analysis with carbon sequestration at the forest stage

4. LCA

   Lifecycle environmental impacts for cradle-to-gate scope for main impact categories

5. Conclusions



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About the study

About the study

Context

- Corticeira Amorim is the largest world producer of cork products, championing the sector since 1870. The company has a portfolio of products with applications in multiple industries, such as wine, construction, flooring, aeronautical, automobile, footwear, among others. The company has implemented an integrated production process that ensures that no cork is wasted.
- Cork is an ecological and sustainable material 100% natural, renewable, recyclable and reusable.
- Amorim Cork Flooring (ACF), a subsidiary of Corticeira Amorim, is the world leader in producing and distributing cork incorporated floor and wall coverings. It has a unique manufacturing technology that combines the traditional production methods with cutting-edge technology to develop unique cork products with a large range of application, in over 70 countries worldwide. The incorporated cork on the different floor and wall products provides a level of comfort that cannot be achieved with any other covering materials, provides a natural thermal insulation, has impact resistance and makes the products adaptable to residential and commercial spaces.
- The **main purpose** is to quantify the potential environmental impacts of Amorim Wise Cork Pure PU PF produced by Amorim Cork Flooring, through a life cycle approach.
- Amorim Wise Cork Pure PU PF is one of the most sustainable flooring solutions, having a natural cork structure, that provides superior comfort and environmental performance for residential areas, with a genuine cork veener decorative layer and polyurethane finishing. This product is used as a floor covering for domestic use, providing several physical characteristics to the floor, such as stability, comfort, thermal and noise insulation, among others.

Product characteristics	Cork Pure PU	Sensitivity analysis (product size)
Size (mm x mm x mm)	1 m x 1 m x 4 mm	1 m x 1 m x 6 mm
Weight (kg)	2,10	3,12
Components (%)	84,6% cork 15,4% customization products	84,6% cork 15,4% customization products

About the study

Methodology

- The study analyses the environmental footprint of the Amorim Wise Cork Pure PU PF, through a life cycle analysis (LCA) approach.
- **Guidelines:** The study was based on Product Category Rules (PCR) for Construction Products (2019), that are in conformance with EN 15804:2012+A2:2019, ISO 219030:2017, the General Program Instructions of the International EPD® System (v3.01) and also based on with ISO 14040/44 standards.
- **Approach:** *cradle-to-grave* (from raw material extraction to the product end-of-life)
- **Life cycle stages assessed:** forest management activities, broken cork and granulated cork production, agglomerated cork and genuine cork veener layers production, gluing, pressing, sanding, varnishing, cutting and packing, product expedition (transport from the factory gate to the installation site), product installation, maintenance activities, end of life (EoL) stage and the benefits and loads beyond the system boundary.
- **Functional unit***:* 1 m^2 of product installed
- **Modelling software and database***:* SimaPro 9.1 with ecoinvent 3.5 database
- **Method:** The midpoint impact method EN 15804 +A2 was used for the environmental footprint analysis. The potential climate change impacts (**carbon footprint**) of each stage were estimated selecting the impact category Climate Change from the ILCD method.
- **Sensitivity analysis:** A sensitivity analysis was caried to assess the variation on the environmental impacts of Amorim Cork Pure PU PF, when the thickness of the product increases from 4 mm, with 2,10 kg/m2, to 6 mm, with 3,12 kg/m^2.

About the study

Methodology (cont.)

- **Impact categories assessed for the environmental footprint:**

Impact category	Indicator	Description	Reference
Abiotic depletion potential for non-fossil resources (ADPE)	Depletion of abiotic resources - mineral elements	kg Sb-eq.	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002.
Abiotic depletion potential for fossil resources (ADPF)	Depletion of abiotic resources - fossil fuels	MJ, net calorific value	CML 2002 (Guinée et al., 2002) and van Oers et al. 2002.
Acidification	Accumulated Exceedance, Acidification potential AP	mol H^+-eq.	Accumulated Exceedance (Seppala et al. 2006, Posch et al, 2008)
Global Warming total	Global Warming Potential (GWP100)	kg CO_2-eq.	Baseline model of 100 years of the IPCC based on IPCC 2013
GWP fossil	GWP from fossil carbon, removals and emissions	kg CO_2-eq.	Baseline model of 100 years of the IPCC based on IPCC 2013
GWP biogenic	GWP from biogenic carbon, removals and emissions	kg CO_2-eq.	Baseline model of 100 years of the IPCC based on IPCC 2013
GWP land use and land use change	GWP from land use and land use change, removals and emissions	kg CO_2-eq.	Baseline model of 100 years of the IPCC based on IPCC 2013
Eutrophication potential (EP)-terrestrial	Accumulated Exceedance, Eutrophication potential, EP terrestrial	kg N-eq.	Accumulated Exceedance (Seppala et al. 2006, Posch et al, 2008)
Eutrophication potential (EP)-freshwater	Fraction of nutrients reaching freshwater end compartment Europhication potential, EP freshwater	kg P-eq.	EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe

About the study

Methodology (cont.)

- Impact categories assessed for the environmental footprint:

Impact category	Description	Unit	Reference
Eutrophication potential (EP)-marine	Fraction of nutrients reaching freshwater end compartment Europhication potential, EP marine	kg N-eq.	EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe
Ozone Depletion	Depletion potential of the stratospheric ozone layer, ODP	kg CFC11-eq.	Steady-state ODPs 2014 as in WMO assessment
Photochemical ozone creation	Formation potential of tropospheric ozone, POCP	kg NMVOC-eq.	LOTUS EUROS (Van Zelm et al, 2008) as applied in ReCiPE
Water scarcity	User deprivation potential	m^3 world-eq deprived	Available Water Remaining (AWARE)

- Impact categories assessed for the carbon footprint:

Impact category	Description	Unit	Reference
Climate Change (CC)	Global Warming Potential calculating the radiative forcing over a time horizon of 100 years.	kg CO_2 eq	IPCC 2007

About the study

Methodology (cont.)

- **Data collection procedure**

Amorim Wise Cork Pure PU PF production data
↓
Amorim Cork Flooring activity (local data), for the year 2020, using questionnaires

General data (raw materials production, energy, transport and waste management
↓
Ecoinvent 3.5. database, compiled in 2018

- **Biogenic emissions and CO_{2eq} removals due carbon content in the reference flow are also considered, with the following assumptions:**
  - All cork raw materials that enter the system were considered to have a similar amount of carbon stored. The calculation of CO_2 uptake is based on the atomic weights of carbon (12) and carbon dioxide (44), as well as the carbon fraction (dry basis) of 55% and a moisture fraction of 6%[1].
  - Given the purpose of the assessment, emissions from biomass energy production are considered neutral, due to the assumption that the CO_2 that is being released in the incineration process (biogenic CO_2) was captured in the previous product stage 1 - forest management and cork harvesting (uptake), as so, it is no more than a short term delayed emission, resulting in a net neutral balance of CO_2 emissions [2,3].

[1]Dias, A.C., Arroja, L., 2014. A model for estimating carbon accumulation in cork products. Forest Systems 2014 23(2): 236-246
[2]Demertzi, M., Paulo, J.A., Arroja, L., Dias, A.C., 2016. A carbon footprint simulation model for the cork oak sector. Science of the Total Environment 566-567 (2016) 499-511
[3]Rives, J., Fernandez-Rodriguez, I., Rieradevall, J., Gabarrel, X, 2013. Integrated environmental analysis of the main cork products in southern Europe (Catalonia - Spain). Journal of Cleaner Production 51 (2013) 289-298

About the study

Methodology (cont.)

- **Additional scenario analysis of the potential carbon sequestration at the forest stage**
  - A scenario analysis was performed, given past studies[3,4], where it is assumed that carbon sequestration of the cork oak forest can indirectly be attributed to cork products was simulated, as the cork transformation industry contribute to the exploitation and maintenance of the cork oak forest.
  - The analysis compares the GHG emissions of the studied cradle-to-gate system to the cork oak forest carbon uptake, considering the cork weight in the functional unit. The resulting carbon balance is presented as an additional environmental information, as should not be confused with the carbon footprint analysis, where GHG emissions and biogenic stored carbon by cork are addressed.
  - Carbon stored in cork, in the product, was excluded for this scenario to avoid double counting. Allocation of CO_2 uptake to the cork extracted from the cork oak stands follows the same premises of allocating environmental impacts in a previous study[5].
  - In this study, a **weight-based perspective for carbon sequestration at the forest stage was considered**: All CO_2 uptake by the cork oak forest is allocated to extracted cork, as cork production is the main economic activity of cork oak forest, considering the weight of cork present in the functional unit of the final product.
  - The analyzed scenarios consider carbon sequestration in well-managed cork oak forests, with a high tree coverage and good soil and climate conditions, to have an average CO_2 uptake of 11 t CO_2/ha[6] , reaching a maximum of 14,7 t CO_2/ha. Translating[7] these values in function of cork extraction, there is a CO_2 uptake of 55 t CO_2/t of cork extracted, reaching up to 73 t CO_2/t of cork extracted.

[4] EY, 2019. Environmental footprint of natural cork stoppers. Corticeira Amorim, Santa Maria de Lamas.
[5] Dias, A.C., Rives, J.S., González-García, S., Demertzi, M., Gabarrel, X., Arroja, L., 2014. Analysis of raw cork production in Portugal and Catalonia using life cycle assessment. International Journal of Life Cycle Assessment (2014) 19:1985–2000
[6] Figures considered in the "The value of cork oak montado ecosystem services" (EY, 2019c). Average ecosystem CO_2 uptake (11 t CO2/ha) considers wet and dry years in well managed forests, with a maximum of 14,7 t CO2/ha registered in optimal climatic conditions (Costa-e-Silva et al., 2015).
[7] Conversion of forest ecosystem uptake per tonne of extracted cork considers the total cork oak occupation area in Portugal (719 937 ha) (ICNF, 2019) and an average value of cork production (145 000 t cork) based on a nine-year series (2003-2011) (APCOR, 2011).

About the study

Assumptions

- **Life cycle stages assessed:**

A - Product			Construction		B: Use							C: EOL				D: Benefits
Raw material supply	Transport	Manufacturing	Transport	Construction-Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction/ demolition	Transport	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	x	x	ND	x	ND	ND	ND	ND	ND	x	x	x	x	x

Product stage A1-A3

- Provision of all raw materials,
- Transport of raw materials to the production site.
- Resources consumption during the manufacturing of the product, packaging of final product, the different air emissions, as well as processing of waste generated by the factory.

Construction stage A4 - A5

- A4 includes the product's transport from the factory to the installation site (**Central Europe**)
- A5 includes the consumables and energy required and processing of waste generated during the installation.

Use stage B1-B7

- Only B2 is included, that represents the product's maintenance.

End of life stage C1-C4

- Includes transport of the product to the end of life processing facility
- Includes a mixed scenario for the product's end of life :
  - Incineration with electricity production (R1>0.6) - 40%
  - Landfill disposal - 60%

Benefits (D)

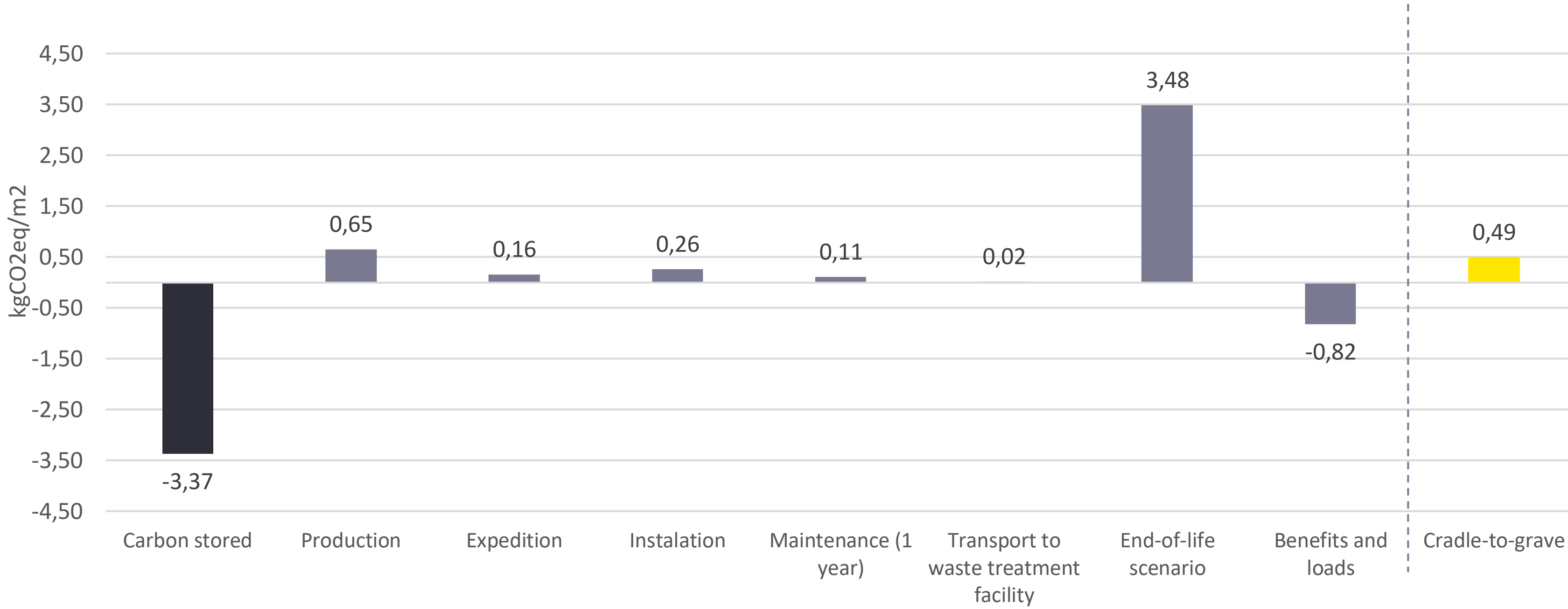
- Includes benefits associated with the recovering, recycling and reuse of the product in its end of life.

2

Carbon footprint

Carbon footprint - Cradle-to-grave

Amorim Wise Cork Pure PU PF (4 mm)

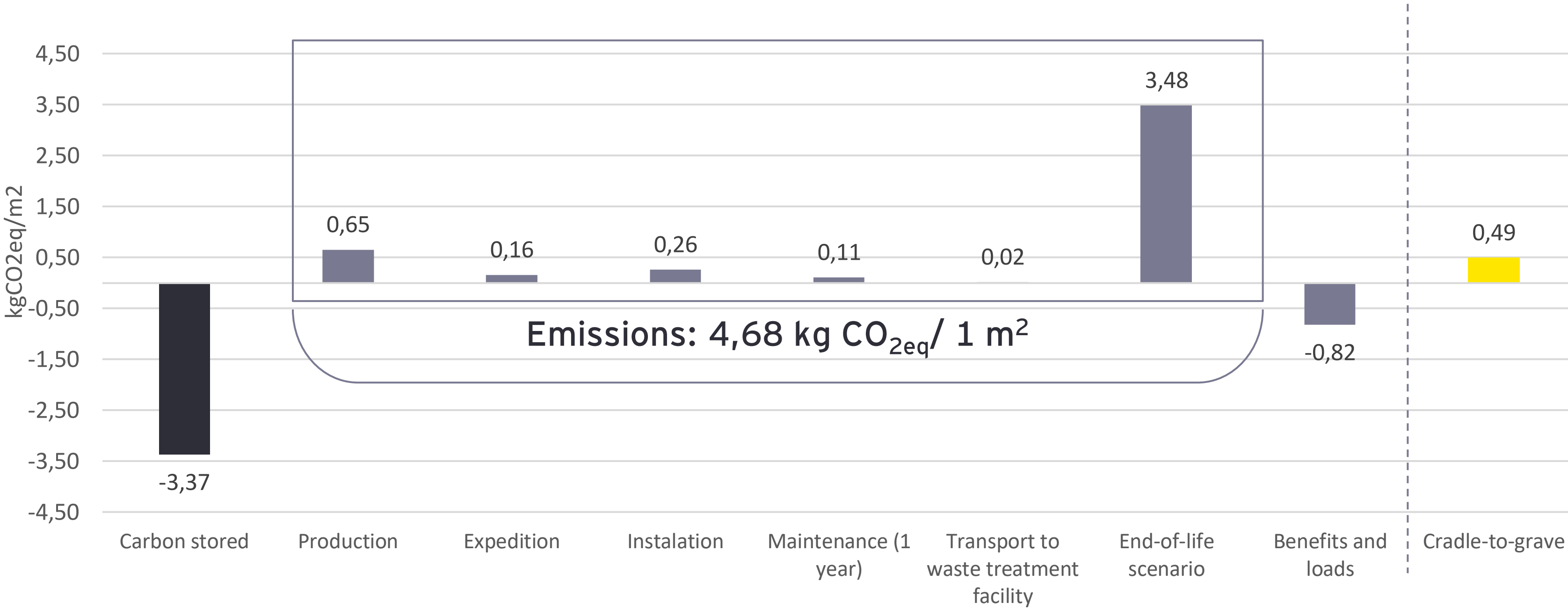


Amorim Wise Cork Pure PU PF carbon footprint:

- Carbon stored in cork : **-3,37** kg CO_2 /1 m^2
- Cradle-to-grave: **0,49** kg CO_{2eq} /1 m^2

Carbon footprint - Cradle-to-grave

Amorim Wise Cork Pure PU PF (4 mm)



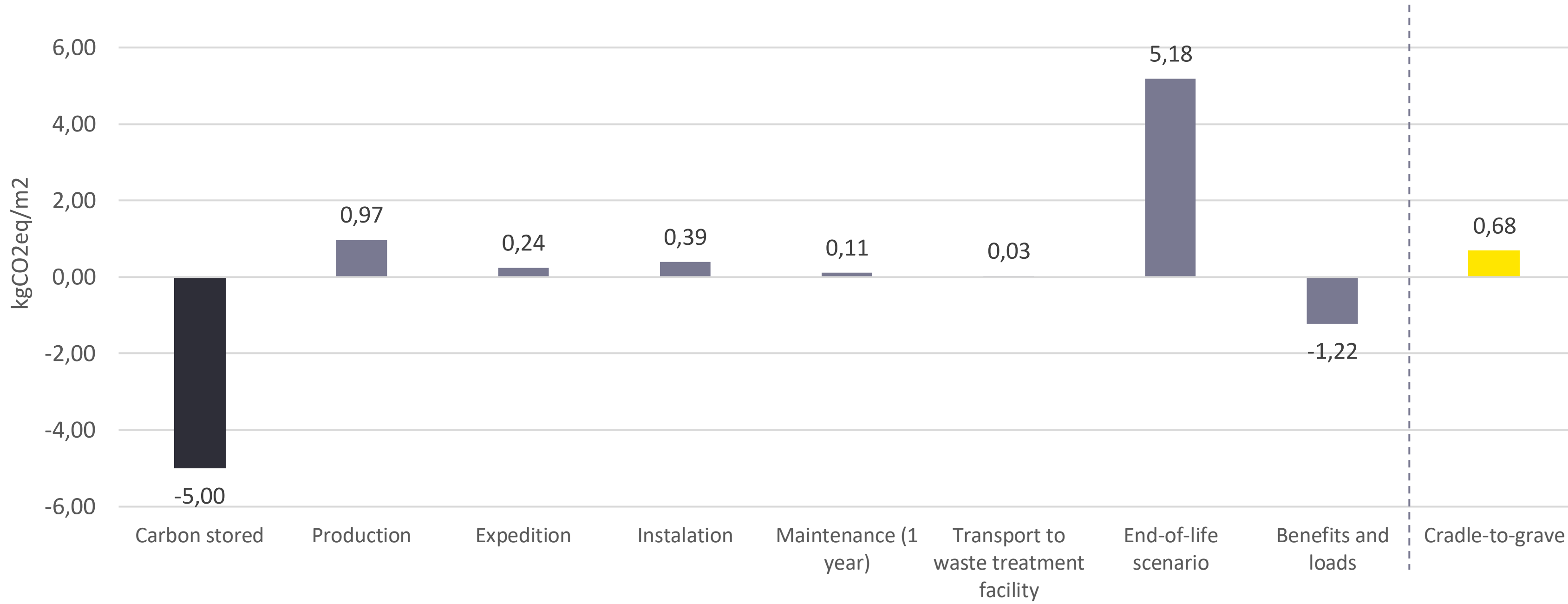
74% emissions associated with the end-of-life stage and 14% associated with production stage

- Most upstream value chain activities carbon impacts (e.g. production and purchase of chemical products), energy consumption and biogenic carbon uptake and release

Carbon footprint - Sensitivity analysis

Amorim Wise Cork Pure PU PF (6 mm)

- A sensitivity analysis was caried to assess the variation on the environmental impacts of Cork Pure PU, when the thickness of the product increases from 4 mm , with 2,10 kg/m^2, to 6 mm, with 3,12 kg/m^2.



Overall impacts increase in line with the increase in thickness by an average factor of 1,49 in production (modules A1-A3) expedition and installation (modules A4 and A5) and transportation to EoL (module C2).

3
Carbon balance

Carbon balance: results

Scenario analysis with carbon sequestration in the cork oak montado

For the average weight Amorim Wise Cork Pure PU PF (4 mm) when considering carbon sequestration in the cork oak* montado:

There is a **forest storage up to**:

- 130

kg CO_2/1 m^2

Therefore, the **carbon balance reaches up to**

-125

kg CO_{2eq}/1 m^2

* scenario analysis based on well-managed cork oak montado

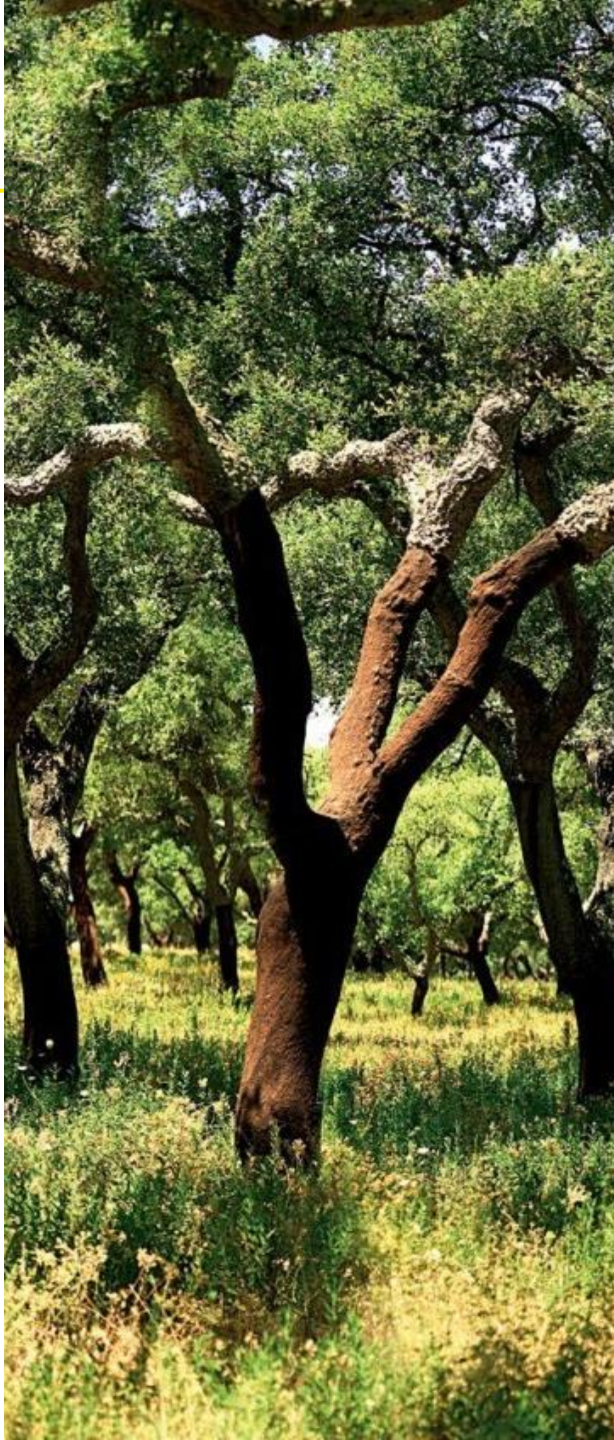
- 73 t CO_2/t cork

Maximum ecosystem CO_2 uptake registered (14,7 tCO_2/ha) (Costa-e-Silva et al., 2015).

with the **average ecosystem** CO_2 uptake being **- 55 t CO_2**/t cork, considering wet and dry years in well managed forests (11 t CO_2/ha).[9]

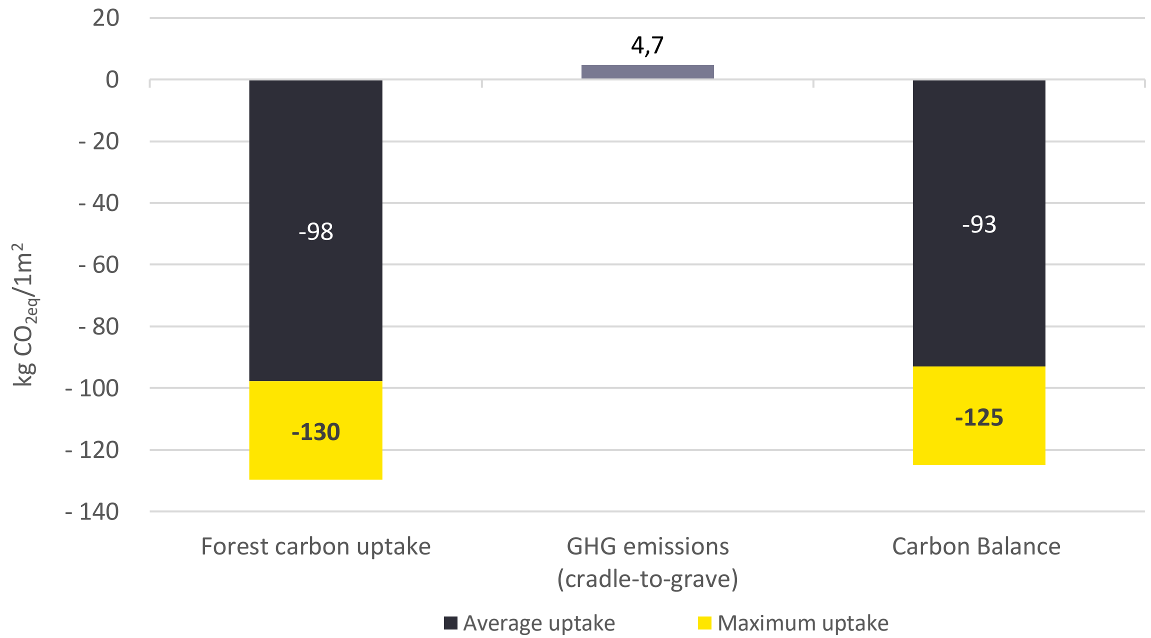
[9] figures used in "The value of cork oak montado ecosystem services, EY 2019"

Weight-based perspective: 100% of forest carbon sequestration allocated to cork (total cork oak sequestration is allocated to stopper cork weight, as cork industry is a key enabler for the montado)



Carbon balance

Amorim Wise Cork Pure PU PF (4 mm)



Carbon balance reaches up to:

-125

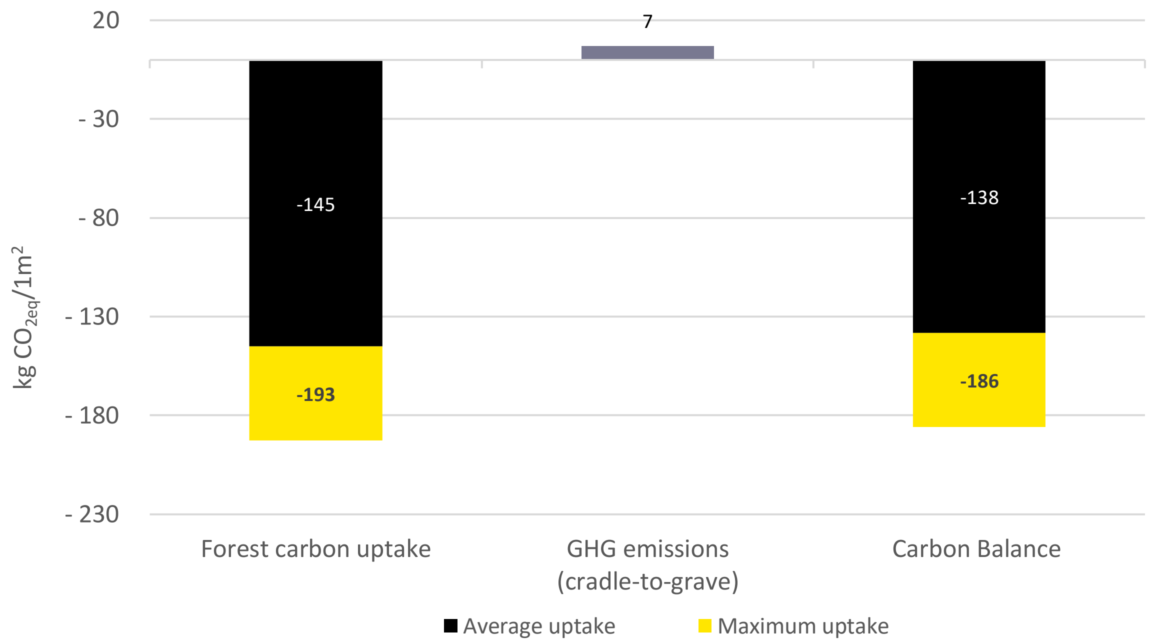
kg CO_{2eq}/m^2

Considering:

- ILCD method carbon footprint results
- Maximum ecosystem CO_2 uptake capacity registered in a well managed cork oak montado in weight-based perspective
- Cradle-to-grave GHG emissions, thus excluding carbon stored in the final product (Production and EoL) and potential future benefits and burdens beyond the system boundary.
- Destination: Central Europe
- End-of-life mix scenario (60% landfill; 40% incineration)
- 1-year maintenance (for 23 year reference service life)

Carbon balance - Sensitivity analysis

Amorim Wise Cork Pure PU PF (6mm)



Carbon balance reaches up to:

-186

kg CO_{2eq}/m^2

Considering:

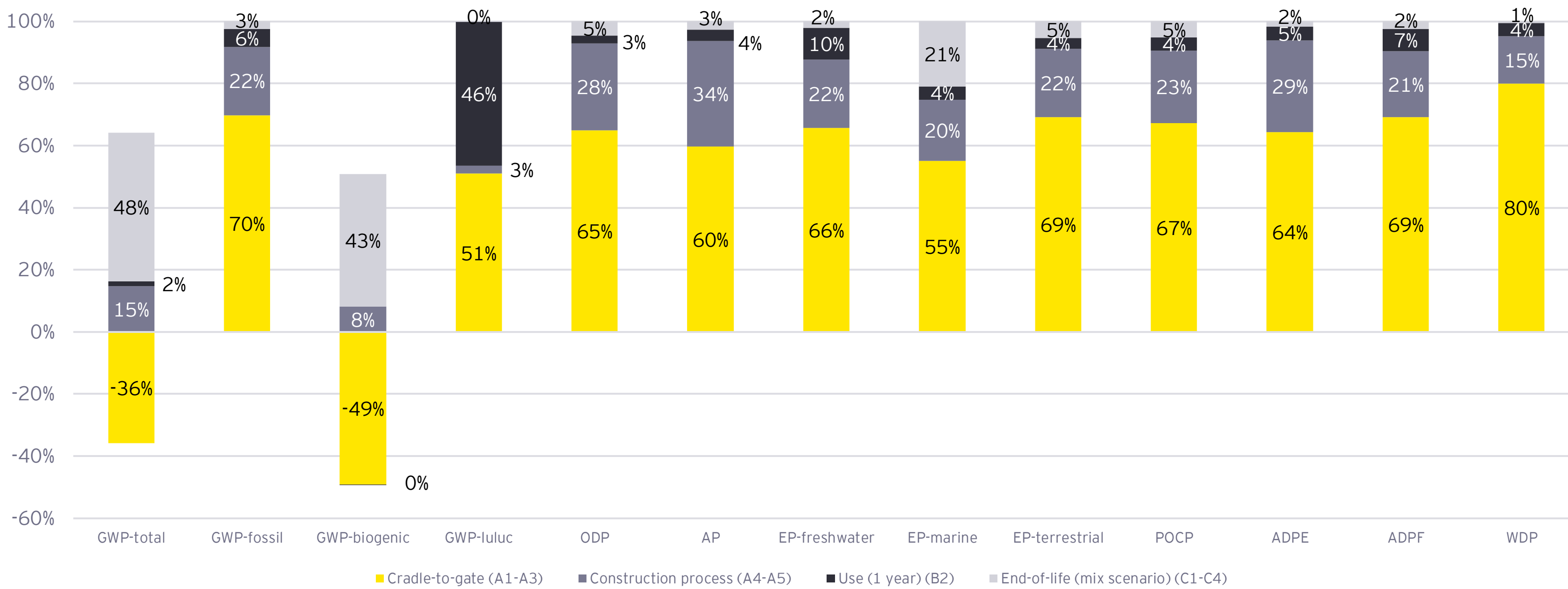
- ILCD method carbon footprint results
- Maximum ecosystem CO_2 uptake capacity registered in a well managed cork oak montado in weight-based perspective
- Cradle-to-grave GHG emissions, thus excluding carbon stored in the final product (Production and EoL) and potential future benefits and burdens beyond the system boundary.
- Destination: Central Europe
- End-of-life mix scenario (60% landfill; 40% incineration)
- 1-year maintenance (for 23 year reference service life)

4

LCA environmental footprint

LCA results: 1m² Amorim Wise Cork Pure PU PF

Environmental footprint for 1 m² of Amorim Wise Cork Pure PU (4 mm)



Stages with higher environmental impacts

- Product stage, due to chemical products use and electricity
- Construction, due to product expedition and use of chemicals at installation
- End-of-life stage (GWP indicators), due to biogenic emissions

Impact indicators : GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential

5

Conclusions

Conclusions

Environmental and carbon footprint

- Overall results for year 2020 show that, under a cradle-to-grave approach, the highest environmental impacts are associated with the processes where the use of both chemical products and electricity is higher, as a result, the impact of Amorim Wise Cork Pure PU PF production and end-of-life stages across all LCA impact categories is more significant.

- By using natural raw materials, such as cork, Amorim Cork Flooring is able to lower the potential environmental impacts stemming from its product, as it is the sole main component of the final product.

- The construction process stage, that includes the product's expedition and installation, also shows relevant potential impacts for the majority of the impact categories, namely due to transport and chemical products use, together with the end of life scenarios.

- Total emissions account for an overall climate change impact of 3,9 kg CO_{2eq} per 1 m^2. Considering the carbon stored in the cork used to produce Amorim Wise Cork Pure PU PF (3,4 kgCO_2/ 1 m^2), the carbon footprint of the product is +0,5 kgCO_{2eq} per 1 m^2, under a cradle-to-grave approach.

Carbon sequestration of the cork oak forest

- Considering a scenario analysis, where the carbon sequestration of the cork oak forest can indirectly be attributed to cork products, based on well-managed cork oak forests, a forest carbon uptake up to -130 kg CO_2 per 1 m^2 can be observed. Considering both the forest carbon uptake and the GHG emissions of maximum weight Amorim Wise Cork Pure PU PF production (4,7 kg CO_2/ 1 m^2), there is a carbon balance up to -125 kg CO_{2eq} per 1 m^2. This balance illustrates the differentiating factor between cork and other products.

- As the cork oak tree retains carbon for over 100 years, regardless of cork harvesting, cork exploitation supports the maintenance of the ecosystem, thus having a positive contribution to global climate regulation.

B

Amorim Wise Cork Pure UV

Agenda

1. About the study

2. Carbon footprint

   Cradle-to-grave

   Sensitivity analysis

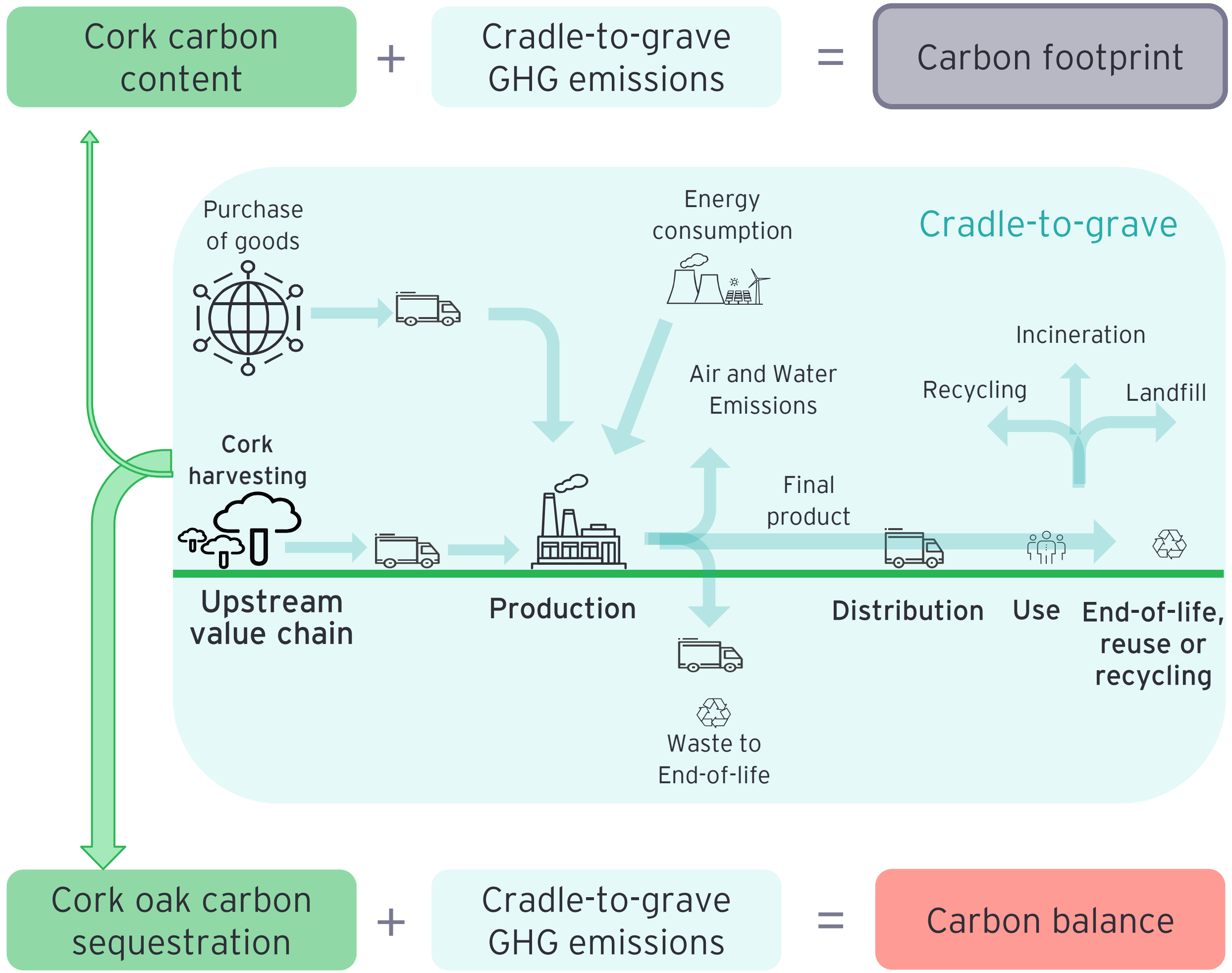
3. Carbon balance

   Scenario analysis with carbon sequestration at the forest stage

4. LCA

   Lifecycle environmental impacts for cradle-to-gate scope for main impact categories

5. Conclusions



EY

1

About the study

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- Cork is an ecological and sustainable material 100% natural, renewable, recyclable and reusable.
- Amorim Cork Flooring (ACF), a subsidiary of Corticeira Amorim, is the world leader in producing and distributing cork incorporated floor and wall coverings. It has a unique manufacturing technology that combines the traditional production methods with cutting-edge technology to develop unique cork products with a large range of application, in over 70 countries worldwide. The incorporated cork on the different floor and wall products provides a level of comfort that cannot be achieved with any other covering materials, provides a natural thermal insulation, has impact resistance and makes the products adaptable to residential and commercial spaces.
- The **main purpose** is to quantify the potential environmental impacts of Amorim Wise Cork Pure UV produced by Amorim Cork Flooring, through a life cycle approach.
- Amorim Wise Cork Pure UV is one of the most sustainable flooring solutions, having a natural cork structure, that provides superior comfort and environmental performance for commercial areas, with a genuine cork veener decorative layer and UV varnish finishing. This product is used as a floor covering for commercial use, providing several physical characteristics to the floor, such as stability, comfort, thermal and noise insulation, among others.

Product characteristics	Cork Pure UV	Sensitivity analysis (product size)
Size (mm x mm x mm)	1 m x 1 m x 4,08 mm	1 m x 1 m x 6 mm
Weight (kg)	2,70	3,25
Components (%)	84,4% cork 15,6% customization products	84,4% cork 15,6% customization products

EY

About the study

Methodology

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- **Approach**: *cradle-to-grave* (from raw material extraction to the product end-of-life)
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- **Functional unit***:* 1 m^2 of product installed
- **Modelling software and database***:* SimaPro 9.1 with ecoinvent 3.5 database
- **Method:** The midpoint impact method EN 15804 +A2 was used for the environmental footprint analysis. The potential climate change impacts (**carbon footprint**) of each stage were estimated selecting the impact category Climate Change from the ILCD method.
- **Sensitivity analysis:** A sensitivity analysis was caried to assess the variation on the environmental impacts of Amorim Cork Pure UV, when the thickness of the product increases from 4,08 mm, with 2,17 kg/m2, to 6 mm, with 3,25 kg/m^2.

About the study

Methodology (cont.)

- Impact categories assessed for the environmental footprint:

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GWP biogenic	GWP from biogenic carbon, removals and emissions	kg CO_2-eq.	Baseline model of 100 years of the IPCC based on IPCC 2013
GWP land use and land use change	GWP from land use and land use change, removals and emissions	kg CO_2-eq.	Baseline model of 100 years of the IPCC based on IPCC 2013
Eutrophication potential (EP)-terrestrial	Accumulated Exceedance, Eutrophication potential, EP terrestrial	kg N-eq.	Accumulated Exceedance (Seppala et al. 2006, Posch et al, 2008)
Eutrophication potential (EP)-freshwater	Fraction of nutrients reaching freshwater end compartment Europhication potential, EP freshwater	kg P-eq.	EUTREND model (Struijs et al, 2009b) as implemented in ReCiPe

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▸ **Impact categories assessed for the environmental footprint:**

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Photochemical ozone creation	Formation potential of tropospheric ozone, POCP	kg NMVOC-eq.	LOTUS EUROS (Van Zelm et al, 2008) as applied in ReCiPE
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Methodology (cont.)

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Amorim Wise Cork Pure UV production data

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Amorim Cork Flooring activity (local data), for the year 2020, using questionnaires

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Ecoinvent 3.5. database, compiled in 2018

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  - All cork raw materials that enter the system were considered to have a similar amount of carbon stored. The calculation of CO_2 uptake is based on the atomic weights of carbon (12) and carbon dioxide (44), as well as the carbon fraction (dry basis) of 55% and a moisture fraction of 6%[1].
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Methodology (cont.)

- **Additional scenario analysis of the potential carbon sequestration at the forest stage**
  - A scenario analysis was performed, given past studies[3,4], where it is assumed that carbon sequestration of the cork oak forest can indirectly be attributed to cork products was simulated, as the cork transformation industry contribute to the exploitation and maintenance of the cork oak forest.
  - The analysis compares the GHG emissions of the studied cradle-to-gate system to the cork oak forest carbon uptake, considering the cork weight in the functional unit. The resulting carbon balance is presented as an additional environmental information, as should not be confused with the carbon footprint analysis, where GHG emissions and biogenic stored carbon by cork are addressed.
  - Carbon stored in cork, in the product, was excluded for this scenario to avoid double counting. Allocation of CO_2 uptake to the cork extracted from the cork oak stands follows the same premises of allocating environmental impacts in a previous study[5].
  - In this study, a **weight-based perspective for carbon sequestration at the forest stage was considered**: All CO_2 uptake by the cork oak forest is allocated to extracted cork, as cork production is the main economic activity of cork oak forest, considering the weight of cork present in the functional unit of the final product.
  - The analyzed scenarios consider carbon sequestration in well-managed cork oak forests, with a high tree coverage and good soil and climate conditions, to have an average CO_2 uptake of 11 t CO_2/ha[6] , reaching a maximum of 14,7 t CO_2/ha. Translating[7] these values in function of cork extraction, there is a CO_2 uptake of 55 t CO_2/t of cork extracted, reaching up to 73 t CO_2/t of cork extracted.

[4] EY, 2019. Environmental footprint of natural cork stoppers. Corticeira Amorim, Santa Maria de Lamas.
[5] Dias, A.C., Rives, J.S., González-García, S., Demertzi, M., Gabarrel, X., Arroja, L., 2014. Analysis of raw cork production in Portugal and Catalonia using life cycle assessment. International Journal of Life Cycle Assessment (2014) 19:1985–2000
[6] Figures considered in the "The value of cork oak montado ecosystem services" (EY, 2019c). Average ecosystem CO_2 uptake (11 t CO2/ha) considers wet and dry years in well managed forests, with a maximum of 14,7 t CO2/ha registered in optimal climatic conditions (Costa-e-Silva et al., 2015).
[7] Conversion of forest ecosystem uptake per tonne of extracted cork considers the total cork oak occupation area in Portugal (719 937 ha) (ICNF, 2019) and an average value of cork production (145 000 t cork) based on a nine-year series (2003-2011) (APCOR, 2011).

About the study

Assumptions

- **Life cycle stages assessed:**

A - Product			Construction		B: Use							C: EOL				D: Benefits
Raw material supply	Transport	Manufacturing	Transport	Construction-Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction/ demolition	Transport	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	x	x	ND	x	ND	ND	ND	ND	ND	x	x	x	x	x

Product stage A1-A3

- Provision of all raw materials,
- Transport of raw materials to the production site.
- Resources consumption during the manufacturing of the product, packaging of final product, the different air emissions, as well as processing of waste generated by the factory.

Construction stage A4 - A5

- A4 includes the product's transport from the factory to the installation site (**Central Europe**)
- A5 includes the consumables and energy required and processing of waste generated during the installation.

Use stage B1-B7

- Only B2 is included, that represents the product's maintenance.

End of life stage C1-C4

- Includes transport of the product to the end of life processing facility
- Includes a mixed scenario for the product's end of life :
  - Incineration with electricity production (R1>0.6) – 40%
  - Landfill disposal – 60%

Benefits (D)

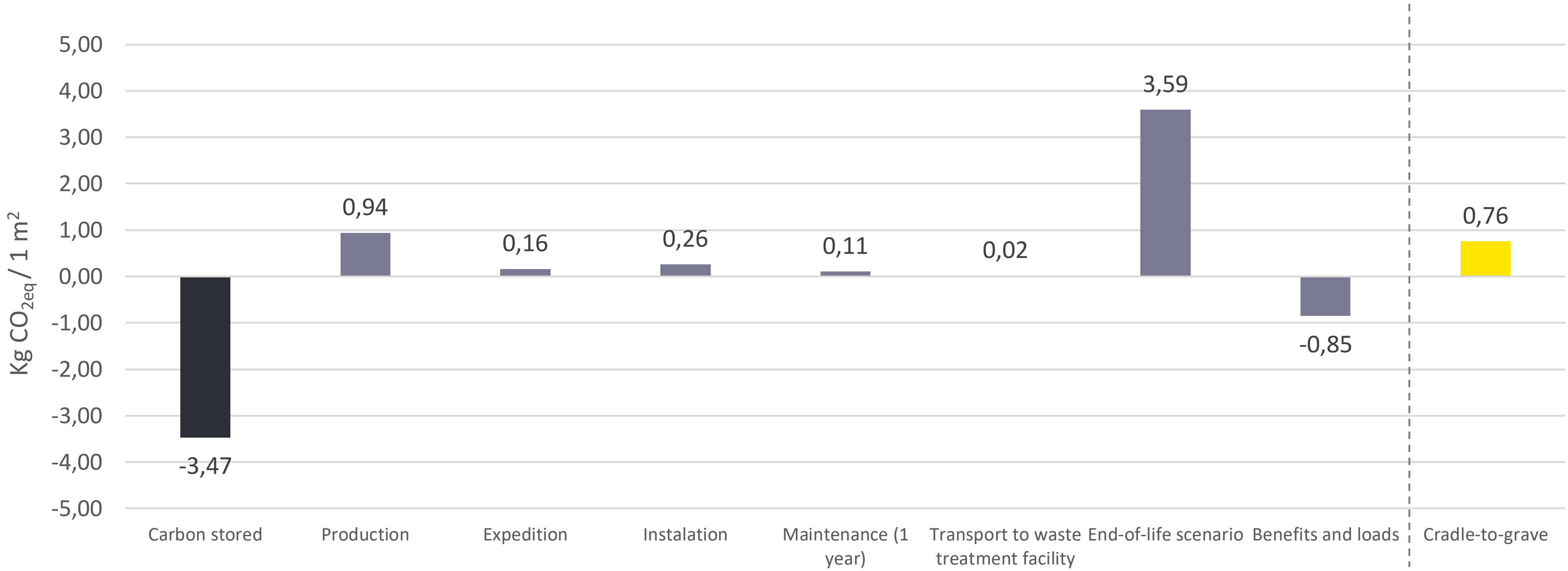
- Includes benefits associated with the recovering, recycling and reuse of the product in its end of life.

2

Carbon footprint

Carbon footprint - Cradle-to-grave

Amorim Wise Cork Pure UV (4 mm)

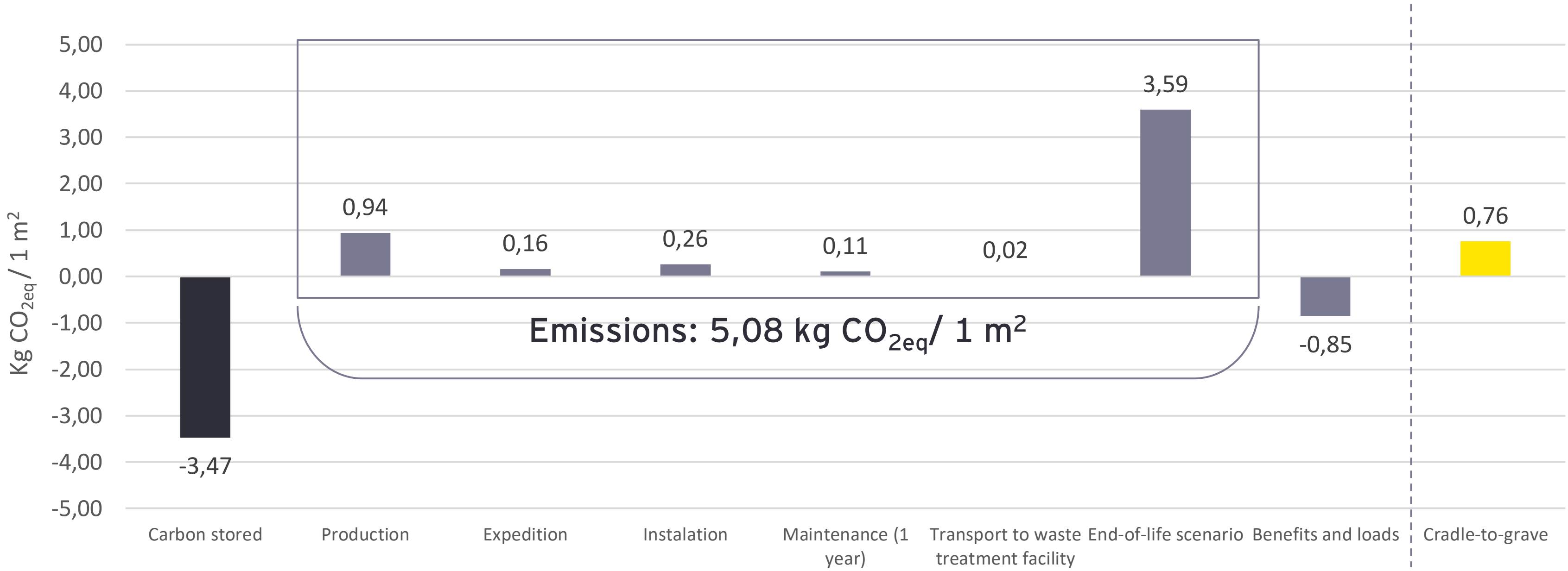


Amorim Wise Cork Pure UV carbon footprint:

- Carbon stored in cork : **-3,47** kg CO_2 /1 m^2
- Cradle-to-grave: **0,76** kg CO_{2eq} /1 m^2

Carbon footprint – Cradle-to-grave

Amorim Wise Cork Pure UV (4 mm)



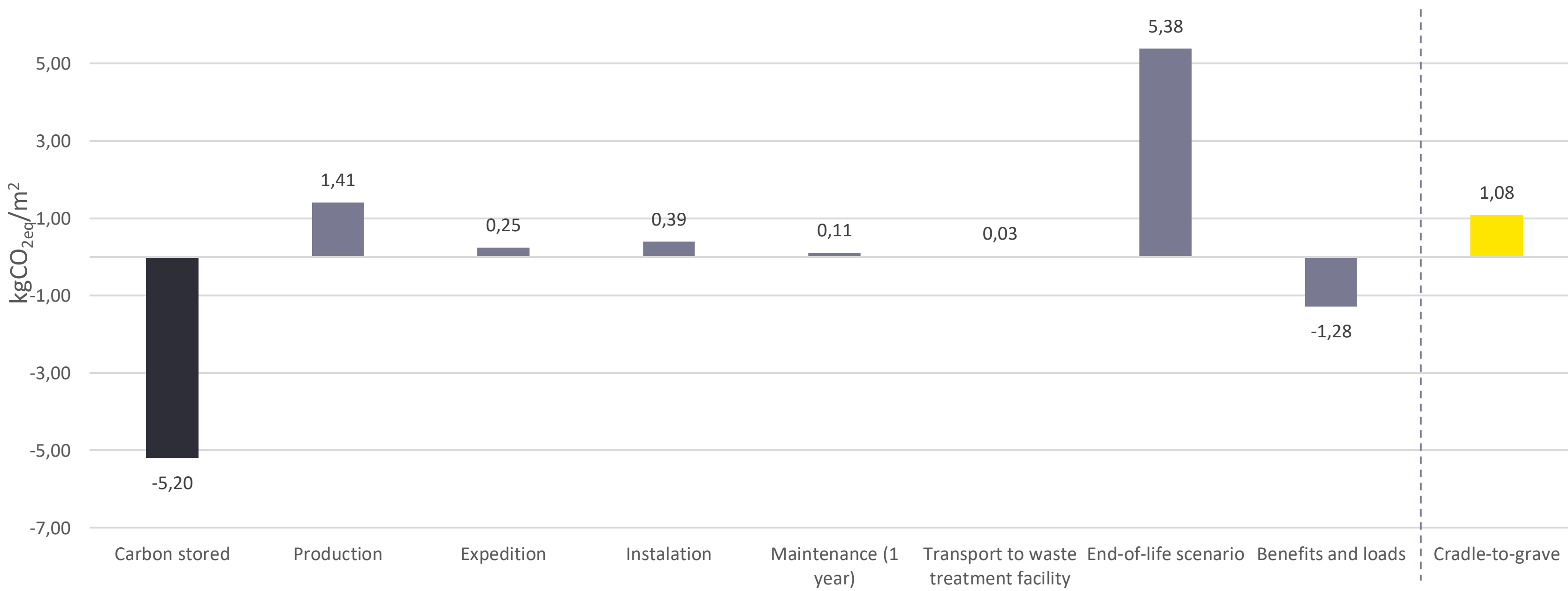
71% emissions associated with the end-of-life stage and 19% associated with production stage

- Most upstream value chain activities carbon impacts (e.g. production and purchase of chemical products), energy consumption and biogenic carbon uptake and release

Carbon footprint – Sensitivity analysis

Amorim Wise Cork Pure UV (6 mm)

- A sensitivity analysis was caried to assess the variation on the environmental impacts of Cork Pure UV, when the thickness of the product increases from 4,08 mm , with 2,17 kg/m^2, to 6 mm, with 3,25 kg/m^2.



Overall impacts increase in line with the increase in thickness by an average factor of 1,49 in production (modules A1-A3) expedition and installation (modules A4 and A5) and transportation to EoL (module C2).

3
Carbon balance

Carbon balance: results

Scenario analysis with carbon sequestration in the cork oak montado

For the average weight Amorim Wise Cork Pure UV (4 mm) when considering carbon sequestration in the cork oak* montado:

There is a **forest storage up to**:

- 134

kg CO_2/1 m^2

Therefore, the **carbon balance reaches up to**

-129

kg CO_{2eq}/1 m^2

* scenario analysis based on well-managed cork oak montado

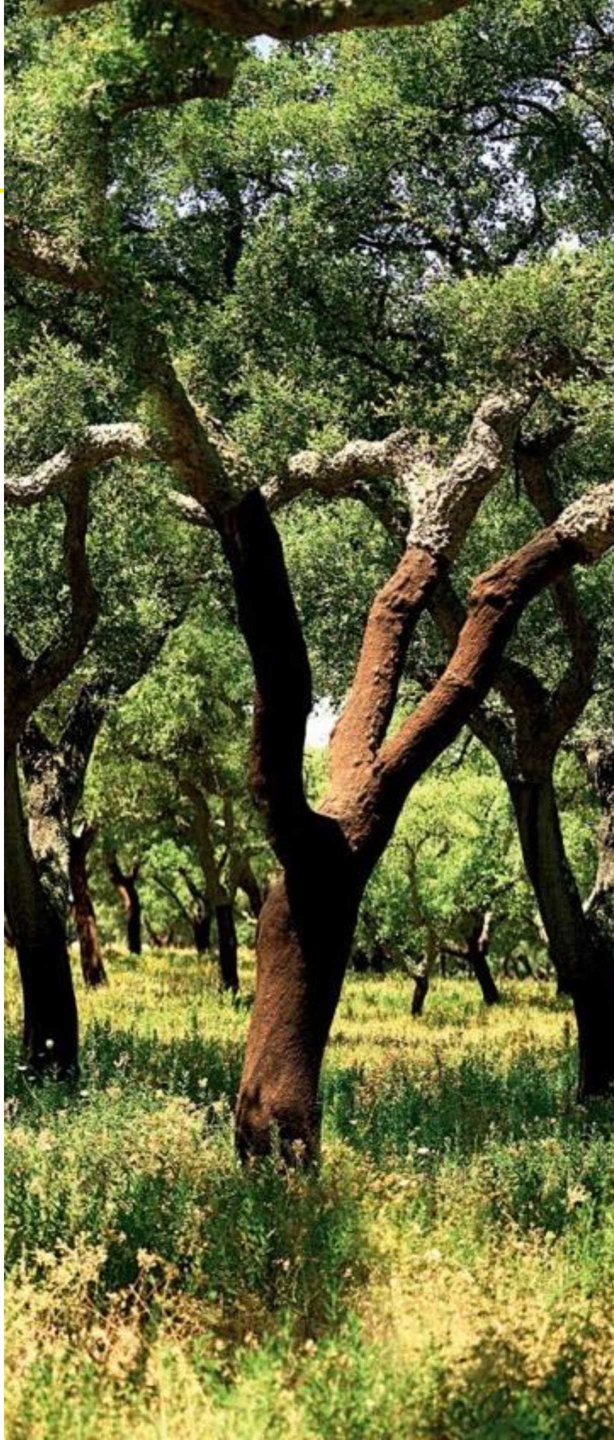
- 73 t CO_2/t cork

Maximum ecosystem CO_2 uptake registered (14,7 tCO_2/ha) (Costa-e-Silva et al., 2015).

with the **average ecosystem** CO_2 uptake being **- 55 t CO_2**/t cork, considering wet and dry years in well managed forests (11 t CO_2/ha).[9]

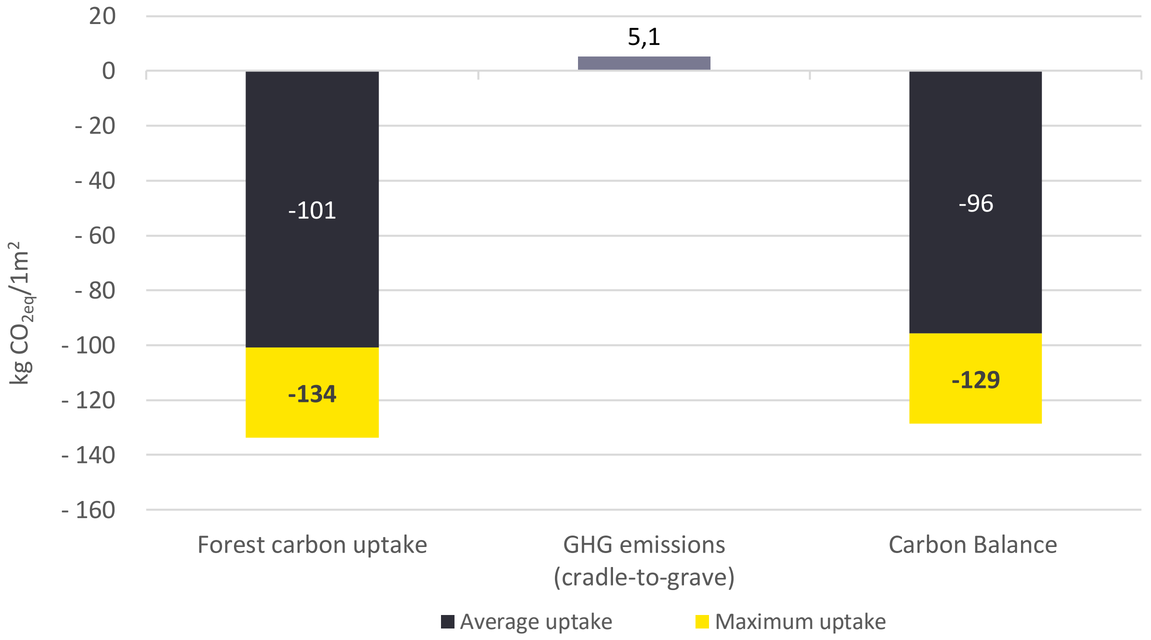
[9] figures used in "The value of cork oak montado ecosystem services, EY 2019"

Weight-based perspective: 100% of forest carbon sequestration allocated to cork (total cork oak sequestration is allocated to stopper cork weight, as cork industry is a key enabler for the montado)



Carbon balance

Amorim Wise Cork Pure UV (4 mm)



Carbon balance reaches up to:

-129

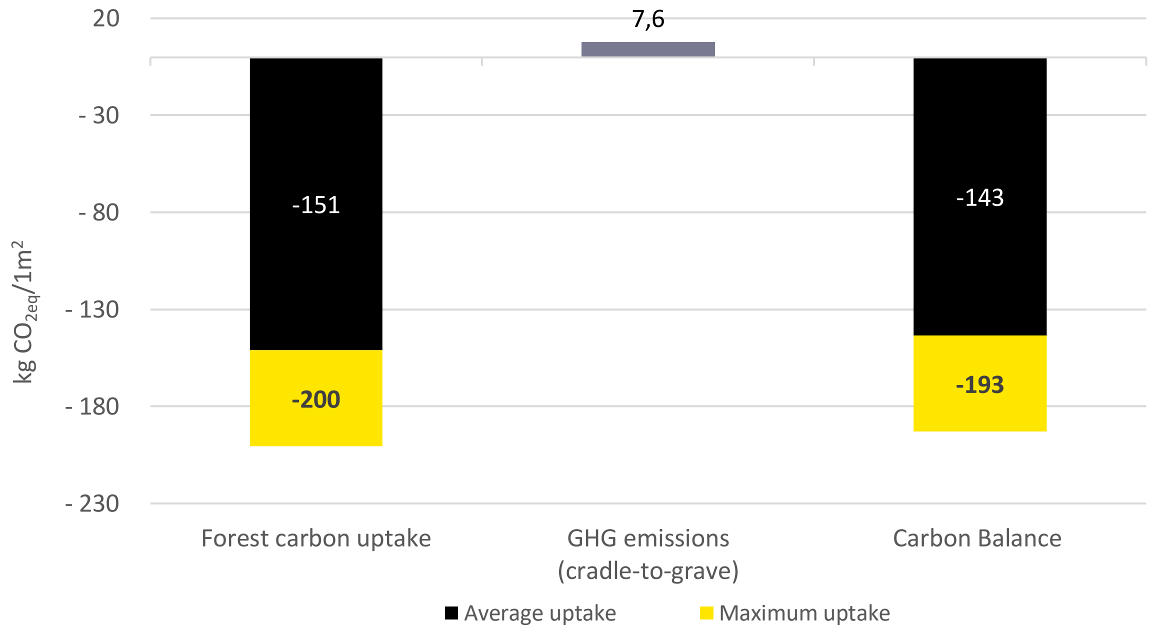
kg CO_{2eq}/m^2

Considering:

- ILCD method carbon footprint results
- Maximum ecosystem CO_2 uptake capacity registered in a well managed cork oak montado in weight-based perspective
- Cradle-to-grave GHG emissions, thus excluding carbon stored in the final product (Production and EoL) and potential future benefits and burdens beyond the system boundary.
- Destination: Central Europe
- End-of-life mix scenario (60% landfill; 40% incineration)
- 1-year maintenance (for 23 year reference service life)

Carbon balance - Sensitivity analysis

Amorim Wise Cork Pure UV (6 mm)



Carbon balance reaches up to:

-193

kg CO_{2eq}/m^2

Considering:

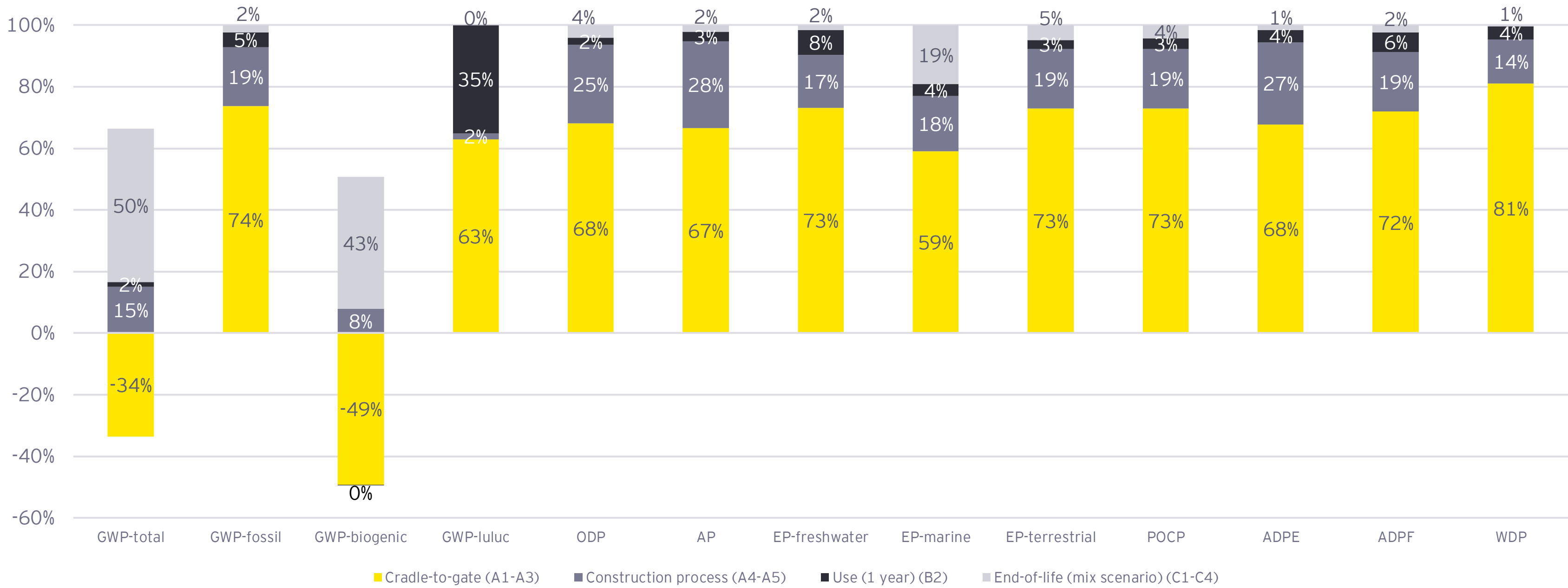
- ILCD method carbon footprint results
- Maximum ecosystem CO_2 uptake capacity registered in a well managed cork oak montado in weight-based perspective
- Cradle-to-grave GHG emissions, thus excluding carbon stored in the final product (Production and EoL) and potential future benefits and burdens beyond the system boundary.
- Destination: Central Europe
- End-of-life mix scenario (60% landfill; 40% incineration)
- 1-year maintenance (for 23 year reference service life)

4

LCA environmental footprint

LCA results: 1m² Amorim Wise Cork Pure UV

Environmental footprint for 1 m² of Amorim Wise Cork Pure UV (4 mm)



Stages with higher environmental impacts

- Product stage, due to chemical products use and electricity
- Construction, due to product expedition and use of chemicals at installation
- End-of-life stage (GWP indicators), due to biogenic emissions

Impact indicators : GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential

5
Conclusions

Conclusions

Environmental and carbon footprint

- Overall results for year 2020 show that, under a cradle-to-grave approach, the highest environmental impacts are associated with the processes where the use of both chemical products and electricity is higher, as a result, the impact of Amorim Wise Cork Pure UV production and end-of-life stages across all LCA impact categories is more significant.
- By using natural raw materials, such as cork, Amorim Cork Flooring is able to lower the potential environmental impacts stemming from its product, as it is the sole main component of the final product.
- The construction process stage, that includes the product's expedition and installation, also shows relevant potential impacts for the majority of the impact categories, namely due to transport and chemical products use, together with the end of life scenarios.
- Total emissions account for an overall climate change impact of 4,2 kg CO_{2eq} per 1 m^2. Considering the carbon stored in the cork used to produce Amorim Wise Cork Pure UV (3,5 kgCO_2/ 1 m^2), the carbon footprint of the product is +0,8 kgCO_{2eq} per 1 m^2, under a cradle-to-grave approach.

Carbon sequestration of the cork oak forest

- Considering a scenario analysis, where the carbon sequestration of the cork oak forest can indirectly be attributed to cork products, based on well-managed cork oak forests, a forest carbon uptake up to -134 kg CO_2 per 1 m^2 can be observed. Considering both the forest carbon uptake and the GHG emissions of maximum weight Amorim Wise Cork Pure UV production (5,1 kg CO_2/ 1 m^2), there is a carbon balance up to -129 kg CO_{2eq} per 1 m^2. This balance illustrates the differentiating factor between cork and other products.
- As the cork oak tree retains carbon for over 100 years, regardless of cork harvesting, cork exploitation supports the maintenance of the ecosystem, thus having a positive contribution to global climate regulation.

Technical sheet

Technical sheet

Title “Environmental footprint of Amorim Wise Cork Pure PU PF: Executive summary”

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