

Enhanced potential of poplar and willow for engineered wood products



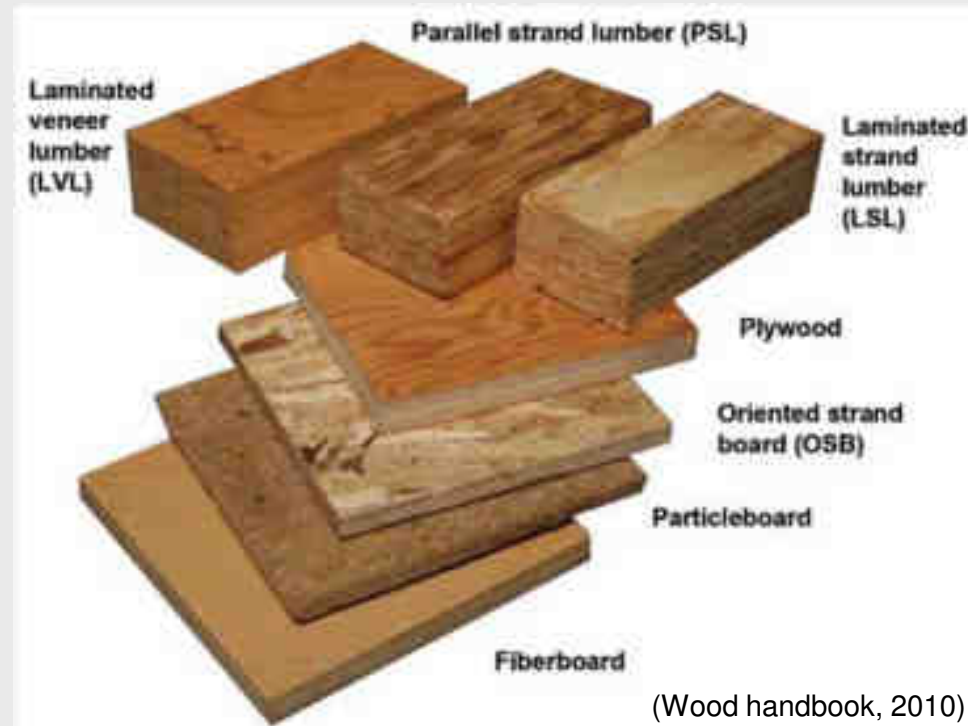
Joris Van Acker
Nele Defoirdt
Jan Van den Bulcke

Engineered wood products (EWP) are made from lumber, veneers, strands of wood, or from other small wood elements that are bound together with structural resins to form lumber-like structural products.



ENGINEERED WOOD PRODUCTS - EWP

Glulam, CLT, Plywood, LVL, LSL, PSL, I-joists, WBP





What industry is involved...



Sawn wood based products

Sawn wood based products

SAWNWOOD - LUMBER – TIMBER

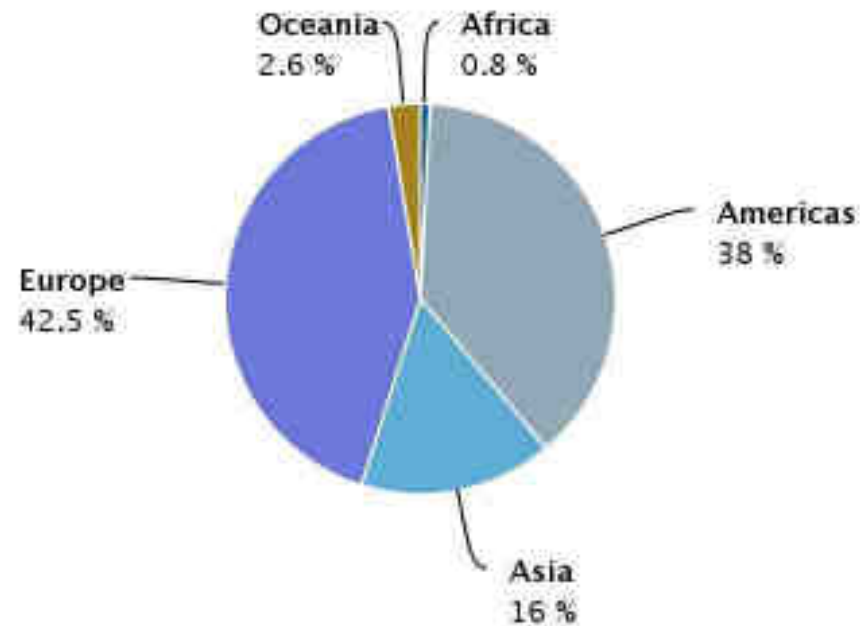
SAWNWOOD - LUMBER – TIMBER



Production

Sawnwood – lumber - timber

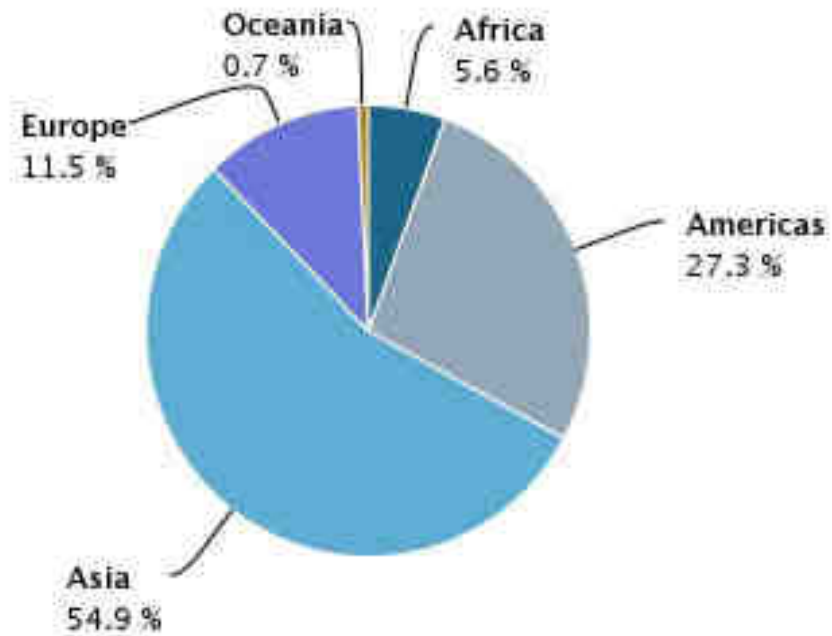
coniferous: 312.1 million m³



Production

Sawnwood – lumber - timber

non-coniferous: 126.6 million m³



Poplar, aspen, willow,...

Sawnwood – lumber - timber

Poplar is well suited. Alternative for softwoods...

Besides its use as structural timber, poplar sawn wood is used in several other applications.

Drying issues: wet pockets, tension wood,...

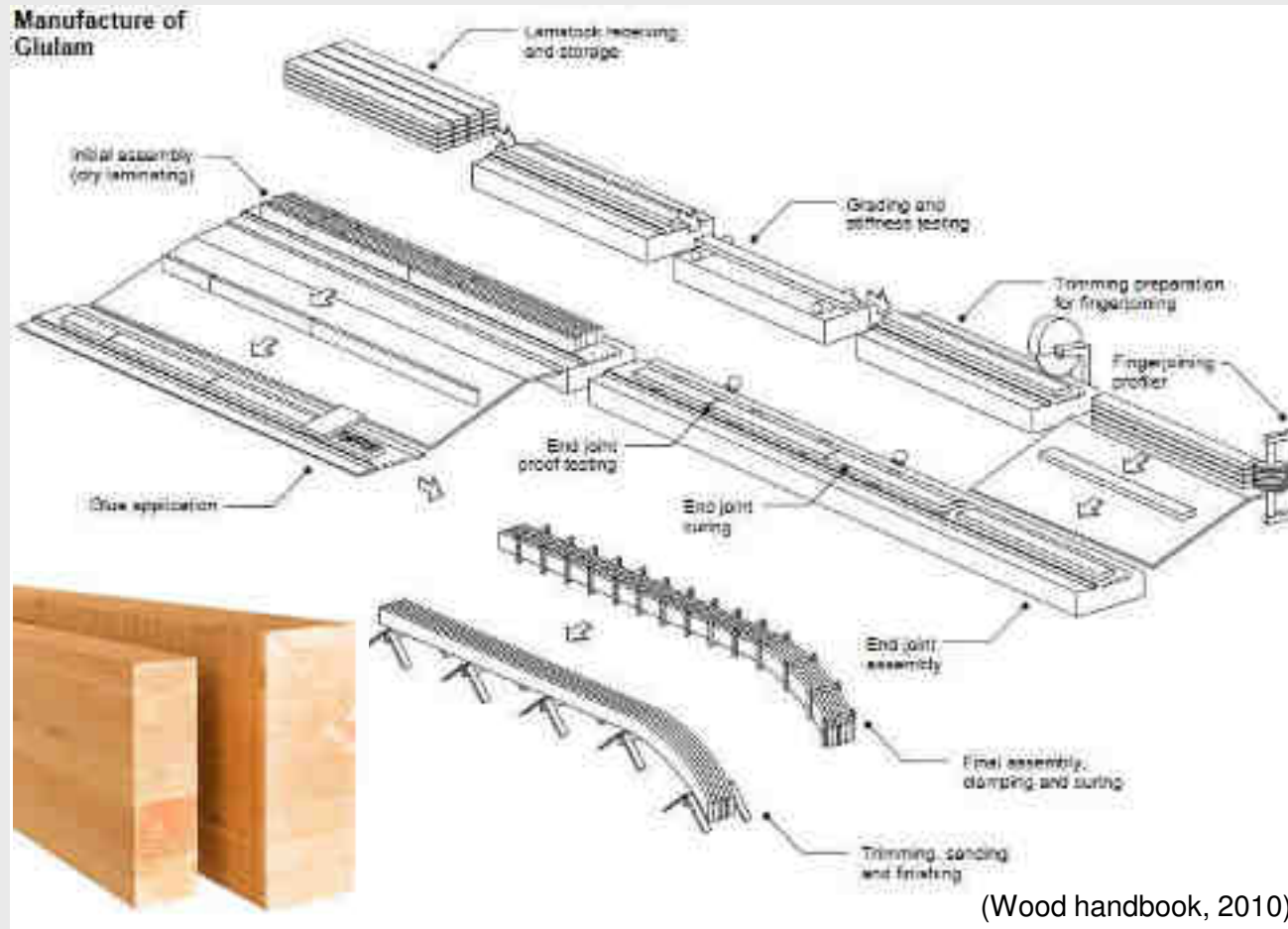
Mechanical stress grading is more reliable for softwoods than for hardwoods like poplar.

Has been considered as an alternative construction lumber.

Sawn wood based products

GLULAM & CLT (Cross Laminated Timber)

GLULAM - GLT



CLT – Cross Laminated Timber



(<http://www.greenspec.co.uk>)



(<http://www.buildingsecrets.be>)

NLT – Nail Laminated Timber



(<http://structurecraft.com>)

Production

GLT (Glulam)

5 million m³ (2.7 Europa, 2.0 Asia, 0.3 North America)

GLT production in Europe is heading for 4 million m³

CLT (Cross laminated timber)

0.6 million m³

About 90% of CLT production worldwide is located in Europe, with a total production volume of 560 thousand m³ in 2014.

Poplar, aspen, willow,...

Glulam - CLT

Poplar has been assessed as alternative for softwood to produce glulam, often combination with other hardwoods.

A CLT product option is not yet fully assessed for poplar.

Veneer based products

Veneer based products

VENEER

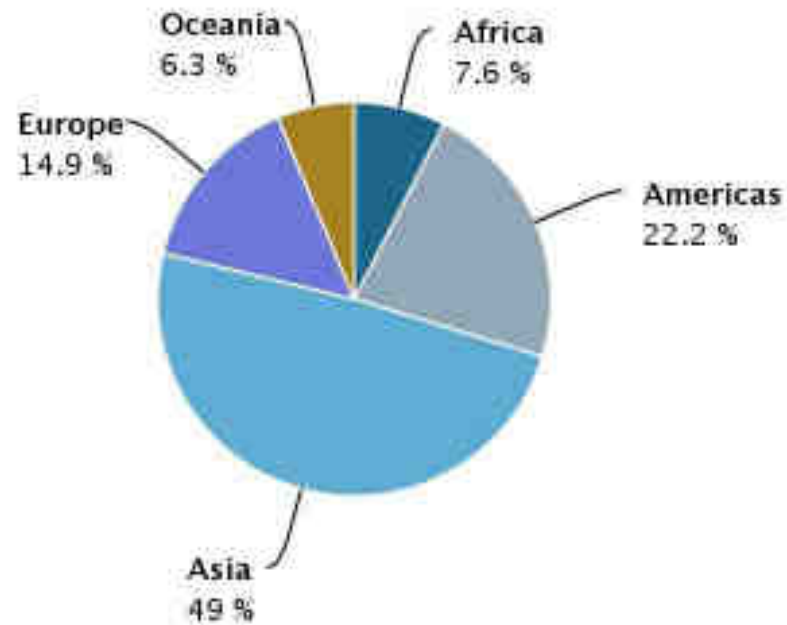
Veneer



Production

Veneer

13.5 million m³



Poplar, aspen, willow,...

Veneer

The match industry as well as a segment of the packaging industry, for example for fruit and vegetable baskets and cheese boxes use poplar veneer.

Rotary cut poplar veneers can be combined into multilaminar wood (MLW).

Veneer based products

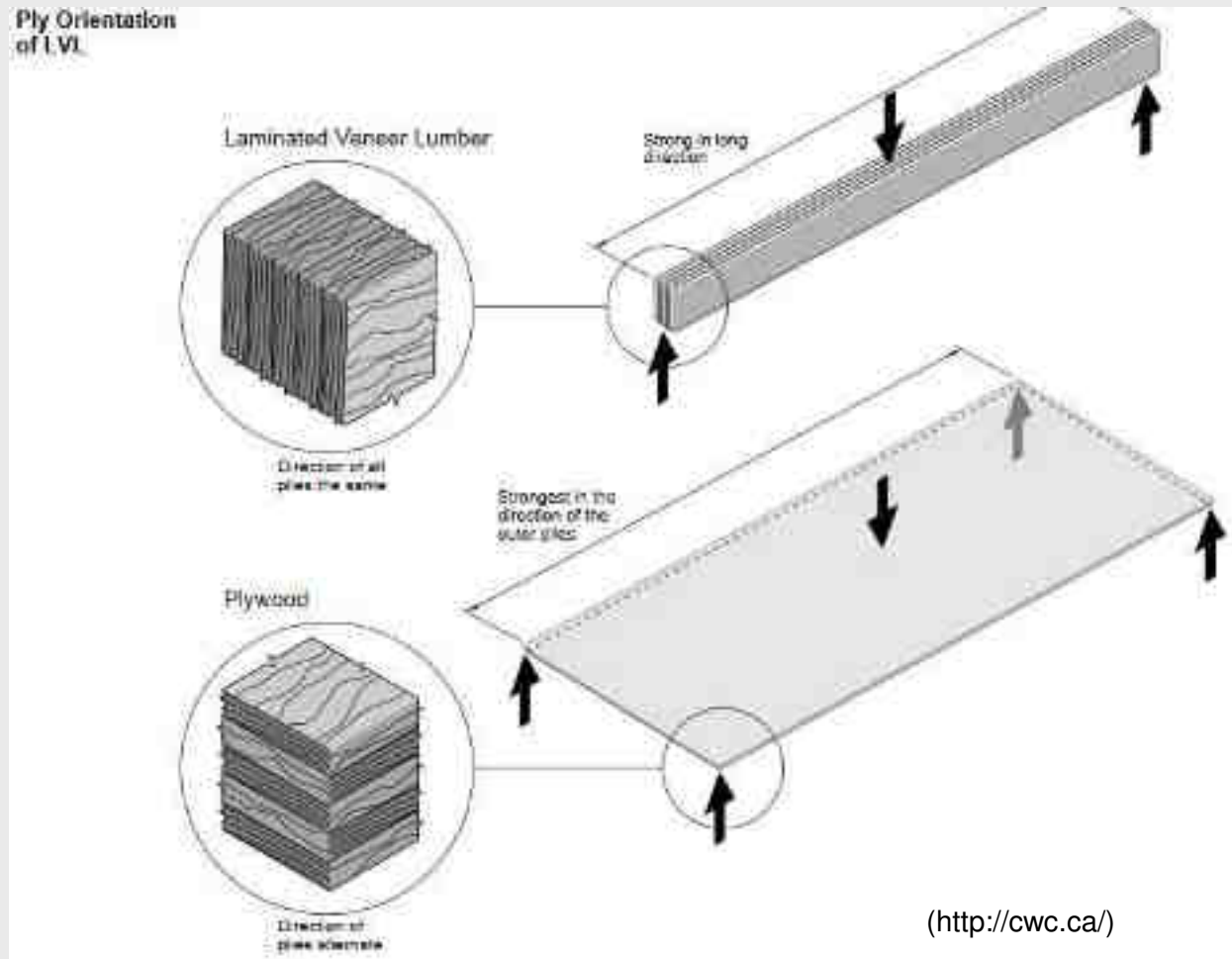
PLYWOOD & LVL (Laminated Veneer Lumber)

Plywood



(<http://www.apawood.org>)

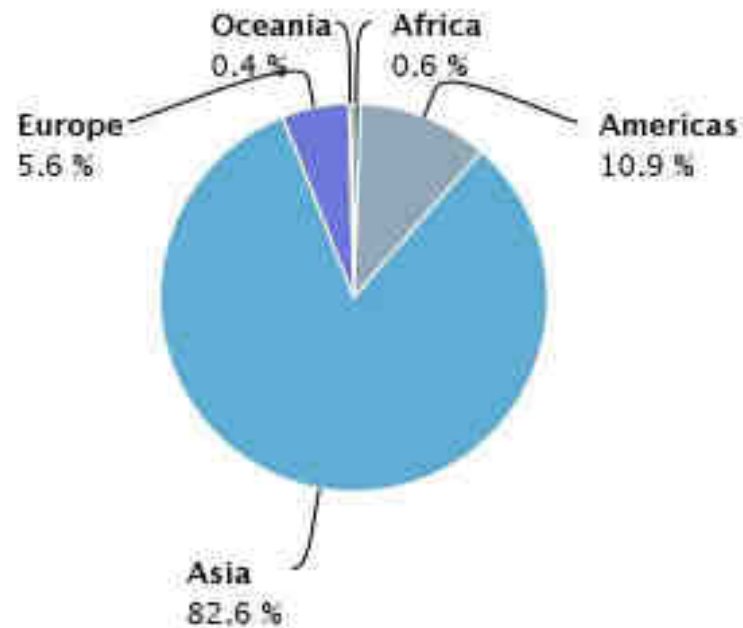
LVL - Laminated Veneer Lumber



Production

Plywood

147.6 million m³



Poplar, aspen, willow,...

Plywood

Poplar wood is well suited for the manufacture of veneer and plywood, but veneer and plywood production requires logs of the high quality.

The production of poplar plywood in North America has declined and been displaced by OSB. However, in Europe, and especially in China, the poplar plywood industry is thriving.

Production

LVL – laminated veneer lumber

4.6 million m³ (estimated)

1.7 million m³ in North America

Estimated consumption indicate a 4.0 million m³

Pollmeier (Germany) commenced production of beech LVL in 2014 and plans to produce 150.000–180.000 m³ of this product per year

Poplar, aspen, willow,...

LVL – laminated veneer lumber

Aspen (*Populus tremuloides*) is a relatively new substitute species in North America for LVL production.

It is worthy to note that two LVL mills in Canada pioneered the manufacture of aspen LVL. The success of these mills demonstrate that poplars are very suitable for LVL production.

Potential of European poplar clones for LVL production.

Particle based products

Particle based products

PARTICLEBOARD – OSB (Oriented Strand Board)

Chipboard & OSB – Oriented Strand Board



(<http://www.unilinpanels.com>)



(<http://www.norbord.nl>)

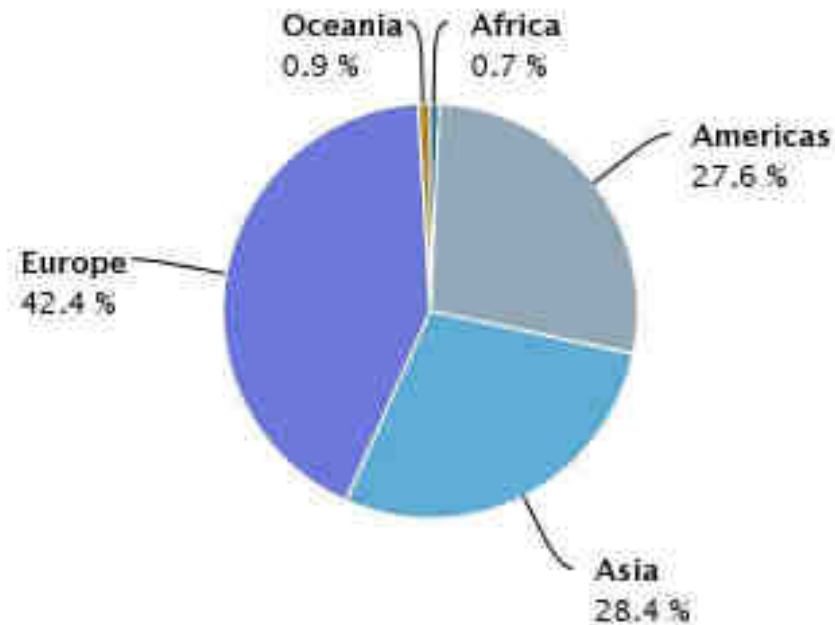


(<http://www.apawood.org>)

Production

Particleboard

110.9 million m³



Poplar, aspen, willow,...

Particleboard

Poplars and willows are well suited for the manufacture of particleboard, especially because of their good bonding characteristics and compressibility.

The production and quality of hybrid poplar based OSB was confirmed, as well as OSB based on willow.

Particle based products

STRUCTURAL COMPOSITE LUMBER

LSL – Laminated Strand Lumber

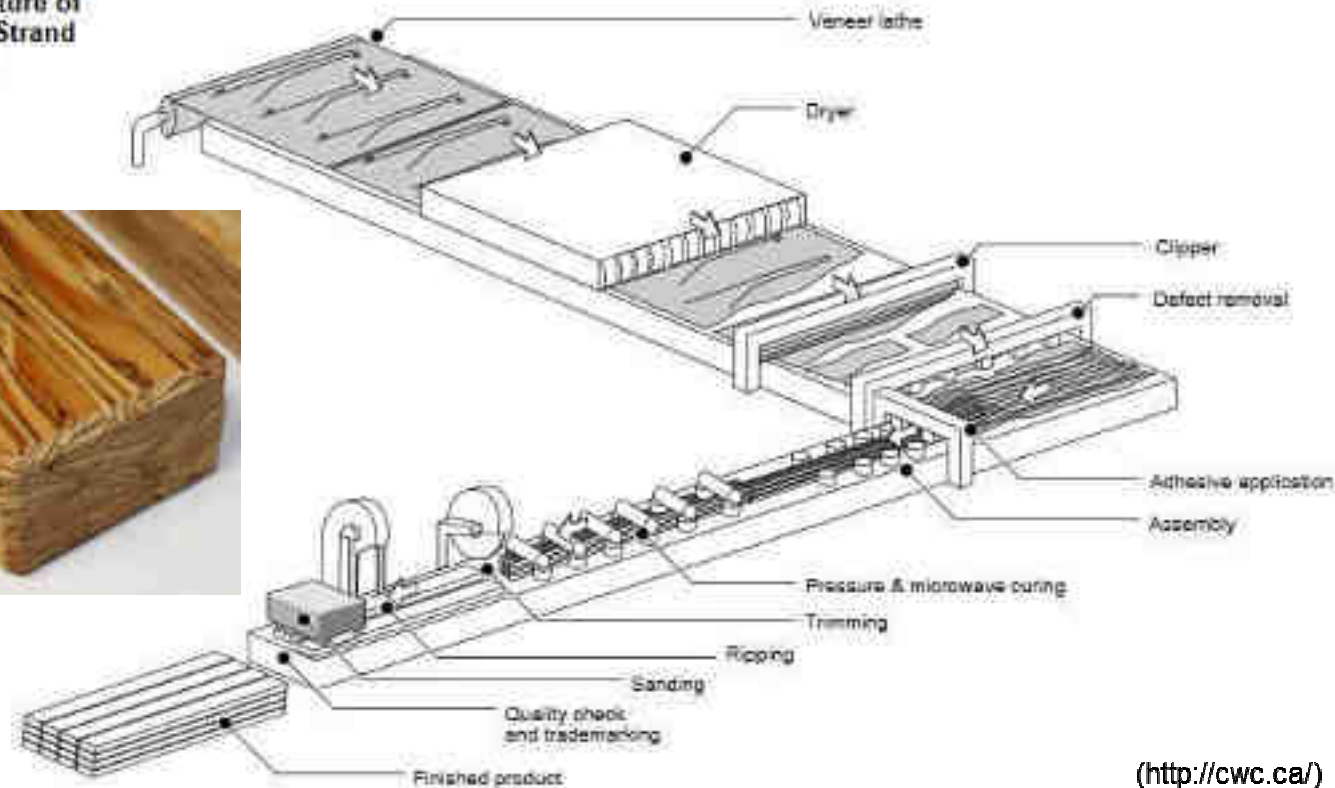


OSL – Oriented Strand Lumber



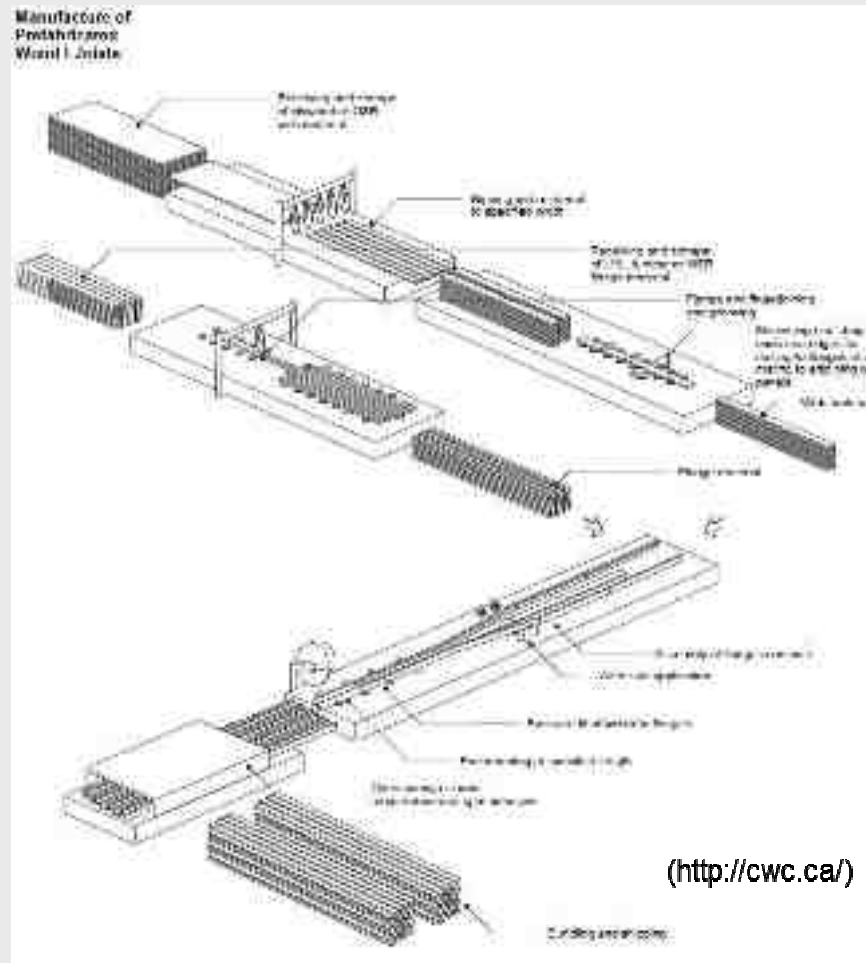
PSL – Parallel Strand Lumber

Manufacture of
Parallel Strand
Lumber



(<http://cwc.ca/>)

Prefabricated Wood I-joist



Production

Structural composite lumber - SCL

Proportional to the LVL production the different structural composite lumber products are produced in lower volumes but their engineering aspect is considerable.

I-beams: 200 million linear meters in North America

Poplar, aspen, willow,...

Structural composite lumber - SCL

Reported that hybrid poplar was suitable for the manufacture of PSL.

LSL is a typical North-American product is primarily made from long strands coming from fast-growing aspen or poplar.

There is a potential opportunity for the utilization of poplars in I-joists, where both the web and the flange may be made of poplar, for example poplar OSB and poplar LVL.

Fibre based products and hybrid products

Fibre based products

FIBREBOARD

Fiberboard



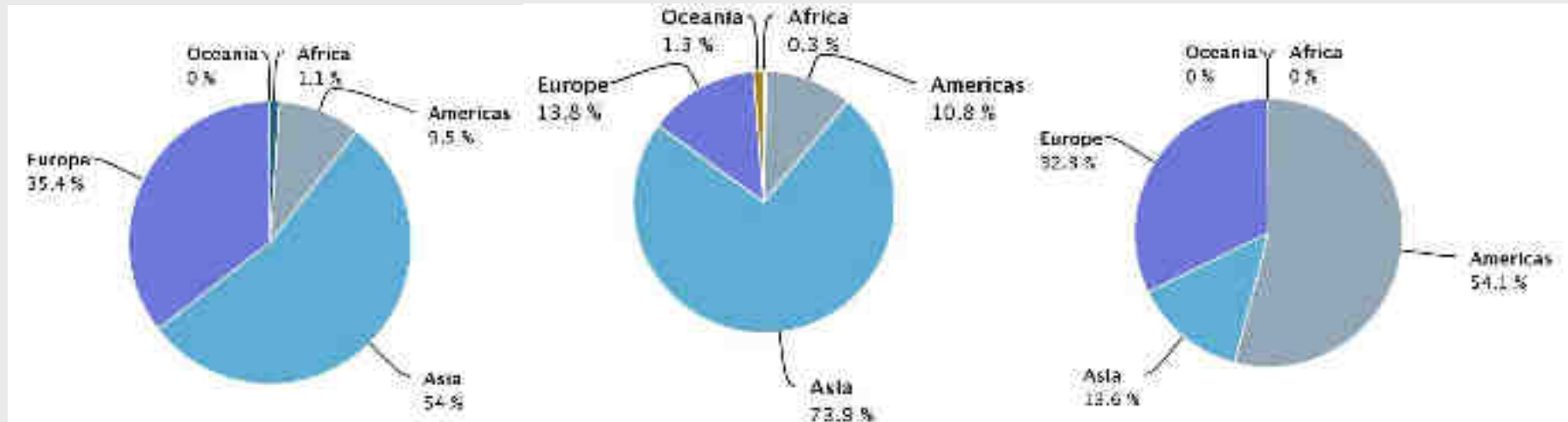
Production

Fiberboard

Hardboard: 12.3

MDF: 93.5

Insulation board: 9.9 million m³



Poplar, aspen, willow,...

Fiberboard

Fibre material of willow and poplar wood is very suitable for the production of all different types of fibreboard.

Fibre based hybrid products

WOOD-CEMENT PRODUCTS

(mineral-bonded wood composites)

Wood-cement products



Production

Wood cement board

Estimated production of fibre cement board is 26 million tons.

Wood cement board often contain approx. $\frac{1}{4}$ wood.

Market is expected to grow more than 4 % p.a.

Poplar, aspen, willow,...

Wood cement board

Some researchers are looking for specific opportunities for poplar.

Fibre based hybrid products

WOOD-POLYMER COMPOSITES

WPC – Wood Polymer Composites



Production

Wood-Polymer Composites - WPC

2.5 million m³ or 3.0 million tons estimated (50% wood)

This market is expected to grow some 10 % p.a.

Approximately half of the worldwide production is located in North America.

Poplar, aspen, willow,...

Wood-Polymer Composites

WPCs can also use poplars and willows as feedstock materials.

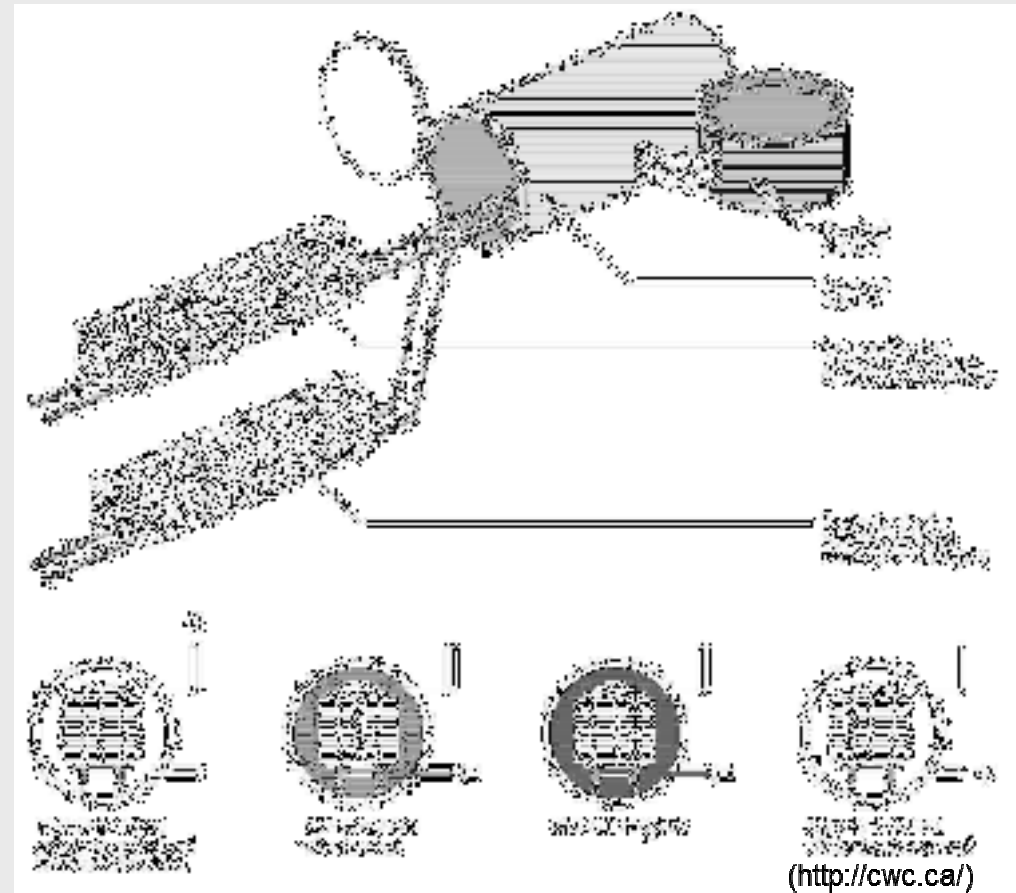
Treated engineered wood products

Treated engineered wood products

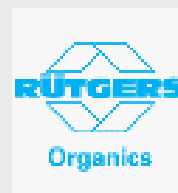
TREATED WOOD & MODIFIED WOOD

Wood preservation

- Toxic threshold values
- Biocides
- Related to use classes
- Traditional focus on UC 4



What industry is involved...



Wood modification

- **Brand names**
- **'New' wood species**
- **Biological durability?**
- **Other properties**
 - dimensional stability
 - weathering performance



Wood modification

- **Thermally modified timber (TMT)**
- **Chemical modification:** acetylation, furfurylation,...
- **Hydrophobation**
- **Others...**

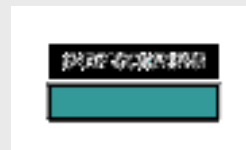


Wood modification

- **Non-biocidal systems**
- **Focus on Use Class 3**



What industry is involved...



Production

Treated wood products

The pressure-treated wood industry is producing approximately 16.5 million m³ of preserved wood per year. In Europe the wood preserving industry produces around 6.5 million m³ of pressure-treated wood per year.

Modified wood production can be estimated at about 250 000 m³ in total, of which 60 000 m³ is chemical wood modification (acetylation, furfurylation,...).

Poplar, aspen, willow,...

Treated wood products

Treatability of poplar, aspen and willow can be considered rather straightforward but still requires some technicalities due to difficult to impregnate transition zones.

Also plywood can be considered non-durable and protective treatments can be necessary to comply with service life expectations in harsher environments.

However, when considering also the moisture dynamics some plywood products can perform quite well in outdoor conditions without ground contact. Good performance in combination with okoumé.

THANK YOU

Joris.VanAcker@UGent.be

Nele.Defoirdt@UGent.be

Jan.VandenBulcke@UGent.be

Please forward extra input...?

© All pictures are property of UGent - WOODLAB (or mentioned otherwise).
It is not allowed to use them without permission.
Some pictures are copied from websites as illustration.