Carbon storage in wooden furniture

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INTRODUCTION

[Image: Global temperature change
Relative to average of 1971-2000 [°C]

https://showyourstripes.info/s/globe - No changes were made.
Graphics and lead scientist: Ed Hawkins, National Centre for Atmospheric Science, University of Reading.
Data: Berkeley Earth, NOAA, UK Met Office, MeteoSwiss, DWD, SMHI, UoR, Meteo France & ZAMG]
INTRODUCTION

https://climate.nasa.gov

Carbon Storage in Wooden Furniture

Source: climate.nasa.gov

https://climate.nasa.gov
**INTRODUCTION**

**SOME DEFINITIONS**

**Greenhouse gas – GHG**: any gas in the atmosphere that absorbs and re-emits heat (CO₂, CH₄, …).

**Global warming potential – GWP**: indicates the amount of warming caused by a gas over period of time; GWP value of CO₂ is 1.

**Carbon dioxide equivalent - CO₂e**: indicates, for any greenhouse gas, the amount of CO₂ with equivalent global warming impact.

<table>
<thead>
<tr>
<th>GHG</th>
<th>GWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide (CO₂)</td>
<td>1</td>
</tr>
<tr>
<td>Methane (CH₄)</td>
<td>25</td>
</tr>
</tbody>
</table>

1 kg CH₄ = 25 kg CO₂e
SOME DEFINITIONS

**Embodied (embedded) carbon**: the greenhouse gas (GHG) emissions associated with the manufacture a product.

**Carbon neutral**: CO₂ released into the atmosphere from an activity/product/etc. is balanced by removing an equivalent amount.

**Climate positive**: describes an activity/product etc. that goes beyond carbon neutral emissions by removing additional carbon dioxide from the atmosphere (Carbon negative).

**Net zero carbon emissions**: state in which the greenhouse gasses released into the atmosphere by human activity are balanced by removals from the atmosphere (so that the final balance is zero).

**Race to net zero**: actions/commitment to cut greenhouse gas emissions, at global level, to as close to zero as possible by 2050.
**Carbon Storage in Wooden Furniture**

**Introduction**

\[
\text{CO}_2
\]

Molecular mass \(\text{CO}_2\) (u) = 44,010

\[
m_{\text{CO}_2} = m_C + 2 \cdot m_O
\]

\[
m_{\text{CO}_2} \text{ (u)} = 12,017 + 2 \cdot 15,999
\]
6 CO₂ (carbon dioxide) + 6 H₂O (water) + Light → C₆H₁₂O₆ (sugar molecule) + 6 O₂ (oxygen)
Carbon storage in non-certified and certified forests

CARBON STORAGE AND SUSTAINABLY MANAGED FORESTS

- SUSTAINABLE FOREST MANAGEMENT OPENS THE WAY TO THE ECOLOGICAL VALUES OF WOOD-BASED PRODUCTS
- MITIGATION OF NATURAL DISTURBANCES (E.G., FIRES)
- SPECIES RICHNESS SEEMS CORRELATED TO CARBON STOCK
- IMPROVING FOREST MANAGEMENT CAN STRONGLY CONTRIBUTE TO C STORAGE
CARBON STORAGE AND SUSTAINABLY MANAGED FORESTS

CRITERION 1: Maintenance or appropriate enhancement of forest resources and their contribution to the global carbon cycle

8.1 The standard requires that the quantity and quality of the forest resources and the capacity of the forest to store and sequester carbon shall be safeguarded [...].

CRITERION 2: Maintenance of forest ecosystem health and vitality

8.2 The standard requires that adequate genetic, species and structural diversity shall be encouraged or maintained to enhance the stability, vitality and resilience of the forests to adverse environmental factors and strengthen natural regulation mechanisms.

https://pefc.org/standards-implementation/standards-and-guides
FROM FORESTS TO WOOD

RAW MATERIAL

SEMIFINISHED PRODUCTS

FINISHED PRODUCTS
“[…] People should be able to feel, see and experience the European Green Deal. Whether thanks to a construction industry that uses natural materials such as wood or bamboo. Or architecture that adopts near-natural forms and construction principles, that considers ecosystems from the outset, that enables and plans for sustainability and reusability […]”.

Wooden products lock in carbon throughout their lifetimes, helping to combat climate change.
CARBON STORAGE IS PART OF THE CARBON FOOTPRINT

- Chemical composition and density
- Dimensions
- Wood percentage
- Service life, reuse, recycle
COEFFICIENT CONSIDERING THE ATOMIC MASS OF C IN THE CO₂ MOLECULE

\[ P_{CO_2} = 3.67 \cdot 0.5 \cdot \frac{\rho_\omega \cdot V}{1 + \frac{\omega}{100}} \]

AMOUNT OF CARBON DIOXIDE SEQUESTERED BY THE PRODUCT (KG)

DENSITY (KG/M³)

VOLUME (M³), NOTE: PRODUCT’S VOLUME X WOOD PERCENTAGE

C FRACTION IN WOOD

WOOD MOISTURE CONTENT (%)

CARBON STORAGE IN WOODEN FURNITURE
1 cubic meter of spruce solid wood

$$P_{CO_2} = 3.67 \times 0.5 \times \frac{460 \times 1}{1.12} = 1.835 \times 410,714 = 754 \text{ kg}$$

1 cubic meter of birch solid wood

$$P_{CO_2} = 3.67 \times 0.5 \times \frac{660 \times 1}{1.12} = 1.835 \times 589,286 = 1081 \text{ kg}$$

For wood-based products (WBP), the fraction of wood in the WBP has to be calculated.
An example from a scientific case study

AN EXAMPLE FROM A SCIENTIFIC CASE STUDY

ENTIRE APARTMENT: 3,500 kg of CO$_2$ sequestered in 77 m$^2$
ENTIRE APARTMENT: 3,500 kg of CO₂ sequestered in 77 m²
AN EXAMPLE FROM A SCIENTIFIC CASE STUDY

Case study without parquet flooring

Case study with the ‘addition’ of parquet flooring in bathroom and kitchen, and wooden windows

Carbon storage in wooden furniture
**Cascading principle:** “Under this principle, wood is used in the following order of priorities: 1) wood-based products, 2) extending their service life, 3) re-use, 4) recycling, 5) bio-energy and 6) disposal”. [EU forest strategy]
In the furniture sector, the cascading use involves various design aspects: whether or not to use wood, how much, which wood-based products, etc.

Cascading use of wood

Before (step 1)  
After (step 3-6)  
Service life (step 2)
Suppliers develop carbon negative products or services

Carbon removals are verified, and certificates issued

Companies purchase and retire certificates

https://puro.earth/
Presentazione del progetto Legno Clima

Nato da una intuizione iniziale di FederlegnoArredo, il progetto Legno Clima ha sviluppato una metodologia per la contabilità del carbonio stoccato nei prodotti legnosi generati con legno vergine nazionale: tale metodologia è gestita da una piattaforma digitale “web based” che permette l’inserimento dei dati di produzione da parte delle Aziende nazionali del settore del legno opportunamente registrate, al fine di monitorare i flussi di produzione degli HWP e di tracciare lo stoccaggio carbonioso da essi operati lungo intervalli temporali definiti.

Le finalità di tale contabilità e – più in generale- dell’intero Progetto Legno Clima sono:

- valorizzare il ruolo delle aziende nazionali della filiera legno nell’ambito del contrasto al cambiamento climatico, associando a ciascuna il quantitativo di carbonio stoccato nei prodotti legnosi da essa prodotta;
- supportare la realizzazione di statistiche nazionali di produzione legnosa (in sostituzione delle statistiche ISTAT, oggi non più realizzate);
- favorire “l’aumento dell’utilizzo sostenibile di prodotti legnosi può limitare sostanzialmente le emissioni e aumentare gli assorbimenti di gas a effetto serra dall’atmosfera” (da Decisione 529/2013/UE).

Le Aziende coinvolte sono primariamente quelle appartenenti al circuito confindustriale di FederlegnoArredo (FLA), in quanto associate ad una delle Associazioni di categoria federate in FLA medesima.

https://www.conlegno.eu/legnoclima
CONCLUSION

FINAL REMARKS (just to pick some)

Carbon storage is part of the carbon footprint

Wooden furniture can considerably contribute in the race to net zero

To companies, carbon storage in wooden furniture is relevant both for ethical and marketing reasons.
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https://www.researchgate.net/profile/Francesco-Negro-7