# Promoting the Environmental Credentials of American Hardwoods

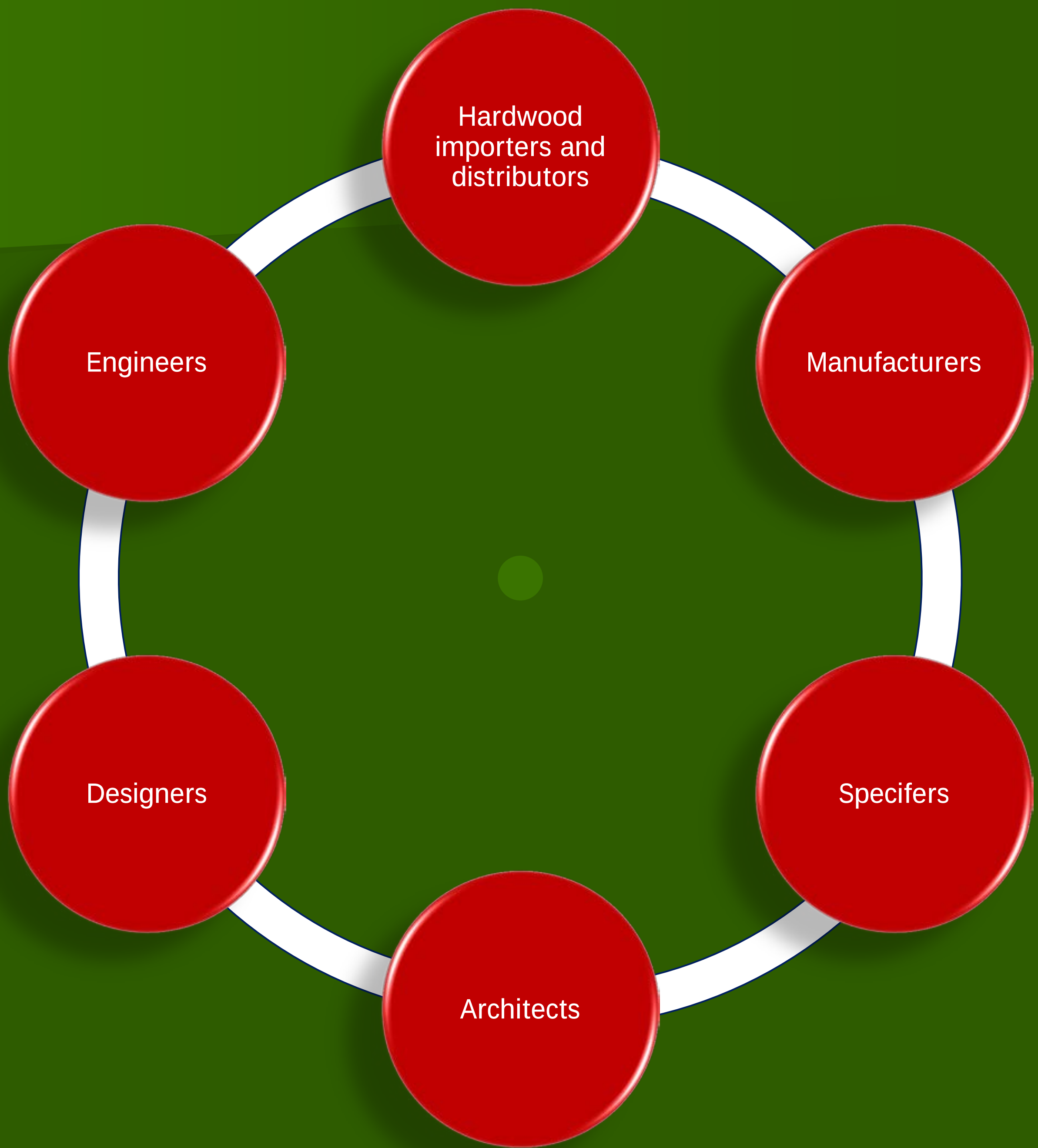
AMERICAN HARDWOOD EXPORT COUNCIL®

**Michael Snow**
**American Hardwood Export Council**

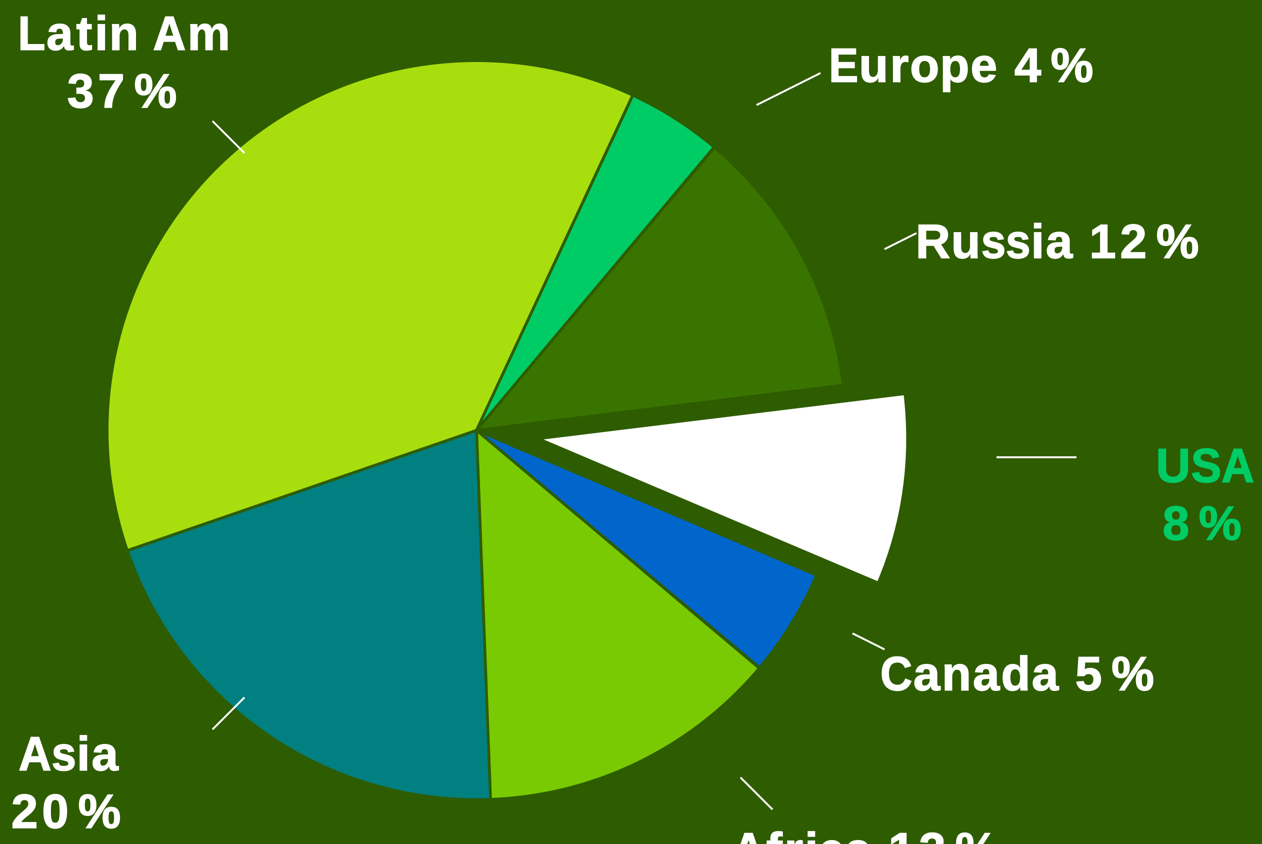
**July 2015**

**www.americanhardwood.org**

# AHEC's Global Reach

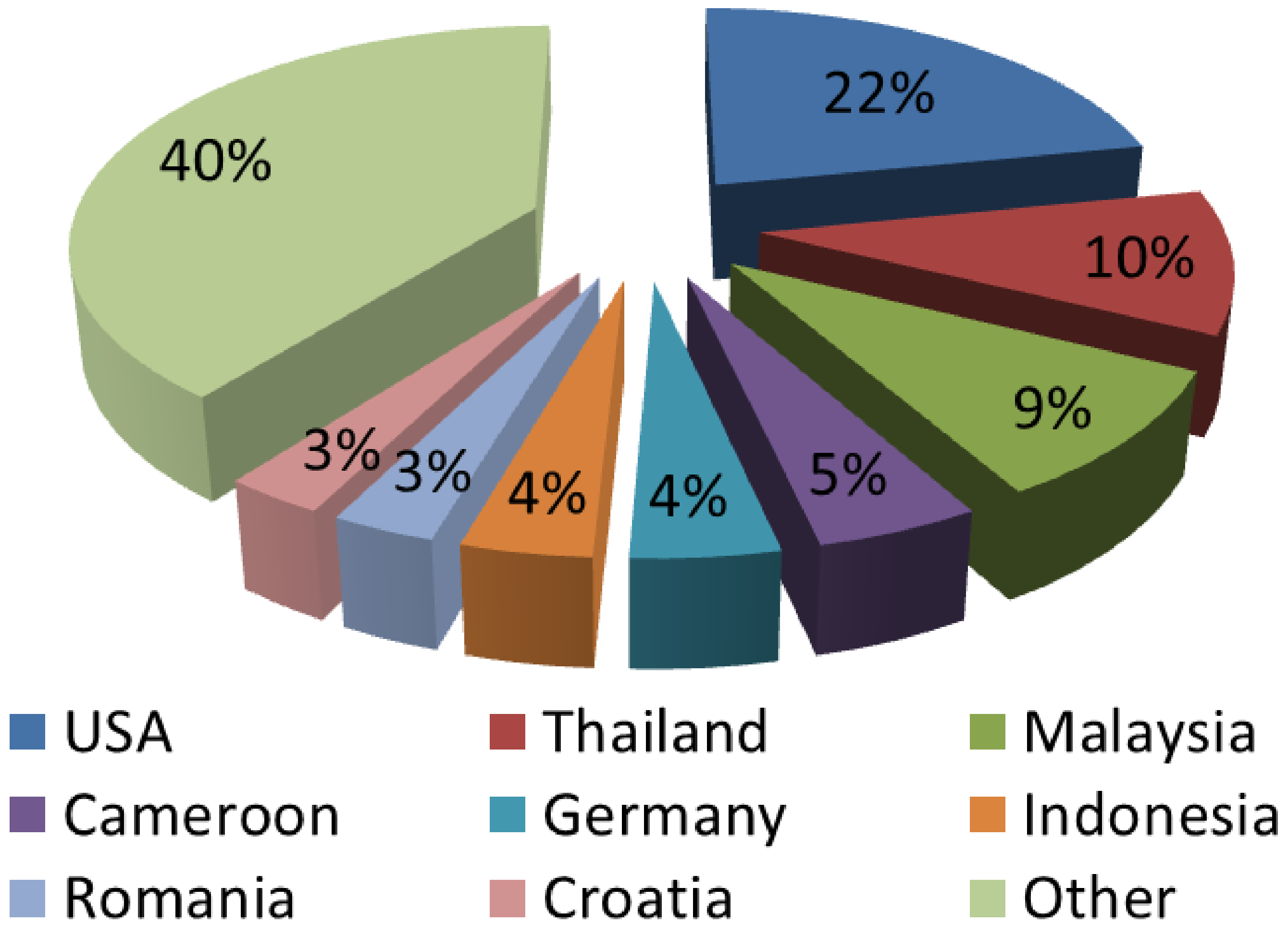

Hardwood importers and distributors
Manufacturers
Specifers
Architects
Designers
Engineers

# Global Hardwood Forests

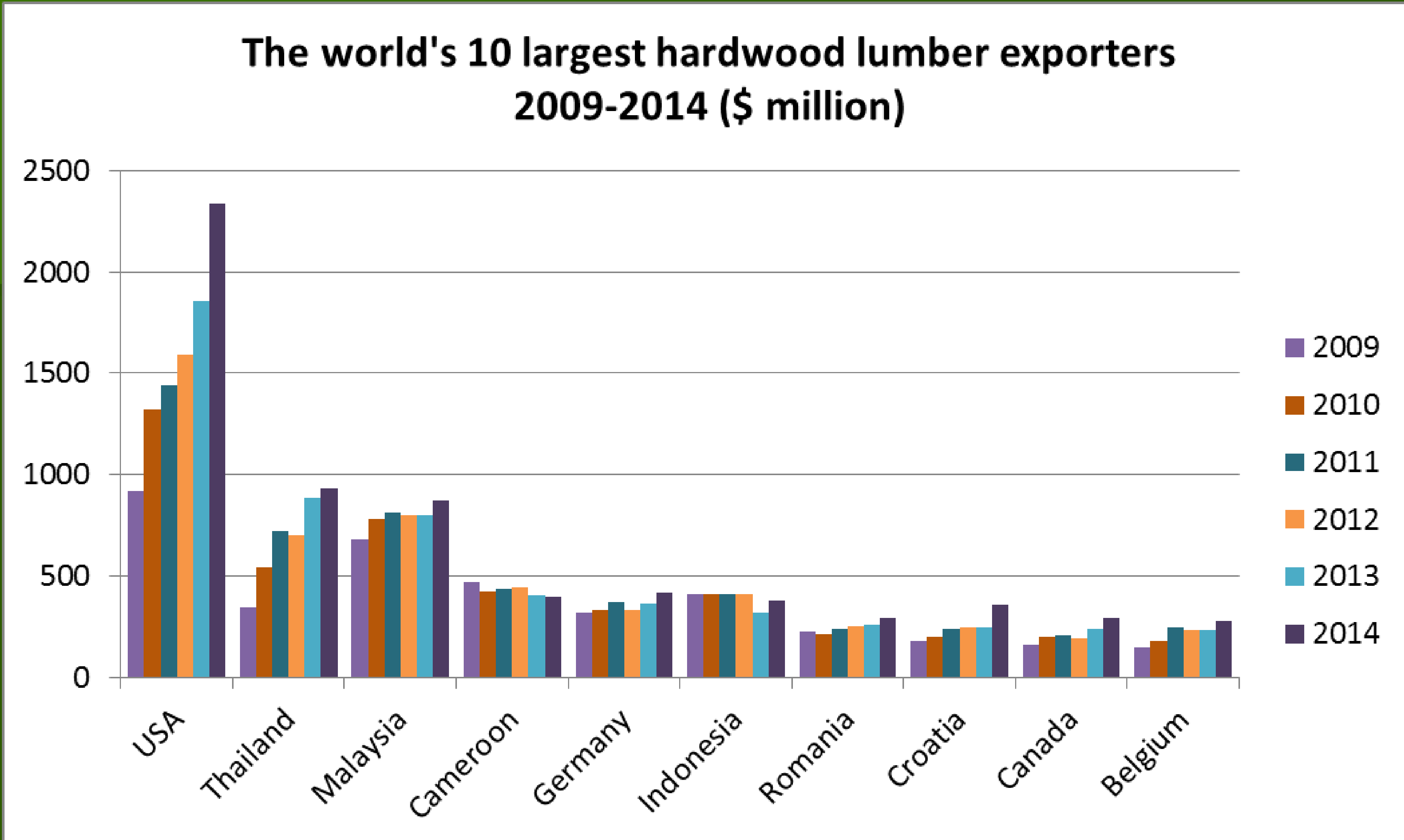



Source: FAO

# Share of global hardwood lumber trade in 2013 ($ value)




*Source: Global Trade Atlas & FAO Forstat*




*Source: Global Trade Atlas & Eurostat*

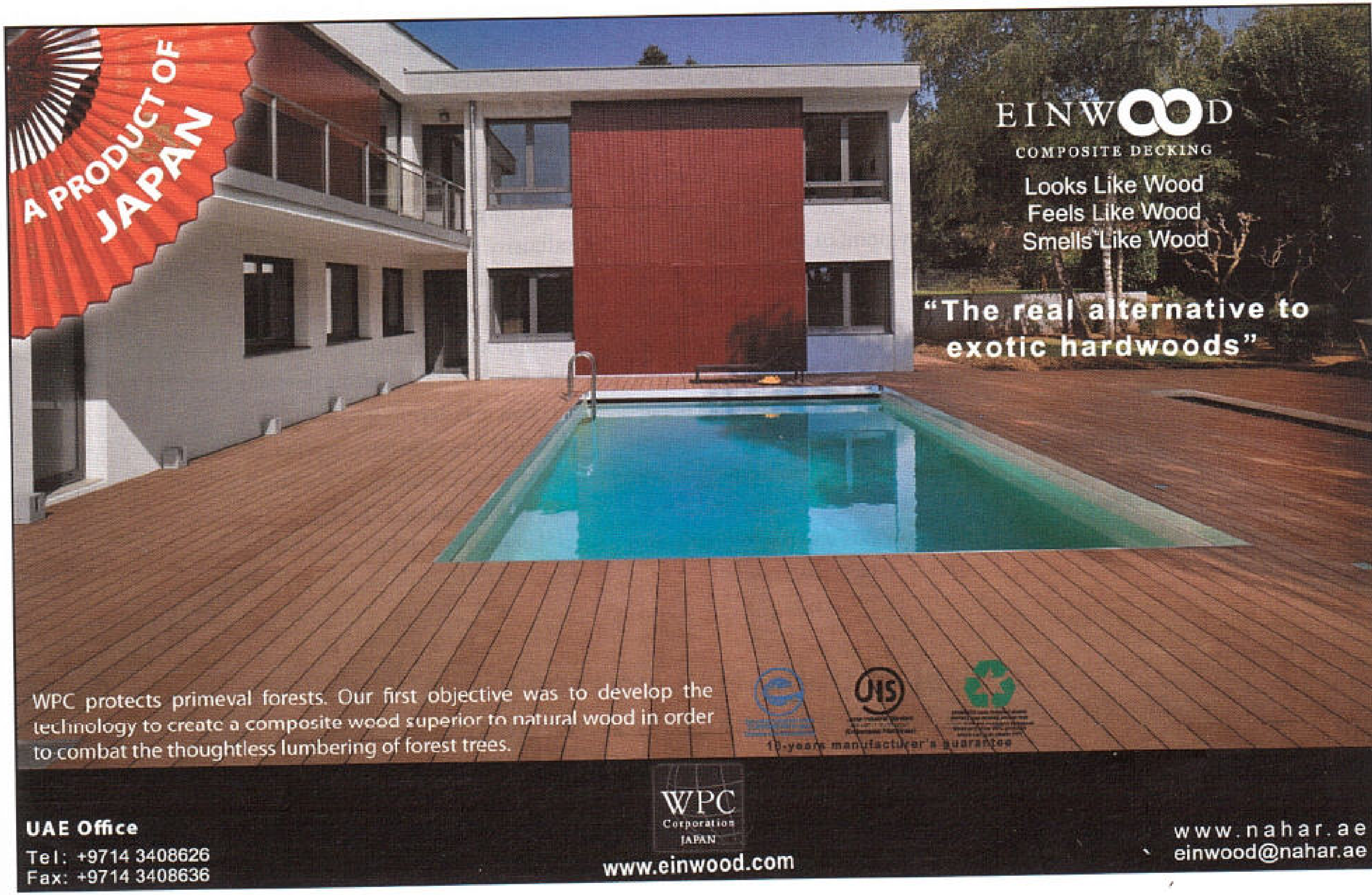
# Consumer Confusion……….

# SAY NO TO WOOD.

# SAY YES TO KALINGASTONE.

## AND, DO YOUR BIT TO CONSERVE NATURE.

Use of wood leads to deforestation and massive destruction of nature.
Use our engineered stone and show your commitment to conservation of nature.
Our engineered marble and quartz collection is maintenance free and long lasting,
and thus has become the preference of architects and interior designers globally,
rapidly becoming an identity for CMC in India. Get high quality
engineered stone from Kalingastone.


A PRODUCT OF JAPAN
EINWOOD
COMPOSITE DECKING
Looks Like Wood
Feels Like Wood
Smells Like Wood
"The real alternative to exotic hardwoods"
WPC protects primeval forests. Our first objective was to develop the technology to create a composite wood superior to natural wood in order to combat the thoughtless lumbering of forest trees.
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UAE Office
Tel: +9714 3408626
Fax: +9714 3408636
WPC Corporation JAPAN
www.einwood.com
www.nahar.ae
einwood@nahar.ae


We may run out of wood but not
Aluminium
Well at least not for the next 200 year
Century Extrusions Ltd (CEL) commenced commerc
operations in April 1991. The Company has extrusion manufacturi
facility spread over an area of 7.31 Acres at Kharagpur (West Beng
India, with an installed capacity of 15000 M.T. per annu
THE COMPANY
The company has three extrusion lines with presses of capaciti
2700 M.T. & 1620 M.T. (UBE, Japan) and 1250 M.T. (Indigenous)
cater to a very large range of extrusions. These presses are capable
producing extrusions in alloys ranging from 1xxx to 7xxx serie
The Company has complete in-house facilities f
Die manufacturing and for Heat Treatment of Dies. Remelt Sh
for manufacture of Billets besides the facilities for Extrusi
and Quality Assurance.
PRODUCT RANGE
The Company manufactures and supplies extrusions for vario
applications, such as Architecture, Road Transport Vehicles, Railway
Electrical & Electronic Applications, Consumer Durables, Irrigatio
General Engineering, Defence applications, etc.
The Company has an inventory of more than 6000 Di
to manufacture more than 4000 different profiles.
QUALITY ASSURANCE
The Company has an excellent Quality Management Syste
The Plant has been accredited with ISO-9001:2008 for its quality syste
by DNV, The Netherlands.
The Company usually supplies extrusions as per the toleranc
prescribed by the Bureau of Indian Standards (BIS). The Company
well equipped to supply extrusions as per the tolerances specified
other similar standards such as BS, DIN & others and also as p
customers' specifications, by mutual agreement.
MARKET NETWORK
The Company has market presence all over India with its Marketi
Offices in North, South, East & West Regions.
CEL
CENTURY EXTRUSIONS LIMITED
113, Park Street, 'N' Block, 2nd Floor,
Kolkata-700 016
Tel : +91 33 2229 1012/1291 Fax : +91 33 2249 5656
Email : marketing@centuryextrusions.com
Regional offices :
Bengaluru • Chennai • Delhi • Kolkata • Mumbai
Website : www.centuryextrusions.com

# Bauxite “sludge” in Hungary 2010

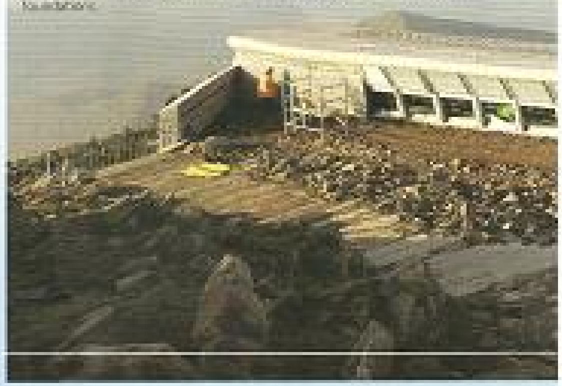
# Steel: the ultimate sustainable material

**The sustainable qualities of steel are built in to the material. Simply choosing steel as a building material enables specifiers to deliver unrivalled sustainability performance – for life, and for all its subsequent lives.**

Manufactured from the most abundant element on earth, iron, steel can be recycled or reused endlessly without detriment to its properties. Its superior strength-to-weight ratio means a little steel goes a long way, giving architects complete flexibility to achieve their most ambitious designs. Manufactured in a controlled factory environment, pre-engineered steel components are delivered to site ready for rapid assembly, with no waste.

Steel can be re-used repeatedly without ever losing its qualities as a building material. This unique characteristic gives all steel a high value at all stages of its life cycle. The recovery infrastructure for steel recycling is highly developed and highly efficient, and has been in place for decades. Current recycling and reuse rates in the UK are 99 per cent for structural steelwork and 94 per cent for all steel construction products – figures that far exceed those for any other construction material.

Significant environmental damage can be caused at the end of a building's life when it has to be demolished and its materials scrapped. Steel-framed buildings, however, do not decay, and are easily adaptable if the configuration of the building needs to change. The ability of steel to bridge long spans means that steel buildings contain large open-plan spaces which are easily reconfigured with partition walls. The steel frame itself can be adapted, with parts added or taken away, and its light weight means that extra floors can often be added without overloading existing foundations.



## The thermal mass myth

Research shows that the optimum floor thickness required to achieve an effective thermal mass is readily delivered by steel-framed buildings. There is a common misconception that buildings must be heavyweight to achieve an optimum thermal mass. This myth has probably arisen because buildings such as churches are cool in the summer. However, the main reason that churches stay cool is because they have very few windows, which reduces solar gain.

In modern buildings, the greatest accessible mass is found in the concrete floor slab. Independent research has shown that the optimum thickness of concrete floor slab for providing thermal mass is 75-100mm. This thickness of concrete floor slab is routinely available in almost all steel-framed buildings, which are generally the lightest weight form of construction.

The extra weight associated with heavy, bulky concrete frames is not required to improve thermal mass and is surplus to requirements. In fact, the extra mass of heavyweight concrete components may actually increase the energy required to heat and cool the building.

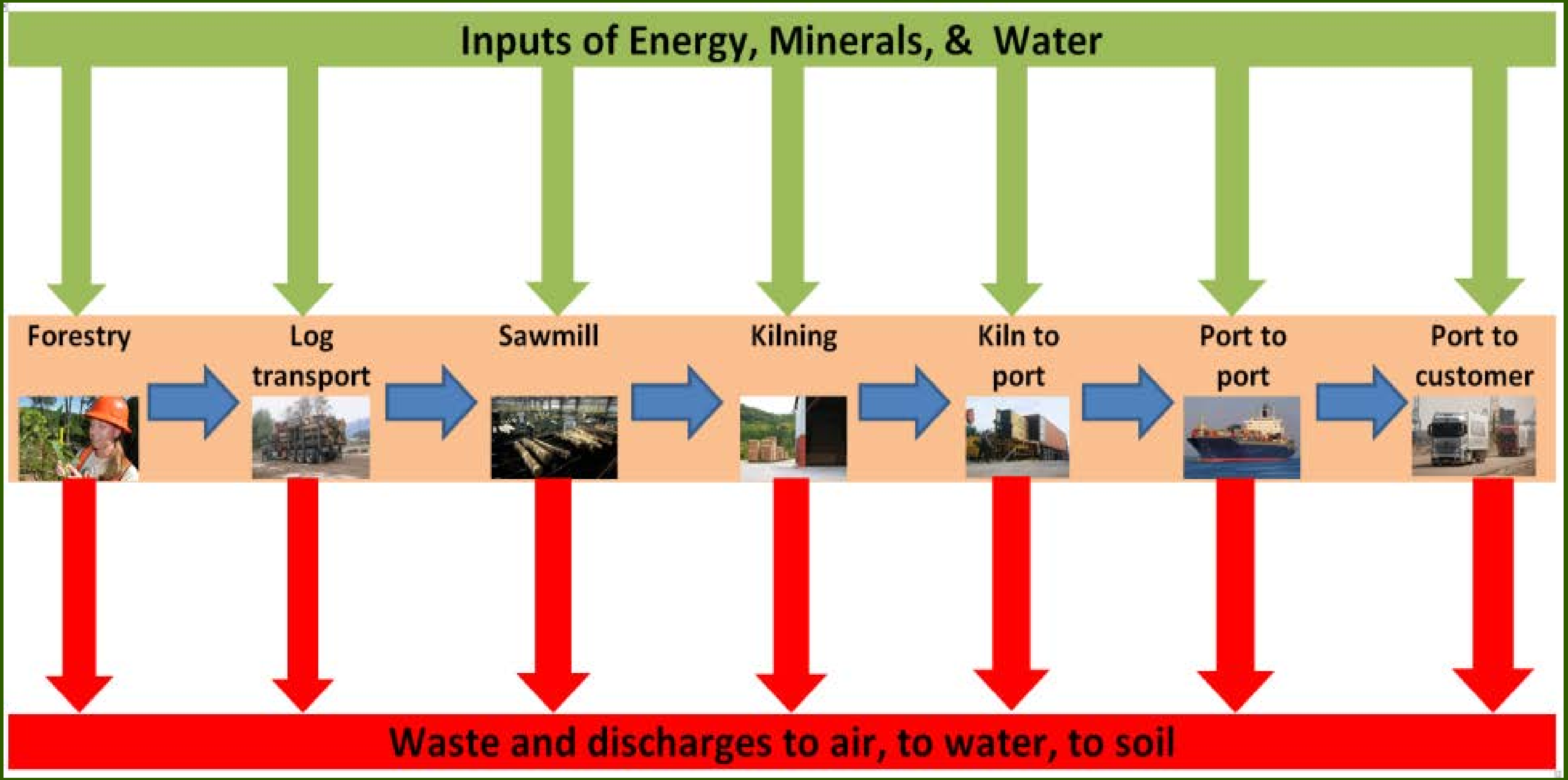
For more information visit www.constructionalsteel.com/thermalmass

# Strip mining for iron ore……

# Low environmental impact?????

# Compiling Life Cycle Inventory data

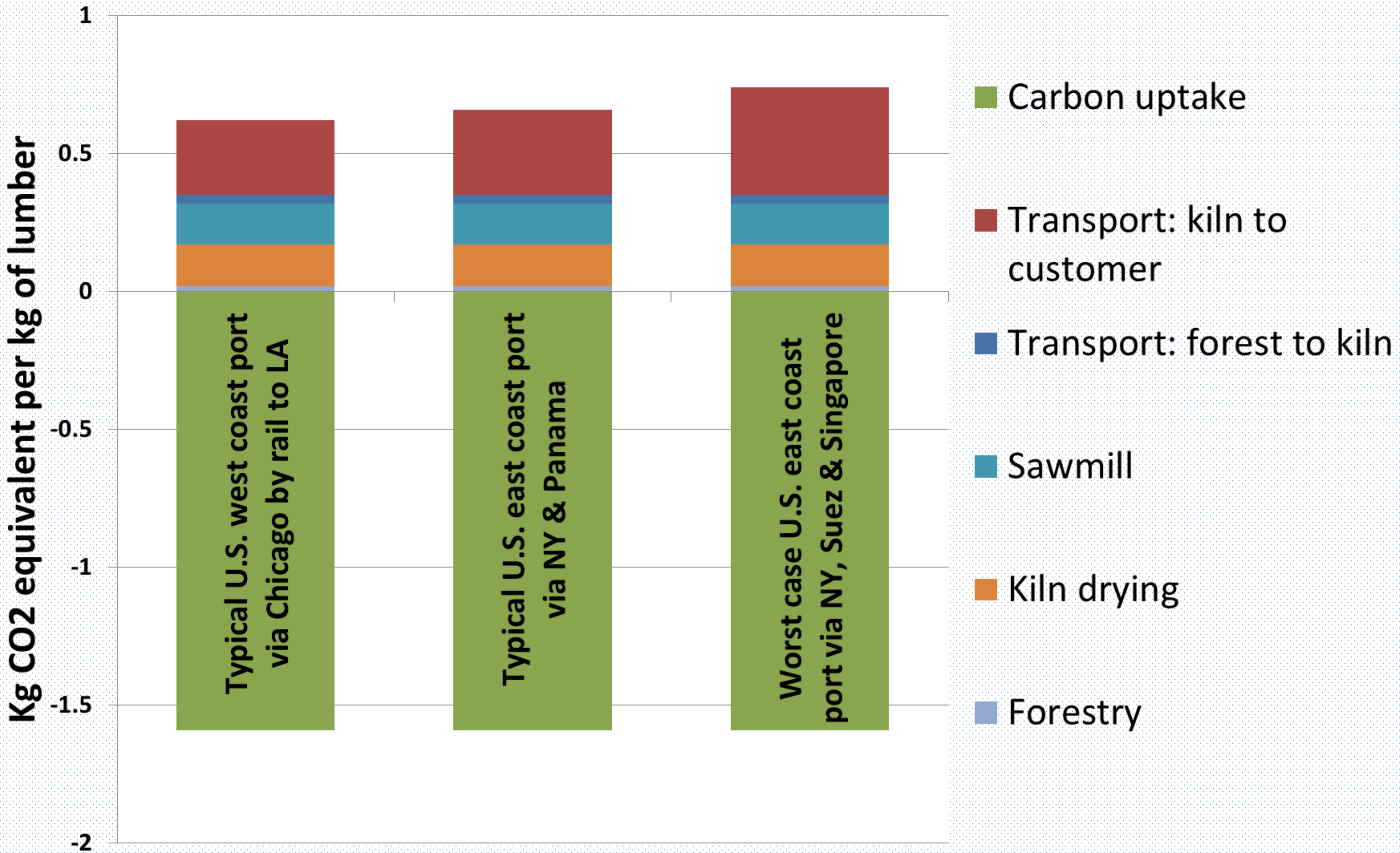
- Identify and describe unit processes, gather data on wood flow, energy/material inputs & outputs of product, waste and emissions
- Data from companies combined with existing public & commercial databases



# LCA Impact Categories

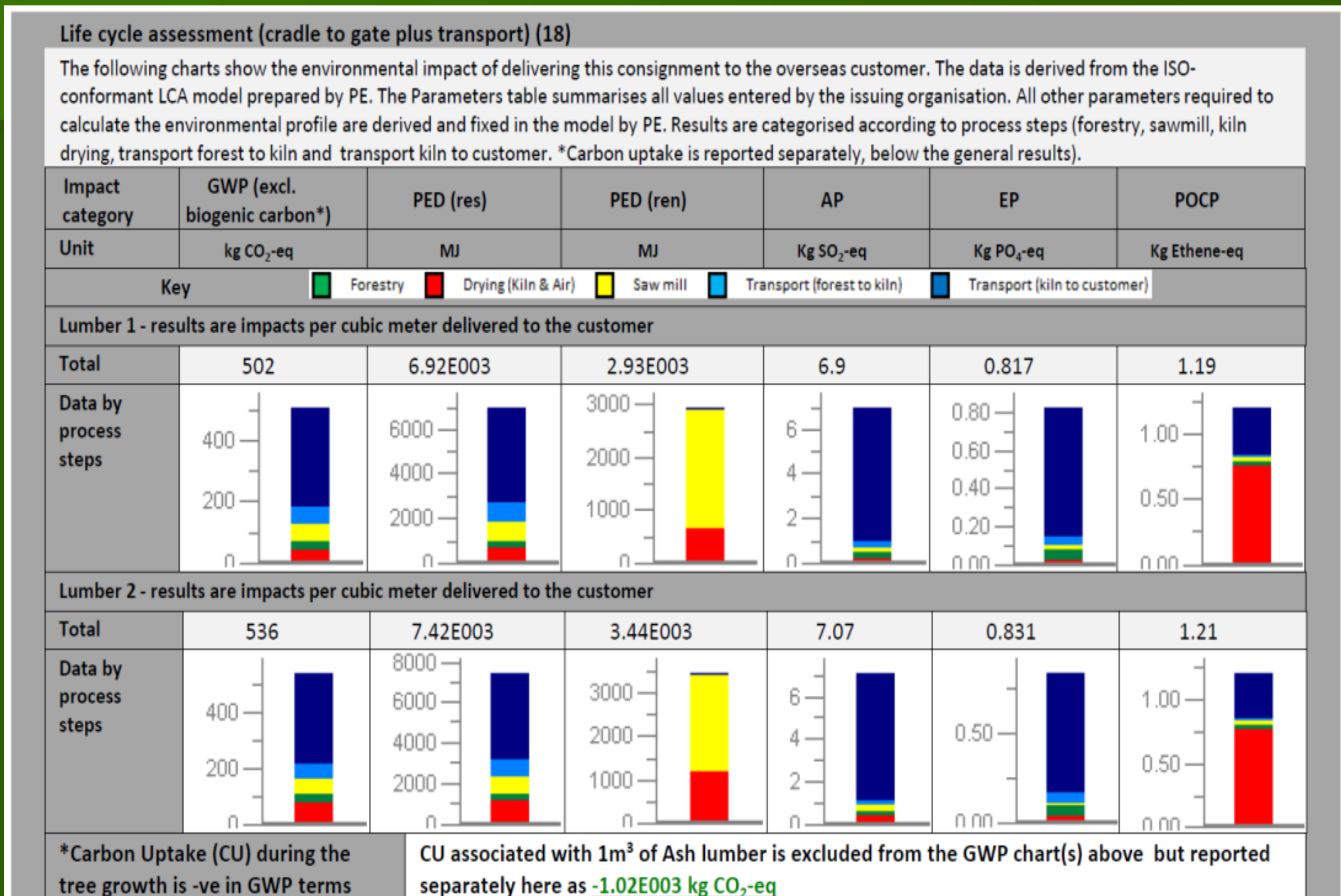
| Icon | Name | Description | Units of measurement |
|---|---|---|---|
| | **Embodied energy – not renewable** | Energy from fossil fuels | MJ |
| | **Embodied energy – renewable** | Energy from renewable sources | MJ |
| | **Greenhouse potential** | Emissions that contribute to climate change | kg $CO_2$ equivalent |
| | **Acidification potential** | Emissions that damage vegetation, buildings, aquatic life, and human health | kg $SO_2$ equivalent |
| | **Ozone depletion potential** | Emissions that cause thinning of the earth's stratospheric ozone layer adversely affecting human health, natural resources and the environment | kg R11 equivalent |
| | **Eutrophication potential** | Emissions that increase the nutrients in water or soil affecting the natural biological balance | kg phosphate equivalent |
| | **Photochemical ozone creation potential** | Emissions of chemicals that cause smog, adversely affecting human health, ecosystems and crops | kg ethene potential |
| | **Human toxicity potential** | Emissions of materials toxic to humans, animals or plants | kg DCB equivalent |

# Global Warming Potential (Carbon Footprint) of 1" KD US ash lumber for different transport routes to China




*Derived from PE/AHEC ireport*

# Important factors about LCA



Life cycle assessment (cradle to gate plus transport) (18)

The following charts show the environmental impact of delivering this consignment to the overseas customer. The data is derived from the ISO-conformant LCA model prepared by PE. The Parameters table summarises all values entered by the issuing organisation. All other parameters required to calculate the environmental profile are derived and fixed in the model by PE. Results are categorised according to process steps (forestry, sawmill, kiln drying, transport forest to kiln and transport kiln to customer. *Carbon uptake is reported separately, below the general results).

| Impact category | GWP (excl. biogenic carbon*) | PED (res) | PED (ren) | AP | EP | POCP |
|---|---|---|---|---|---|---|
| Unit | kg $CO_2$-eq | MJ | MJ | Kg $SO_2$-eq | Kg $PO_4$-eq | Kg Ethene-eq |
| Key | Forestry | Drying (Kiln & Air) | Saw mill | Transport (forest to kiln) | Transport (kiln to customer) | |
| Lumber 1 - results are impacts per cubic meter delivered to the customer | | | | | | |
| Total | 502 | 6.92E003 | 2.93E003 | 6.9 | 0.817 | 1.19 |
| Data by process steps | | | | | | |
| Lumber 2 - results are impacts per cubic meter delivered to the customer | | | | | | |
| Total | 536 | 7.42E003 | 3.44E003 | 7.07 | 0.831 | 1.21 |
| Data by process steps | | | | | | |

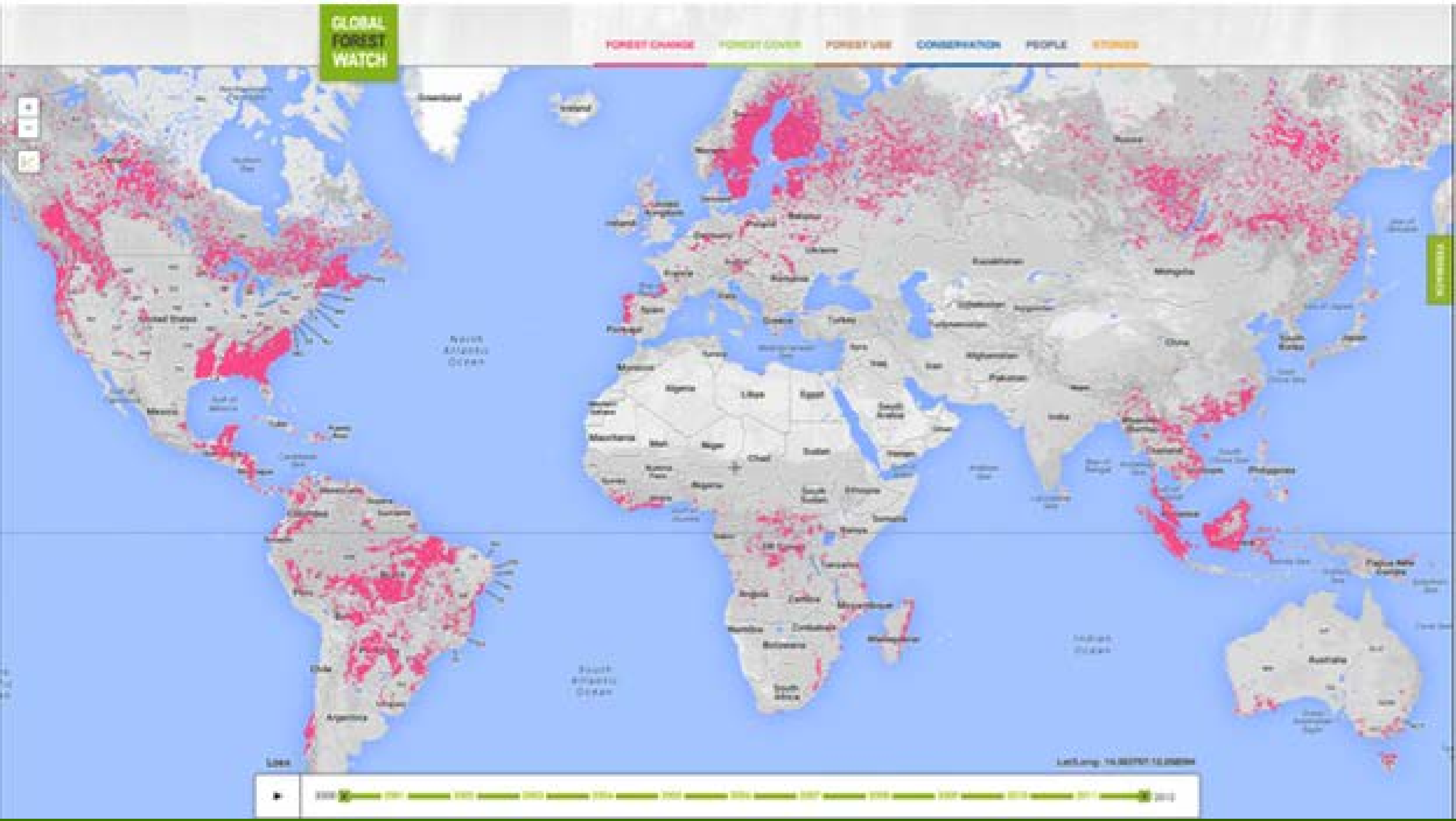
| *Carbon Uptake (CU) during the tree growth is -ve in GWP terms | CU associated with 1m³ of Ash lumber is excluded from the GWP chart(s) above but reported separately here as -1.02E003 kg $CO_2$-eq |
|---|---|

- Science based
- International standards (ISO 14040)
- Broad range of impacts not just carbon footprint
- Helps industries improve efficiency
- Basis for EPD's on products and materials

# EPDs

Nutrition Facts
Serving Size 1 Tbsp (14g)
Servings per container 30
Amount Per Serving
Calories 50 Calories from Fat 45
% Daily Value*
8%
Total Fat 5g
5%
Saturated Fat 1g
Trans Fat 0g
Polyunsaturated Fat 2.5g
Monounsaturated Fat 1g
Cholesterol 0mg 0%
Sodium 65mg 4%
Total Carbohydrate 0g 0%
Protein 0g
Compare For Yourself!
Per Serving
ICBINB! Light
Butter
Calories 50 100
Fat 5g 11g
Sat. Fat 1g 7g
Trans Fat 0g 0g
Cholest. 0mg 30mg
Naturally Cholesterol Free
GLUTEN-FREE

# But… perception that wood is scarce




**<u>AP Wire/BBC News, February 23, 2014</u>: "A new global monitoring system has been launched that promises "near real time" information on deforestation around the world. Forest campaigners say this is the equivalent of 50 football fields of trees being cut down, every minute of every day over the past 12 years."**

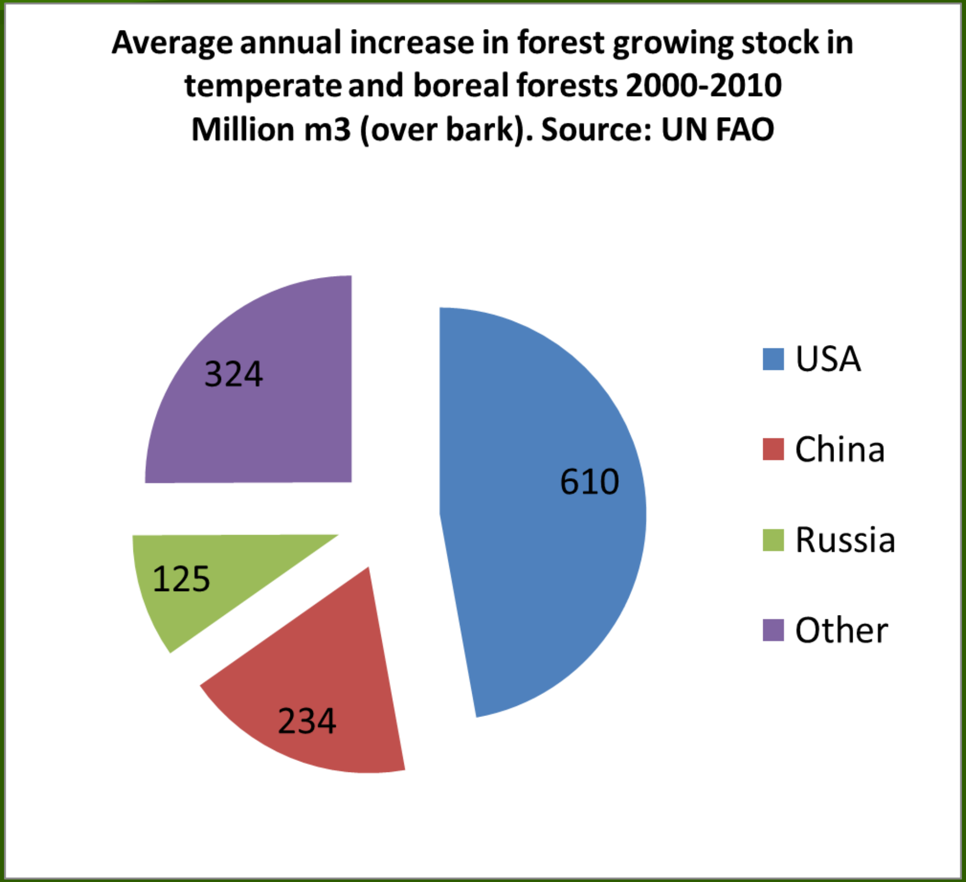
# A fence to the sun and back...

- During the 1990s, volume of wood standing in temperate and boreal forests increased by 21,000 million m3.
- That’s enough wood to build a 1m x 8cm fence to the sun and back (or 7500 times round the earth)

# 58 million houses a year....

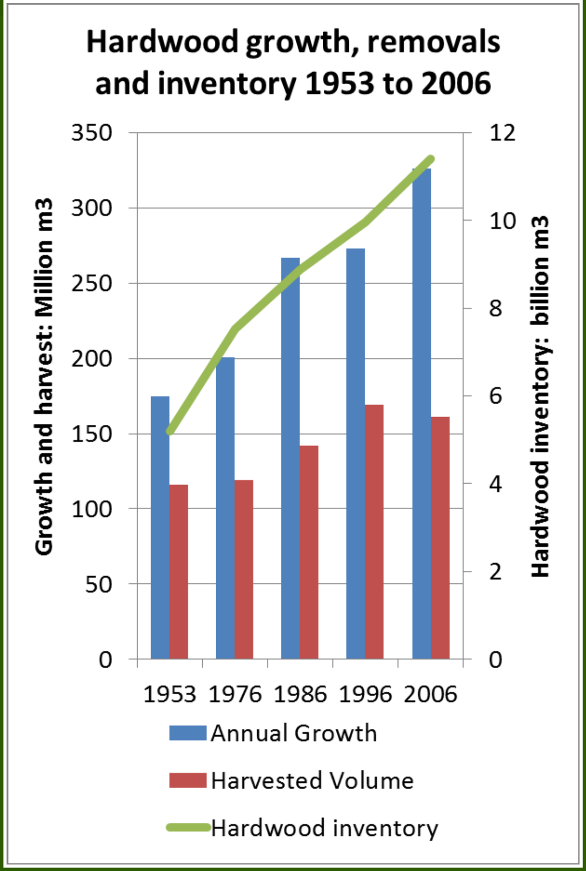
- Between 2000 and 2010, volume of wood standing in temperate and boreal forests increased by 1290 million m3 per year
- Enough to build 58 million two storey timber frame houses every year (assumes 50% conversion & 11 m3 per house)
- Global  housing starts = approx 36 million/ann.

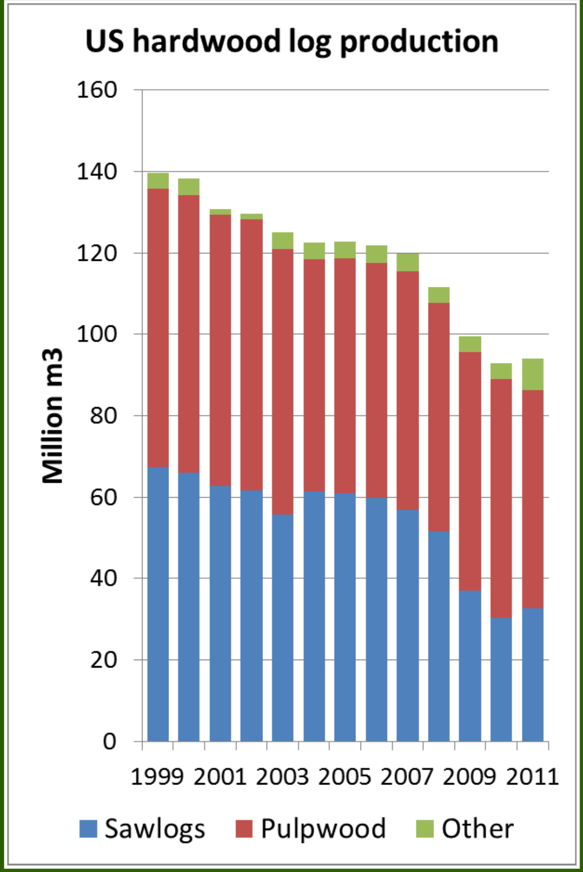
# Much of the increase in forest growing stock is in the USA

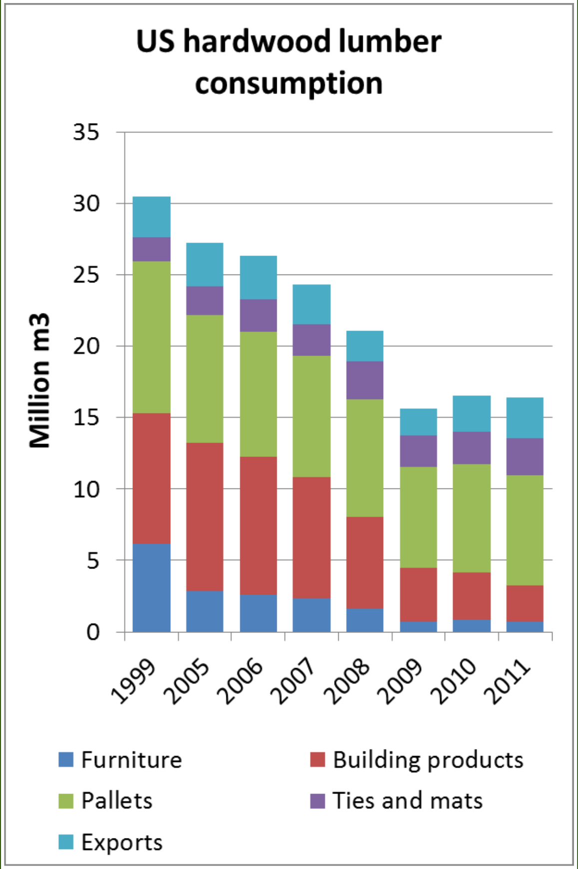


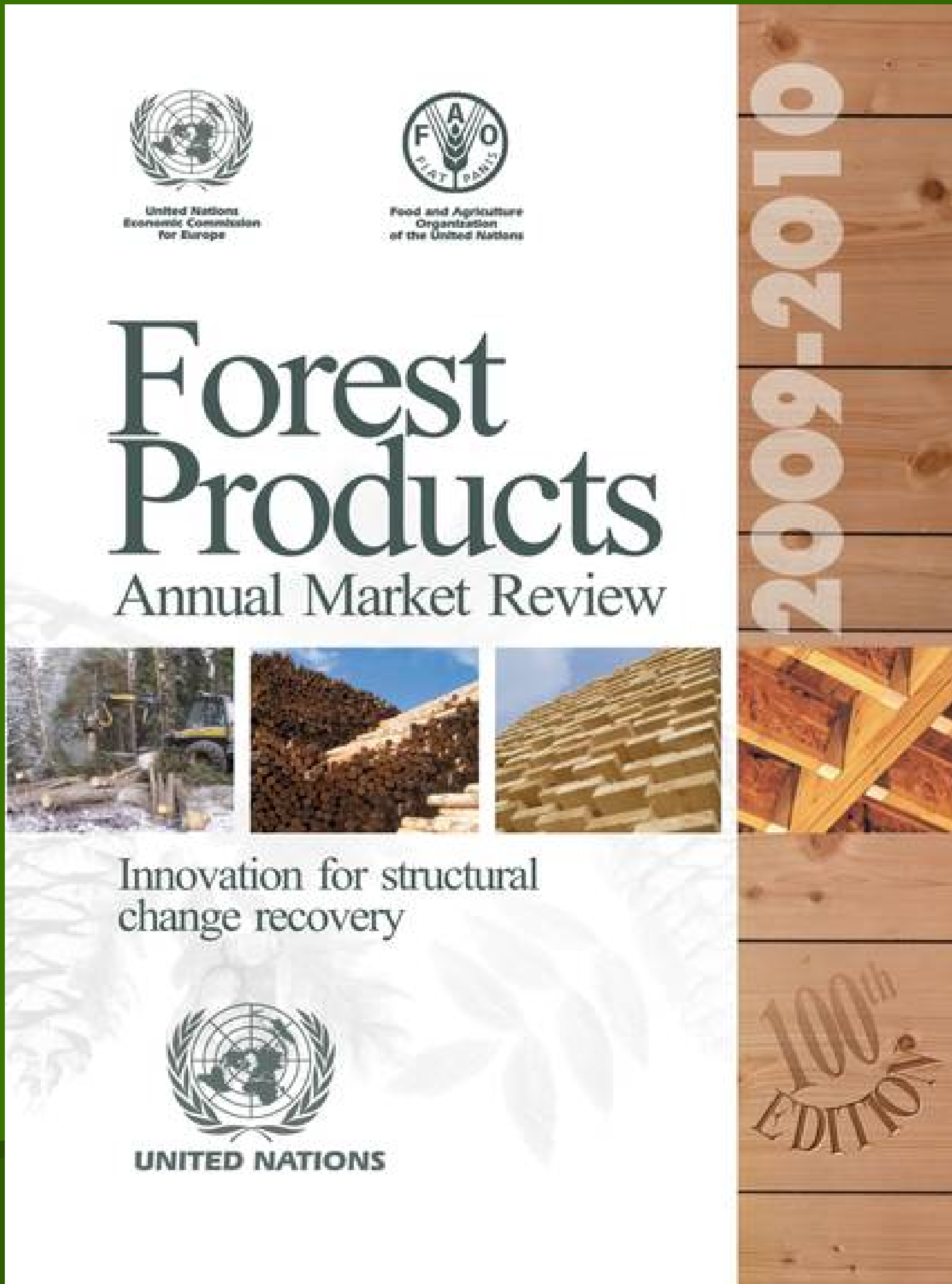

- Volume of wood standing in US forests increased by 610 million m3 per year between 2000 and 2010 according to FAO Forest Resource Assessment

# US hardwood is under-utilised






**"…there is growing concern that the US hardwood resource is now being severely underutilized"**

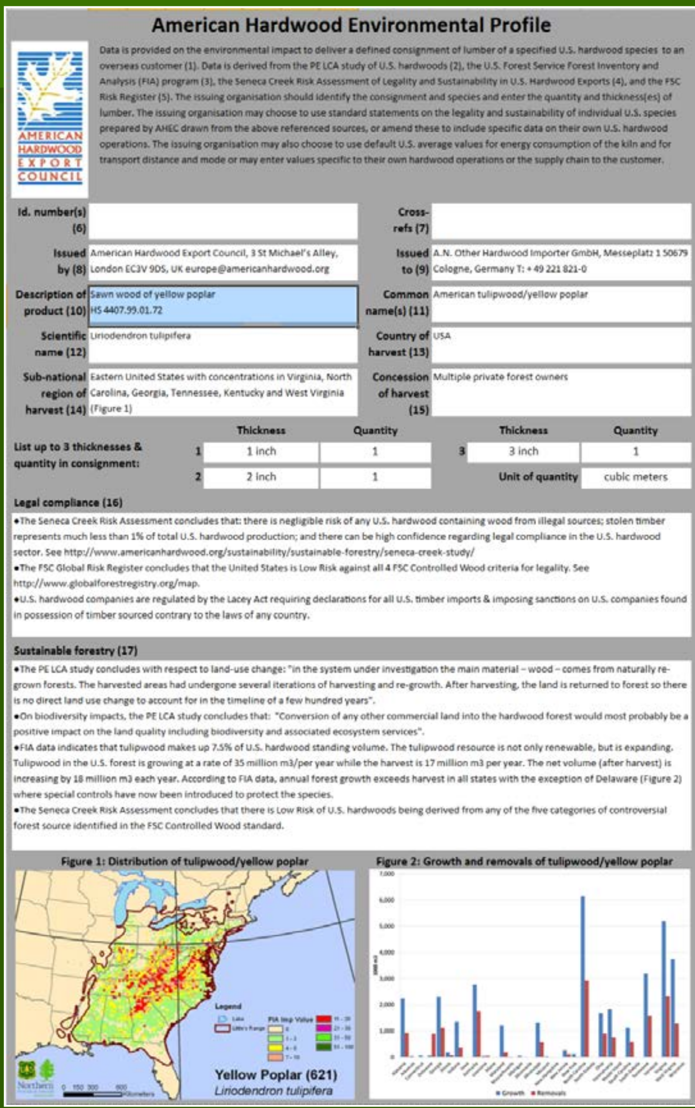
# Growth-Removal Ratios, 2012

- Hardwood Growth to Removal is 2.4 to 1
- Softwood Growth to Removal is 1.9 to 1
- Hardwood Details:
  - Growth 304 million $m^3$
  - Removals 128 million $m^3$
  - Mortality 109 million $m^3$

(Source: Forest Resources of the United States, 2012; U.S. Department of Agriculture, Forest Service, Gen. Tech. Rep. Draft Review).

**Mortality before harvesting leads to the release of *160 million tons of $CO_2$* to the atmosphere**

# Consignment-based *American Hardwood Environmental Profile* (AHEP)



## American Hardwood Environmental Profile

AMERICAN HARDWOOD EXPORT COUNCIL

Data is provided on the environmental impact to deliver a defined consignment of lumber of a specified U.S. hardwood species to an overseas customer (1). Data is derived from the PE LCA study of U.S. hardwoods (2), the U.S. Forest Service Forest Inventory and Analysis (FIA) program (3), the Seneca Creek Risk Assessment of Legality and Sustainability in U.S. Hardwood Exports (4), and the FSC Risk Register (5). The issuing organisation should identify the consignment and species and enter the quantity and thickness(es) of lumber. The issuing organisation may choose to use standard statements on the legality and sustainability of individual U.S. species prepared by AHEC drawn from the above referenced sources, or amend these to include specific data on their own U.S. hardwood operations. The issuing organisation may also choose to use default U.S. average values for energy consumption of the kiln and for transport distance and mode or may enter values specific to their own hardwood operations or the supply chain to the customer.

| | | | |
|---|---|---|---|
| Id. number(s) (6) | | Cross-refs (7) | |
| Issued by (8) | American Hardwood Export Council, 3 St Michael's Alley, London EC3V 9DS, UK europe@americanhardwood.org | Issued to (9) | A.N. Other Hardwood Importer GmbH, Messeplatz 1 50679 Cologne, Germany T: + 49 221 821-0 |
| Description of product (10) | Sawn wood of yellow poplar HS 4407.99.01.72 | Common name(s) (11) | American tulipwood/yellow poplar |
| Scientific name (12) | Liriodendron tulipifera | Country of harvest (13) | USA |
| Sub-national region of harvest (14) | Eastern United States with concentrations in Virginia, North Carolina, Georgia, Tennessee, Kentucky and West Virginia (Figure 1) | Concession of harvest (15) | Multiple private forest owners |

List up to 3 thicknesses & quantity in consignment:

| | Thickness | Quantity |
|---|---|---|
| 1 | 1 inch | 1 |
| 2 | 2 inch | 1 |
| 3 | 3 inch | 1 |
| Unit of quantity | | cubic meters |

**Legal compliance (16)**

- The Seneca Creek Risk Assessment concludes that: there is negligible risk of any U.S. hardwood containing wood from illegal sources; stolen timber represents much less than 1% of total U.S. hardwood production; and there can be high confidence regarding legal compliance in the U.S. hardwood sector. See http://www.americanhardwood.org/sustainability/sustainable-forestry/seneca-creek-study/
- The FSC Global Risk Register concludes that the United States is Low Risk against all 4 FSC Controlled Wood criteria for legality. See http://www.globalforestregistry.org/map.
- U.S. hardwood companies are regulated by the Lacey Act requiring declarations for all U.S. timber imports & imposing sanctions on U.S. companies found in possession of timber sourced contrary to the laws of any country.

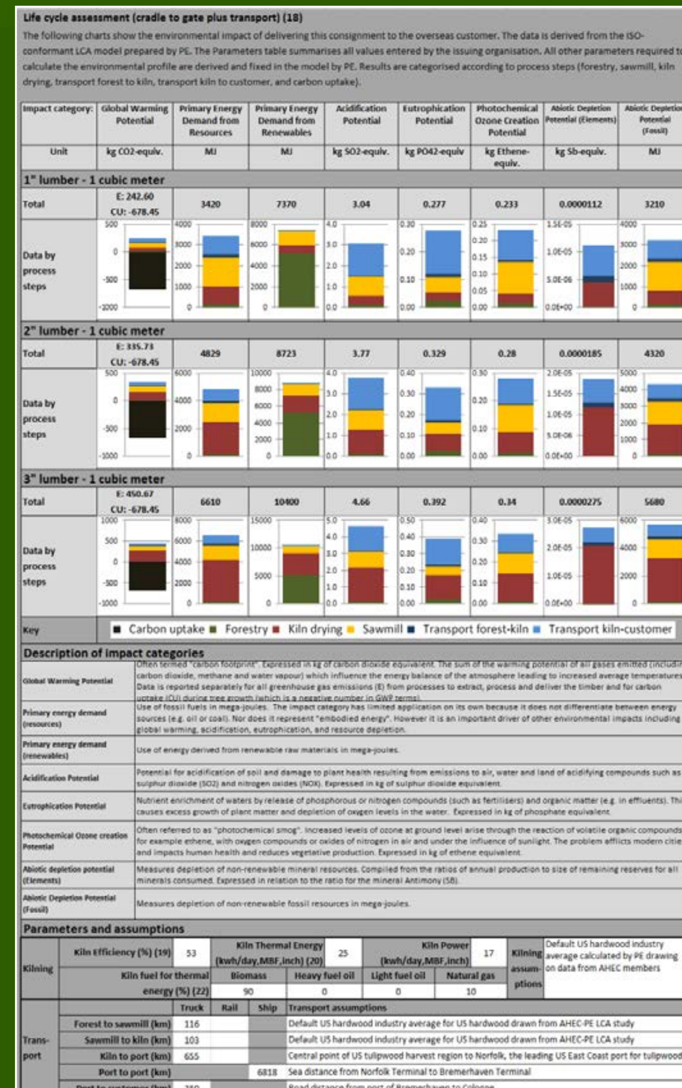
**Sustainable forestry (17)**

- The PE LCA study concludes with respect to land-use change: "in the system under investigation the main material – wood – comes from naturally re-grown forests. The harvested areas had undergone several iterations of harvesting and re-growth. After harvesting, the land is returned to forest so there is no direct land use change to account for in the timeline of a few hundred years".
- On biodiversity impacts, the PE LCA study concludes that: "Conversion of any other commercial land into the hardwood forest would most probably be a positive impact on the land quality including biodiversity and associated ecosystem services".
- FIA data indicates that tulipwood makes up 7.5% of U.S. hardwood standing volume. The tulipwood resource is not only renewable, but is expanding. Tulipwood in the U.S. forest is growing at a rate of 35 million m3/per year while the harvest is 17 million m3 per year. The net volume (after harvest) is increasing by 18 million m3 each year. According to FIA data, annual forest growth exceeds harvest in all states with the exception of Delaware (Figure 2) where special controls have now been introduced to protect the species.
- The Seneca Creek Risk Assessment concludes that there is Low Risk of U.S. hardwoods being derived from any of the five categories of controversial forest source identified in the FSC Controlled Wood standard.

Figure 1: Distribution of tulipwood/yellow poplar

Yellow Poplar (621)
*Liriodendron tulipifera*

Figure 2: Growth and removals of tulipwood/yellow poplar



**Life cycle assessment (cradle to gate plus transport) (18)**

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| Impact category: | Global Warming Potential | Primary Energy Demand from Resources | Primary Energy Demand from Renewables | Acidification Potential | Eutrophication Potential | Photochemical Ozone Creation Potential | Abiotic Depletion Potential (Elements) | Abiotic Depletion Potential (Fossil) |
|---|---|---|---|---|---|---|---|---|
| Unit | kg CO2-equiv. | MJ | MJ | kg SO2-equiv. | kg PO42-equiv | kg Ethene-equiv. | kg Sb-equiv. | MJ |
| **1" lumber - 1 cubic meter** | | | | | | | | |
| Total | E: 242.60 CU: -678.45 | 3420 | 7370 | 3.04 | 0.277 | 0.233 | 0.0000112 | 3210 |
| Data by process steps | | | | | | | | |
| **2" lumber - 1 cubic meter** | | | | | | | | |
| Total | E: 335.73 CU: -678.45 | 4829 | 8723 | 3.77 | 0.329 | 0.28 | 0.0000185 | 4320 |
| Data by process steps | | | | | | | | |
| **3" lumber - 1 cubic meter** | | | | | | | | |
| Total | E: 450.67 CU: -678.45 | 6610 | 10400 | 4.66 | 0.392 | 0.34 | 0.0000275 | 5680 |
| Data by process steps | | | | | | | | |

Key: Carbon uptake, Forestry, Kiln drying, Sawmill, Transport forest-kiln, Transport kiln-customer

**Description of impact categories**

| | |
|---|---|
| Global Warming Potential | Often termed "carbon footprint". Expressed in kg of carbon dioxide equivalent. The sum of the warming potential of all gases emitted (including carbon dioxide, methane and water vapour) which influence the energy balance of the atmosphere leading to increased average temperatures. Data is reported separately for all greenhouse gas emissions (E) from processes to extract, process and deliver the timber and for carbon uptake (CU) during tree growth (which is a negative number in GWP terms). |
| Primary energy demand (resources) | Use of fossil fuels in mega-joules. The impact category has limited application on its own because it does not differentiate between energy sources (e.g. oil or coal). Nor does it represent "embodied energy". However it is an important driver of other environmental impacts including global warming, acidification, eutrophication, and resource depletion. |
| Primary energy demand (renewables) | Use of energy derived from renewable raw materials in mega-joules. |
| Acidification Potential | Potential for acidification of soil and damage to plant health resulting from emissions to air, water and land of acidifying compounds such as sulphur dioxide (SO2) and nitrogen oxides (NOX). Expressed in kg of sulphur dioxide equivalent. |
| Eutrophication Potential | Nutrient enrichment of waters by release of phosphorous or nitrogen compounds (such as fertilisers) and organic matter (e.g. in effluents). This causes excess growth of plant matter and depletion of oxygen levels in the water. Expressed in kg of phosphate equivalent. |
| Photochemical Ozone creation Potential | Often referred to as "photochemical smog". Increased levels of ozone at ground level arise through the reaction of volatile organic compounds, for example ethene, with oxygen compounds or oxides of nitrogen in air and under the influence of sunlight. The problem afflicts modern cities and impacts human health and reduces vegetative production. Expressed in kg of ethene equivalent. |
| Abiotic depletion potential (Elements) | Measures depletion of non-renewable mineral resources. Compiled from the ratios of annual production to size of remaining reserves for all minerals consumed. Expressed in relation to the ratio for the mineral Antimony (SB). |
| Abiotic Depletion Potential (Fossil) | Measures depletion of non-renewable fossil resources in mega-joules. |

**Parameters and assumptions**

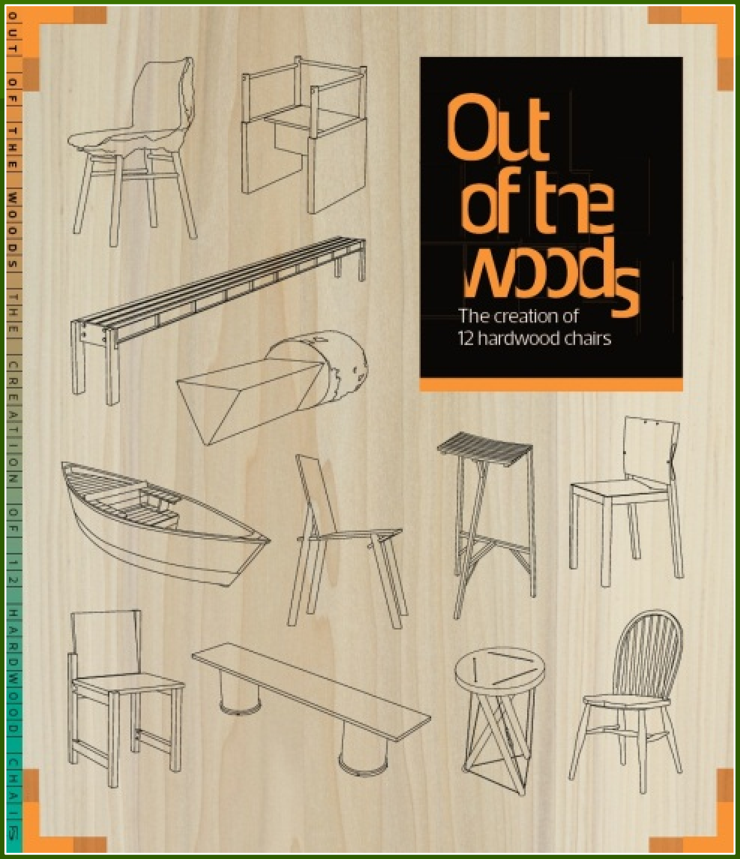
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Kilning | Kiln Efficiency (%) (19) | 53 | Kiln Thermal Energy (kwh/day,MBF,inch) (20) | 25 | Kiln Power (kwh/day,MBF,inch) | 17 | Kilning assumptions: Default US hardwood industry average calculated by PE drawing on data from AHEC members |
| | Kiln fuel for thermal energy (%) (22) | Biomass | Heavy fuel oil | Light fuel oil | Natural gas | | |
| | | 90 | 0 | 0 | 10 | | |

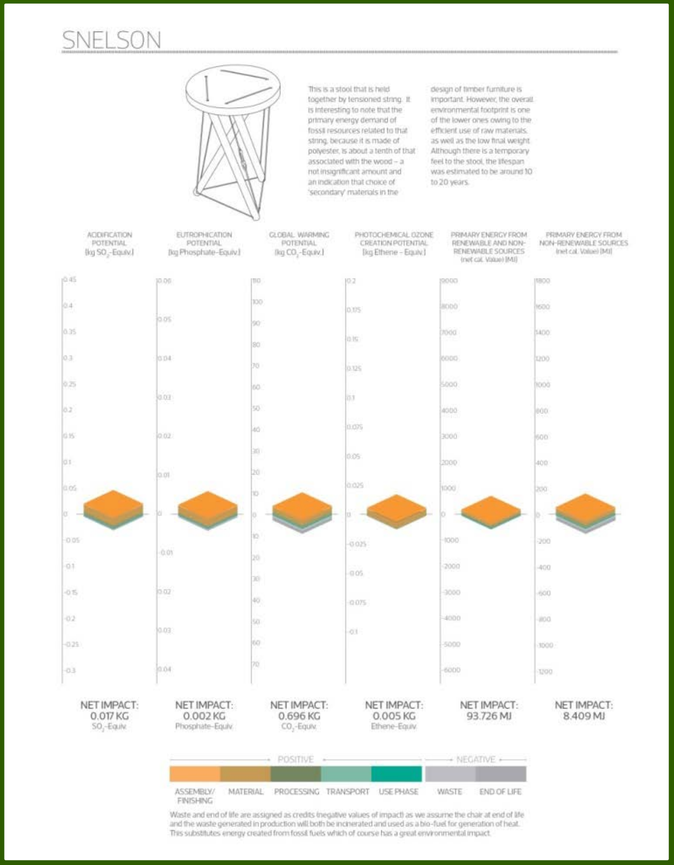
| Trans-port | Truck | Rail | Ship | Transport assumptions |
|---|---|---|---|---|
| Forest to sawmill (km) | 116 | | | Default US hardwood industry average for US hardwood drawn from AHEC-PE LCA study |
| Sawmill to kiln (km) | 103 | | | Default US hardwood industry average for US hardwood drawn from AHEC-PE LCA study |
| Kiln to port (km) | 655 | | | Central point of US tulipwood harvest region to Norfolk, the leading US East Coast port for tulipwood |
| Port to port (km) | | | 6818 | Sea distance from Norfolk Terminal to Bremerhaven Terminal |
| Port to customer (km) | 350 | | | Road distance from port of Bremerhaven to Cologne |

# Using Special Projects to Promote Sustainability

www.americanhardwood.org

# Out Of The Woods
## Environmental Profiling

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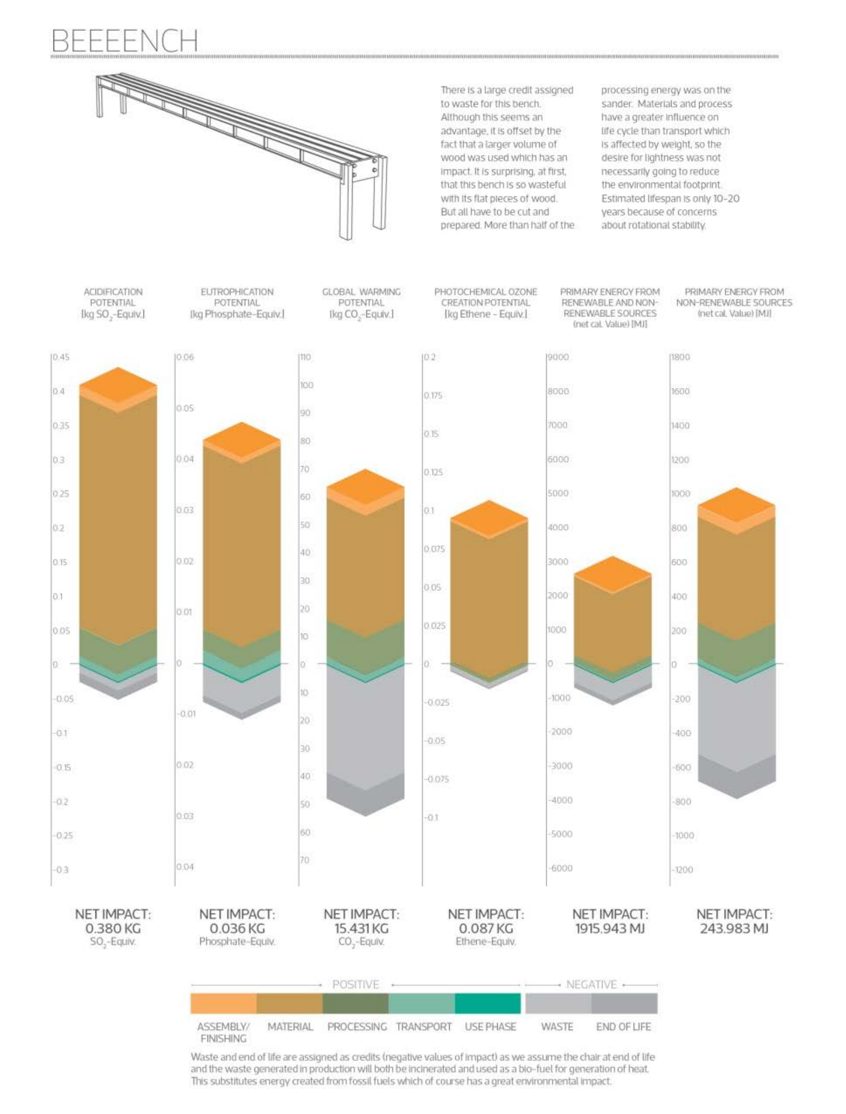
# Out of the Woods: A project with Design Product students at the Royal College of Art

**Workshops & education on:**

- Wood as a design material
- Life Cycle Assessment
- The principles of chair design
- An introduction to American hardwoods
- The forest resource


# Out of the Woods: Full Life Cycle impact assessment for 12 hardwood chairs – BEEEENCH



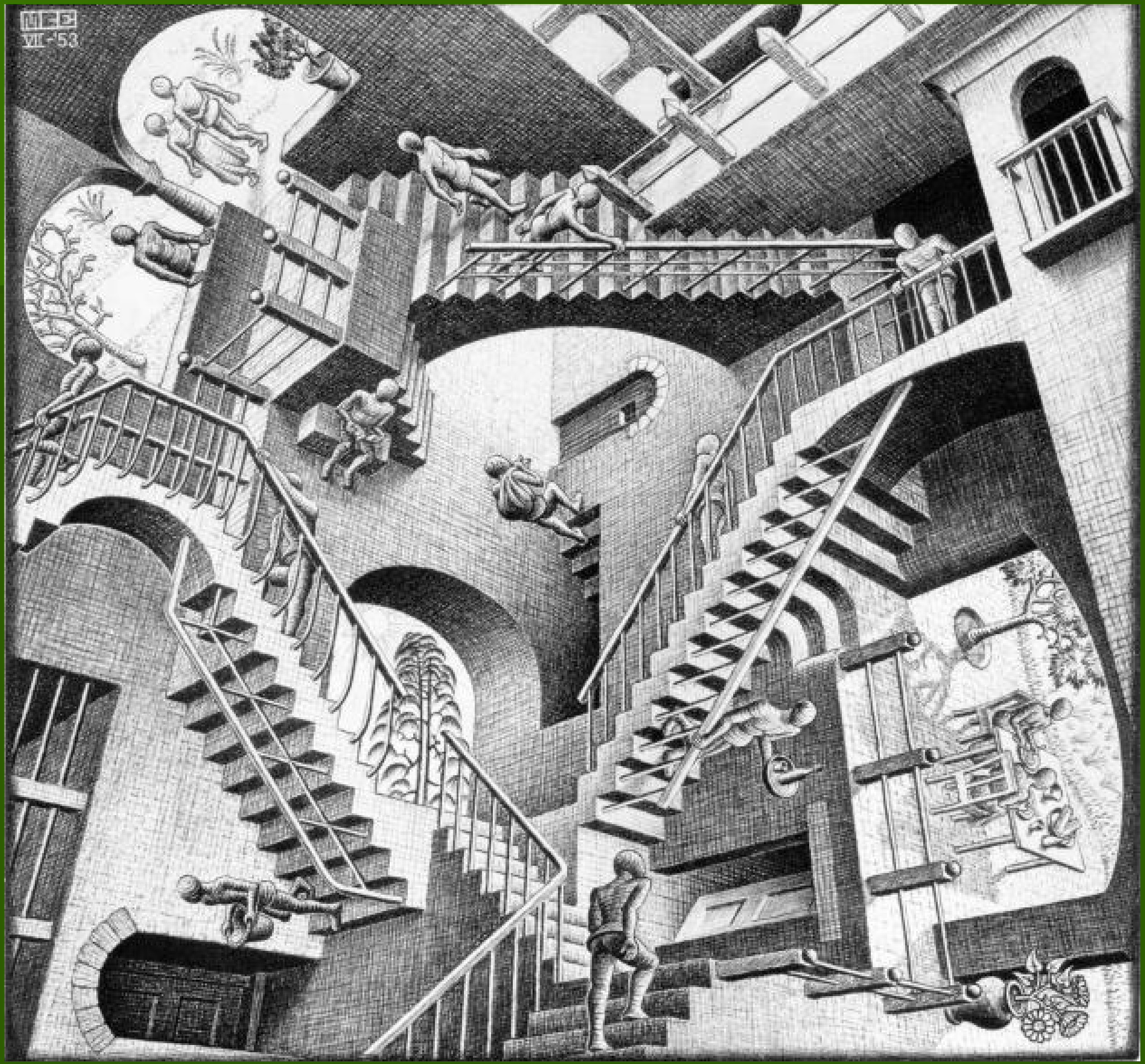

- **Designer aimed for dematerialisation, creating a product that contains more air than matter**
- **Large credit assigned to waste because of high levels of machining**
- **Lightweight solution reduces environmental footprint in transport**
- **Issues of durability**

# Out of the Woods: High profile exhibition at the Victoria & Albert Museum for London Design Festival 2012

# Tulipwood cross-laminated timber (CLT)

*Results of testing tulipwood CLT:*

| | Density | Rolling shear | |
|---|---|---|---|
| | | Strength | Stiffness |
| Softwood | 420 | 0.8 | 60 |
| Tulipwood | 550 | 2.7 | 210 |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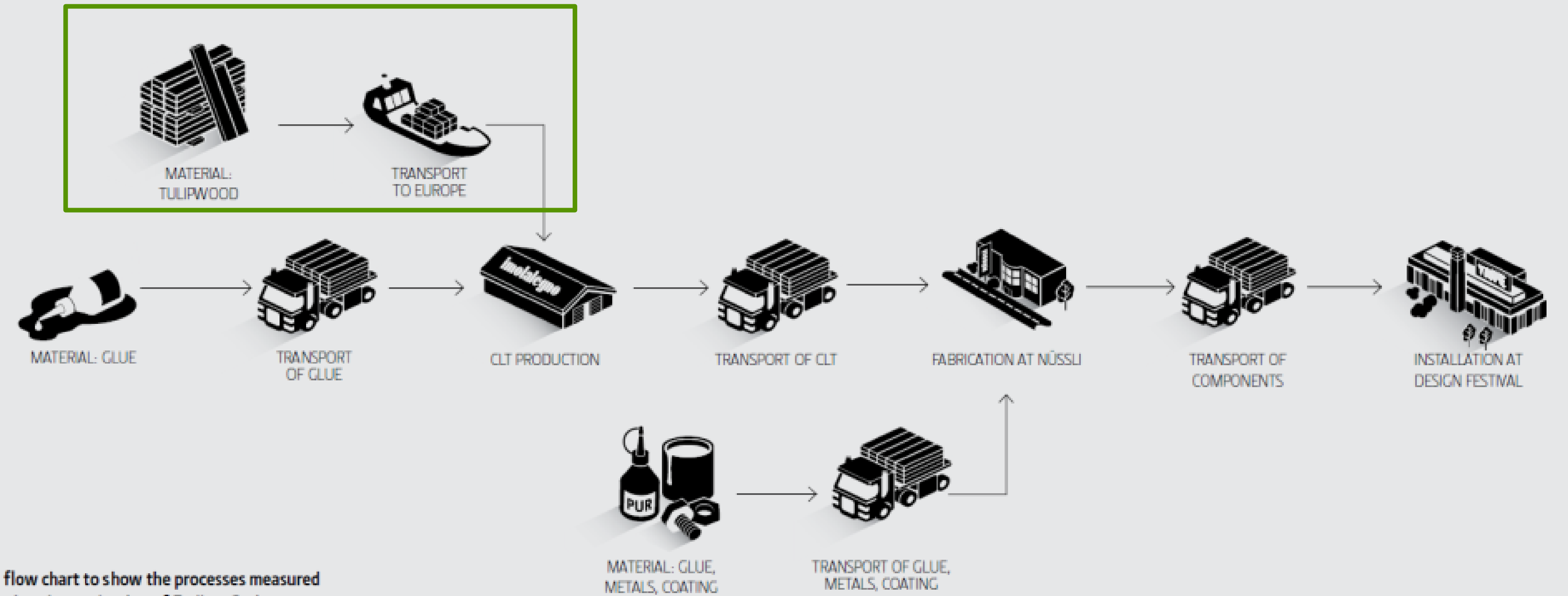
# Endless Stair – adding a new dimension to timber in construction

# Endless Stair LCA data collection & modelling

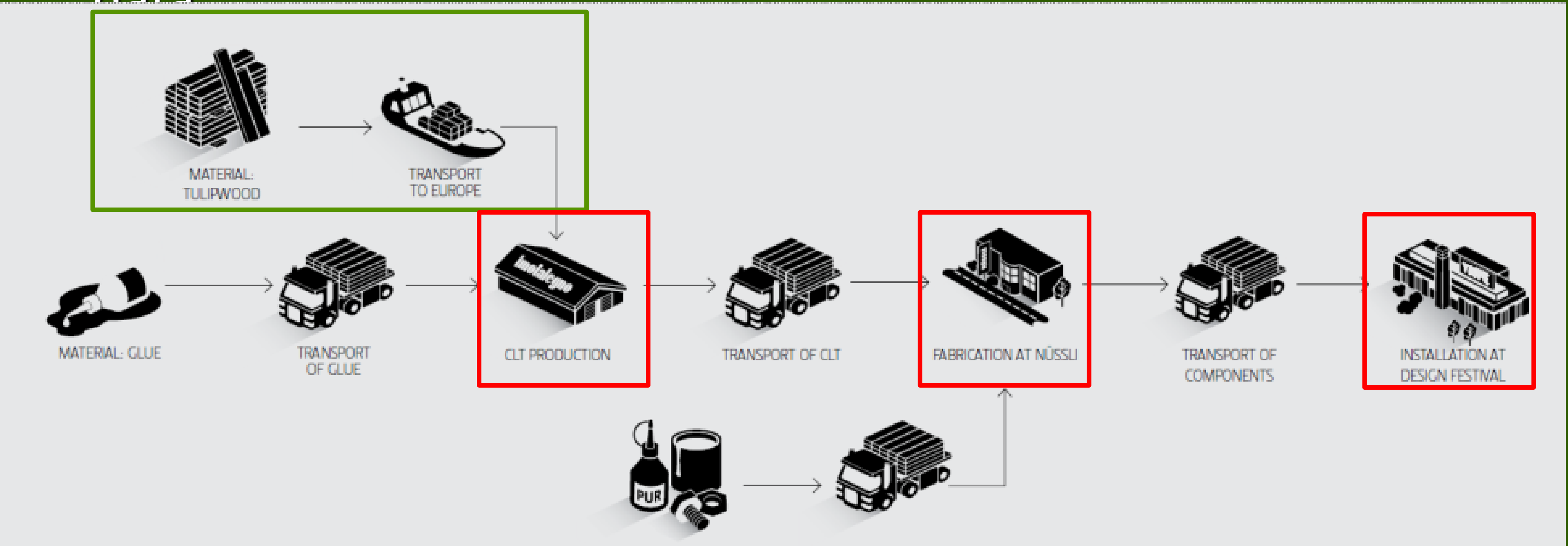
AHEC lumber study data




A flow chart to show the processes measured during the production of Endless Stair.

# Endless Stair LCA data collection & modelling

AHEC lumber study data



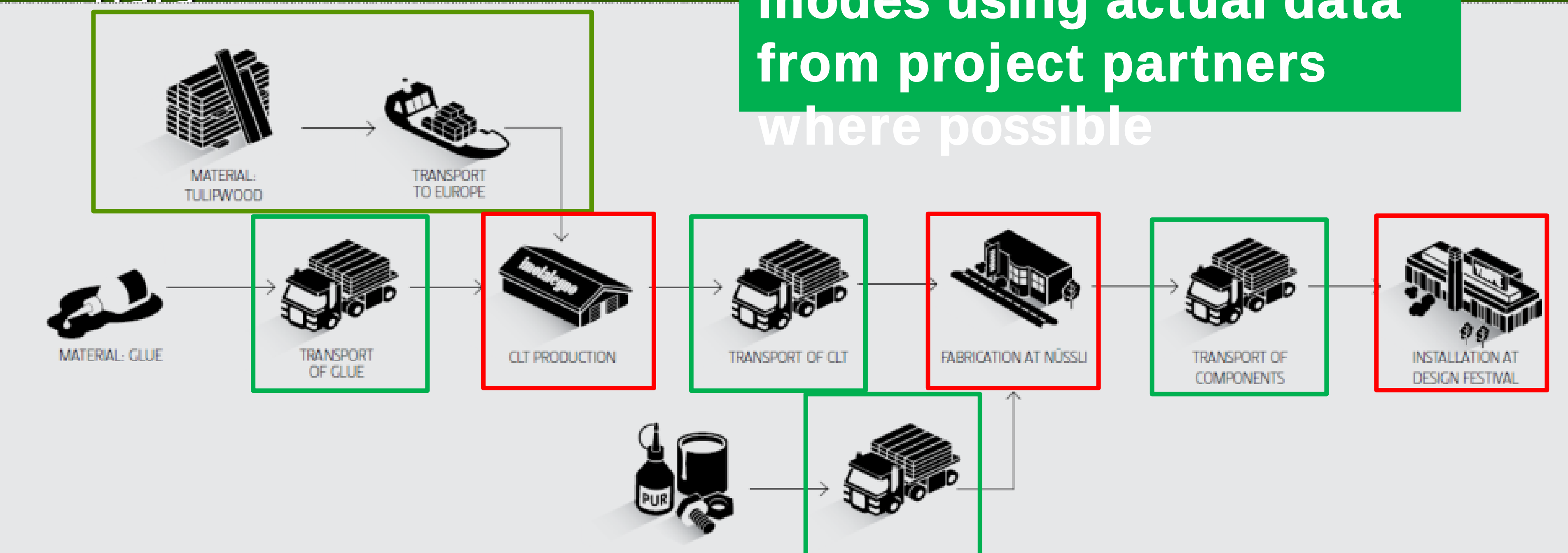

A flow chart to show the processes measured during the production of Endless Stair.

**Project specific data derived from project partners & collated by PE**

# Endless Stair LCA data collection & modelling

AHEC lumber study data

**Transport distances and modes using actual data from project partners where possible**




A flow chart to show the processes measured during the production of Endless Stair.

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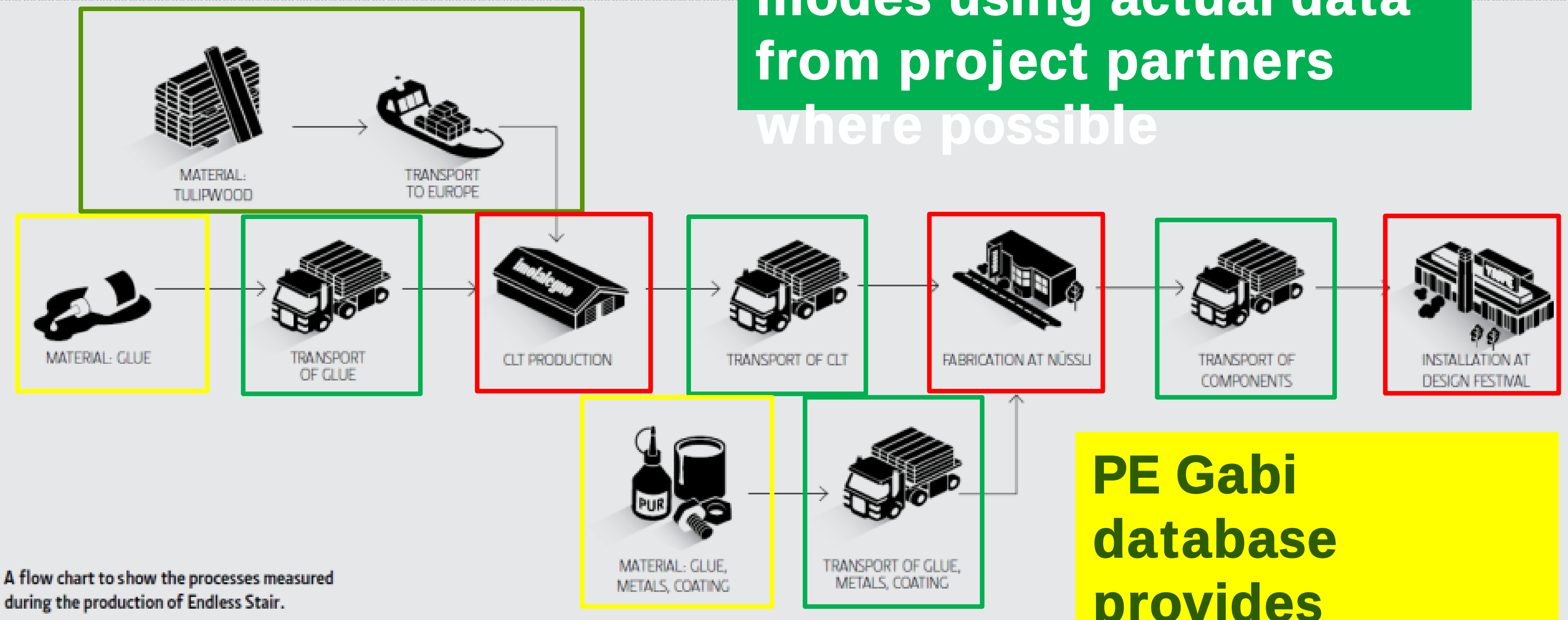
# Endless Stair LCA data collection & modelling

AHEC lumber study data

**Transport distances and modes using actual data from project partners where possible**




A flow chart to show the processes measured during the production of Endless Stair.

**PE Gabi database provides industry average data**

**Project specific data derived from project partners & collated by PE**

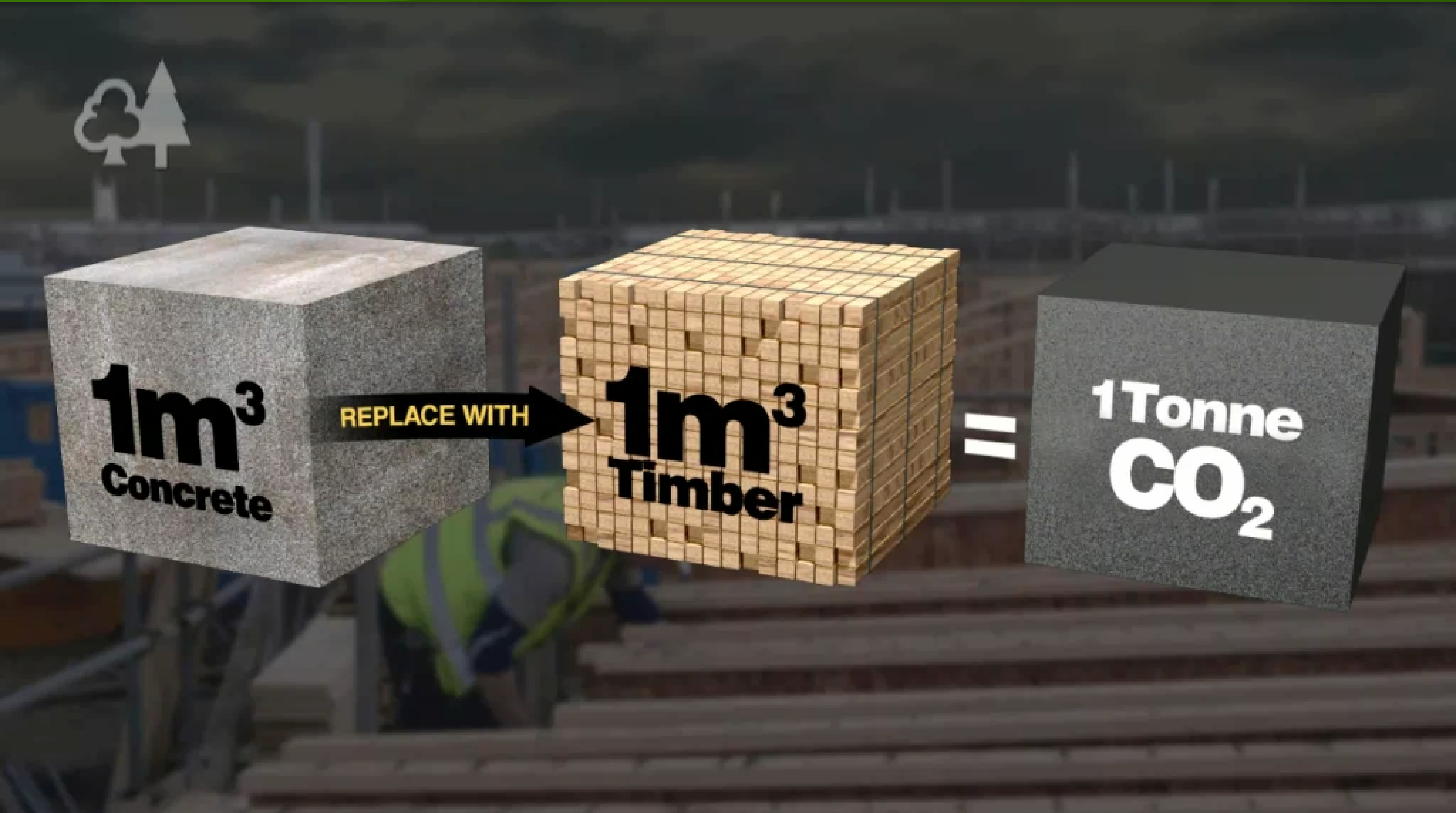
# Environmental Impact Headline Results from “Endless Stair”

- The finished structure “in situ” in London has a negative carbon footprint.
- The largest single contributor to carbon emissions of the entire project were the concrete footers.
- Based on the most recent FIA data for tulipwood growth to removal rates, it took the forest approximately 66 seconds to replace all of the wood used in the project.

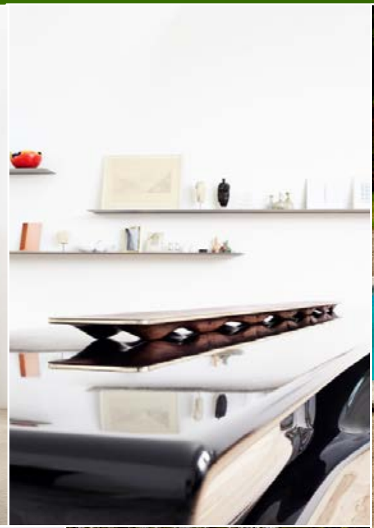
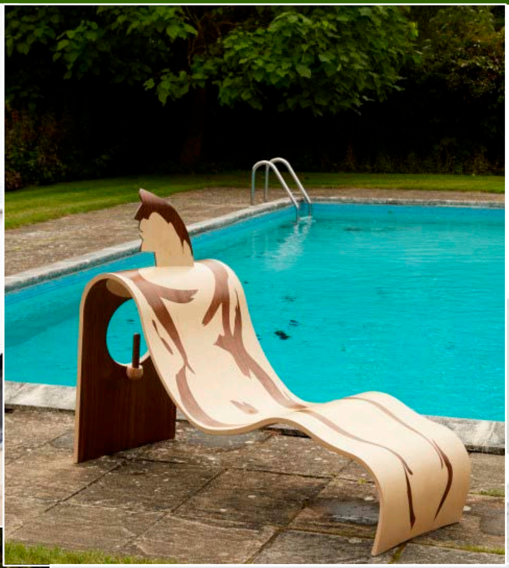
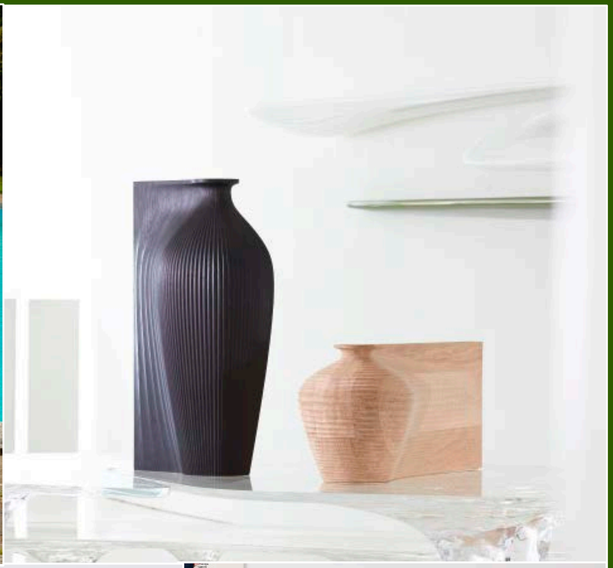
# Murray Grove, London

- Waugh Thistleton Architects
- 9 storey timber building
- Cross laminated lumber
- Completed 2008
- 4 carpenters assembled structure on-site at a rate of 1 storey a week
- Building weighs 300 tonnes
- ¼ weight of equivalent concrete building
- Saves 306 tonnes of carbon to a comparable steel and concrete tower, with 183 tonnes locked into the timber.

# Wood: The Substitution Effect



# Ten Projects; Twenty designers

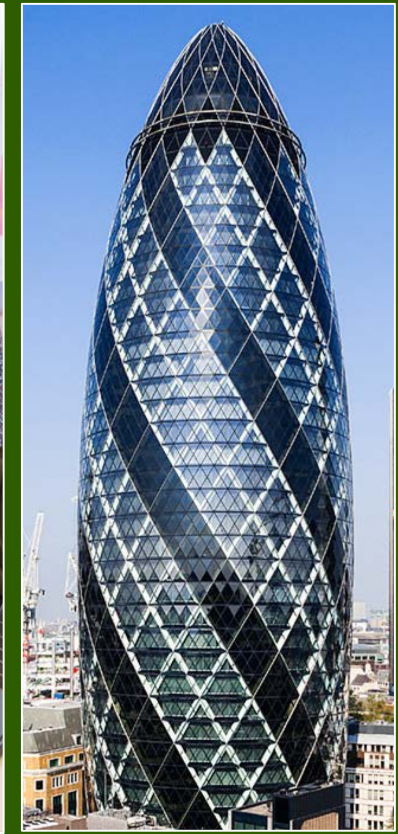









# Norman Foster – *‘Tulipifera Sharpeners’*

*“… of all the samples that we examined it was uniquely pale and the grain had an almost marble like quality – so in an aesthetic sense it was intrinsically beautiful. The quest was to make a jewel-like object out of what is often dismissed the most base of all the hardwoods.”* **Norman Foster**



Wembley Stadium, London


HSBC Bank, Hong Kong

# The Wish List – Life cycle environmental assessment

**Total carbon footprint for all of the The Wish List projects combined is only 0.61 tonnes of $CO_2$ equivalent.** ***That's less than the carbon footprint of one person on a return flight from London to New York!***

**Total volume of hardwood used - 13 m$^3$**

****Less than 2 seconds to replace the 13 m$^3$ of US hardwood for Wish List***

**CONCLUSION – MORE US HARDWOOD = LOWER CARBON FOOTPRINT (wood waste substituted for fossil fuels)**

THE·WISH·LIST

ENVIRONMENTAL LIFE - CYCLE ASSESSMENT

## A STOOL FOR THE KITCHEN

STOOL BY FELIX DE PASS WITH ALISON BROOKS

MADE IN AMERICAN CHERRY

### SUMMARY

Felix de Pass created two stools for the Wish List, one tall and the other short. This commentary refers only to the tall stool. In practice, the impact of the two stools is almost exactly equivalent with just a marginal saving for the small stool due to lower material usage. American cherry is a positive environmental choice for the stool, being a highly desirable timber which is readily available in the US forest but which has been under-utilised in recent years.

The stool is carbon neutral on a cradle to grave basis. Very few non-wood materials are used and the carbon emissions from supply of wood are offset by energy recovery from wood waste which substitutes for fossil fuels.

The small amount of plywood used to create the jig for the stool has a relatively minor effect across all environmental impact categories. For this analysis, the full impact of the plywood is allocated to the first stool. However, if the stool were produced commercially, the plywood jig would be reused and this impact would be allocated among multiple products.

### WOOD RESOURCE

U.S. government forest inventory data[1] shows that American cherry growing stock is 306 million m$^3$, 2.7% of total U.S. hardwood growing stock. American cherry is growing 8.6 million m$^3$ per year while the harvest is 3.5 million m$^3$ per year. After harvesting, an additional 5.1 million m$^3$ of cherry accumulate in U.S. forests every year. American cherry growth exceeds harvest in all states. It takes just over a second for new growth in the U.S. forest to replace the cherry logs harvested to manufacture each stool.

### CARBON FOOTPRINT

The stool's carbon footprint is -0.2 kilograms of $CO_2$ equivalent on a cradle to grave basis. Carbon emissions during all stages of material extraction and processing, product manufacturing, and transport are 25.2 kilograms of $CO_2$ equivalent. These emissions are offset by 25.4 kilograms of avoided emissions from energy recovery.

A large proportion of the wood required to manufacture the stool did not end up in the finished product. This reduces the long-term carbon storage potential but it also means that there is a significant volume of

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THE·WISH·LIST

ENVIRONMENTAL LIFE - CYCLE ASSESSMENT

## GETTING AWAY FROM IT ALL

WORKSPACE BY SEBASTIAN COX WITH TERENCE CONRAN

MADE IN AMERICAN RED OAK AND CHERRY

### SUMMARY

The workspace is composed primarily of two American hardwoods – Cherry and Red oak – which are abundant and under-utilised. The US resource of both hardwoods is large and expanding. Use of these timbers, combined with strong craftsmanship skills – with their emphasis on efficient material and energy use - contribute to a strong environmental profile. The carbon footprint of the workspace is extraordinarily low for such a large and striking piece. Much of the energy input into material production derives from renewables. The waste wood produced during manufacturing and at End Of Life can be used for energy production, thereby offsetting use of fossil fuels.

Of course it would be a shame for such workmanship to be sent to the incinerator too soon. Such an outcome seems unlikely - the quality, beauty and durability of the design suggest the workspace will remain in use and act as a carbon store for many years. Such longevity also reduces the need for replacement, mitigating the significant acidification and POCP environmental impacts of material supply and manufacturing.

### WOOD RESOURCE

The wood content of the workspace comprises about one third cherry and two thirds red oak. Red oak is the most abundant hardwood in the U.S. forest accounting for 19% of wood volume. U.S. cherry accounts for 2.7% of U.S. hardwood growing stock. U.S. government forest inventory data[1] shows that U.S. red oak is growing 51.9 million m$^3$ per year while the harvest is 32.4 million m$^3$ per year. U.S. cherry is growing 8.6 million m$^3$ per year while the harvest is 3.5 million m$^3$ per year. After harvesting, an additional 19.5 million m$^3$ of red oak and 5.1 million m$^3$ of cherry accumulate in U.S. forests every year. It takes less than five seconds for new growth in the U.S. forest to replace the hardwood required for the workspace.

### CARBON FOOTPRINT

On a cradle to grave basis, the carbon footprint of the workspace is 53 kilograms of $CO_2$ equivalent. That's roughly equivalent to the carbon emissions of driving 240 miles (380 km) by the average UK car[2].

Carbon emissions during all stages of material extraction and processing, product manufacturing, and transport are 404 kilograms of $CO_2$ equivalent. Of these emissions, 279 kilograms of $CO_2$ equivalent are associated with processing and supply of American red oak and ash to the UK. However these are offset by 351 kilograms of avoided carbon emissions resulting from substitution of fossil fuels through reuse of wood waste.

Only 86 kilograms of carbon emissions are due to the electrical energy used at Benchmark – a testament to the efficiency of the manufacturing process. An additional 30 kilograms of carbon emissions are due to the glues. Use of other non-wood materials is negligible. Efficient utilisation of material means that there is relatively little manufacturing waste associated with this product. The credits received for energy production from wood waste during manufacturing are about equivalent to those received from final disposal at End of Life.

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THE·WISH·LIST

ENVIRONMENTAL LIFE - CYCLE ASSESSMENT

## TABLE TURNED

DINING TABLE BY BARNBY & DAY WITH ALEX DE RIJKE

MADE IN AMERICAN TULIPWOOD

### SUMMARY

Unsurprisingly, the mass of tulipwood used to construct the table dominates the environmental impact, both positively and negatively. On the one hand the energy generated from wood waste during manufacturing and at End of Life offsets most of the carbon emissions. The product is highly durable and therefore has potential to act as a carbon store for decades. The fact that tulipwood is a quick drying hardwood species requiring no more than 7 to 10 days in the kiln, also helps to reduce environmental impact.

On the other hand, the volume of tulipwood used in the table contributes to more significant acidification and eutrophication impacts during transport. It also contributes to relatively high photo-chemical ozone creation potential (POCP). Partially mitigating these impacts is the potential for the table to remain in use for many years, minimising the need for replacement.

### WOOD RESOURCE

From a forestry perspective, tulipwood is a good environmental option. Tulipwood is a relatively under-utilised species which accounts for 8% of wood volume in the U.S. forest. U.S. government forest inventory data[1] shows that U.S. tulipwood is growing 32.6 million m$^3$ per year while the harvest is 13.3 million m$^3$ per year. After harvesting, an additional 19.3 million m$^3$ of tulipwood accumulate in U.S. forests every year. It takes less than four seconds for new growth in the U.S. forest to replace the hardwood required to manufacture the table.

### CARBON FOOTPRINT

Cradle to grave, the carbon footprint of the table is 135 kilograms of CO2 equivalent. That's roughly equivalent to the carbon footprint of driving 600 miles (970 km) in the average UK car[2].

Carbon emissions during all stages of material extraction and processing, product manufacturing, and transport are 687 kilograms of $CO_2$ equivalent. Two thirds of carbon emissions - 423 kilograms of $CO_2$ equivalent – are associated with processing and supply of tulipwood to the UK. However these emissions are offset by 552 kilograms of avoided emissions resulting from substitution of fossil fuels through reuse of wood waste.

A large proportion of the wood required to manufacture the table did not end up in the finished product. This reduces the long-term carbon storage potential but it also means that there is a significant volume of waste wood diverted to energy production. The overall mass of wood waste arising during manufacture is much more than the final mass of the product, so the carbon credits from processing waste are greater than those at the End of Life.

119 kilograms of $CO_2$ equivalent is due to the use of grid electricity to power the moulder, sanders and lathe for creating the table at Benchmark. However, the glues were more significant, contributing 144 kilograms of $CO_2$ equivalent.

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THE·WISH·LIST

ENVIRONMENTAL LIFE - CYCLE ASSESSMENT

## VES-EL

TABLEWARE BY GARETH NEAL WITH ZAHA HADID

MADE IN AMERICAN WHITE OAK

### SUMMARY

A large proportion of the wood required to manufacture the tableware did not end up in the finished product. This reduces the long-term carbon storage potential but it also means that there is a significant volume of waste wood diverted to energy production. The overall mass of wood waste arising during manufacture is much greater than the final mass of the product. As a result the credits from processing are greater than those from end of life.

A significant proportion of the tableware's carbon footprint is due to use of grid energy to power the CNC machine at Benchmark. This exceeds the carbon emissions resulting from all stages to extract process and transport the US hardwood to the UK.

### WOOD RESOURCE

The tableware is composed of American white oak, one of the most abundant hardwoods in the U.S. forest accounting for 15% of wood volume. U.S. government forest inventory data[1] shows that U.S. white oak is growing 36 million m$^3$ per year while the harvest is 19.3 million m$^3$ per year. After harvesting, an additional 16.7 million m$^3$ of white oak accumulates in U.S. forests every year. It takes less than a quarter of a second for the U.S. hardwood logs harvested to manufacture the tableware to be replaced by new growth in the U.S. forest.

### CARBON FOOTPRINT

On a cradle to grave basis, the carbon footprint of the tableware is 76 kilograms of $CO_2$ equivalent. That's roughly equivalent to the carbon emissions of driving 340 miles (550 km) in the average UK car[2].

Carbon emissions during all stages of material extraction and processing, product manufacturing, and transport are 143 kilograms of $CO_2$ equivalent. These emissions are offset by 67 kilograms of $CO_2$ equivalent resulting from substitution of fossil fuels through use of wood waste generated both during manufacturing and at end of life for energy production.

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# Moseley & Rogers Ladder – The Wish List

**Total Carbon Footprint: 106 kg $CO_2$e**

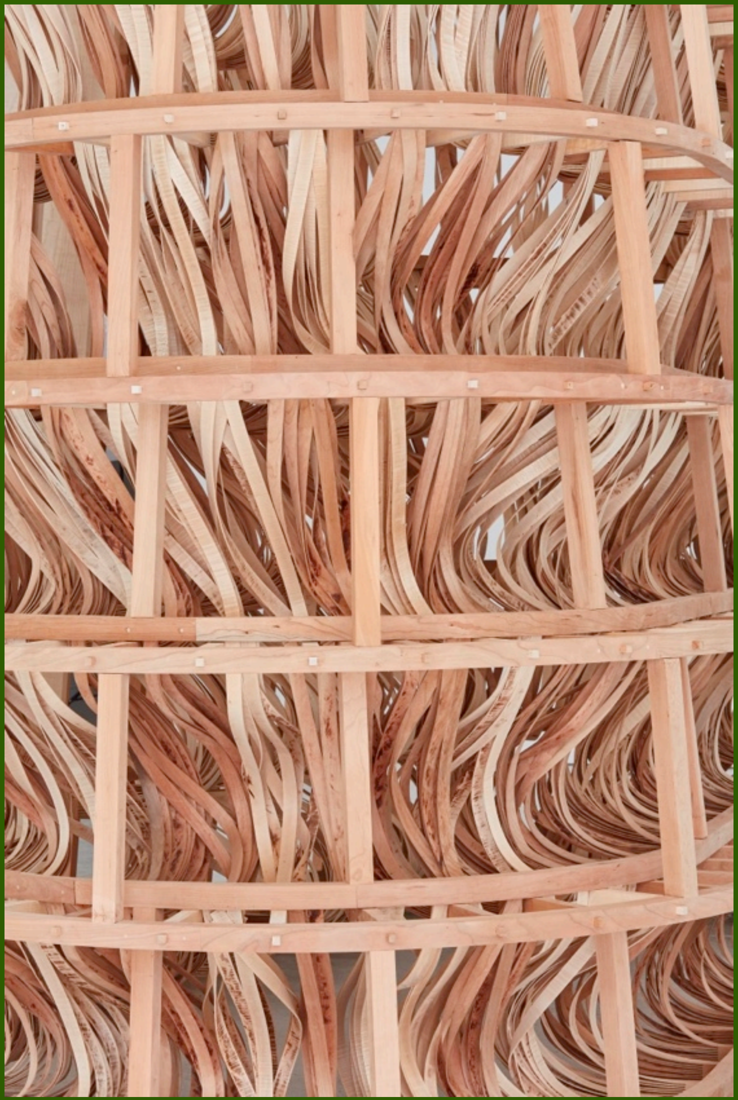
- Supply of wood: **+55 kg $CO_2$e**
- Offset by **-48 kg $CO_2$e** due to energy from waste wood substituting fossil fuels in other industrial processes:
- Leather: **+49 kg $CO_2$e**
- Metals: **+17 kg $CO_2$e**
- Coating: **+2 kg $CO_2$e**
- UK processing: **+31 kg $CO_2$e**

# 500m2 American white oak deck for the USA pavilion at Milan Expo 2015

While in use the deck stores **14.5 metric tons** of C02

it takes **25 seconds** for the white oak used to be replaced by new growth in the forest

# The Invisible Store of Happiness
## A collaboration between a furniture maker and a sculptor in American cherry and soft maple








The structure has half the carbon footprint of a smart phone
it takes less than 15 seconds to replace the lumber used by new growth

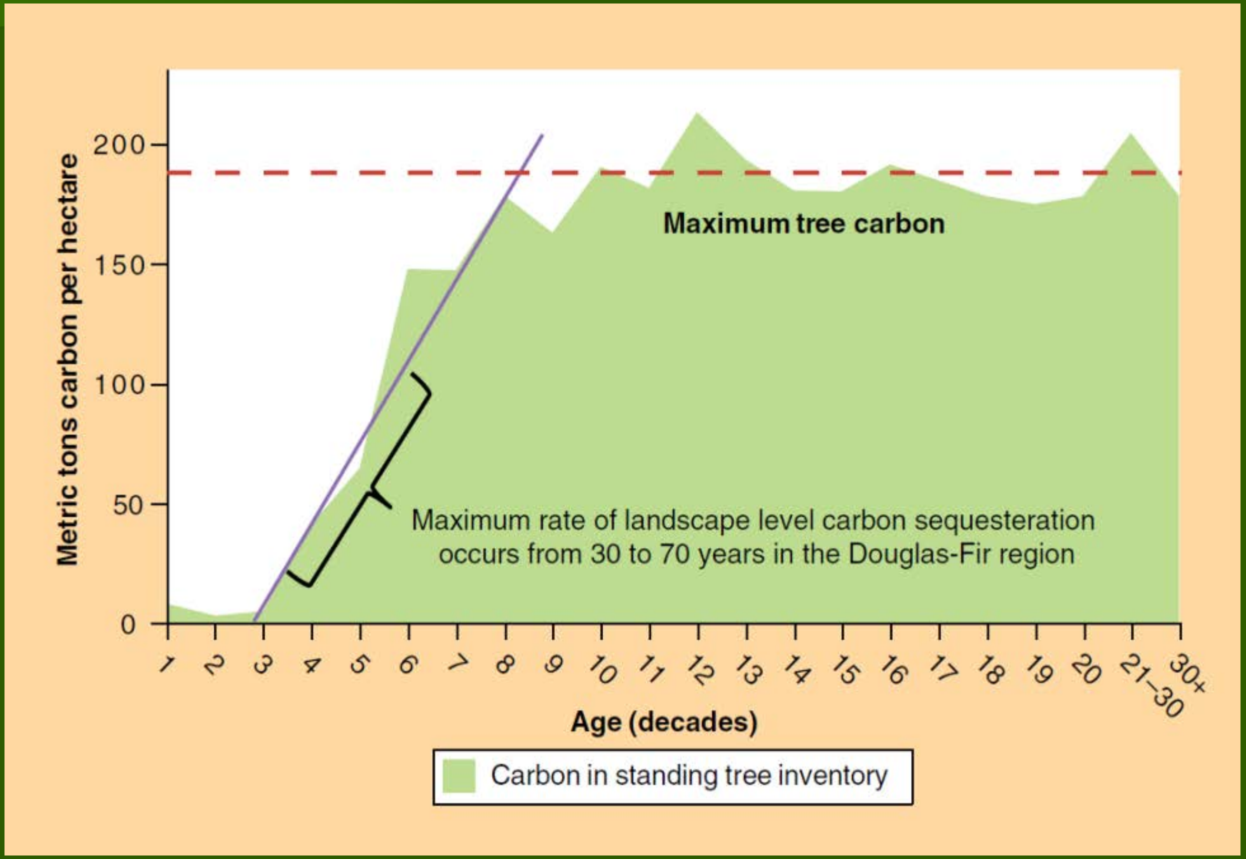
# Unprecedented media coverage


# Questions?

**www.americanhardwood.org**

# Impact of forest preservation on carbon storage

- Forest carbon growth rates slow with age
- Little or no increase in carbon storage when the forest reaches maturity.



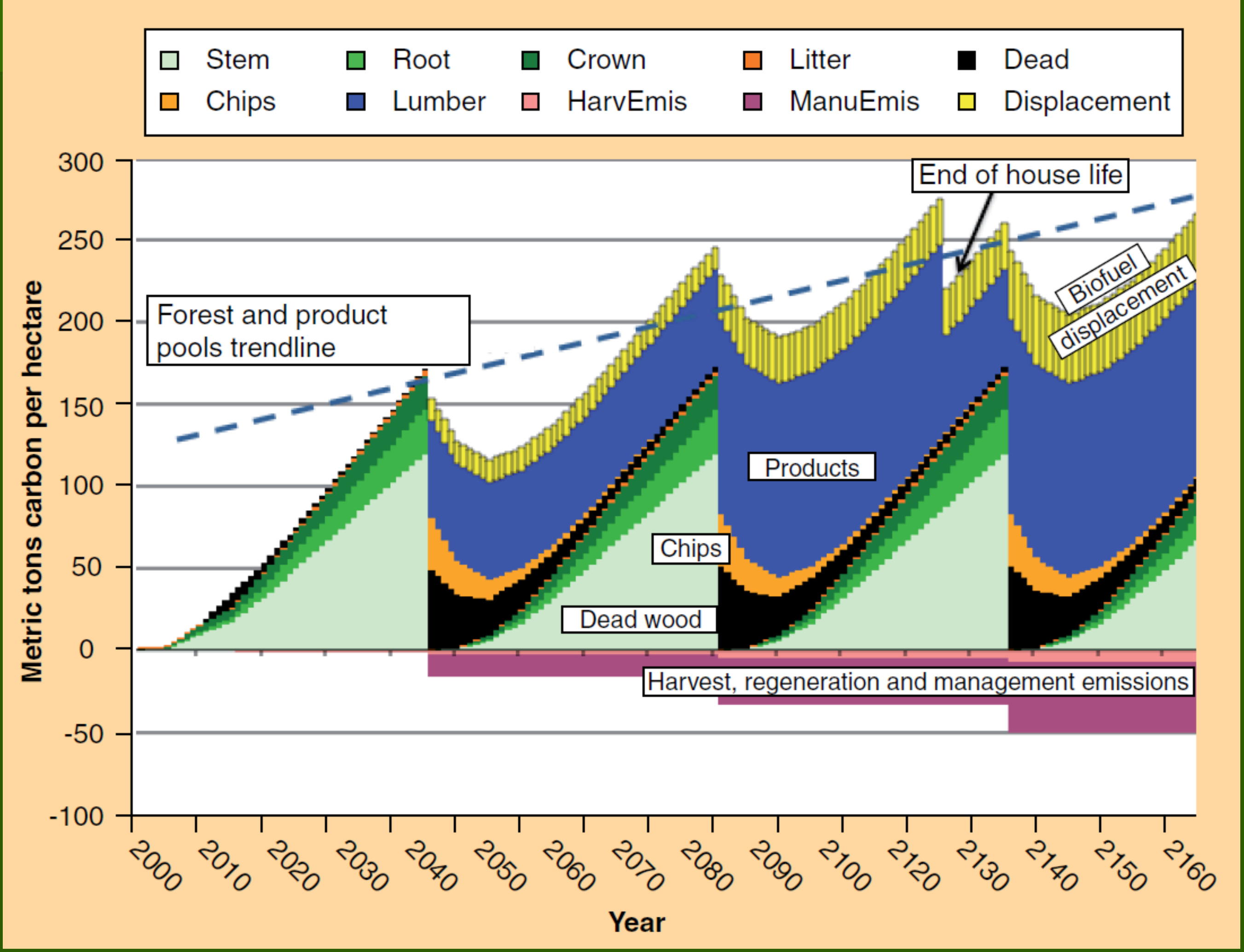

*Data relates to Douglas-Fir in Western Washington. Bruce Lippke et al, 2011, drawing on US Forest Service Forest Inventory*

# The story doesn't end there – only considering GWP at one point in the life cycle – need to consider effect on carbon pools across entire life cycle

**Forest plus product-carbon pools and process-energy emissions for a 160 year period (4 forest rotations) in the Pacific North West.**

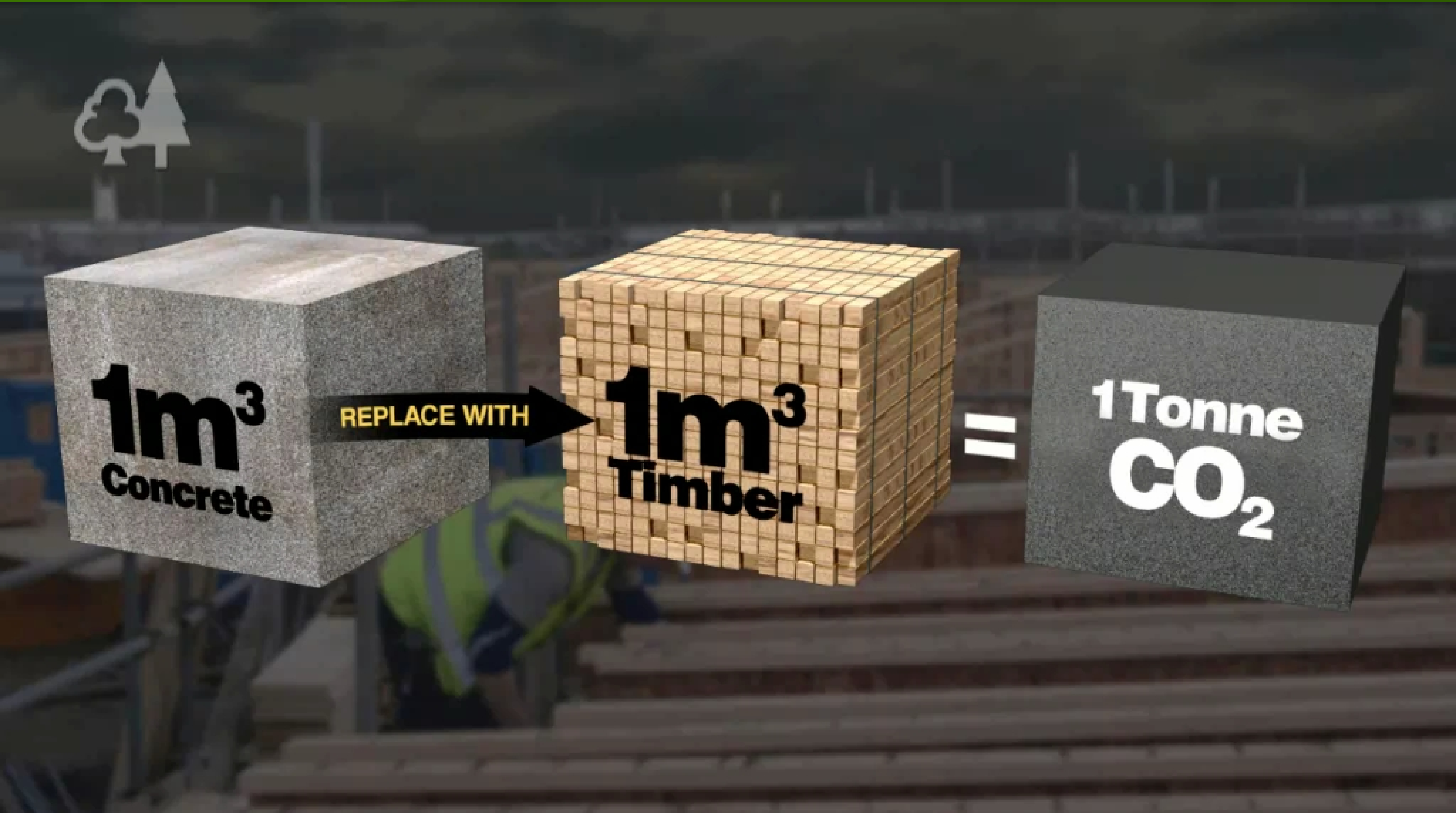
**Variables:**

- Distribution of carbon in the forest (between stem, root, crown, litter, soil)
- Intensity of harvesting & rate of forest regeneration
- Distribution of carbon between chips and lumber following harvesting
- Length of life in use of lumber products



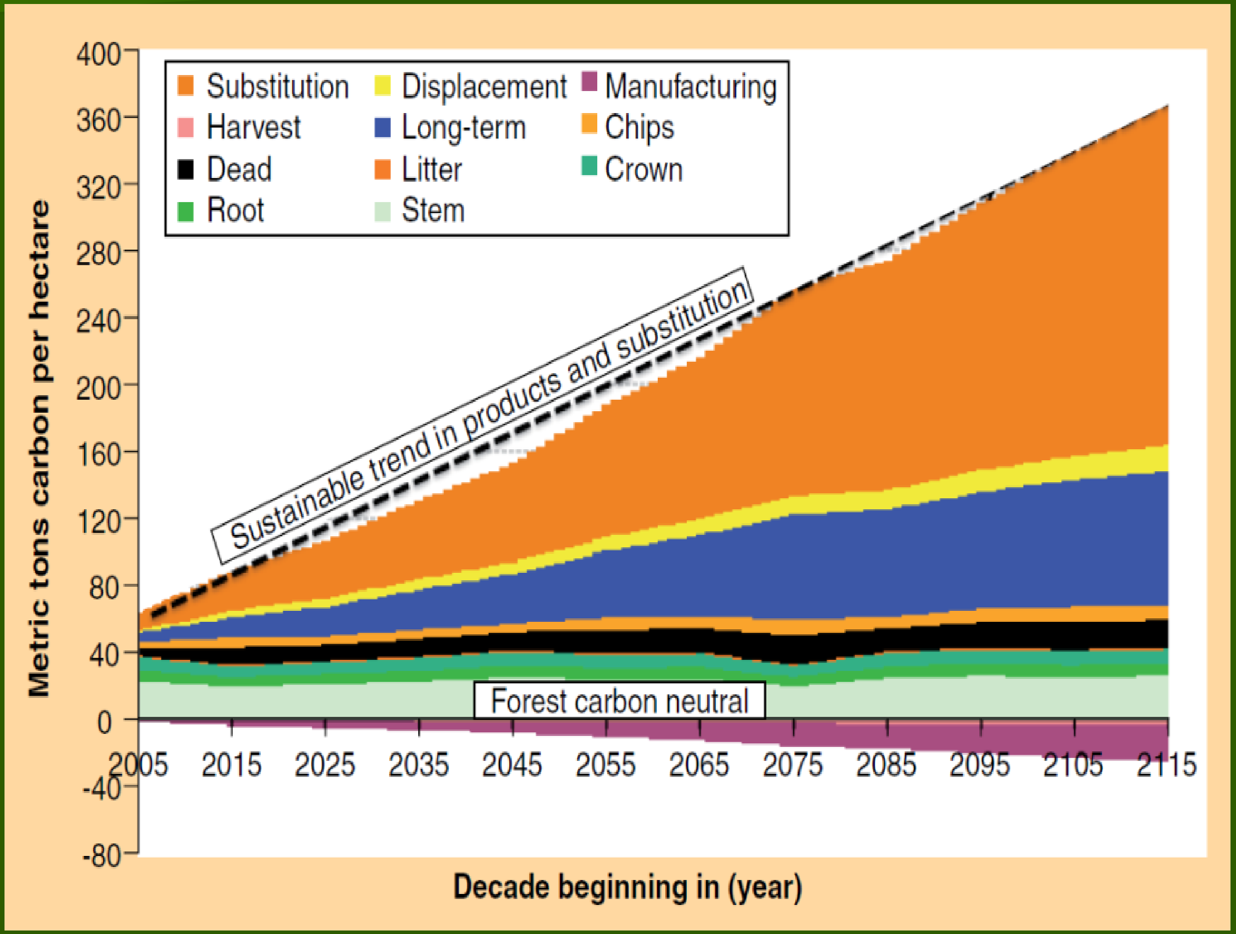

*Source:Life cycle impacts of forest management and wood utilization on carbon mitigation: knowns and unknowns, Lippke et al, Carbon Management (2011) 2(3), 303–333*

# Wood: The Substitution Effect



# Impact of sustainable timber harvesting on carbon storage

- Carbon in forest supplemented by progressive increase in carbon stored in long-term forest products
- Carbon storage benefits outweigh (relatively minor) manufacturing emissions
- Most significant benefit due to substitution of more fossil fuel intensive materials (steel concrete)




*Data relates to U.S. Inland Northwest state and private forests. Bruce Lippke et al, from Wood Fibre Science 42, 144–164(2010)*