

From Forest to Frame: Innovations in Wood Architecture

TH502

Thursday, June 21, 2018, 10:30 AM – 11:30 AM

1.00 LUs/HSW/GBCI/RIBA

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Questions related to specific products and services may be addressed at the conclusion of this presentation.

Acknowledgements/Credits

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- Microtec
- Milestones in Communication
- NASA
- Nordic Structures
- Hubert Rieß
- Stora Enso
- StructureCraft
- Structurlam
- UBC Sustainability Initiative (USI)
- Waugh Thistleton Architects

Speakers List

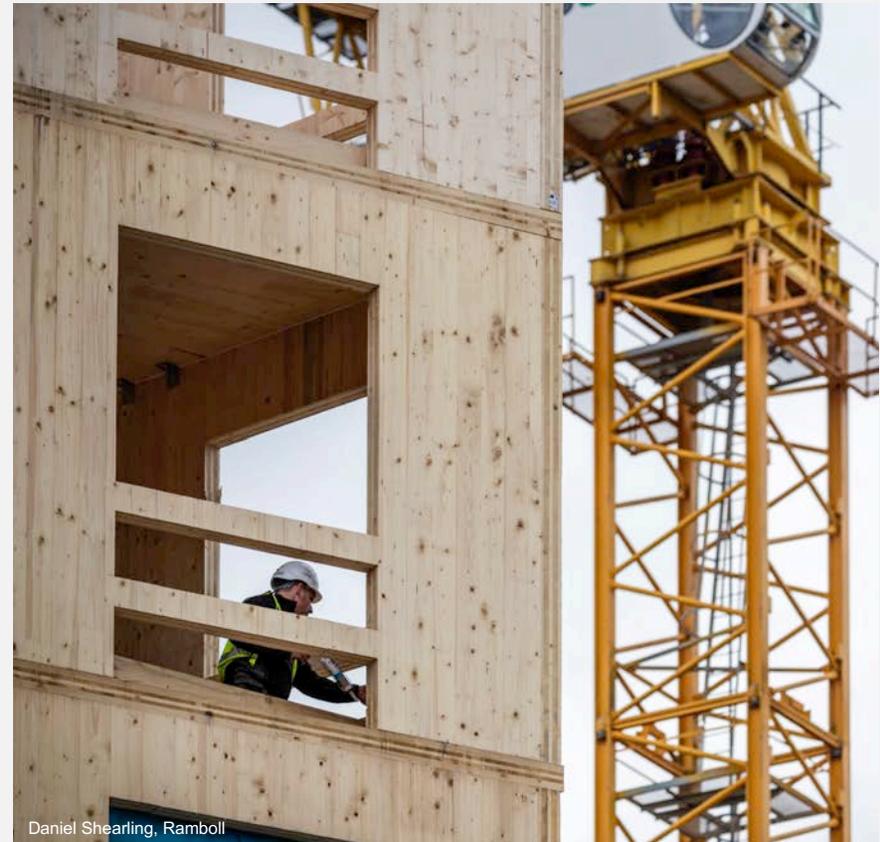
- Ulrich Dangel, AIA
Associate Professor of Architecture
The University of Texas at Austin
Austin, Texas

Course / Learning Objectives

- Learn to identify the latest engineered wood products and timber building systems—and how to apply them to design projects.
- Assess and compare the environmental impact of wood products along the entire process chain, from resource extraction to final built project.
- Identify the effects of wood products on human health and well-being.
- Evaluate wood construction based on its ability to address current environmental, economic, and social concerns.

Content

- 1 – Forestry and Sustainability
- 2 – Products and Manufacturing
- 3 – Craft and Construction
- 4 – Potential and Outlook
- 5 – Q & A



Daniel Shearling, Ramboll

What is the major cause for deforestation in the Southern Hemisphere?

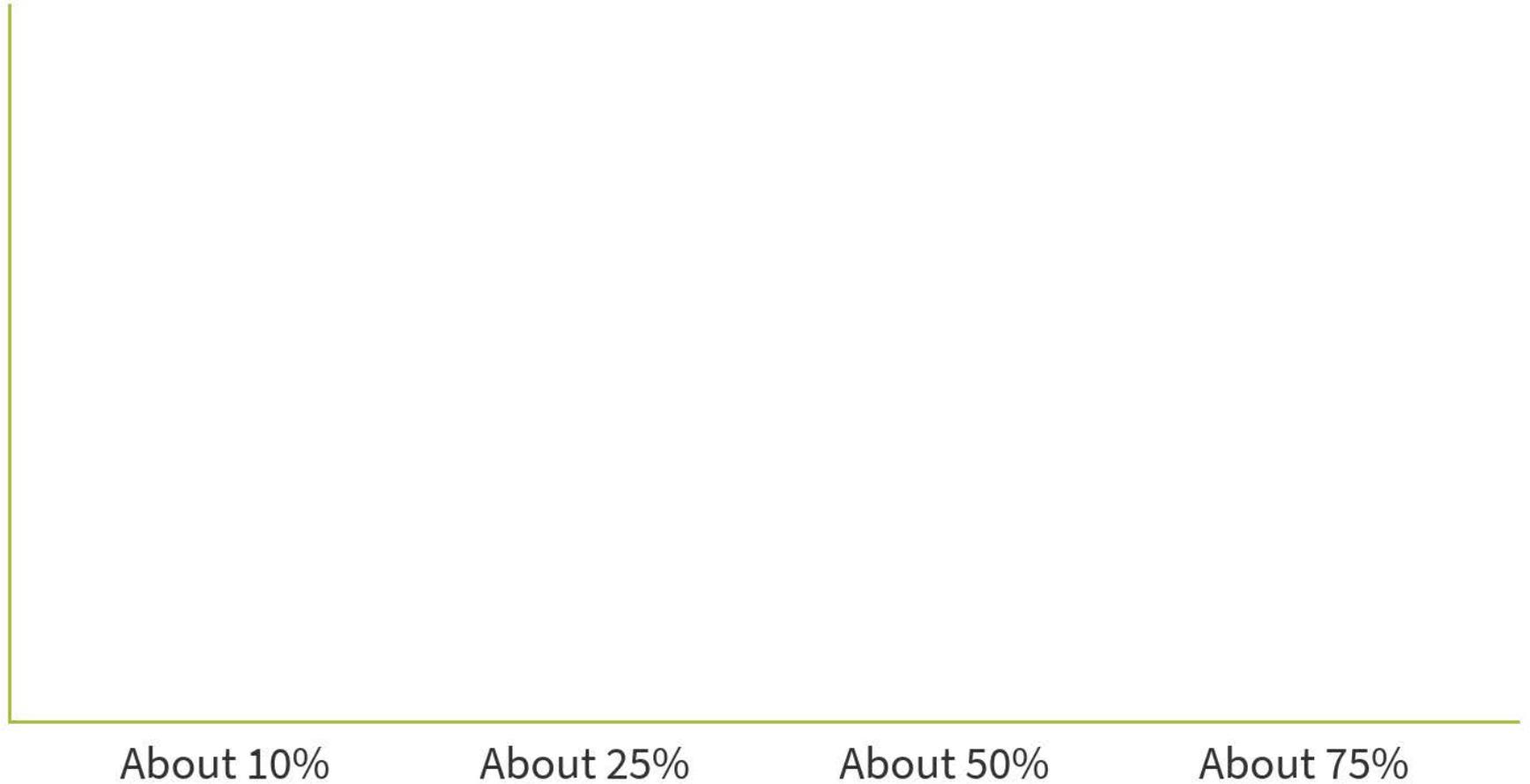
Harvesting of wood
for construction

Wildfires

Clearing of land for
agricultural uses

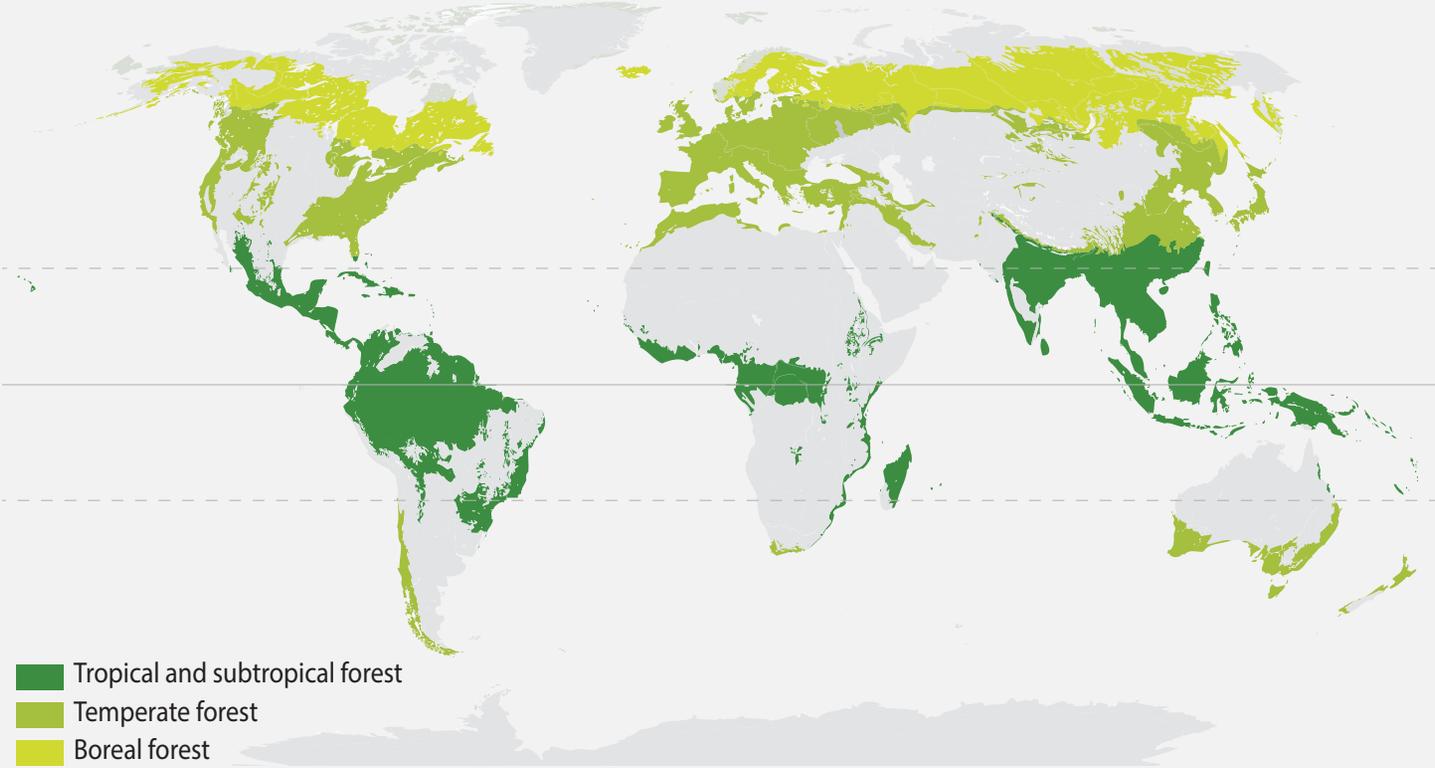
Consumption of
paper goods

How much of the world's forest area is certified?



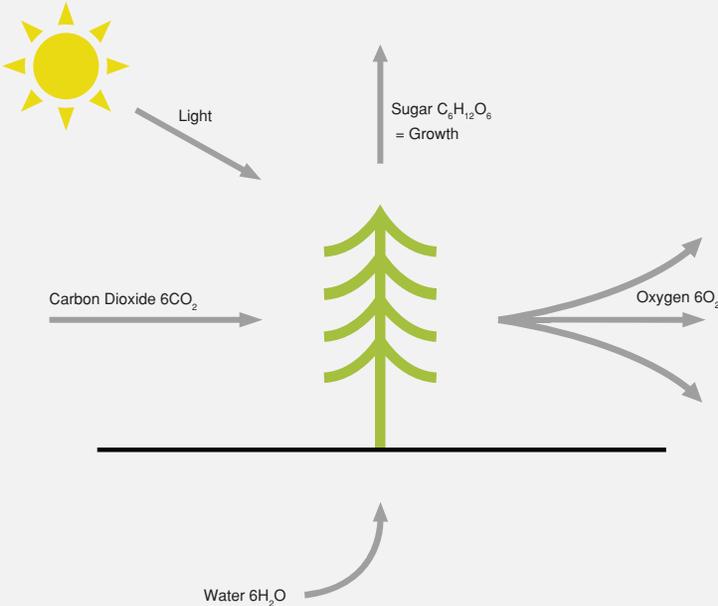
The World's Forests

Forestry and Sustainability



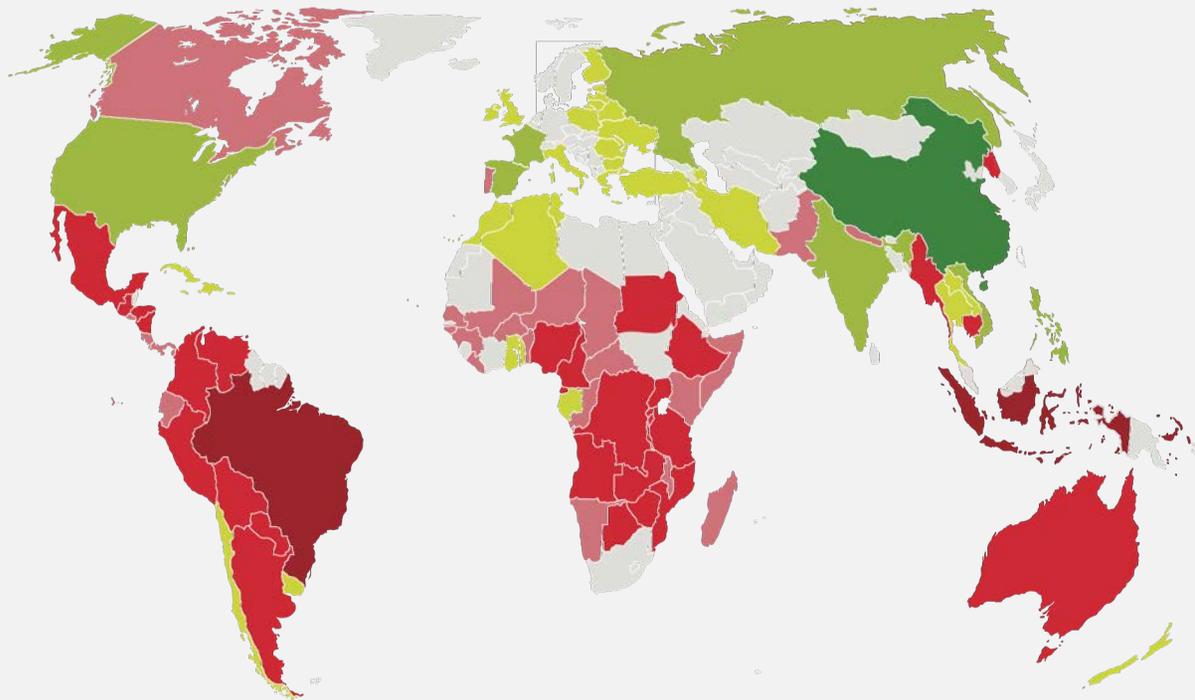
Photosynthesis

Forestry and Sustainability



Deforestation

Forestry and Sustainability



Net Gain

- More than 500,000 ha
- >100,000 - 500,000 ha
- >10,000 - 100,000 ha

Net Loss

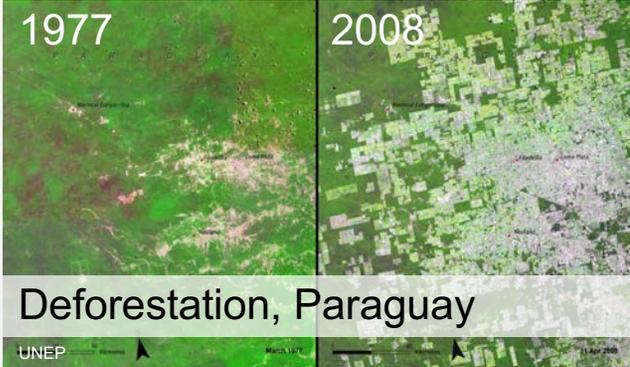
- More than 500,000 ha
- > 100,000 - 500,000 ha
- > 10,000 - 100,000 ha
- No change

Annual Net Forest Gain and Loss (1990-2015)

Deforestation



Forestry and Sustainability



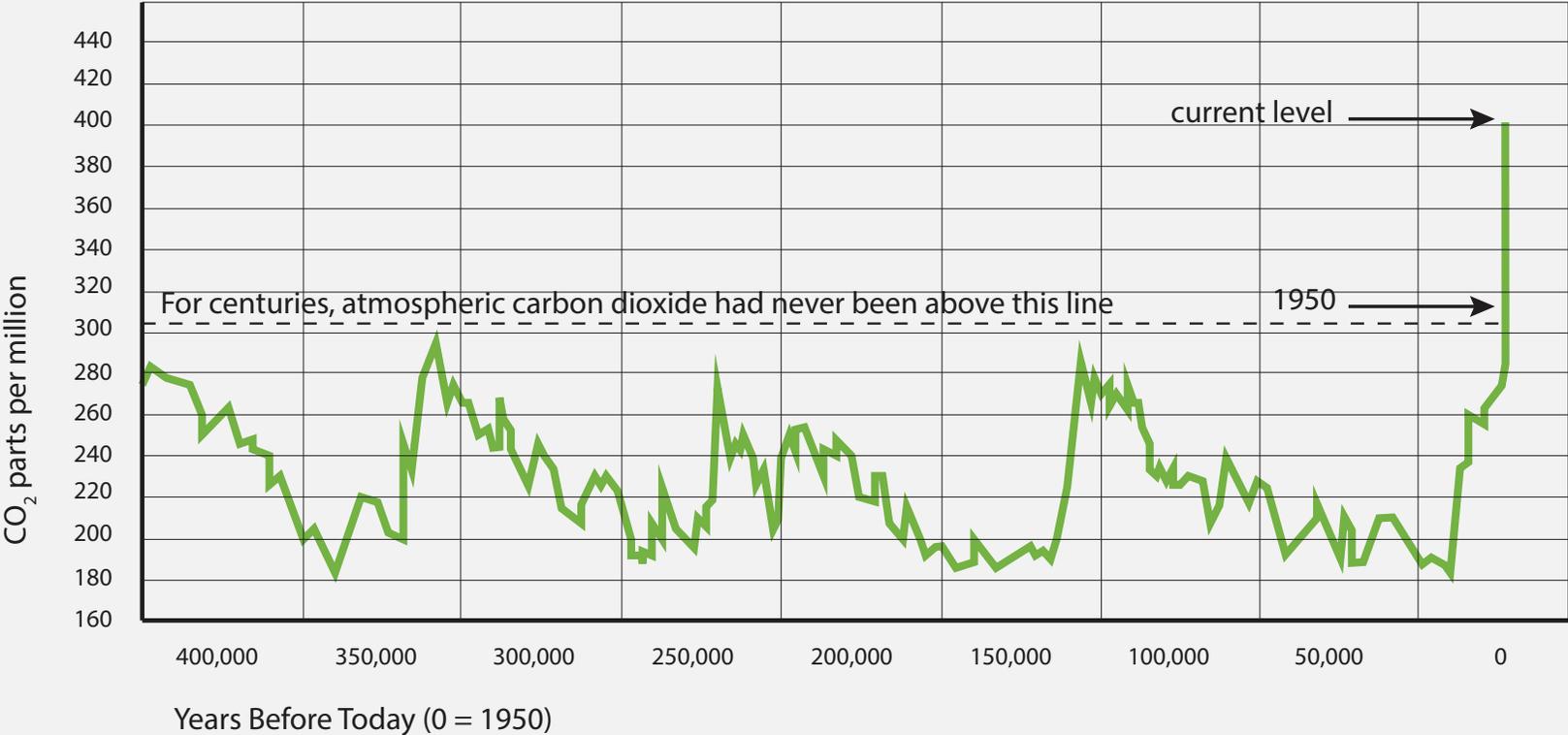
Deforestation, Paraguay



Slash-and-burn Farming, Brazil

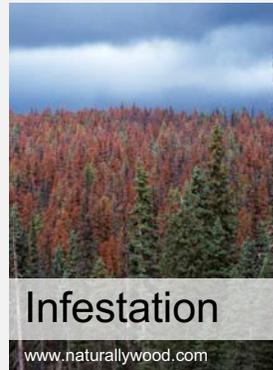
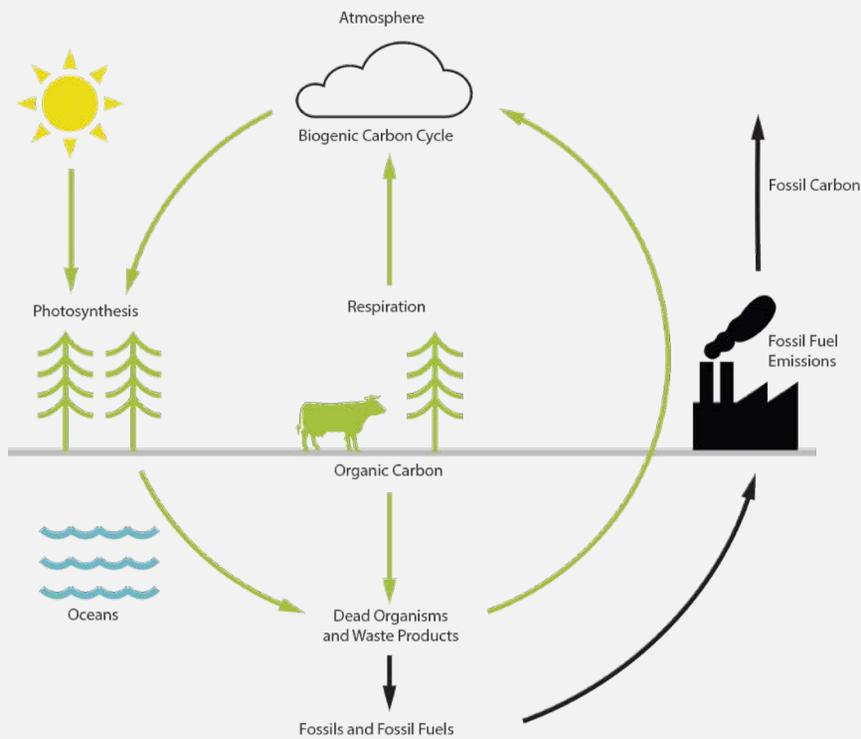
Atmospheric Carbon Dioxide Levels

Forestry and Sustainability



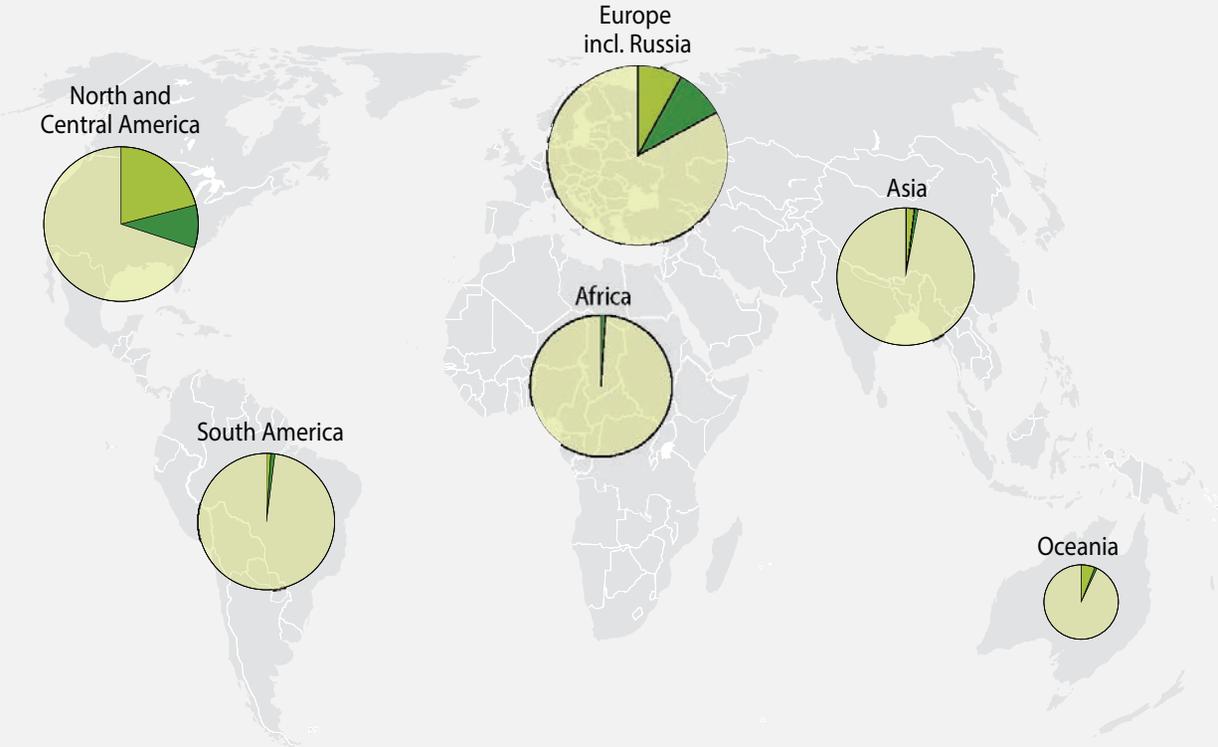
Carbon Cycle / Sustainable Forest Management

Forestry and Sustainability



Forest Certification

Forestry and Sustainability

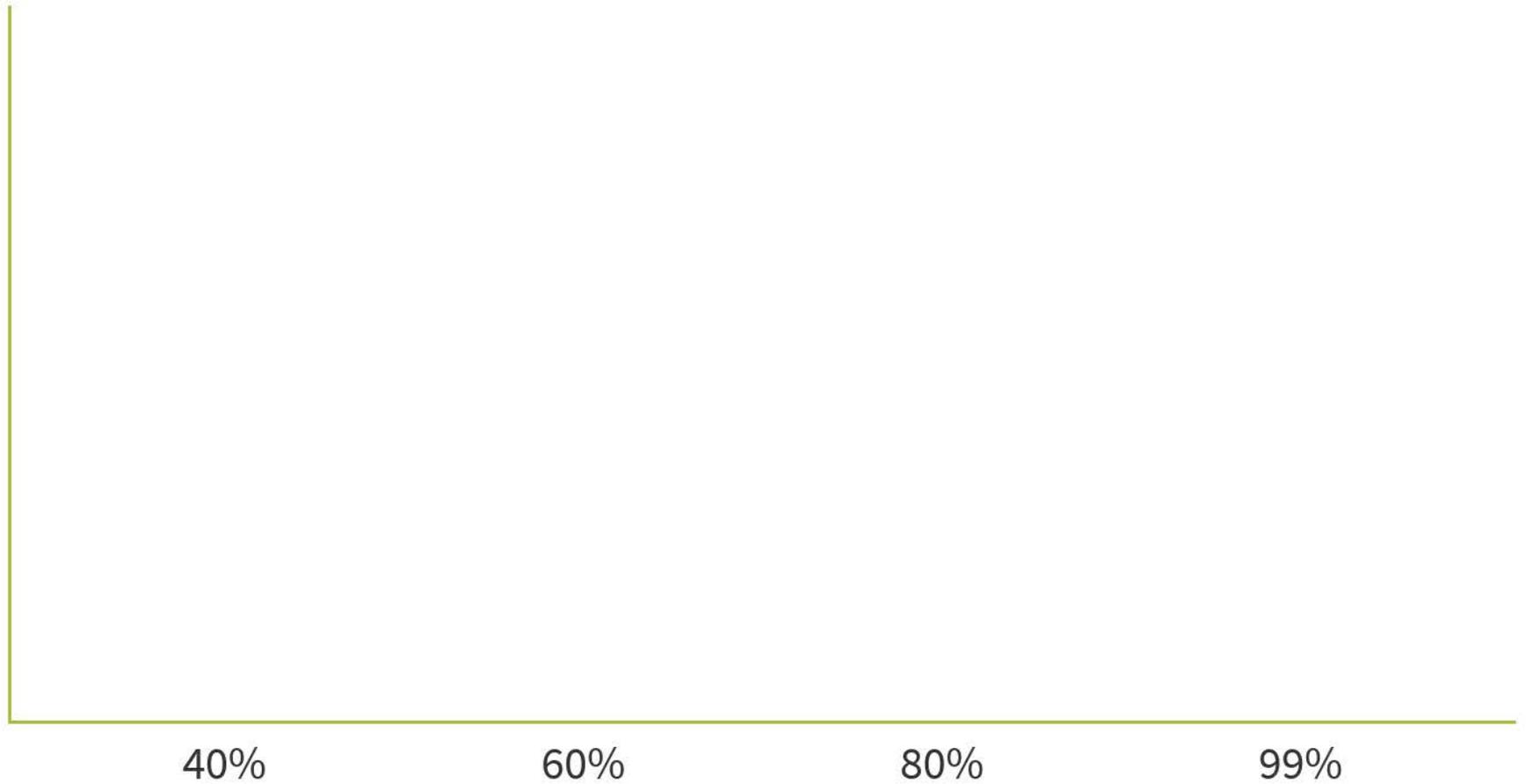


PEFC
Programme for the
Endorsement of Forest
Certification

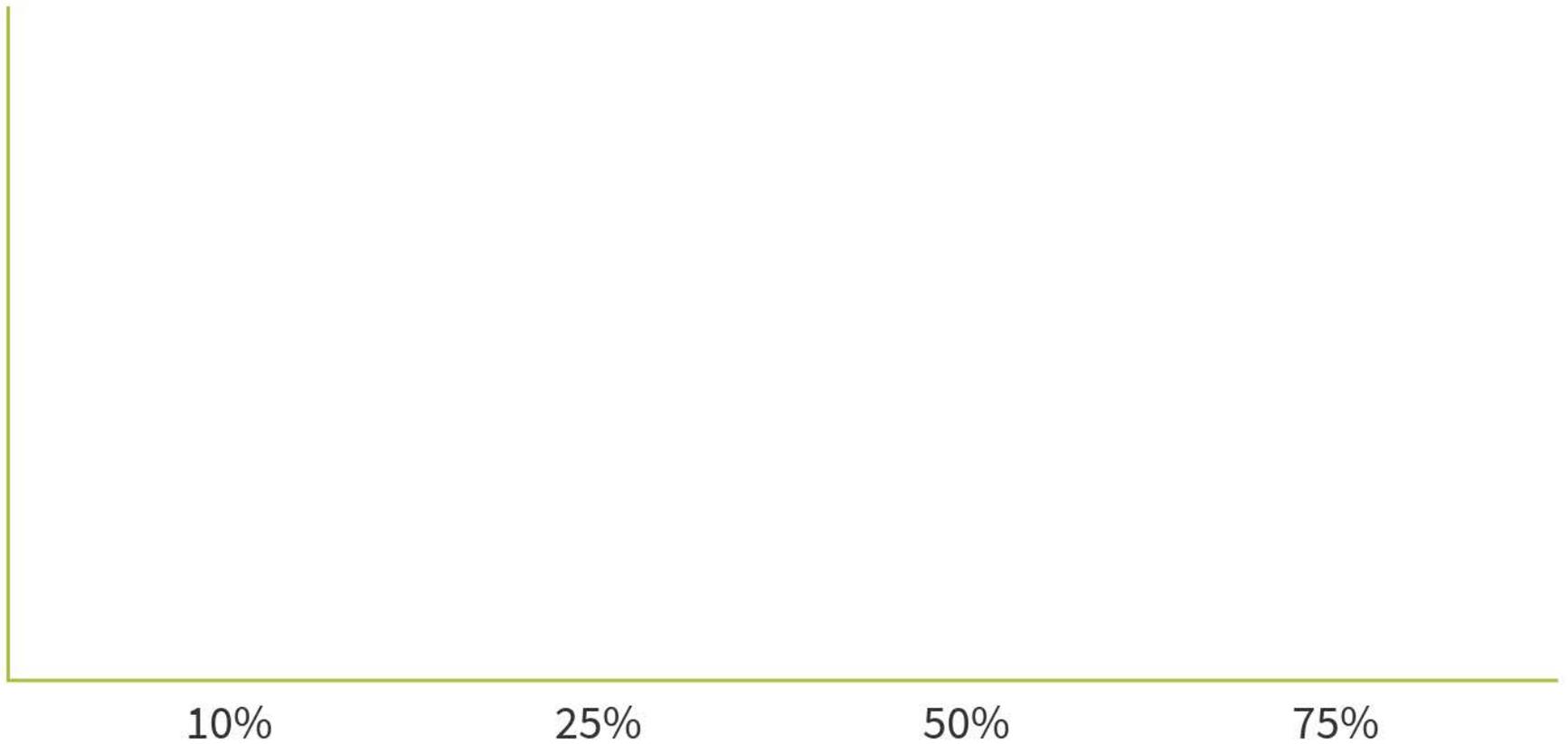
FSC
Forest Stewardship
Council

- PEFC Certified Forest Area
- FSC Certified Forest Area
- Non Certified Forest Area

What percentage of a harvested log is converted into usable products?



Plantation forests account for how much of the global industrial roundwood production?



Forest Products

Products and Manufacturing



Engineered Wood Products

APA – The Engineered Wood Association



NTFP: Latex



Wood Fuel: Pellets

Stora Enso

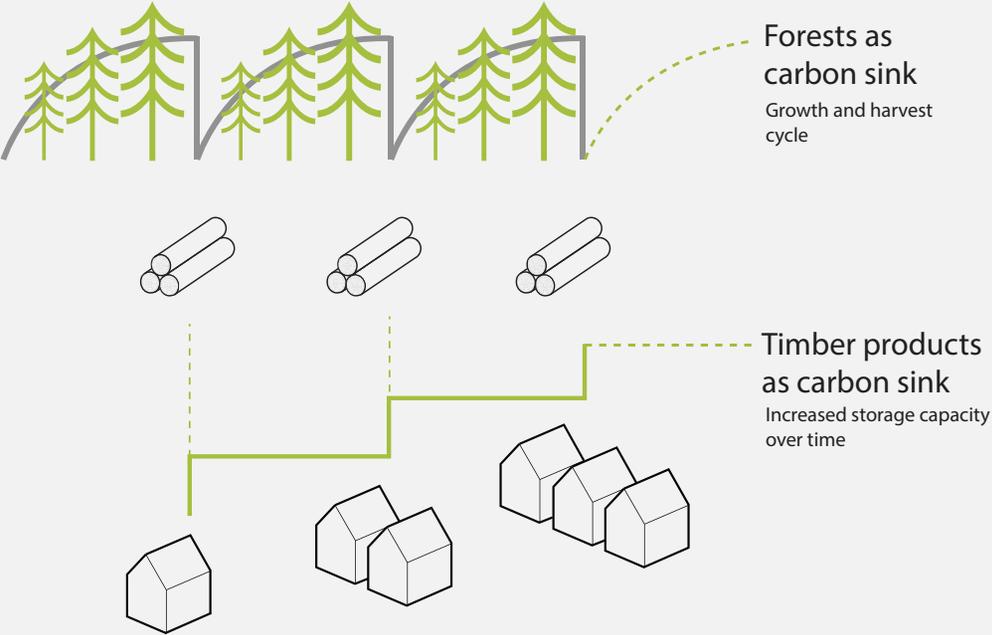


NTFP: Cork



Pine Forest Plantation

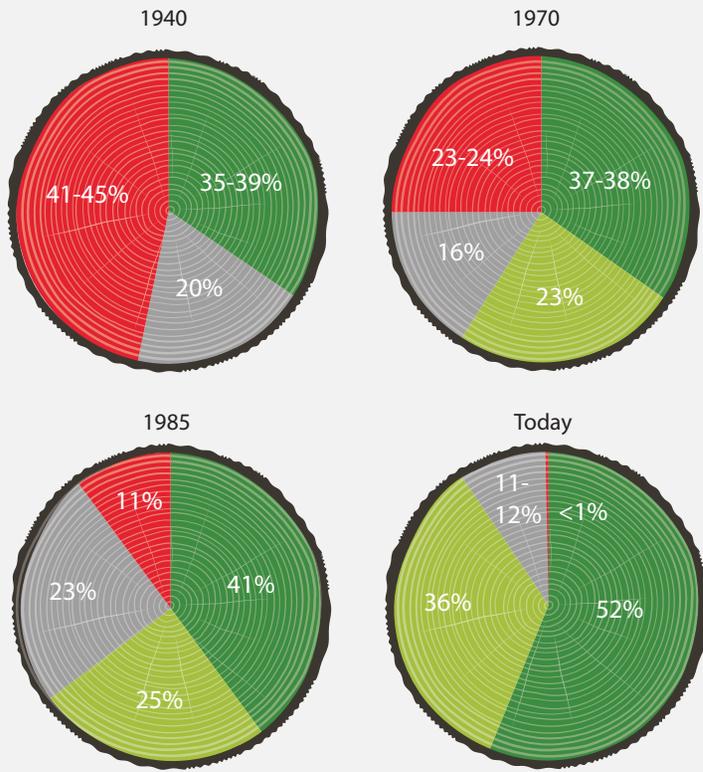
Carbon Sequestration



Products and Manufacturing



Industry and Wood Utilization



- Processed into lumber
- Transferred to other facilities to use as raw materials
- Recovered for energy production
- Incinerated as waste or landfilled

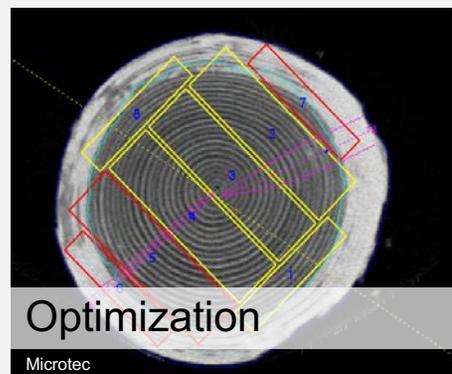
Wood Utilization

Products and Manufacturing



CT Scan for Defects

Microtec



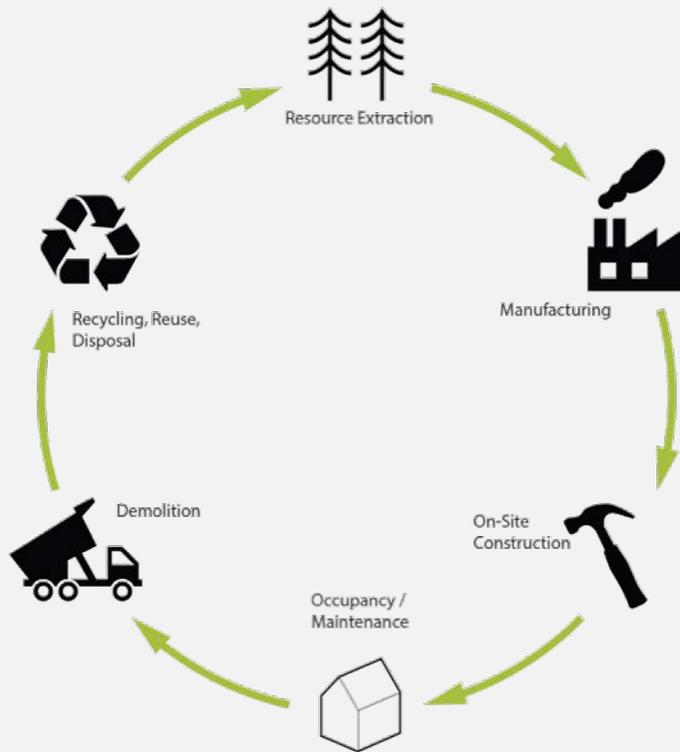
Optimization

Microtec



OSB Production

Life Cycle Assessment



Products and Manufacturing

CERTIFIED
Environmental Product Declaration

EPD Transparency Summary

Company Name: American Wood Council
Product Line: Wood Products
Product Name: North American Laminated Veneer Lumber
Product Definition: Laminated Veneer Lumber (LVL) is manufactured by pressing sheets of veneer from log "blocks", which are then dried, combined with resin and pressed, and torched to specified dimensions.
Product Category: North American Structural and Architectural Wood Products
EPD: EPDs, Version 1 (UN CFC 21, NAICS 2011, 8 November 2011)
Declaration Number: 13CA2484.006.1

LIFECYCLE IMPACT CATEGORIES
The environmental impacts listed below were assessed throughout the product's lifecycle - including raw material extraction, transportation, manufacturing, packaging, use, and disposal of end-of-life.

	ATMOSPHERE	WATER	WASTE	ACIDIFICATION	SMOG	CLIMATE CHANGE	TERRESTRIAL ECOSYSTEMS	WATER RESOURCES	MINERAL RESOURCES
Global Warming Potential (GWP)	26.81 kg CO2e/kg	107.7 kg CO2e/kg	0.0001 kg CO2e/kg	0.176 kg CO2e/kg	0.176 kg CO2e/kg	0.176 kg CO2e/kg	0.176 kg CO2e/kg	0.176 kg CO2e/kg	0.176 kg CO2e/kg
Acid Equivalency Potential (AEP)	0.0001 kg SO2e/kg	0.0001 kg SO2e/kg	0.0001 kg SO2e/kg						
Smog Potential (SP)	0.0001 kg CO2e/kg	0.0001 kg CO2e/kg	0.0001 kg CO2e/kg						
Terrestrial Ecosystems (TE)	0.0001 kg CO2e/kg	0.0001 kg CO2e/kg	0.0001 kg CO2e/kg						
Water Resources (WR)	0.0001 kg CO2e/kg	0.0001 kg CO2e/kg	0.0001 kg CO2e/kg						
Mineral Resources (MR)	0.0001 kg CO2e/kg	0.0001 kg CO2e/kg	0.0001 kg CO2e/kg						

UL Environmental Product Declaration
American Wood Council

ENVIRONMENTAL PRODUCT DECLARATION
NORTH AMERICAN GLUED LAMINATED TIMBERS
AMERICAN WOOD COUNCIL
CANADIAN WOOD COUNCIL

The American Wood Council (AWC) and Canadian Wood Council (CWC) are pleased to present this Environmental Product Declaration (EPD) for North American glued laminated timbers (glulam). This EPD was developed in compliance with ISO 14040 and ISO 14044 and has been verified under IA, Environmental's EPD program.

The EPD includes Life Cycle Assessment (LCA) results for all processes up to the point that glulam is packaged and ready for shipment at the manufacturing gate. The cradle-to-gate product system includes forest management, logging, transportation of logs to lumber mills, sawing, planing, transportation of lumber to glulam plants, finger jointing and gluing, drying, and final planing.

The AWC and CWC represent wood product manufacturers across North America. Our organizations have undertaken numerous sustainability initiatives on behalf of our membership and we are pleased to present this document to show how we are doing. The publication of this EPD, which is based on rigorous LCA research, is our effort to back up with science what we know to be true - that wood products stand alone as a green building material.

Please follow our sustainability initiatives at www.awc.org and www.cwc.ca

CERTIFIED
Environmental Product Declaration

American Wood Council

Environmental Product Declarations (LVL / Glulam)

Globalization Trends

Products and Manufacturing



Shipping Yard, New Zealand



Eucalyptus Plantation, Brazil

Which construction system offers complete separation of structure and enclosure?

Platform Frame
Construction

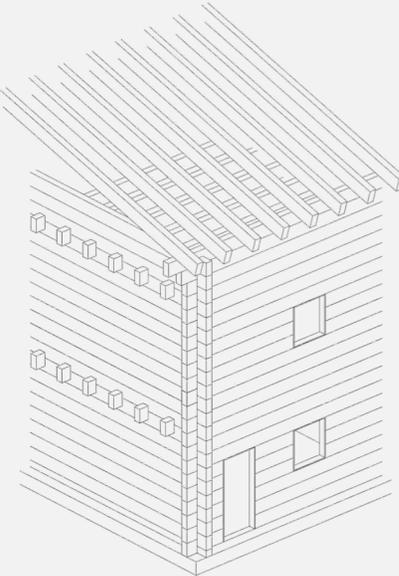
Log Construction

Post and Beam
Construction

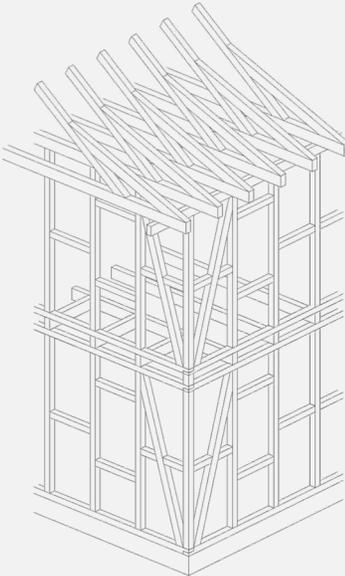
Mass Timber Panel
Construction

Timber Construction Systems

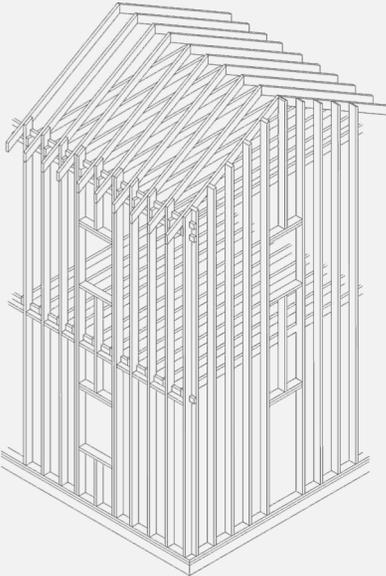
Craft and Construction



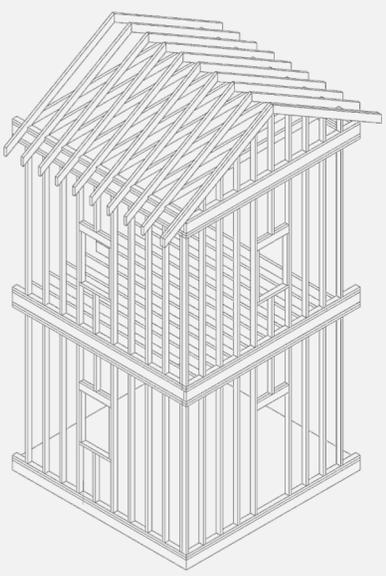
Log Construction



Timber Frame Construction



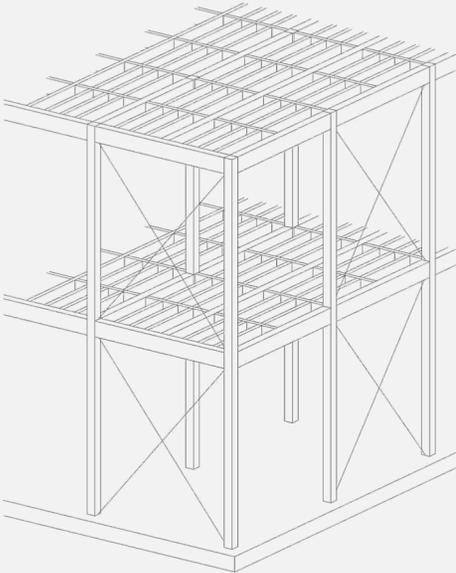
Balloon Frame Construction



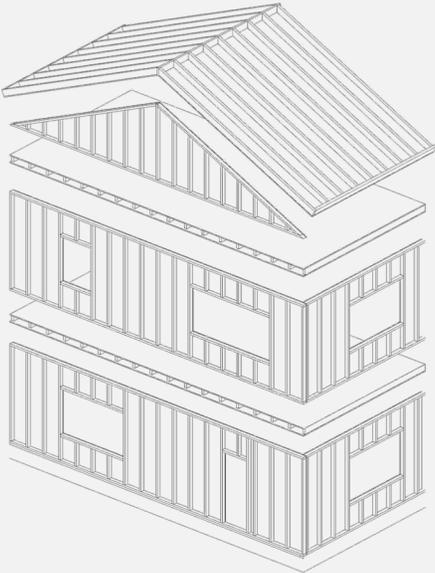
Platform Frame Construction

Timber Construction Systems

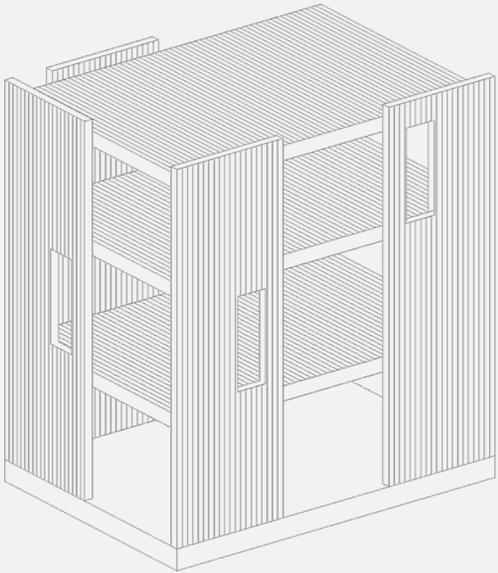
Craft and Construction



Frame
Construction



Panel
Construction



Solid Timber
Construction

Timber Construction Systems

Craft and Construction



Hartl Haus



Frame Construction

Structurlam



KLH UK



Panel Construction

Hartl Haus



Solid Timber Construction

KLH UK

Wood-Based Composite Products

Craft and Construction



Glulam

APA – The Engineered Wood Association



LVL



OSB

APA – The Engineered Wood Association



Plywood



Nail-Laminated Timber

StructureCraft



LSL

StructureCraft



PSL



Cross-Laminated Timber

Stora Enso



Dowel-Laminated Timber

StructureCraft

Hybrid Construction and Composite Components

Craft and Construction



Prefabrication and Mass Customization

Craft and Construction



Wood Technology and Digital Manufacturing

Craft and Construction



Exposed wood surfaces on the interior are...

Health and Well-Being

Craft and Construction



Exposed Wood Surfaces

Ema Peter

Health and Well-Being

Potential and Outlook

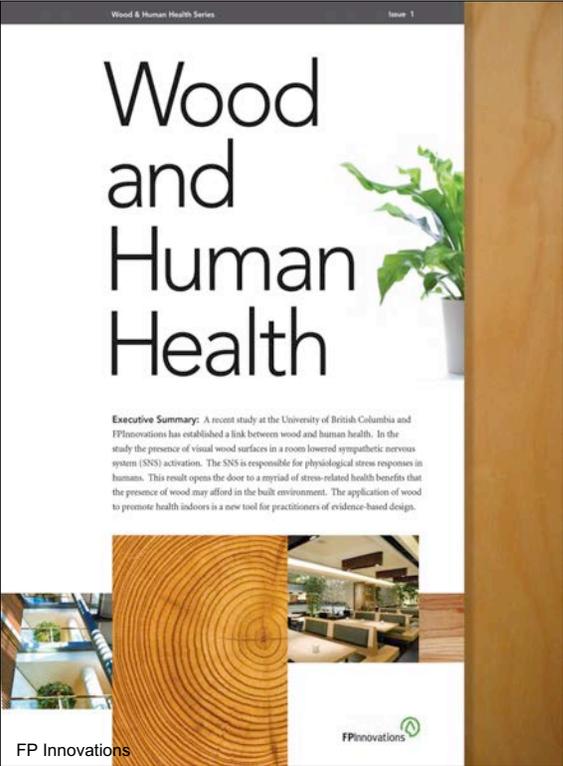


C. Kelz, V. Grote, and M. Moser, “Interior Wood Reduces Pupils’ Stress Levels” (2011)

Hans-Peter Schiess

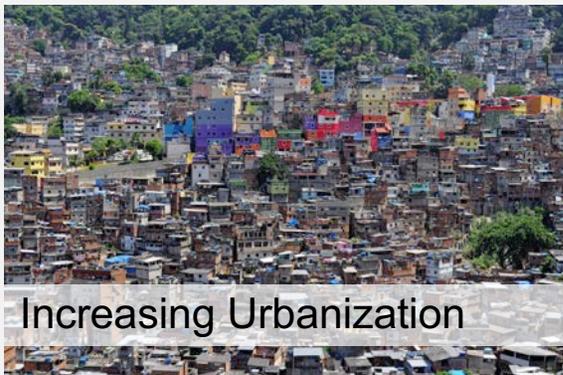
Health and Well-Being

Potential and Outlook



D. Fell, "Wood and Human Health" (FP Innovations, 2010)

Wood in the City



Increasing Urbanization



Mass Timber: London

Daniel Shearling, Ramboll

Potential and Outlook



Mass Timber: Portland

Lever Architecture

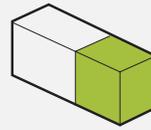


Mass Timber: Zurich

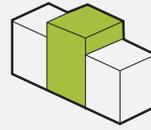
Blumer-Lehmann AG

Building in Existing Fabric

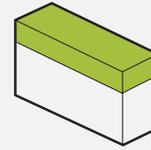
Potential and Outlook



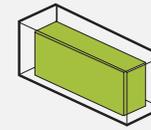
Extension



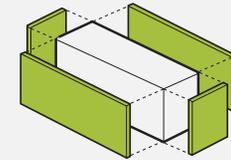
Infill



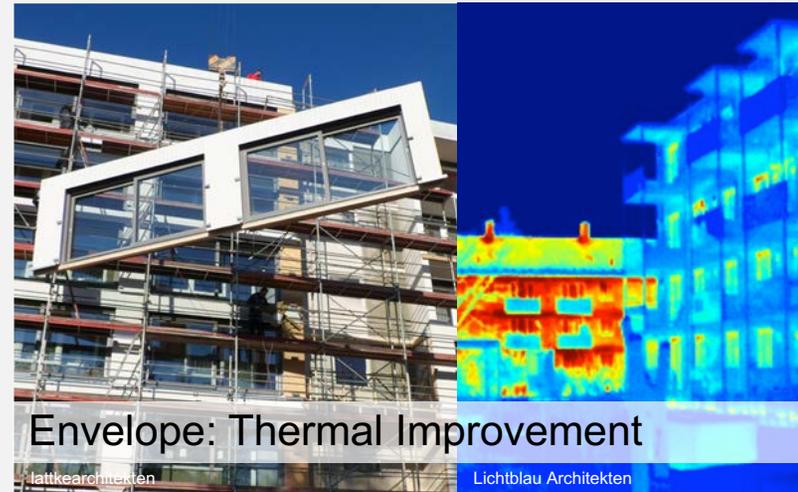
Rooftop Addition



Insertion

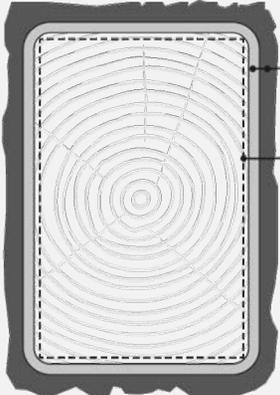


Envelope



Multi-Story Timber Construction

Potential and Outlook



Sacrificial Layer
(Char layer and pyrolysis zone;
no structural capacity)

Residual Cross Section
(Structural capacity retained)



Seagate Structures



Vienna: 24 Stories (2019)



Charring of Mass Timber

FP Innovations



Vancouver: 18 Stories (2017)

KK Law & www.naturallywood.com

schreinerkastler.at

Rapid Housing

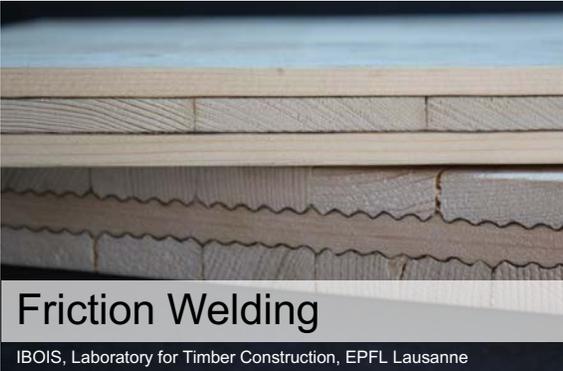
Potential and Outlook

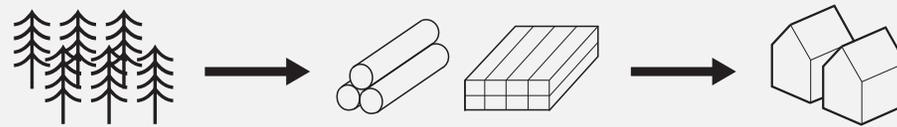


Future Developments



Potential and Outlook

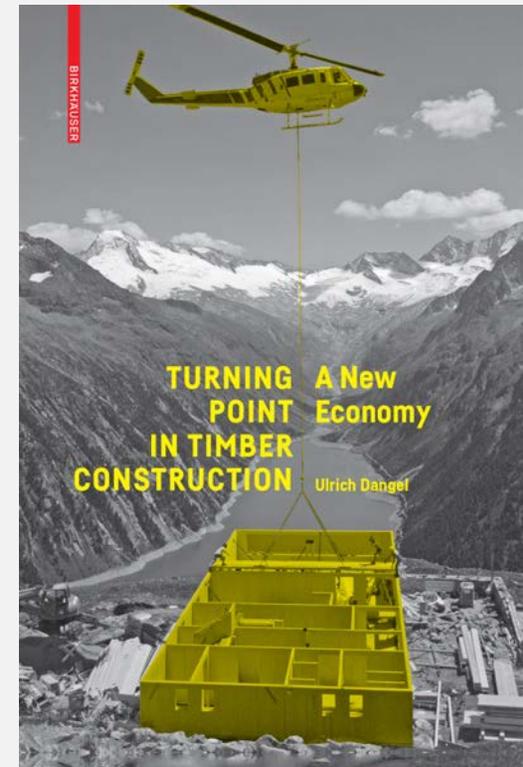




Questions?

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Thank you!