

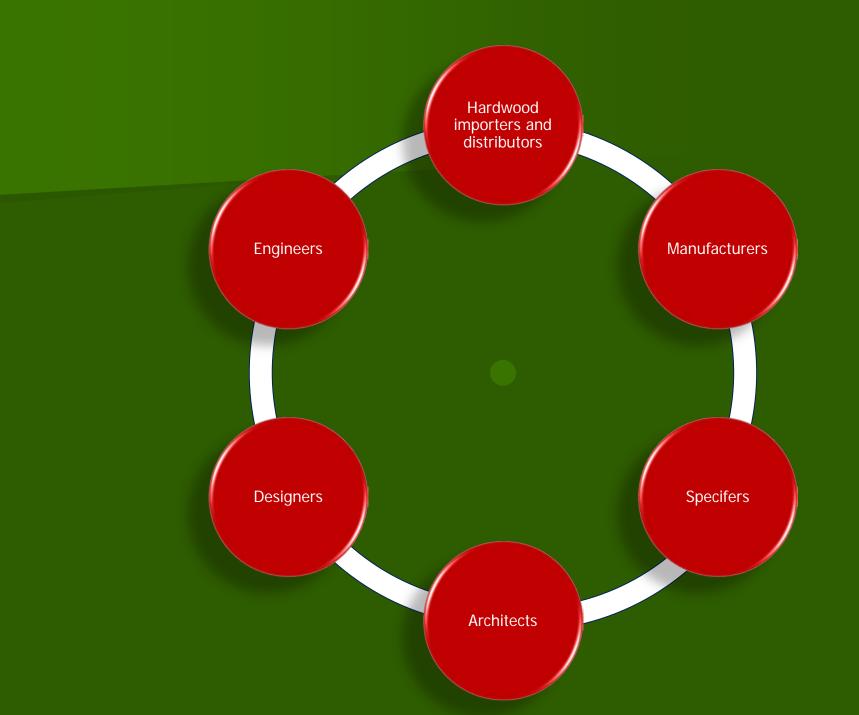
Promoting the Environmental Credentials of American Hardwoods

Michael Snow American Hardwood Export Council July 2015

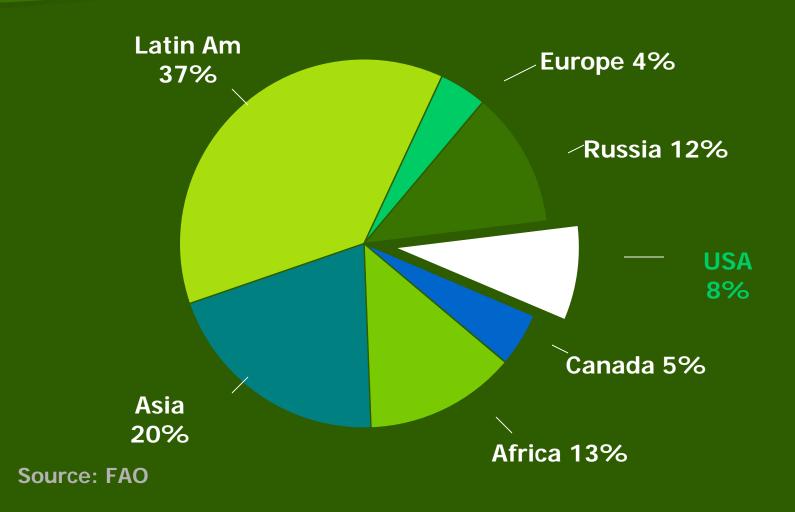
www.americanhardwood.org

# AHEC's Global Reach

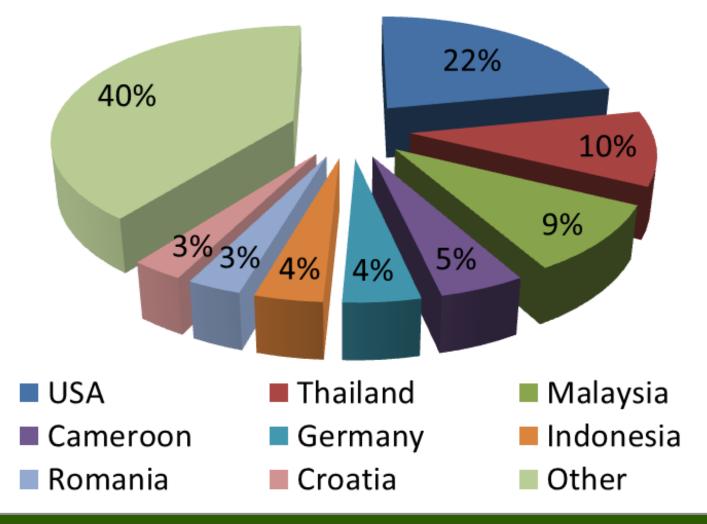




# **Global Hardwood Forests**



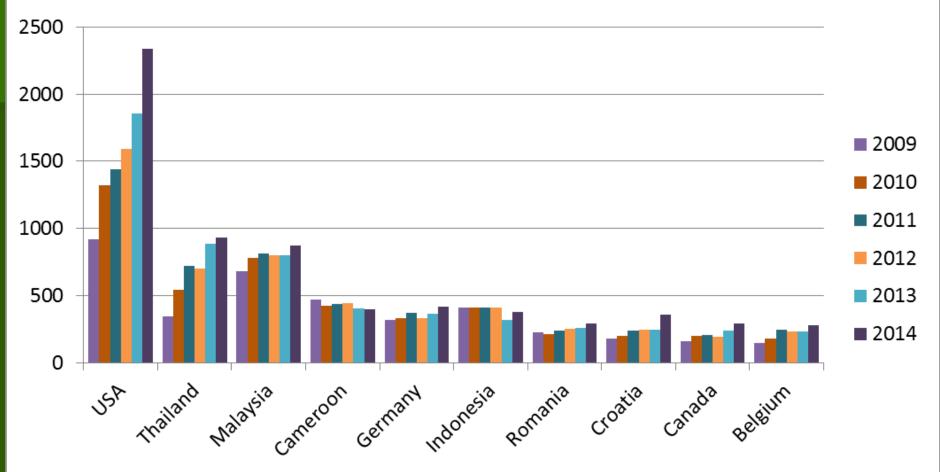
# Share of global hardwood lumber trade in 2013 (\$ value)



Source: Global Trade Atlas & FAO Forstat

AMERICAN HARDWOOD

# The world's 10 largest hardwood lumber exporters 2009-2014 (\$ million)





#### Source: Global Trade Atlas & Eurostat

### Consumer Confusion.....

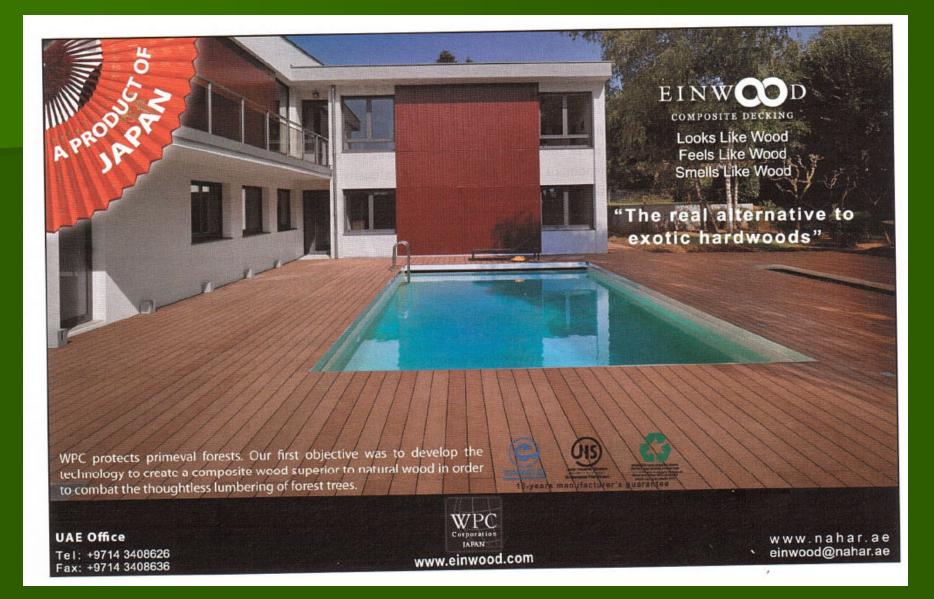


#### SAY NO TO WOOD. Say yes to Kalingastone.



#### 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.



### We may run out of wood but not ıminium

#### Well at least not for the next 200 years

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 Benga 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 She for manufacture of Billets besides the facilities for Extrusion and Quality Assurance.

#### PRODUCT RANGE

CEL .

G

Cel .

The Company manufactures and supplies extrusions for vario applications, such as Architecture, Road Transport Vehicles, Railway Electrical & Electronic Applications, Consumer Durables, Irrigatic General Engineering, Defence applications, etc.

The Company has an inventory of more than 6000 Di to manufacture more than 4000 different profiles.

#### QUALITY ASSURANCE

CEL ° century

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

CEL ® century

The Company has an excellent Quality Management Syster The Plant has been accredited with ISO-9001:2008 for its quality system 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 Marketin Offices in North, South, East & West Regions.



### Bauxite "sludge" in Hungary 2010

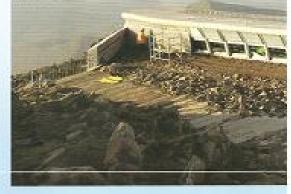


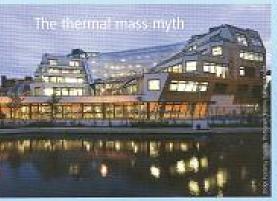
### Steel: the ultimate sustainable material

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. Interaction to the second start descent or really, not, show that the terms of the manufacture book and the second start descent or the terms of the second start of the second start book as many a little show part, a book you, going a strate to complete function to care a little show part, a book you, going a strate to complete function to care the second start book along the second start and a second should factory environment, are impressed start components are different to also reads for second care to a start of the components are different to also reads for second care to a start of components are different to also reads for second care to a start of components are different to also reads for second care to a start of components are different to also reads for second care to a start of components are different to also reads for second care to a start of components are different to also reads for second care to a start of components are different to also reads for second care to a start of components are different to also reads for second care to a start of components are different to also reads for second care to a start of components are different to also start and to a start of components are different to also second start and to be second as starts are start as the second start of the second start and the second of starts are start as the second start of the second start as the second start as starts are start as the second start as the second start as starts are starts as the second start as starts are starts are start as starts are starts as the second start as starts are starts are start as starts are starts as starts are starts are start as starts are starts a

Start can be re-assolve parabolic webcast over losing its a webles as a building reasons. This untiple characteristic gives all start arrival value of all pages of its life type. The recovery infection/tark for street installing it highly developed and highly efficient, and has been in plans for decades. Connect recovering and highly efficient, and has been in plans for decades. Connect recovering and highly efficient is the UK are the thread of the should be consisted and the plan each to all start and contractions products – liques that he encoded these for any other contractions methods.

Significate evolutionmental damage can be caused at the end of a buildings life when it has to be demodeled and to materials or appeal. Significate databased buildings, however, do not decay and are easily adapted in the configuration of the building notice is to develop. The definition of deel to building quark means that their buildings contain large operation spaces which are appropriately well with participation wells. The total forme database the actuated, with parts added or taken means and its light renging means the cause former and other the added interval added and the large means the cause former and the added interval.





Interacts shows that the optimum from thickness requiring to interact an interactive talential mass is made observed by deep knewed loadships. There is a common instances for that backforgs and all the heavy weight to achieve an optimum thermal mass. This wight has producibly allow backdow backforgs back as charafter are cost in the beam of the producibly allows backdow backforgs back as charafter are cost in the beam of the producibly allows back to back the start cost is beam and the fact charafter start cost is beam at the

in modern buildings, the generation accessible mass is faund in the consorts floor this, toolgoenderst movement has shown that the optimum

take gain

Hadowaik of science/let from table for providing the mail make a 7% (Dimme). This fractions of sciences from slab is notificate available in almost all stack-frammer ballotting, which are provided the lightest available from all providing the lightest available from all providing the.

The endra weight associated with hoses, bolly concerns herein in not experied to express thermal mass and in scretch to separate thermal mass and in scretch to separate thermal mass and in scretch to separate the scretch to components may according increase the or weigh weighted to fear and cost the building:

For some information skill reverse complete displayed out-West-Solitant

# Strip mining for iron ore.....

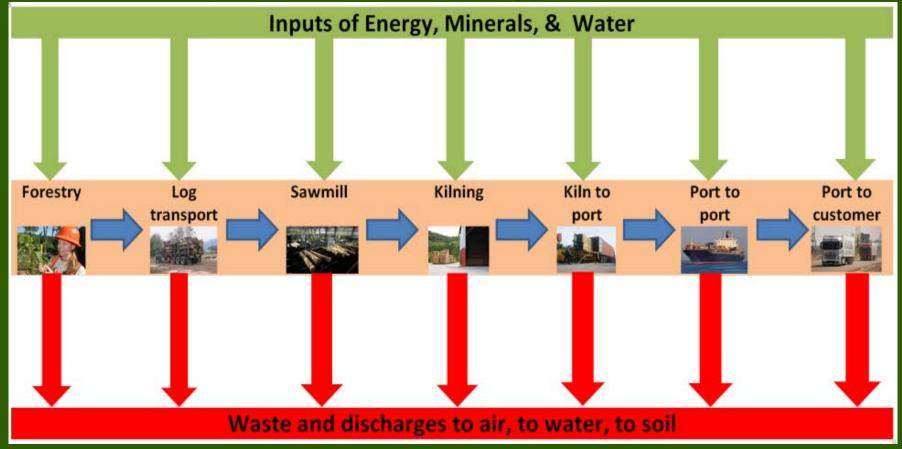


### Low environmental impact?????



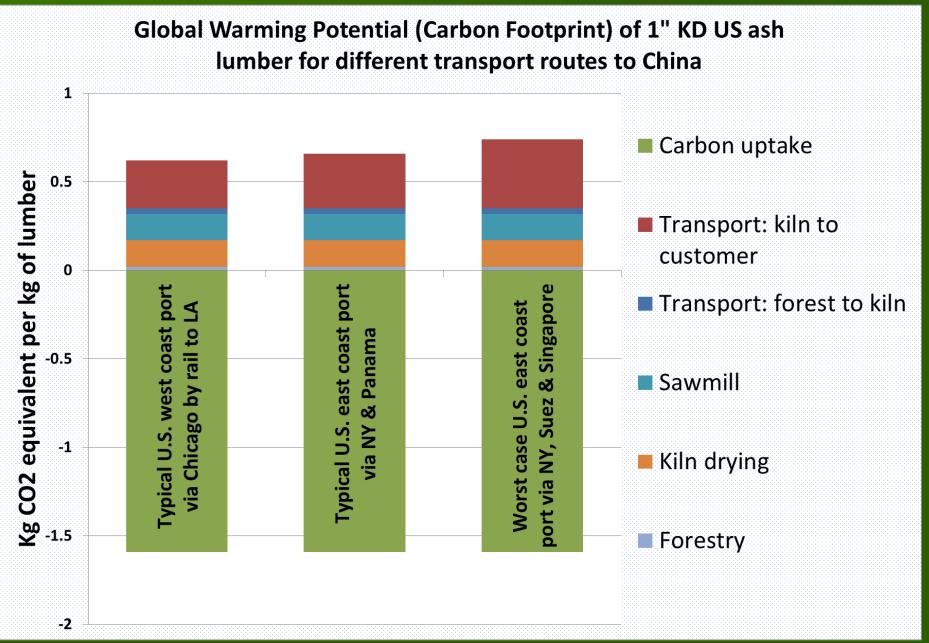
### Compiling Life Cycle Inventory data

- 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
Å	Embodied energy – not renewable	Energy from fossil fuels	MJ
$\rightarrow$	Embodied energy – renewable	Energy from renewable sources	MJ
0	Greenhouse potential	Emissions that contribute to climate change	kg CO <sub>2</sub> equivalent
	Acidification potential	Emissions that damage vegetation, buildings, aquatic life, and human health	kg SO <sub>2</sub> 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
æ	Human toxicity potential	Emissions of materials toxic to humans, animals or plants	kg DCB equivalent

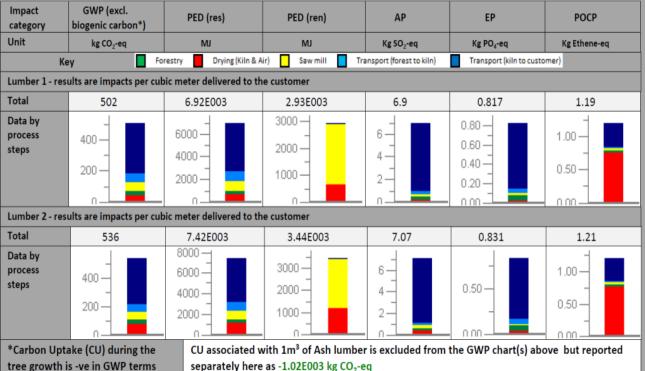


Derived from PE/AHEC ireport

### 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 ISOconformant 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).



- Science based International
- standards (ISO 14040)
- Broad range of impacts not just carbon footprint

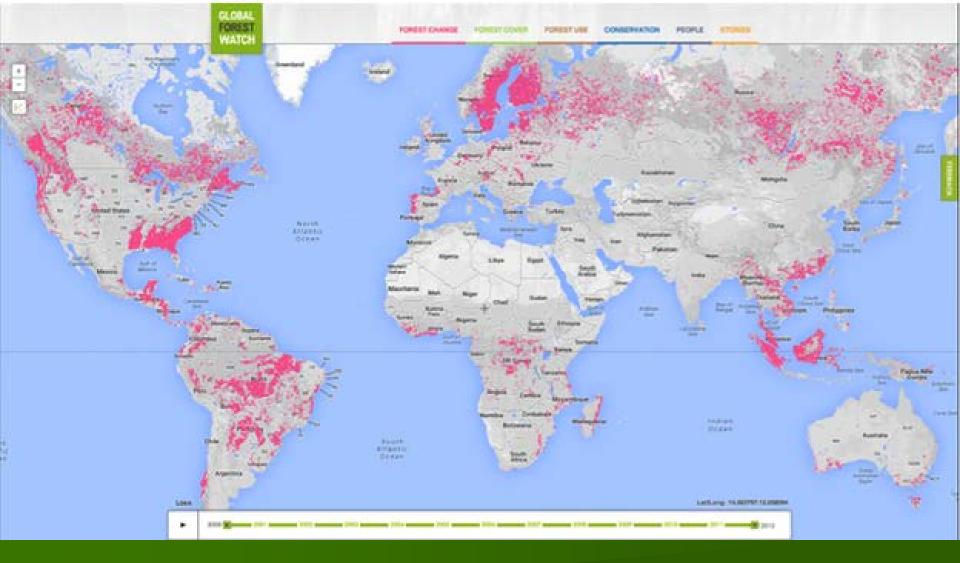
- Helps industries improve efficiency
- Basis for EPD's on products and materials

# EPDs

ition Facts	Compare For Yourself: Neared as 20 persons to the test
Nutrition Facts Serving Size 1 Tosp (14g) Serving Per container 30 Servings per container 30	Per ICBINBI Butter Butter Dimension In Deck
Telef Fail 50 Calories Hom Fail 40 Subset 50 Calories Hom Fail 40 Subset Fail 50 Subset Fai	Calories     50     100     States is sponsored in the set of the
Statesterol Orng     0%       Sofium 85mg     4%       Total Carbohydrate Og     0%       Potein Og     0%       Potein Og     0%       Reist 1%     Krightet some of Datasy Film, Supers, ten Carbohydrate on a 2,000 calorie del.	Naturally Cholesterol Free Ingreenents: Water, Vegetare or rend along some r, war hydrogenated Soviesan or, wateral smet den renalt is gelatik, Vegetare mono and diriveres, man, sy esk potassem soremet, calcium decorm edga ised in rost not. W Lactic acid, natural and artifical randes, vitam a punce in the carcitere for color.

# But... perception that wood is scarce

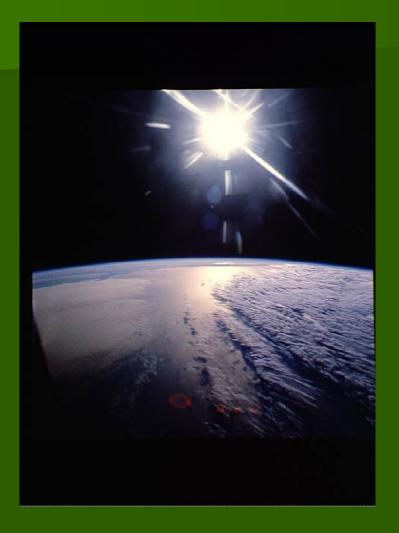




#### AP Wire/BBC News, February 23, 2014: "A new global

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....

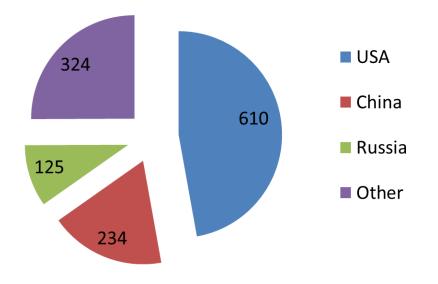


Between 2000 and 2010, volume of wood standing in temperate and boreal forests increased by 1290 million m3 per year Enough to build 58 million two storey timber frame houses every year (assumes 50%) conversion & 11 m3 per house)

Global housing starts = approx 36 million/ann.

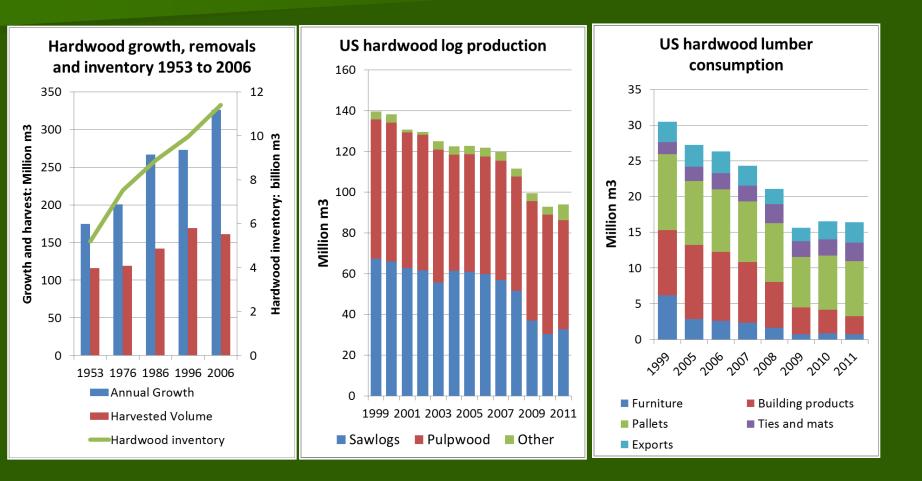
# Much of the increase in forest growing stock is in the USA

Average annual increase in forest growing stock in temperate and boreal forests 2000-2010 Million m3 (over bark). Source: UN FAO



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







## Forest Products Annual Market Review







Innovation for structural change recovery





"...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<sup>3</sup>
  - Removals128 million m<sup>3</sup>
  - Mortality 109 million m<sup>3</sup>

(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 CO2 to the atmosphere

### Consignment-based American Hardwood Environmental Profile

#### American Hardwood Environmental Profile

The approvement of the environmental impact to deliver a defined consignment of lumber of a specified U.S. hardwood specifies of u.S. hardwood specifies of u.S. hardwood respectives to a overses current (JL). Date is derived from the PLC U.S. hardwood (JL). The U.S. Foreit Service Foreice Torrest Inventory and Analysis (HA) program (JL), the Senece Creek Risk Assessment of Legality and Sustainability in U.S. Hardwood Espects (Ja), and the PSC Risk Register (JS), the issuing organisation should identify the consignment and species and enter the quantify and thickness(s) of lumber. The sissuing organisation may aloo choice to use default U.S. servage values of or energy compution of the kin and for transport distance and mode or may enter values specific to their own hardwood operations or the supply chain to the customer.

ld. number(s) (6)				Cross- refs (7)			
	d American Hardwood Export Council, 3 St Michael's Alley, 8) London EC3V 9DS, UK europe@americanhardwood.org			Issued A.N. Other Hardwood Importer GmbH, Messeplatz 1 to (9) Cologne, Germany T: + 49 221 821-0			
Description of Sawn wood of yellow poplar product (10) H5 4407.99.01.72		Common name(s) (11)	American tulipwood/yellow poplar				
Scientific Uriodendro name (12)	Uriodendron tulipifera			Country of harvest (13)			
Sub-national Eastern Unit region of Carolina, Ge harvest (14) (Figure 1)				Concession of harvest (15)	Multiple p	ivate forest owners	
		Thickness		Quantity		Thickness	Quantity
List up to 3 thicknesses & guantity in consignment:	1	1 inch		1	3	3 inch	1
quantity in consignment:	2	2 inch		1		Unit of quantity	cubic meters

#### Legal compliance (16)

The Seneca Creak Risk Assessment concludes that there is negligible risk of any U.S. hardwood containing wood from lilegal sources; tolen 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.americahardwood.org/subtainability/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)

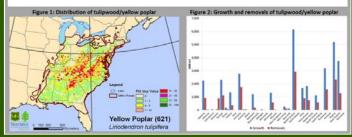
 The PE LCA study concludes with respect to land-use change: "In the system under investigation the main material – wood – comes from naturally regrown forests. The harvested areas had undergone several iterations of harvesting and re-growth. After harvesting, the land is returned to forest so there is no direct fand use chanse to account for in the timeline of a few hundred wava".

•On biodiversity impacts, the PE LCA study concludes that: "Conversion of any other commercial land into the hardwood forest would most probably be positive impact on the land quality including biodiversity and associated ecosystem services".

•FA data indicates that tullipwood makes up 2.3% of U.S. hardwood standing volume. The tullipwood resource is not only revensable, but is expanding. Tullipwood 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 FA data, annual forest growth exceed harvest in all states with the exception of Dataware (Figure 2).

where special controls have now been introduced to protect the species. • The Service Creek Risk Assessment concludes that there is Low Risk of U.S. hardwoods being derived from any of the five categories of controversia forces source identified in the FSC concluded Wood Standard.

orest source identified in the FSC Controlled Wood standard





#### 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 ISOconformant LCA model prepared by PC. The Parameters table summarise all values entered by the issuing organisation. All other parameters required to calculate the environmental profile are derived and fixed in the model by PC. Results are categorised according to process steps (forestry, sawmill, kiln thring, transport forest to kiln, transport kiln to customer, and archor outlike).

	Global Warmir Potential	Demand from Resources	Primary Energy Demand from Renewables	Acidification Potential	Eutrophication Potential	Photochemical Ozone Creation Potential	Abiotic Depletion Potential (Elements)	Abiotic Depter Potential (Fossil)
Unit	kg CO2-equiv	MI	MU	kg SO2-equiv.	kg PO42-equiv	kg Ethene- equiv.	kg Sb-equiv.	MU
1" lumber - 1	cubic mete	r						
lotal	E: 242.60	3420	7370	3.04	0.277	0.233	0.0000112	3210
	CU: -678.45	4000	8000	4.0	0.30	0.25	156-05	4000
	500				0.30	0.25	130-09	12 CA
Data by	0	3000 -	8000 -	3.0	0.20	0.15	1.05-05	3000
process		2000 -	4000 -	2.0		0.10		2000 -
teps	-500	1000	2000	10	0.10	0.05	5.02-06	1000
	-2000			0.0	0.00	0.00	0.05+00	0
" lumber - 1	cubic mete	r						
otal	E: 335.78	4829	8723	3,77	0.329	0.28	0.0000185	4320
	CU: -678.45	6000	10000	4.0	0.40	0.80	3.04-05	\$000
			8000					4000 -
lata by	0	4000	8000	3.0 -	0.30 -	0.20	1.55-05 -	3000
rocess			4000 -	2.0	0.20		1.05-05	2000 -
teps	-500	2000	2000 -	10-10-10-	0.10	0.10	3.08-06	1900 -
	-1000			0.0	0.00	0.00	0.05+00	0
" lumber - 1								
otal	E: 450.67	6610	10400	4.66	0.392	0.34	0.0000275	5680
	CU: -678.45	8000	15000	5.0	0.50	0.40	3.06-05	6000
	500	6000		40-	0.40	0.30 -		
lata by			10000	3.0	0.30		2.05-05	4000
rocess	0	4000	5000	2.0 -	0.20	0.20	1.05-05	2000 -
teps	-500	2000						
				10	0.10	0.10		
	-3000	•		0.0	0.10	0.00	0.05+00	
Key		o uptake E For		0.0	0.00	0.00	1000	
cey Description o	Carbo	n uptake E For	estry 🔳 Kiln dr	ving Sawm	e.co	t forest-kiln	oot-oo Transport kilr	-customer
Description o	Carbo	n uptake E For	estry E Kiln dr	rying Sawm	e.co	t forest-kiln	0.0E+00 Transport kilr	-customer
Description of	Carbo	n uptake For egories ermed "carbon footp diaxide, methane an reported separately	estry Kiln dr	of carbon dioxide of the influence the en-	0.00 Transpor	t forest-kiln	0.0E+00 Transport kilr	emitted (inclu
Description o	Carbo	n uptake For egories diaside, methane an reported separately iCui during tree arou fossil fuels in mega-	estry Kiln dr nor Expressed in Sg d water vapour) whi for all greenhouse g oth lightich is a negat jouries. The import	of carbon dioxide a cof carbon dioxide a ch influence the en pasemissions (E) fin the number in GWP	a co ill Transpor convertent The sum regulations of the processes to ext remail application on its	t forest-kiln	0.02+00 Transport kilr tential of all gases g to increased avera tiver the timber and s not differentiate b	emitted (inclu ge temperatu f for carbon
Description of the second seco	Carbo of impact cat offen carbor Data is uctakt and Use of source	n uptake For egories ermed "carbon footput disaide, methane an reported separately (DI) during mee moo fossil fuels in mega- sileg, oil or coali. No	estry Kiln dr net Expressed in Eg of wher vapour) whit for all greenhouse g arth lamitch is a nesat jouries. The import or ofoes in represent "	a o Sawm of carbon dioxide a ch influence the en lase missions (D) fri the number in GWP artegory kas limited	a co ill Transpor rouvalent. The sur- rouvalent.	t forest-kiln	0.02+00 Transport kilr tential of all gases g to increased avera tiver the timber and s not differentiate b	emitted (inclu ge temperatu f for carbon
Description of total Warming Pote timary energy dema resources) timary energy dema	Carbo of impact cat often carbo Data is uctake used	n uptake For egories diaside, methane an reported separately iCui during tree arou fossil fuels in mega-	estry Kiln dr nat" Expressed in Eg d water vapour( whi for all greenhouse g inh inhich is a neare pouries. The impact o r does in represent " in, eutrophication, a	of carbon dioxide a cof carbon dioxide a ch influence the en pas emissions (1) fri the oumber in GWP artepoy has limited embodied energy', hd resource depiet	0.00 Transpor curvelent The sum processes to ext termal application on its However it is an im-	t forest-kiln	0.02+00 Transport kilr tential of all gases g to increased avera tiver the timber and s not differentiate b	emitted (inclu ge temperatu f for carbon
Description of Robal Warming Poly rimary energy dema resources) rimary energy dema renewables)	Carbo of impact cat Difent and Source global and Use of Datasi	n uptake For egories ermed "carbon foorpy dioxide, methane an ceported separately IDUI durine roce aroo tossil fuels in mega- s (e.g. of or coalit. No warming, scidificatio energy derived from i	estry Kiln dr net" Expressed in 5g dwater vapour) whi for all greenhouse g wh inhich is a negat poules. The impact or r does it represent " on, eutrophication, an renewable raw mate	co Sawm or (arbon dioxide r dr (arbon dioxide r (arbon dioxide r arbon	eco ill Transpor requisitent. The sum rery balance of the the processes to est termal application on its source of the termal source of termal source of	0.00 t forest-kiln and those of the warming point of the warming point of the standard standa	0.00-00 Transport kilr rential of all gases to increased aver- tiver the timber an s not differentiate t er environmental in	enitted (inclu ge temperatu for carbon enween energ npacts includi
Description of Initial Warming Peter Visinary energy dema vescences) Visinary energy dema venewables) coldification Potentia	Carbo of Impact cat Data i uotaka and Use of source and Use of source and Use of source and Use of source	n uptake  For egories termed 'carbon footput (abside, methane an reported separately, (10) during these pro- fossi / heels in meg- soid fossi energy derived from i lai for acidification or ir dioxide (502) and in	estry Kiln dr net" Expressed in sg od water vapout whi for all greenhouse g initich is a netar poles. The impact r does it represent " renewable raw mate f soil and damage to itrogen oxides (NOX)	co Cabon dibuide a co Cabon dibuide a ch influenze the em semissiones (1) frue embodied energy and resource depiets intrats in mega-joole plant health result.	0.00 January Control of Control o	0.00 t forest-kiln in of the warming po manual strange in the second material strange in the second portant driver of other to air, water and is unvalent.	0.06+00 Transport kilr rentiat of all pases to increased avera liver the timber and s not differentiate to er environmental in and of aciditying con	rmitted (inclu ge temperatu for carbon etween energ spacts includi
Description c lobal Warning Peter Visiary energy demo resources) Visiary energy demo renewables) Icidification Potentia	Carbo     Chico     Contor     Contor	n uptake For regories remot "carbon footput disaide, methane an reported separately (10) during metaanow fessil fuels in mega- s (e.g. off or caal). No warming, scidification energy derived from I iai for acidification o	estry Kiln dr rine" Expressed in sg of wher vapour whit har all greenhouse g in anich is a near variantich is a near variantic	co sawm ar carbon dioxide a ch influence the en gar carbon dioxide a ch influence the sam ar emissions (E) fri late counter in GWB ategory Assimiled ategory	and ill Transport represent the sum representation on its application on its application on its application on its supplication on its supplication on its supplication on its supplication on its supplication on its application on its supplication o	0.00 t forest-kiln and the warming polationsphere teading and the warming polations and do own because it doe portaint driver of our to aliv, water and it univatient.	0.02-00 Transport kiln teritial of all gasess tiver the limber an s not differentiate t er environmental if and of aciditying con organic matter (e.g.	rmitted (inclu ge temperatu for carbon etween energ spacts includi
Description c soluted Warning Pole vimacy energy dema resources) vimacy energy dema renewables] cidification Potentia utrophication Potentia	Carbo     C	n uptake  For control control for disside, methane as (control control for disside, methane as (control cospetial expending) (control for south of the cost of the cos	estry Kiln dr met: Expressed in rg d water support the all greenhouse schlahtch is a press polisis. The imperi r does it represent " r does it represent r doel and damage to data facilitate (1000) are by release of pho- prometter and deplie thermical simod,". Incre-	co ying Sawm or carbon dioxeter to influence the en- parentsoles (), for the oursteer in GWA strengory has limited motodied energy. nd resource depiet: ritals in mega-poule plant health result sphorous or nitroge tion of owgen level ison of owgen level ison of owgen level tion owge	0.00 June 1 Transport Source of the sure regulations of the sure regulations of the sure regulations of the sure regulation on its: Source of the sure of the sure sure of the sure of the sure of the sure of the sure of the sure of the sure of the sure of the sure of the sure of the sure of the sure of the sure of the sure of t	0.00 t forest-kiln of the warming po atmosphere leading read, process and do portant driver of oth to alir, water and la usatert as fertilisers; and essed in kg of pho-	0.02-00 Transport kilr rentiat of air gases g to increased aver tilter the limber an and of acidifying con organic matter (e.g phate equivalent:	-customer mitted (inclu ge temperatu for carbon spects includi spects includi spects includi spects includi spects includi
	Carbo     Carbo     fimpact cal     Carbo     Carbo	n uptake <b>E</b> For eportes emined caboo toop dioxide, methane as reported separately 1001 during mean toop and the second result was an emined energy derived from i lai for solidification on dioxide [102] and excess prowth of pla	estry Kiln dr net", Expressed in ag of water vapoully white for all pre-thouse g tith labic is a netter in govern in the present ", networksite raw matter of soil and damage to itingen nuides (NOS) not by release of pho- nor metter and deple themical smg". Income	e D viring Sawm of carbon discute dh influence the en- dh influence in GMU as emissions (E) first as emissions (E) first and of the energy of the mitodic an energy. as a mission of the plant health result Expressed in Eg of oxygen level splant health result expressed in Eg or an of oxygen level oxides of nitrogen in of oxygen level	a.zo iii Transpor equivalent The sur- erry balance of the processes to est remain application on its application on its supplication on its supplic	0.00 of the warming po atmosphere leading real, process and dr own because it does portant driver of other to air, water and Is unalters: to air, water and Is unalters: to air, water and Is as fertilisers; and eased in kg of phor- rise through the re- influence of sunlig	0.02-00 Transport kilr rentiat of air gases g to increased aver tilter the limber an and of acidifying con organic matter (e.g phate equivalent:	-customer mitted (inclu ge temperatu for carbon spects includi spects includi spects includi spects includi spects includi
Description of solution warring Petro resources) Vimary energy demo resources) Vimary energy dem	Carbo     Carbo     Constant     Consta	nuptake B For inceprise and a calhon Kongel and a calhon Kongel and a calhon Kongel and a calhon Kongel and a calhon and a and a and a calhon and a and a an	estry Kiln dr net" Expressed in sg di water vapoul (whi for all preenhouse eth) Innich Is a netar eth) Innich Is a netar the second second second designed and the second designed second second f soil and damage to the second second the second second the second second the second second second second the second second second second the second second the second the second second second the second second second the second second second second the second second second second the second	of Galebon dioxide 4 of Galebon dioxide 4 is of Galebon dioxide 4 plant health nesult 5 opressed in 8g of sphorous or nitrogen tion of oxigen level seased levels of Occor oxides of nitrogen i here production. Expr resources. Complete	CO     Control of the sum of	a construction of the warming point of the warming point annoyaber leading and the point of the warming point of the warming and the point of the second sec	0.00-00 Transport kilr rential of all gases to increased aver- tiors the linker and a not differentiate in environmental in environmental in environmental is environmental ex- panse equivalent. eccion of volatile or, h. The problem effi	-customer emitted (inclue etemperature) for carbon etween energy spects includi appounds such in effluents), 1 anic compound cts modern ch
Description o sknat Warning Pata vinacy energy demi- escotten) vinacy energy demi- enerwables) kcidification Potenti- hotochemical Ocon- istential abotic depletion Pot-	Carboo	In uptake B For incorrect Final Calibra Monthane ar- reported separately (disside, networks are reported separately (disside, networks are result of a second are second are and and for activitications on ar disside (102) and in ot anrichment of walk excess provin of pla- efferted to as "photos are depletion of non- bla consumed. Expression	estry Kiln dr net, "Laversset ny k di water sponsi lub fra all greenhouse poules. The impact is a nears withinkich is a nears thinkich is a nears renew kole raw nate renew kole raw nate faoli and damage to integen anides (topo) ars by relass of phone on meter and deale themical smodil. Income the state of the state set in relation to the set in relation to the	ying Sawm of carbon dioxide re bindherene the or na amesian (t) fi hi endodine arception de secure administration plant heath results administration mag-public secure administration mag-public plant heath results administration mag-public secure administration administra- tion of acquere level tion of acquere level secure administration. Rup resources of ministration results of our manual resources of ministration. Rup resources of the ministra- resources of the ministra-	control of the service of the s	a construction of the warming point of the warming point annoyaber leading and the point of the warming point of the warming and the point of the second sec	0.00-00 Transport kilr rential of all gases to increased aver- tiors the linker and a not differentiate to environmental in environmental in environmental is environmental ex- panse equivalent. eccion of volatile or, h. The problem effi	-customer emitted (inclue etemperature) for carbon etween energy spects includi appounds such in effluents), 1 anic compound cts modern ch
Description of stokal Warning Prov Visinary corregy demi- resources) visinary energy demi- resources) visinary energy demi- networkers vising for the stokal vising of the stokal stokal stokal vising of the stokal stokal stokal vising of the stokal stokal stokal stokal vising of the stokal stokal stokal stokal stokal vising of the stokal stokal stokal stokal stokal stokal stokal vising of the stokal stokal stokal stokal stokal stokal stokal stokal stokal stokal vising of the stokal stokal vising of the stokal stokal vising of the stokal stokal vising of the stokal	Carboo     fimpact cas     of impact as     carbor     direct     direct	In uptake II For regories seried 'cabob footback (diskie, retraine are reported separately to have retrained separately to the series and the response of the series an engy derived from 1 lais for acidification excess growth of plat elements do as "photos elements do as "photos papers human health res despiration of nom-	estry Kiln dr net, "Laversset ny k di water sponsi lub fra all greenhouse poules. The impact is a nears withinkich is a nears thinkich is a nears renew kole raw nate renew kole raw nate faoli and damage to integen anides (topo) ars by relass of phone on meter and deale themical smodil. Income the state of the state set in relation to the set in relation to the	ying Sawm of carbon dioxide re binflavene the or na amesian (1) for an amesian (1) for a secure application of assertion (1) for a secure application of assertion (1) for a secure application) (1) for a secure a	control of the service of the s	a construction of the warming point of the warming point annoyaber leading and the point of the warming point of the warming and the point of the second sec	0.00-00 Transport kilr rential of all gases to increased aver- tiors the linker and a not differentiate to environmental in environmental in environmental is environmental ex- panse equivalent. eccion of volatile or, h. The problem effi	-customer emitted (inclue etemperature) for carbon etween energy spects includi appounds such in effluents), 1 anic compound cts modern ch
Description o sknat Warning Pata vinacy energy demi- escotten) vinacy energy demi- enerwables) kcidification Potenti- hotochemical Ocon- istential abotic depletion Pot-	Carboo     fimpact cas     of impact as     carbor     direct     direct	In uptake <b>B</b> For egories an ear characteristic and a second reported and a second and a second reported and a second and a second term of the second and a second term of the second and a second and for additional second and a second and a second and a second and the additional second and a second and a second and a second and the second and a second and a second a second and a second and a second a s	estry <b>#</b> Kiln dr nor, topesset in space diverse space) which indexis in a negative diverse space) which indexis in a negative of deal in reservent in or deal in reservent in the negative space of the space of deal in reservent in the space of the space of the space of the space of the space of the space of the space of the space of the space of the space of the space of the space of the space of the space of the spa	columnational and a set of the	Constraints of the second	a construction of the warming point of the warming point annoyaber leading and the point of the warming point of the warming and the point of the second sec	o st-ou Transport kill refinist of any passes to increase a early passes in of a clighting con- organic matter (a g ohne quivalent. In the problem eff to size of remaining	-customer mitted (inclu- ge temperatur for cartion reserven energy nexts includion repounds such in efficients). It anic compound cas modern cit
Description of shall Warning Pelevine secures) winay energy demi- encewakes) secures	Carboo     fimpact cas     of impact as     carbor     direct     direct	Duptake <b>III</b> For expression of the provided	estry Kiln dr net, "Laversset ny k di water sponsi lub fra all greenhouse poules. The impact is a nears withinkich is a nears thinkich is a nears renew kole raw nate renew kole raw nate faoli and damage to integen anides (topo) ars by relass of phone on meter and deale themical smodil. Income the state of the state set in relation to the set in relation to the	cp J vying Sawm of zakon doniest of calebox discrete the influence the en- age emission (G is the influence of the influence in the influence of the influence of the influence influence of the influence of the influence of the influence influence of the influence of the influence of the influence influence of the influence of th	control of the service of the s	a construction of the second o	0 35-00 Transport kill refinan of sing gases: the involved and entry gases: the involved and entry gases: the involved and the involved and the involved activity involved and the phone equivalent. The provident divident of a phone equivalent. The provident divident of a phone equivalent. The provident divident of a construction of vident of	-customer mitted (inclu- ge temperatur for carban enveen energi neets includi apounds such in efficients). 1 anic compound reserves for a col industry b by 6E drawin
Association of the second seco	Carboo     Timpact cast     Carbo     Single Cast     Carbo     Single Cast     Carbo     Single Cast     Carbo     Single Cast     C	Duptake <b>B</b> For egentes control characteristics of the second sec	estry  Killn dr rot <sup>-</sup> , tapesed takes available takes available rot <sup>-</sup> , tapesed takes available takes available des in sparsest rot des in sparsest des in sparsest rot des in sparsest rot	o Junior Contraction of the second se	200 International Internationa	2.20 t forest-kilo of the warming po atmosphere lead- introvalence lead- the atmosphere lead- the atmosphere lead- work the atmosphere lead- the atmosphere lead- atmosphere lea	0 25-00 Transport kiln remain of and gases to increased event to increase devent to increase devent to increase devent to increase devent to increase devent to increase devent remain of activitying con- organic matter is a proposition of volacile org- mit methods and the problem effi- ing of remaining Default US handwe	-customer mitted (inclu- ge temperatur for carban enveen energi neets includi apounds such in efficients). 1 anic compound reserves for a col industry b by 6E drawin
Description of shall Warning Pele- sinary energy dem energy dem e	Carboo     Timpact cast     Carbo     Single Cast     Carbo     Single Cast     Carbo     Single Cast     Carbo     Single Cast     C	Public Processing Control (Control (Contro) (Contro) (Contro) (Contro) (Contro) (Contro) (Con	estry      Kiln dr more capression as pro- more capression as pro- more capression as pro- more capression as a pro- more capressi	co	control of the second sec	2.00 the forest-kills and an anomalies in the second second an anomalies in the second second second and the second second second second to air, water and in the second second to air, water and in the second second second to air, water and the second second second second to air, water and the second second second second to air second second second second second second to air second second second second second second second to air second second second second second second second second to air second seco	0 35-00 Transport kill refinan of sing gases: the involved and entry gases: the involved and entry gases: the involved and the involved and the involved activity involved and the phone equivalent. The provident divident of a phone equivalent. The provident divident of a construction of videntie on the phone equivalent. Default US hardwa	-customer mitted (inclu- ge temperatur for carban enveen energi neets includi apounds such in efficients). 1 anic compound reserves for a col industry b by 6E drawin
Description of the second	Carboo     Carboo     Dilaci     Dilaci     Carboo     Dilaci     Carboo     Dilaci     Carboo     Carboo	Purplake III For egenties minist reactions report indicates, minister are consistent and the second report of the	estry      Kiln dr references and the second second references and the second second references and the secon	constraints of the second	add      add      Transport     add      Transport     add      Transport     add      Transport     add      Transport     add      Transport     add     Transport     ad	0.00         If forest-kills         If           1 forest-kills         If         <	o st-do Transport kilr refinan of sing spaces to involve and entry spaces to involve and entry spaces involve and investments of actioffying con- organic matteries and of actioffying con- organic matteries phone equivalent. In the problem divident of the prob	-customer mitted (noture for carbon envices includi appoints such in effluents), panic compounds such carbon compounds such in effluents), reserves for a od industry by PE drawin members
Description of the second seco	Carboo      finpact cas      carboo      finpact act      cas      carboo      cas      carboo      carboo	n uptake <b>W</b> For experies control control of the provided sequence response control of the provided sequence response to the provided sequence response resp	estry      Kiln dr more: topszest is g deters sapool wide deters sapool wide detersapool wide deters sapool wide deters	Constraints of the second	and the second sec	0.00         If forest-kills           t forest-kills         If the warming point and the state process and the state process and the state process and the state process and the state state and is operated warm of or the state	0.05-00 Transport kill rentral of and gales to increase a energy to increase a energy to one of energy to one of the energy one of exciding one one of exciding one contract one of the energy one of exciding one contract one of the energy one of exciding one on size of remaining Default US hardway average calculates on data from AHEC	ecustomer emitted (inclu- ge temperature) for carbin environmental includion appounds such in efficients). panic compounds carbinets for a reserves for a od industry b by 6¢ draws : members
Description of the second seco	Carbo     Direct     Direct	Particle III Fore expression of the second s	estry  Kiln dr ref <sup>44</sup> tabers estopol table t	Comparing Samma Comparing Samma C	and the second sec	0.00         If forest-kills         If           of first warring point answarring point and answarring point	a strong Transport kill Transport kill Transport kill till the transport kill till the transport kill till the transport till the transport	-customer mitted (include for carbon environment in environment mice and a such in effluents). and compounds such in effluents). reserves for a od industry by Vé drawis members sudy sudy
escription of warming Person manuf Warming Person measures; image energy deministry energy deministry energy deministry indiffication Potential definition of the second second energy and the second energy and the second energy and energy and	Carboo      finpact cas      carboo      finpact act      cas      carboo      cas      carboo      carboo	Drake III For general control of the pro- section of the pro- person of the pro- section of the pro- section of the pro- section of the pro- section of the pro- person of the pro- section of the pro- sect	estry      Kiln dr more: Tepresent more: Tepresent market more: Tepresent market more: Tepresent market more: Tepresent more: Tepres	Comparing Samma Comparing Samma C	Constraints     Constrain	a do t forest-kin a of the warming po- annougher leading the second of the warming po- annougher leading the second of the second to allow area and law warmed in a dotter and area of the second of the the second of the second the second of the second of the second of the second the second of the second of the second of the second the second of the second of t	0.05-00 Transport kill rentral of and gales to increase a energy to increase a energy to one of energy to one of the energy one of exciding one one of exciding one contract one of the energy one of exciding one contract one of the energy one of exciding one on size of remaining Default US hardway average calculates on data from AHEC	-customer mitted (include for carbon environment in environment mice and a such in effluents). and compounds such in effluents). reserves for a od industry by Vé drawis members sudy sudy

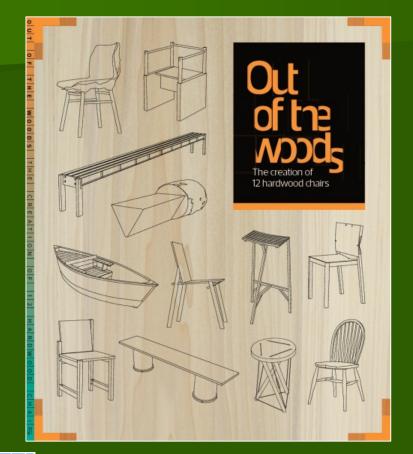


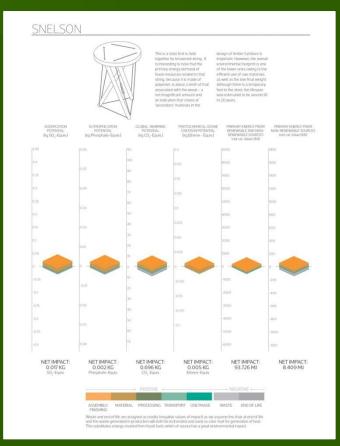
# Using Special Projects to Promote Sustainability

### www.americanhardwood.org



### Out Of The Woods Environmental Profiling







#### 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

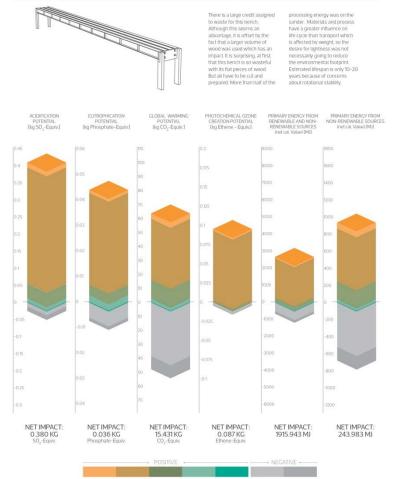






#### Out of the Woods: Full Life Cycle impact assessment for 12 hardwood chairs – BEEENCH

#### BEEENCH



ASSEMBLY MATERIAL PROCESSING TRANSPORT USE PHASE WASTE END OF LIFE FINISHING Waste and end of life are assigned as credits (negative values of impact) as we assume the chair at end of life

Waste and end of life are assigned as credits (negative values of impact) as we assume the chair at end of life and the waste generated in production will both be incinerated and used as a bio-fuel for generation of heat. This substitutes energy created from fossif fuels which of course has a great environmental impact.



- 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)DensityRolling sheat

*Results of testing tulipwood CLT:* 

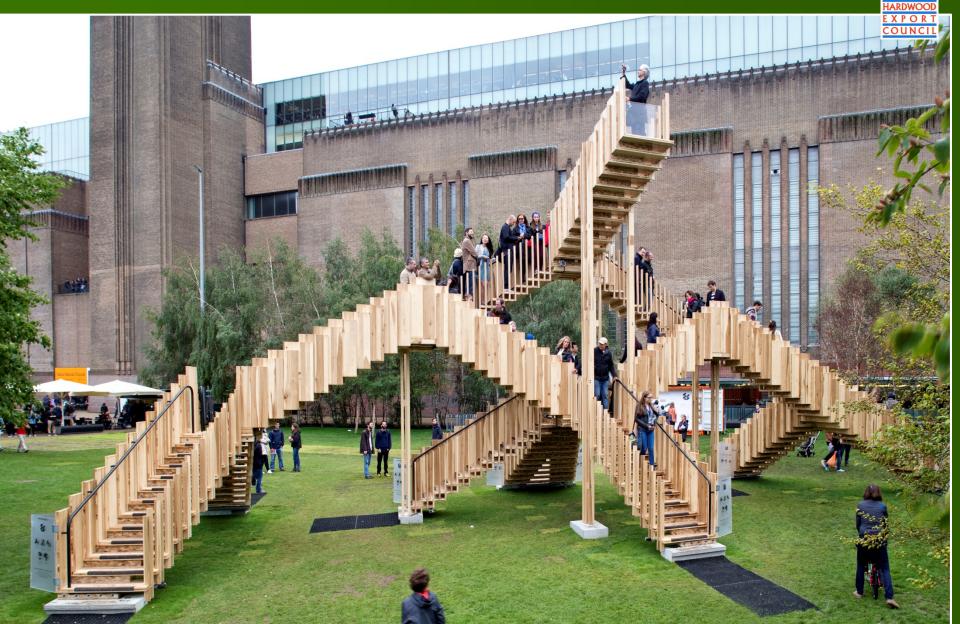
	Density	Rolling shear			
		Strength	Stiffness		
Softwood	420	0.8	60		
Tulipwood	550	2.7	210		





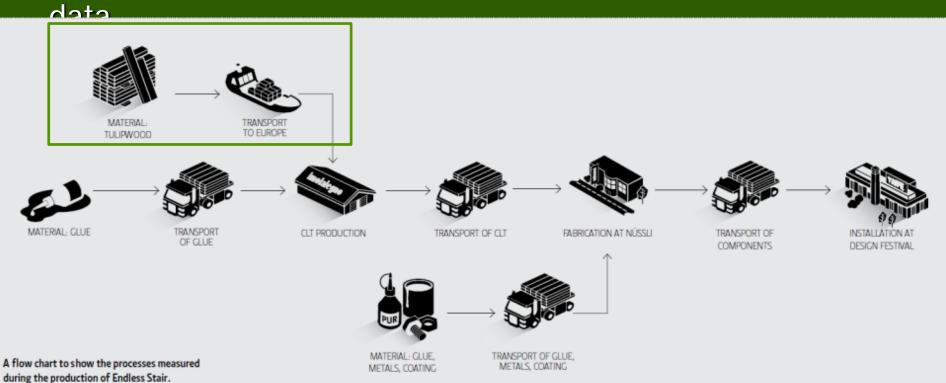


# Endless Stair – adding a new dimension to timber in construction

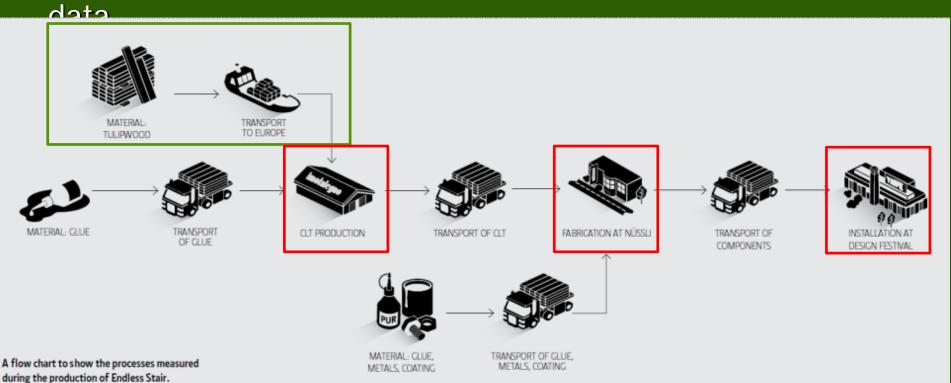




### AHEC lumber study



### AHEC lumber study



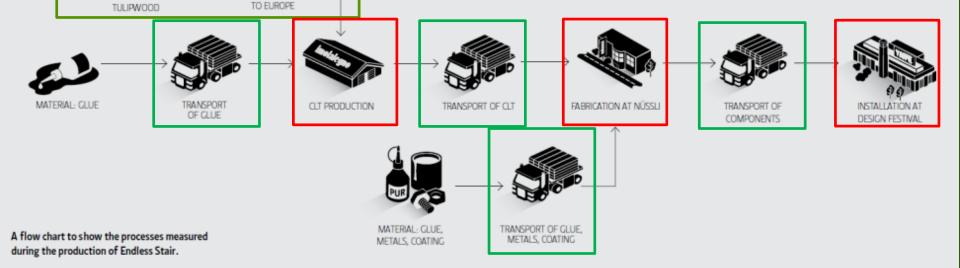
### Project specific data derived from project

# AHEC lumber study

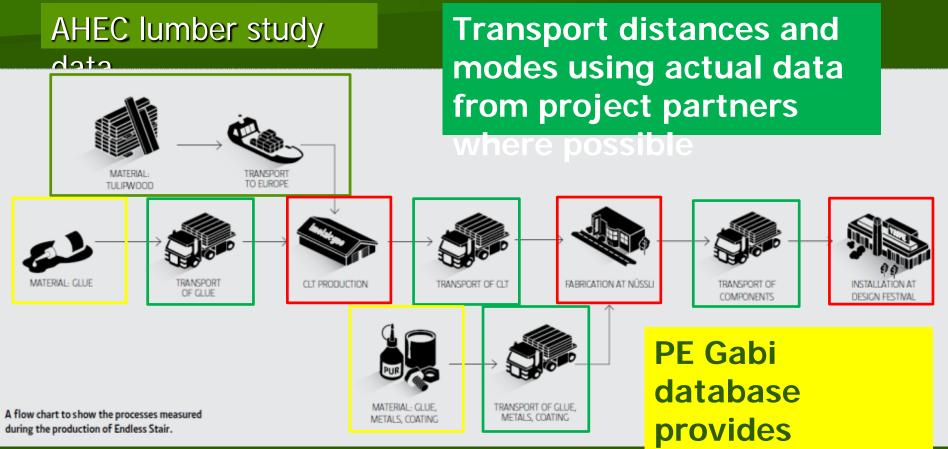
MATERIAL

Transport distances and modes using actual data from project partners

### where possible



## Project specific data derived from project



industry

average data

Project specific data derived from project 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

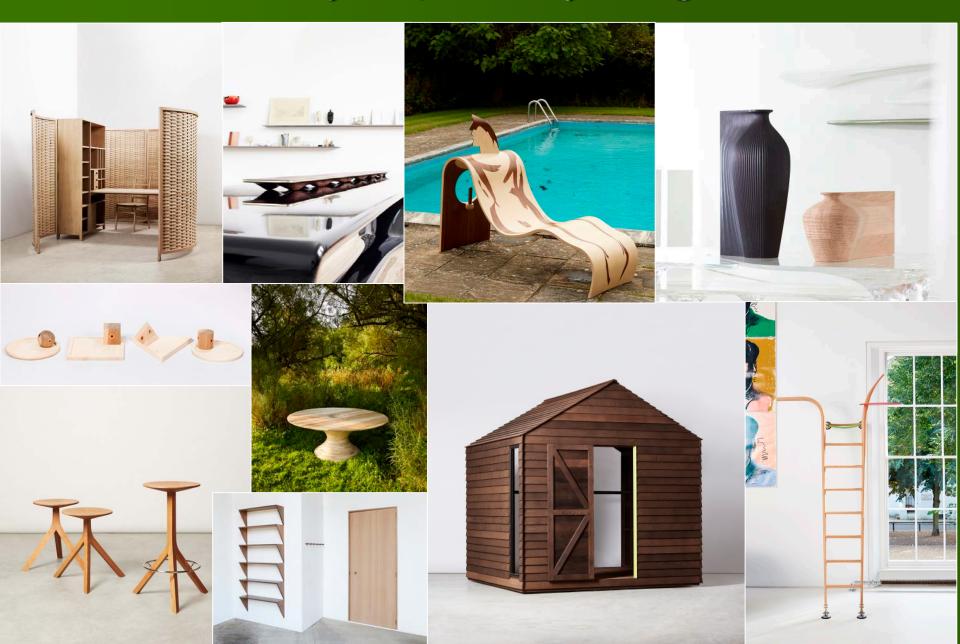
- Waugh Thistleton Architects
- 9 storey timber building
- Cross laminated lumber
- Completed 2008
- 4 carpenters assembled structure on-site at a rate of 1 storey a week
- Building weighs 300 tonnes
- 1/4 weight of equivalent concrete building
- Saves 306 tonnes of carbon to a comparable steel and concrete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



# Wood: The Substitution Effect



# Ten Projects; Twenty designers

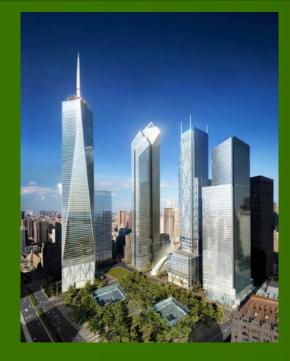


### Norman Foster – 'Tulipifera Sharpeners'

"... 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 jewellike 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<sub>2</sub> 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<sup>3</sup>



A STOOL FOR THE KITCHEN STOOL BY FELIX DE PASS WITH ALISON BROOKS HE WISHLIST MADE IN AMERICAN CHERRY



### WOOD RESOURCE

ent forest inventory data1 shows that American cherry growing stock is 306 million m<sup>1</sup>, 2.7% of total U.S. bardwood growing stock. American cherry is growing 8.6 million m<sup>3</sup> per year while the harvest is 3.5 million m<sup>1</sup> per year. After harvesting, an additional 5.1 million m<sup>1</sup> 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.



SUMMARY

Felix de Pass created two stools for the Wish

List, one tall and the other short. This com-

mentary refers only to the tall stool. In prac-

tice, the impact of the two stools is almost ex-

actly 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

The stool is carbon neutral on a cradle to grave

and the carbon emissions from supply of wood

basis. Very few non-wood materials are used

are offset by energy recovery from wood

The small amount of plywood used to cre-

ate the lig for the stool has a relatively minor

effect across all environmental impact catego

ries. For this analysis, the full impact of the

plywood is allocated to the first stool. How

the plywood iig would be reused and this

impact would be allocated among multiple

CARBON FOOTPRINT

The stool's carbon footprint is -0.2 kilograms of CO.

equivalent on a cradle to grave basis. Carbon emissis

during all stages of material extraction and process-

ing, product manufacturing, and transport are 25.2

by 25.4 kilograms of avoided emissions from energy

A large proportion of the wood required to manufact

ture the stool did not end up in the finished product.

kilograms of CO, equivalent. These emissions are offset

ever, if the stool were produced of

waste which substitutes for fossil fuels.

recent years

products

### HEWISHLIST MADE IN AMERICAN RED OAK AND CHERRY

### SUMMARY

The workspace is composed primarily of two America hardwoods - Cherry and Red oak - which are abundant and under-utilised. The US resource of both hardwood is large and expanding. Use of these timbers, combined with strong craftsmanship skills - with their emphasi 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 mat rial production derives from renewables. The waste wood produced during manufacturing and at End O Life can be used for energy production, thereby offset ting use of fossil fuels Of course it would be a shame for such workmanshi

to be sent to the incinerator too soon. Such an out ome seems unlikely - the quality, beauty and durabil ity of the design suggest the workspace will remain in use and act as a carbon store for many years. Such ngevity also reduces the need for replacement, miti gating the significant acidification and POCP environtal impacts of material supply and manufacturin

### WOOD RESOURCE

The wood content of the workspace comprises ab one third cherry and two thirds red oak. Red oak is the nost 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. governmen tory data1 shows that U.S. red oak is grow ing 51.9 million m<sup>3</sup> per year while the harvest is 32.4 million m<sup>3</sup> per year. U.S. cherry is growing 8.6 million m<sup>3</sup> per year while the harvest is 3.5 million m<sup>3</sup> per year. After harvesting, an additional 19.5 million m<sup>3</sup> of red oak and 5.1 million m<sup>1</sup> 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 equired for the workspace.

### CARBON FOOTPRINT On a cradle to grave basis, the carbon footprint of the

This reduces the long-term carbon storage potentia vorkspace is 53 kilograms of CO, equivalent. That's but it also means that there is a significant volume of





240 miles (380 km) by the average UK car2. Carbon emissions during all stages of material extrac tion and processing, product manufacturing, and transport are 404 kilograms of CO, equivalent. Of these emissions, 279 kilograms of CO, 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 em from substitution of fossil fuels through reuse of wood

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 produc tion from wood waste during manufacturing are about equivalent to those received from final disposal at End of Life





### SUMMARY Unsurprisingly, the mass of tulipwood used to co struct 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 poter tial to art 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 reation potential (POCP). Partially mitigating these pacts is the potential for the table to remain in use r many years, minimising the need for replacement

### WOOD RESOURCE

rom a forestry perspective, tulipwood is a good environmental option. Tulipwood is a relatively under-utilised cies which accounts for 8% of wood volume in the U.S. forest. U.S. government forest inventory data<sup>1</sup> show that U.S. tulipwood is growing 32.6 million m<sup>1</sup> per year while the harvest is 13.3 million m<sup>1</sup> per year. After harvest ing, an additional 19.3 million m' of tulipwood accumulate in U.S. forests every year. It takes less than four second new growth in the U.S. forest to replace the hardwood required to manufa

### 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 Carbon emissions during all stages of material extrac tion and processing, product manufacturing, and trans

port are 687 kilograms of CO<sub>2</sub> equivalent. Two thirds of carbon emissions - 423 kilograms of CO, equivalent - are associated with processing and supply of tulip wood to the UK. However these emissions are offset b 552 kilograms of avoided emissions resulting from sub stitution of fossil fuels through reuse of wood waste.



waste wood diverted to energy production. The overall 119 kilograms of CO, 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 kilo grams of CO, equivalent



est accounting for 15% of wood volume. U.S. government forest inventory data<sup>1</sup> shows that U.S. white oak s growing 36 million m<sup>1</sup> per year while the harvest is 19.3 million m<sup>3</sup> per year. After harvesting, an additional 16.7 million m<sup>3</sup> 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. at end of life for energy production

forest

ENVIRONMENTAL LIFE - CYCLE ASSESSMEN

TABLEWARE BY GARETH NEAL WITH ZAHA HADIE

**VES-EL** 

HEWISHLIST MADE IN AMERICAN WHITE OAK

On a cradle to grave basis, the carbon footprint of the tableware is 76 kilograms of CO<sub>2</sub> equivalent. That's roughly equivalent to the carbon emissions of driving 340 miles (550 km) in the average UK car Carbon emissions during all stages of material extrac tion and processing, product manufacturing, and transport are 143 kilograms of CO, equivalent. These emissions are offset by 67 kilograms of CO, equivalent resulting from substitution of fossil fuels through use of wood waste generated both during manufacturing and

A large proportion of the wood required to manufa ture the tableware did no end up in the finished proc uct. This reduces the longterm carbon storage potenti but it also means that there is a significant volume of waste wood diverted to energy production. The overall ma of wood waste arising during manufacture is much greater than the final mass of the product. As a result the cred its from processing are greate than those from end of life A significant proportion of th tableware's carbon footprint is due to use of grid energy to power the CNC machine at Benchmark. This exceed ing from all stages to extract process and transport the US hardwood to the UK

SUMMARY

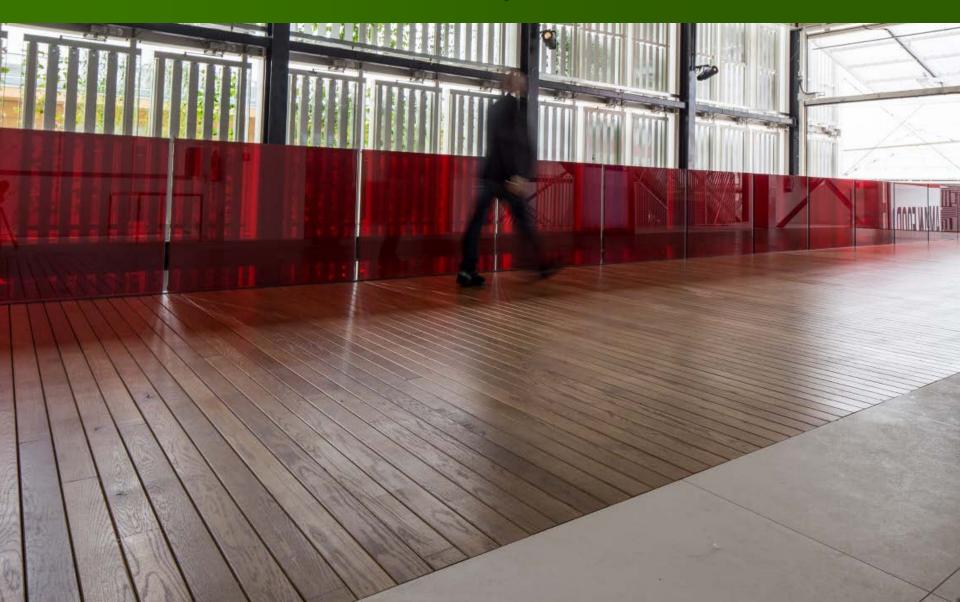
### Moseley & Rogers Ladder – The Wish List

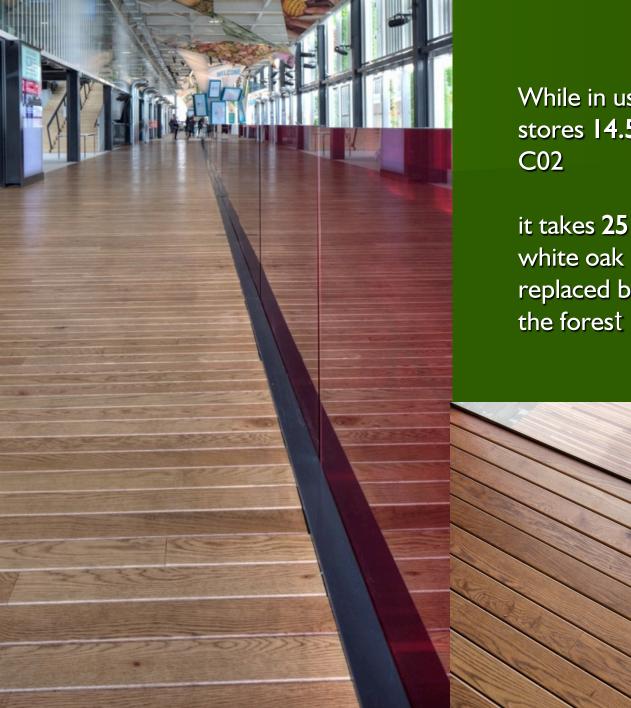
### Total Carbon Footprint: 106 kg CO<sub>2</sub>e

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



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

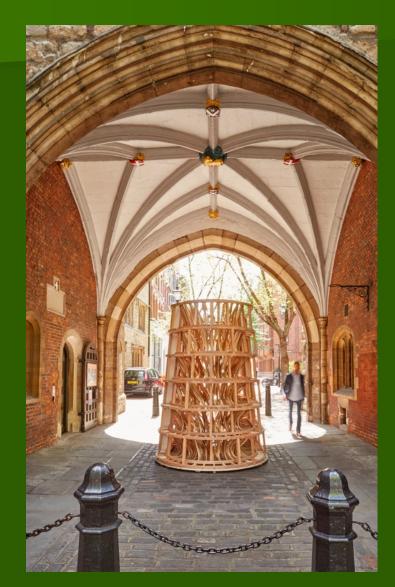




While in use the deck stores **14.5 metric tons** of C02

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



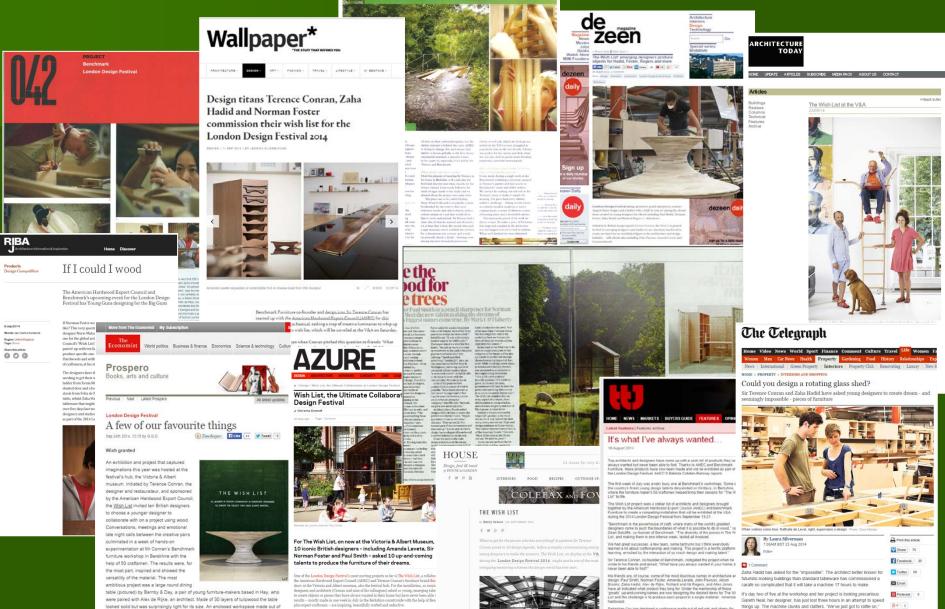




The structure has half the carbon footprint of a smart phone it takes less than 15 seconds to replace the lumber used by new growth



### **Unprecedented media coverage**



matically lining one of the V&A's ornate staircases and landings, the Wish list includes



Interiors and Shopping Hadid and Neal's project is part of the Wish List, a one-off collaboration

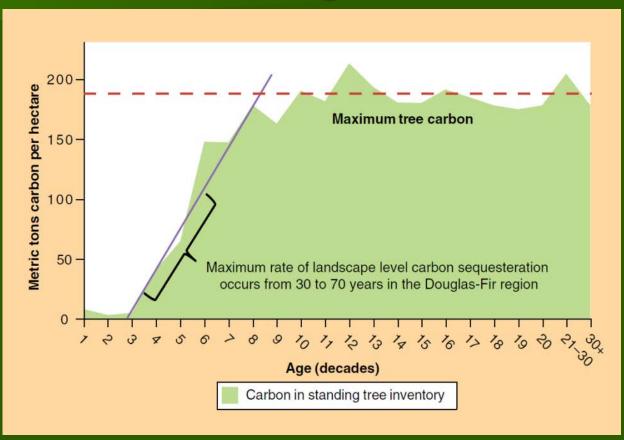


# Questions?

# 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.



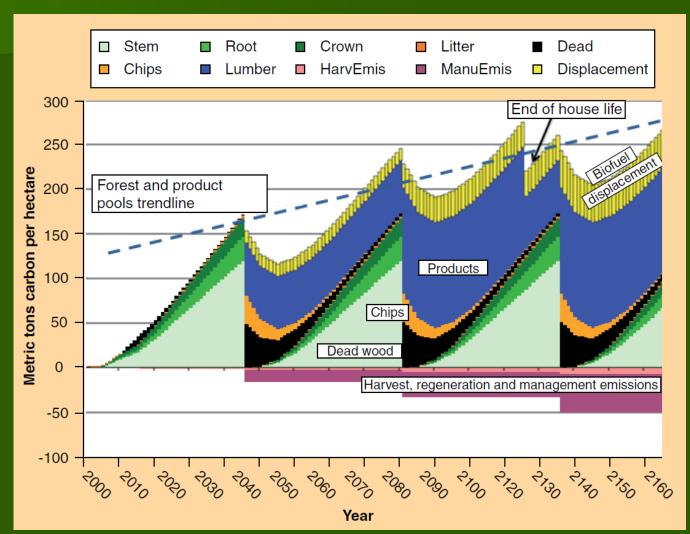
*Data relates to Douglas-Fir in Western Washington. Bruce Lippke et al, 2011, drawing on US Forest Service Forest Inventory* 

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 productcarbon 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



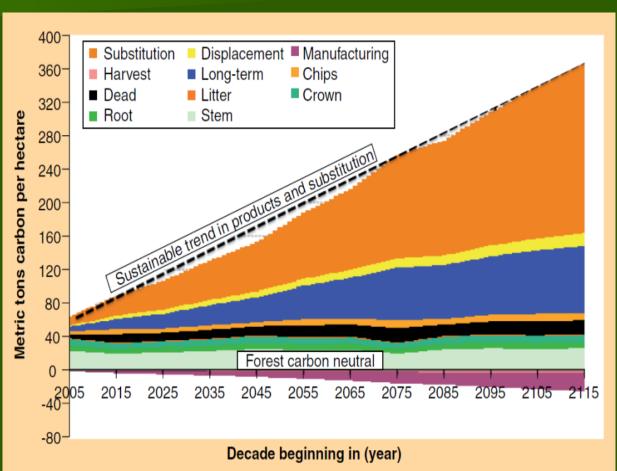
*Source:Life cycle impacts of forest management and wood utilization on carbon mitigation: knowns and unknowns, Lippke et al, Carbon Management (2011) 2(3), 303–333* 

# Wood: The Substitution Effect



# Impact of sustainable timber harvesting on carbon storage

- Carbon in forest supplemented by progressive increase in carbon stored in longterm 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)*