

TREPROX
Trepox, Hvanneyri, 11. October 2021, Ólafur Eggertsson
Erasmus+

Wood Properties and Structure (Viðargæði og bygging)

Labels in diagram: growth ring, heartwood, sapwood, cell wall layers (ML, P, CM, L), Viðarfrumur, Viðarfibrur, BFA matrix, B2 material, B1 material.

Where do wood products come from?

- Wood is from trees!
- Where do trees come from?
- Formed from CO₂ and water using sunlight as an energy source.

This process is known as **photosynthesis** (ljóstillifun)

Carbon dioxide (CO₂) + water + light energy (sólárljós) → carbohydrate (sykrur) + oxygen (súrefni)

Photosynthesis is the process whereby light energy is converted into chemical energy that can then be used by the plant to fuel its metabolism

Tree growth

- Growth occurs in the vascular **cambium (vaxtarvef)** where living cells divide and differentiate outwards to form the **bark** and inwards to form the **wood**.
- The **meristem (toppvaxtarvefur)** is responsible for increasing the height

Basic characteristics of the tree

- **Gymnosperms** (softwoods; conifers; barrtré)
 - Gymnosperms have "**naked seeds**", attached to the surface of cones.
 - Needles, which are **usually evergreen**
- **Angiosperms** (hardwoods; broadleaves; laufré)
 - Angiosperms have **seeds enclosed in fruit** (apple, pear... acorn, etc.)
 - Leaves (which are lost in the autumn in temperate climates)

Tree structure

Environmental factors

- The growth of a tree is a combination of genetics (erfðir) and environmental factors (umhverfi)
- Genes decide species and growth forms etc.
- Environmental factors influence tree growth, for example:
 - Climatic factors (temperature, rain, snow)
 - Soil
 - Location (stand / clearing)
 - External stresses (wind, frost)

Genetics

The wood (viðurinn)

Makrostruktur of wood:

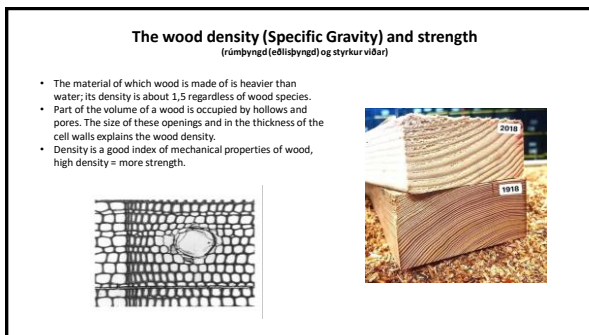
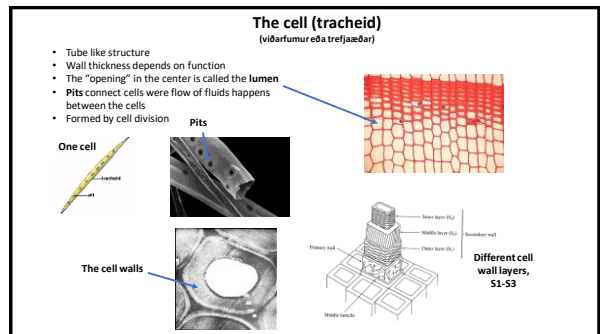
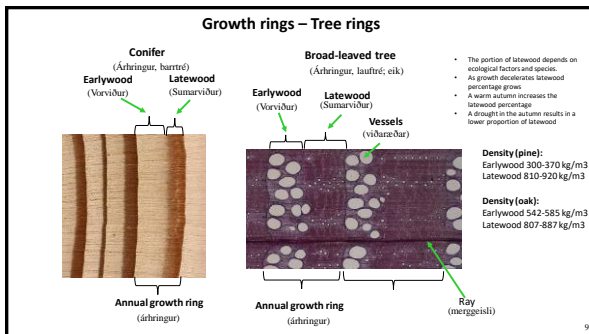
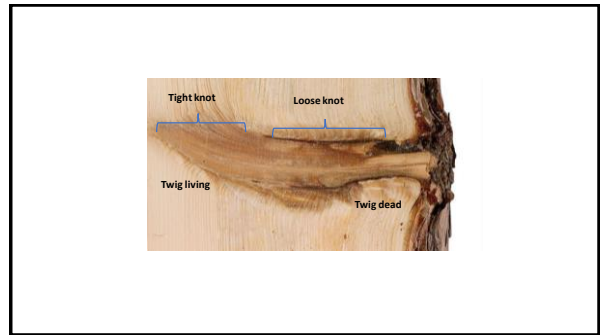
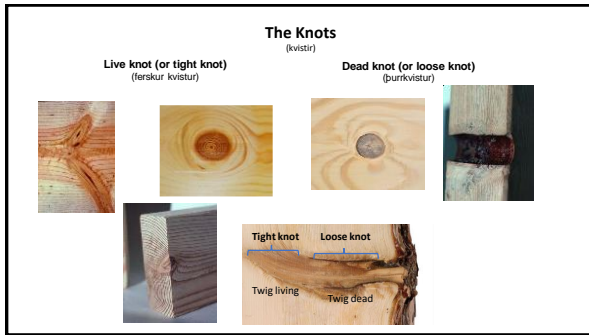
- Visible to the naked eye
- Heartwood/sapwood, growth rings, grain, knots

Microstruktur of wood:

- Visible under a light microscope
- Different cell types, morphology of cells

The cell wall:

- Visible by electron microscopy



Name	Density (dry) g/cm ³
Balsa wood	0.11 - 0.14
Coniferous	0.30 - 0.70
Larch	0.45 - 0.60
Pine	0.39 - 0.65
Jatoba	0.52 - 0.62
Sitka spruce	0.33 - 0.48
Ebony	0.96 - 1.12
Acer	0.62 - 0.75
Oak	0.60 - 0.90
Tekk, (Afrika)	0.98
Tekk, (Indland)	0.66 - 0.88

Name	Density (dry) g/cm ³
Siberian larch	0.40 - 0.63 (0.54)
Contorta pine	0.35 - 0.53 (0.41)
Sitka spruce	0.33 - 0.48 (0.38)
Black cotton wood (alaskaþsp)	0.27 - 0.49 (0.35)

Ebony

Icelandic larch

Wood strengt main parameters

MOE = Modulus of elasticity = Stífni
 MOR = Modulus of Rupture = Beygjutogból (bending strength)

Modulus of elasticity (MOE) is the measures a woods stiffness and is a good overall indicator of its strength.

Modulus of rupture (MOR)
 This reflects the maximum load-carrying capacity of a wood

Grading and Strength Classes (styrkleikflokkun)

Strength classes	C14	C16	C18	C20	C22	C24	C27	C30	C35
Visual Grading (littelflokkun)	T0		T1		T2		T3		
Graded by machine (vefflokkun)		C16	C18	C20	C22	C24	C27	C30	C35
Basic density	0,290	0,310	0,320	0,330	0,340	0,350	0,370	0,380	0,400
Modulus of rupture (MOR)	14	16	18	20	22	24	27	30	35
Modulus of elasticity (MOE)	7,000	8,000	9,000	9,500	10,000	11,000	11,500	12,000	13,000

Icelandic wood	MOR σ_{MOR} [Mpa] Beygjutogból	MOE $E_{0,1}$ [Mpa] Stífi
Siberian larch	92	11,607
Silka spruce	74	10,444
Contorta pine	71	8,278
Alaskan poplar (Alaskalögn)	63	7,044

Wood and water (viður og vatn)

Water can be present in two states in wood:

Free water (laust vatn). Water exist in liquid pockets located in the cell lumen and other open spaces in the wood.

Bound water (bundit vatn). The water is in the cell walls of the wood.

The point (about 30% moisture) where the transition occurs between free water and bound water is called the **Fiber Saturation Point (FSP) (trefjættunarmörk)**. At or above the fiber saturation point, both free water and bound water are present.

The forest value chain (Sweden)

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TAKK

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