

Journées Bouleaux Allemagne

Présentations de résultats de recherche

Propriétés du bouleau et Prototypes de bois lamellé-collés

Tom Mortelmans, ***PhD student in Wood Engineering***

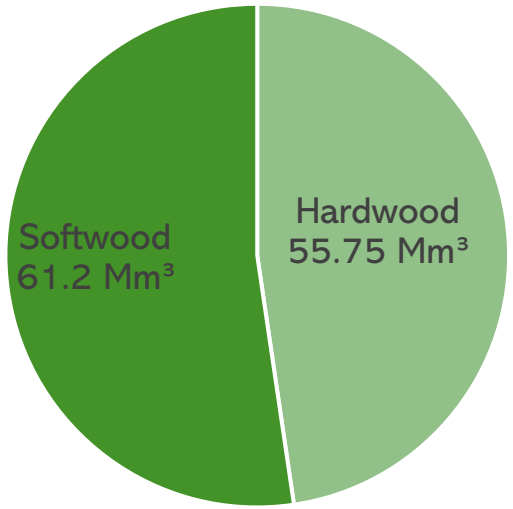
Promotors : Pr. Tom De Mil (ULiège) & Pr. Thierry Descamps (UMons)

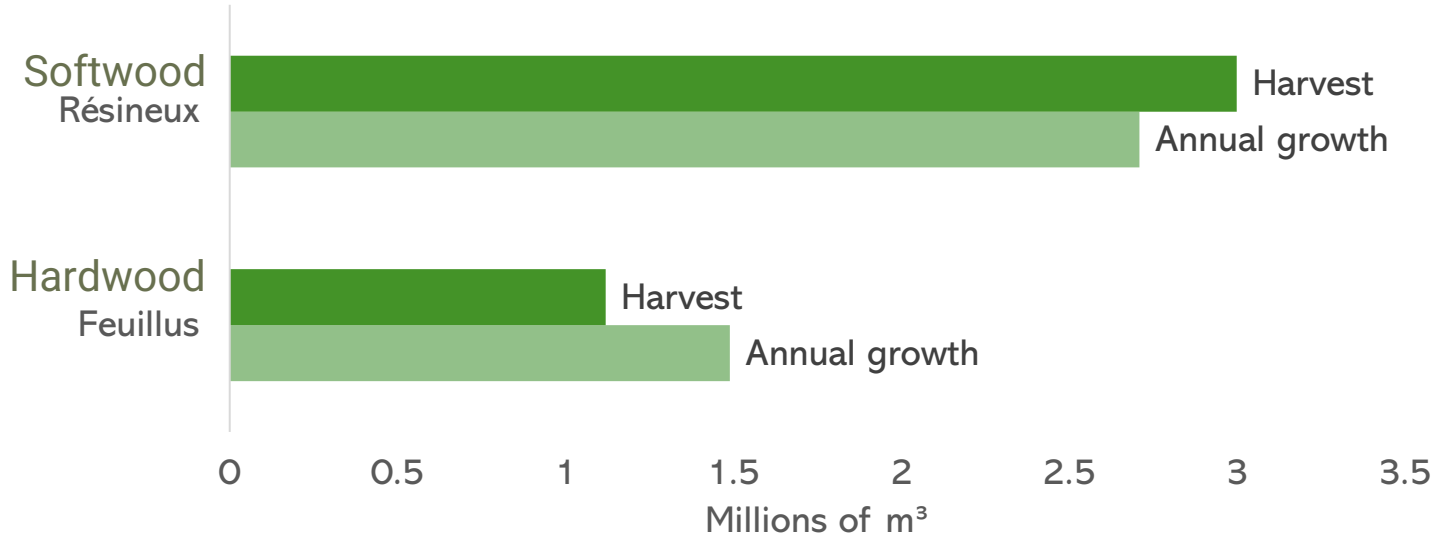
Committee : Pr. Laurent Bléron (ENSTIB), Dr. Liselotte De Ligne (UGENT), Dr. Andrea Di Maria (ULiège), Pr. Philippe Lejeune (ULiège), Dr. Coralie Avez (UMons)

Timber Grading Workshop Napier



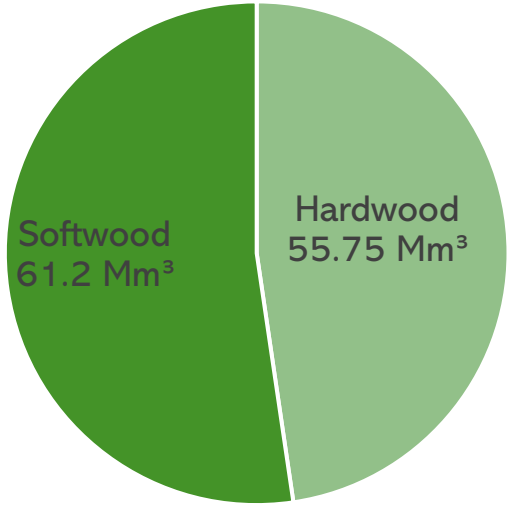
Context
Belgian Forest Overview – hardwoods situation

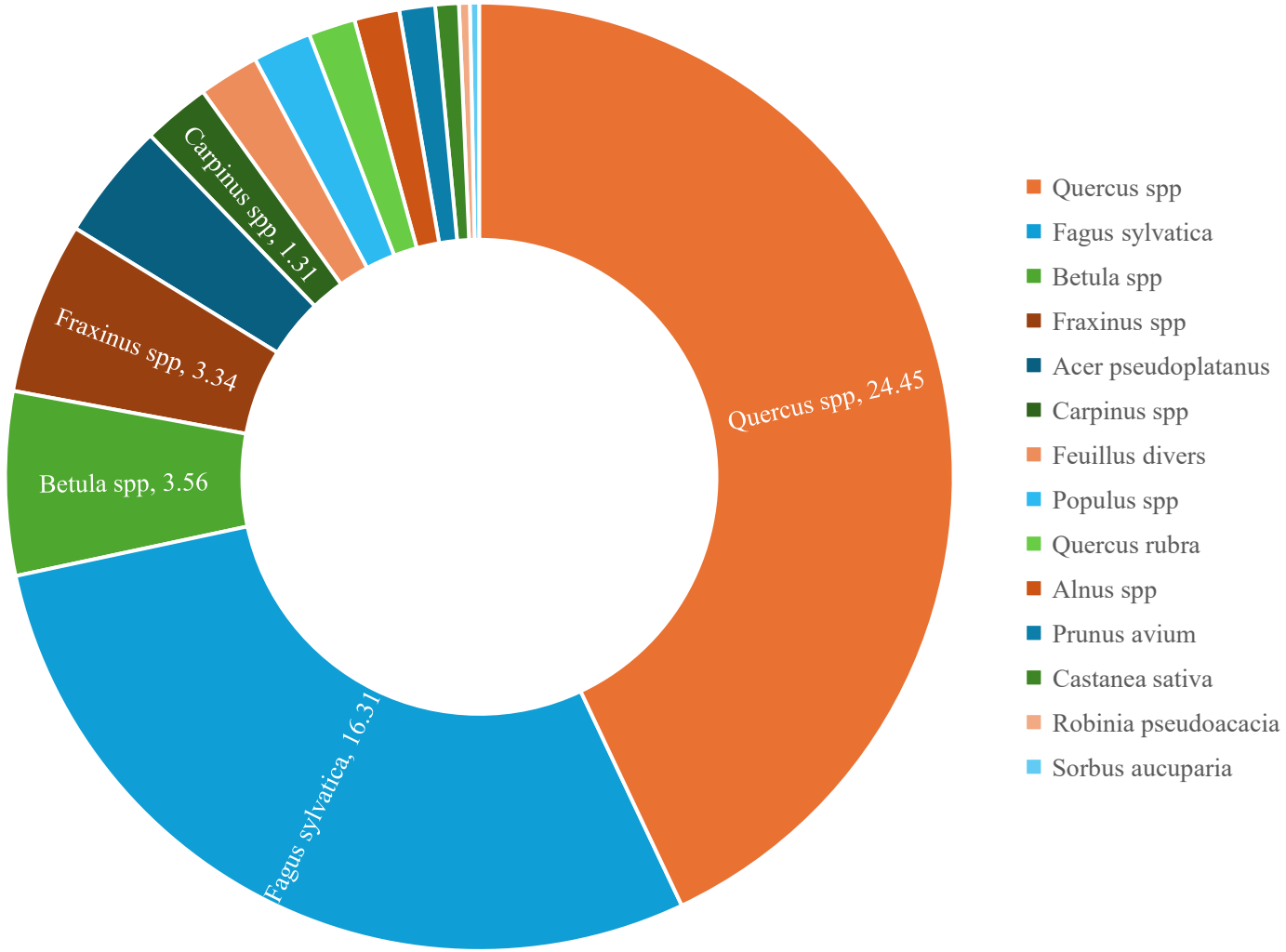




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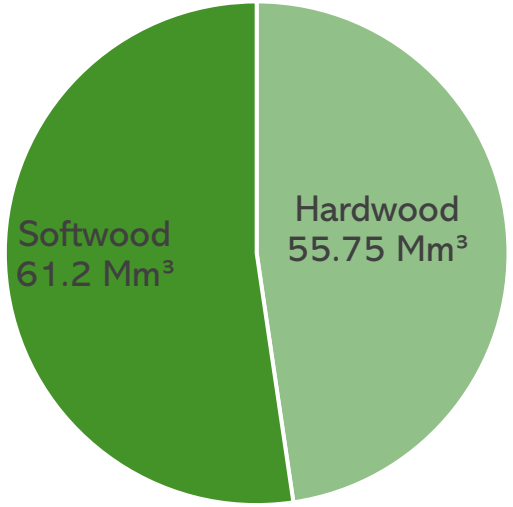
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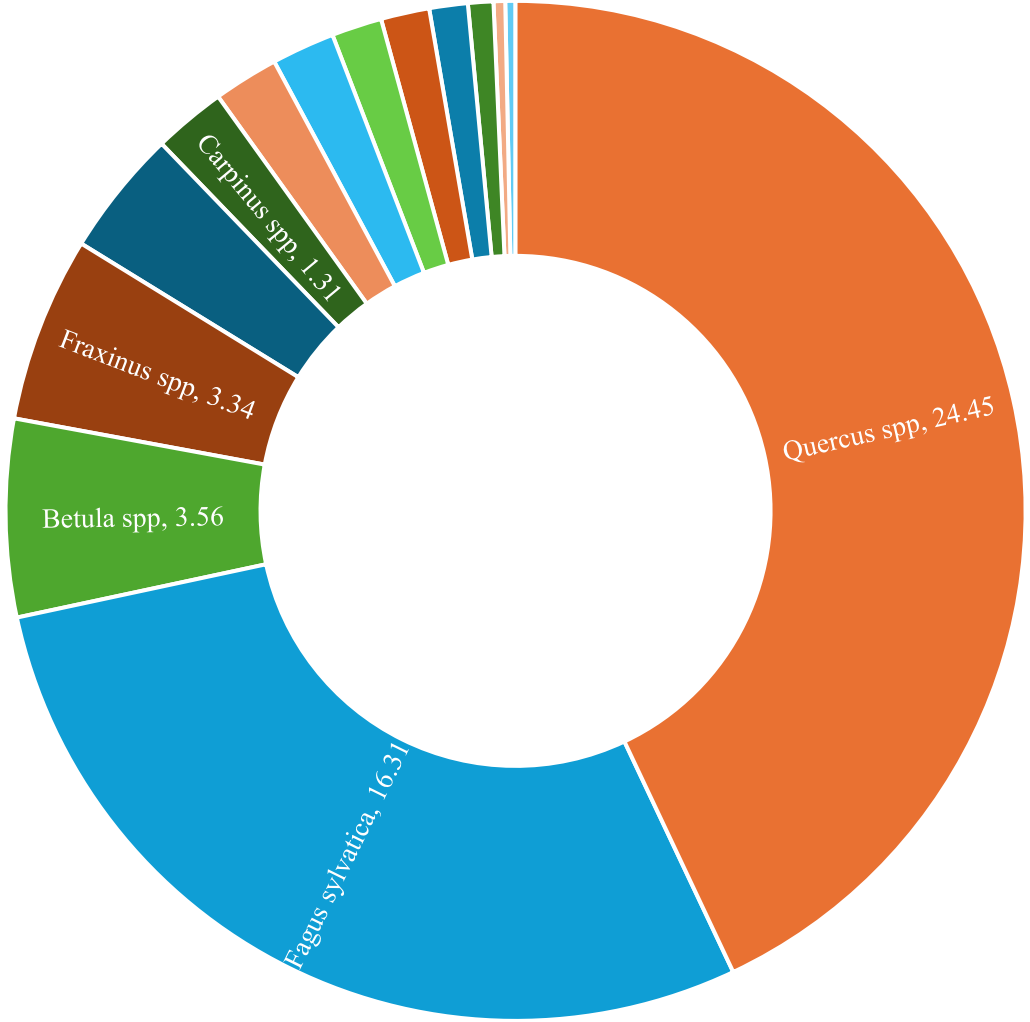


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Belgian Forest Overview – Hardwoods Situation



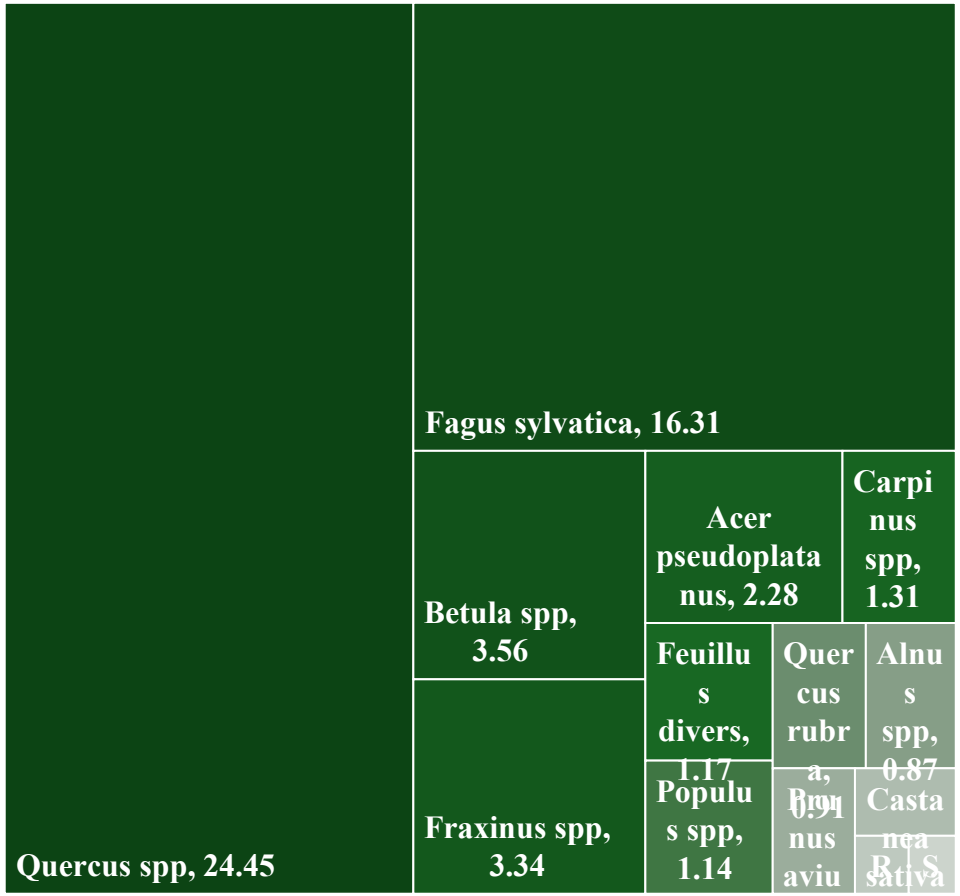


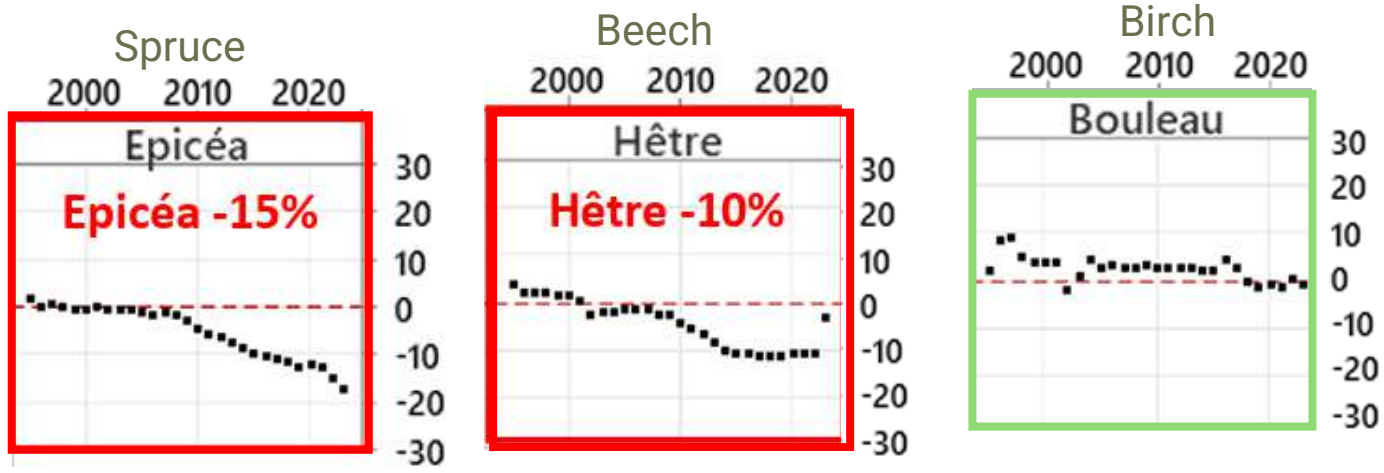


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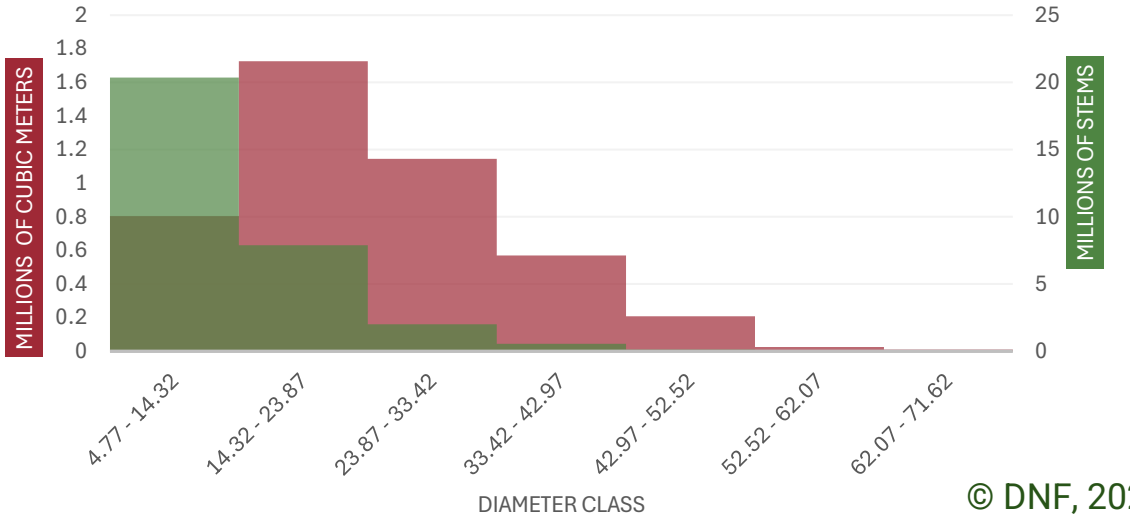
Context
Belgian Forest Overview – growth rates

MILLONS OF CUBIC METER OF STANDING VOLUME OF HARDWOODS IN WALLOON FOREST (2024)





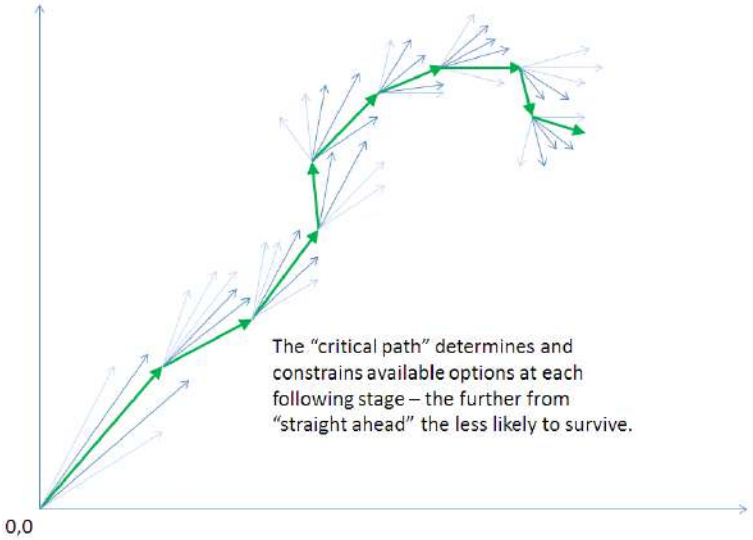
Standing volume of birch per diameter class



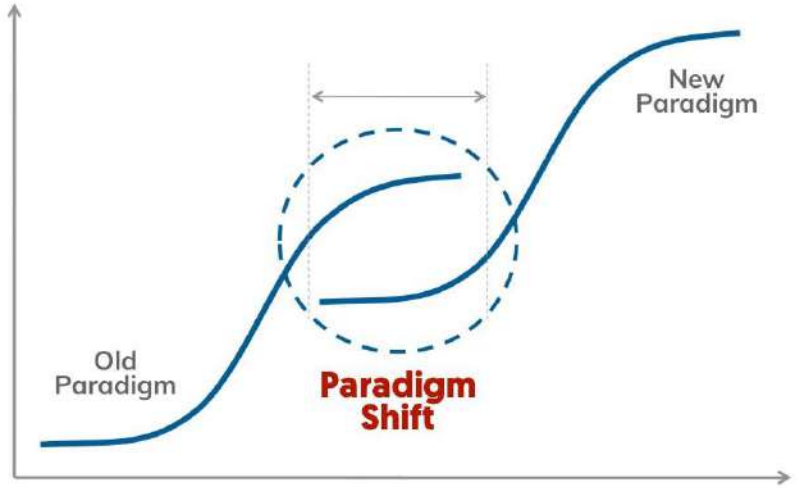
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Wood Sector
Complexity of adopting a new specie

Path dependency



Paradigm shift



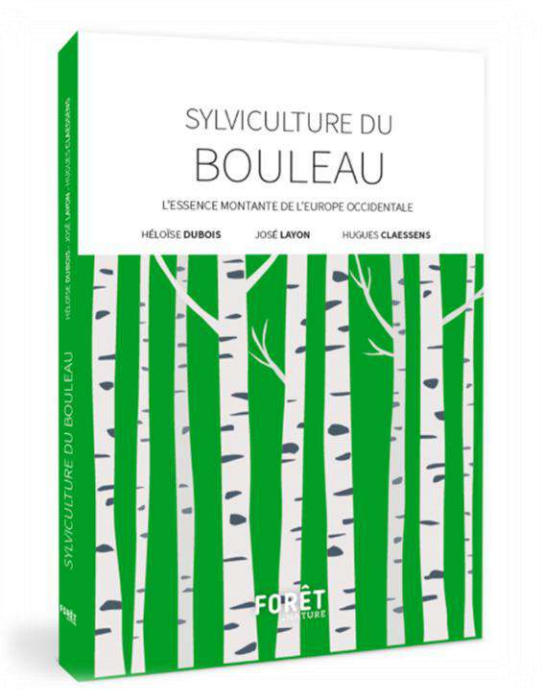
CLT ~ concrete logic applied to wood
Poplar industry ~ softwood logic applied to hardwoods

The Wood Sector
How to start an industry on a new specie

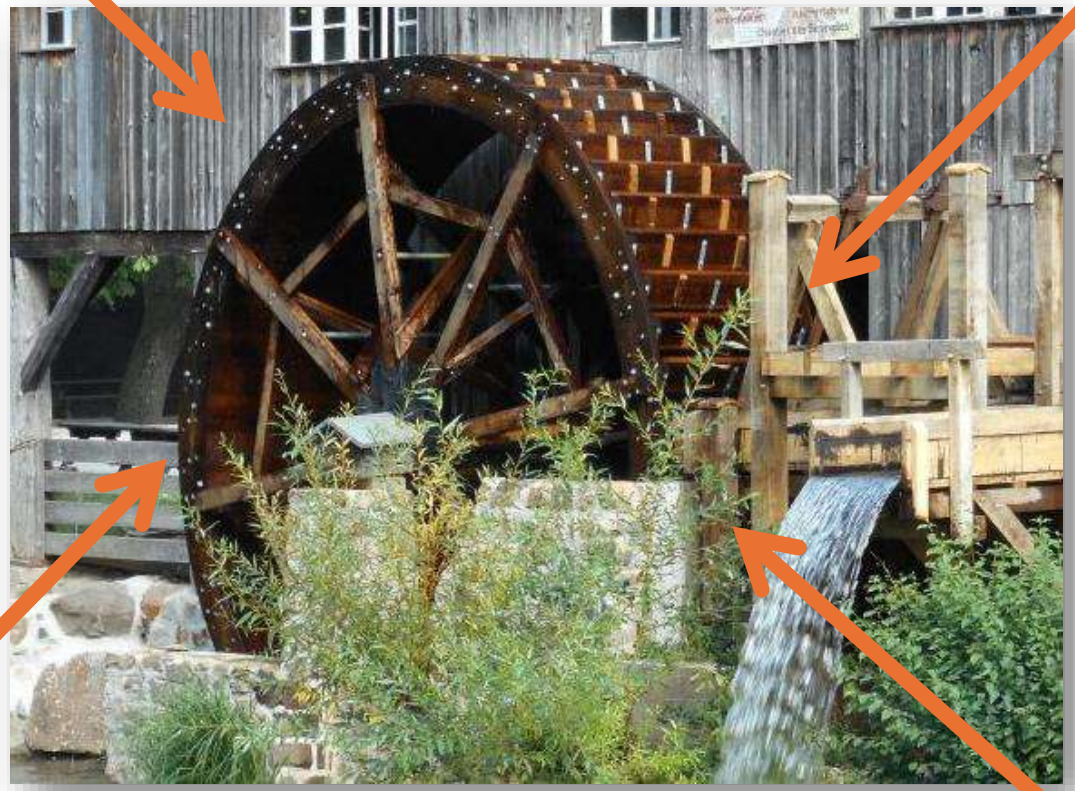


Forest Owner
supply a quality ressource

1st transformation (*sawmills*)
develop know-how on theses novel species



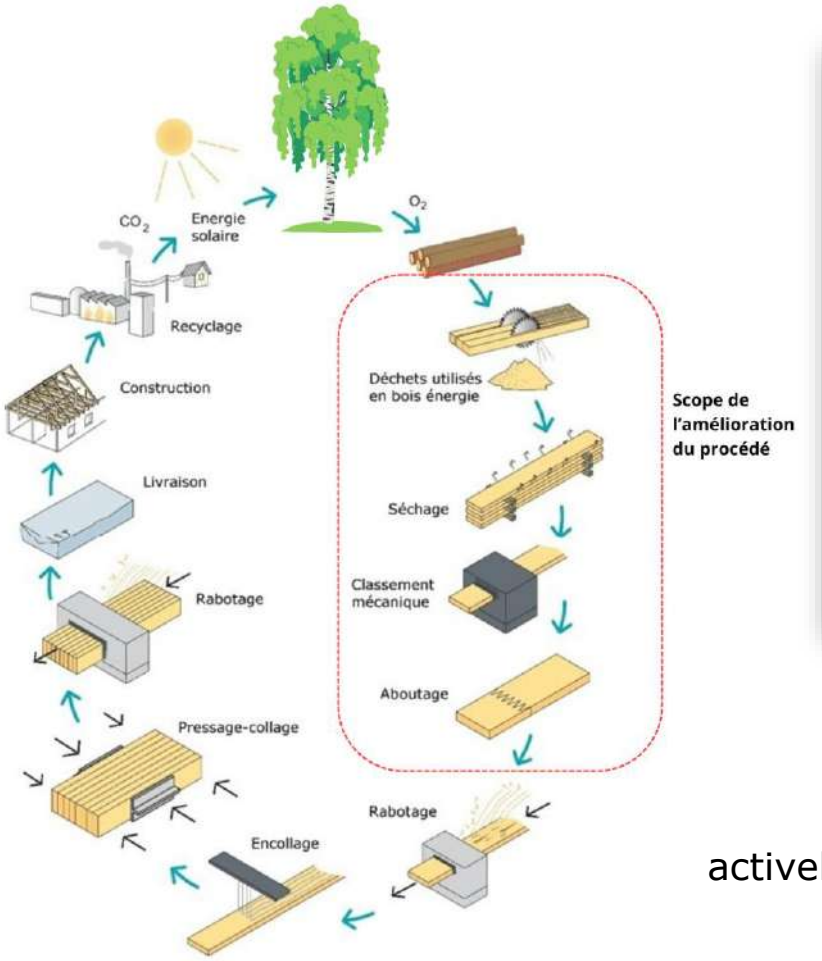
Héloïse Dubois



Final users (*architects, clients..)*
adopt those new products

2nd transformation (*lamellist, constructor, cabinetmakers,..)*
Develop new technology, new products of high added value

Birch Glulam potential
What usage ?



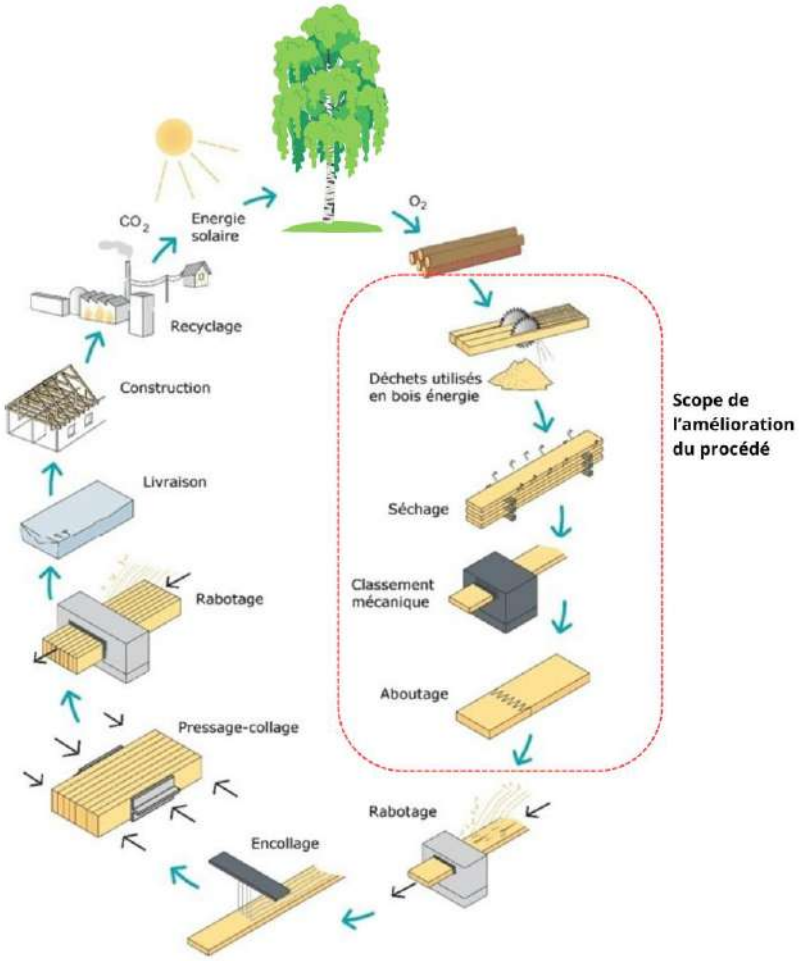


First structural use of birch GLT by Hasslacher in 2015



AZH Zimmerath from FH Aachen is actively developping birch GLT with them
© Tom Jansen, PhD student

Birch Glulam potential
What usage ?





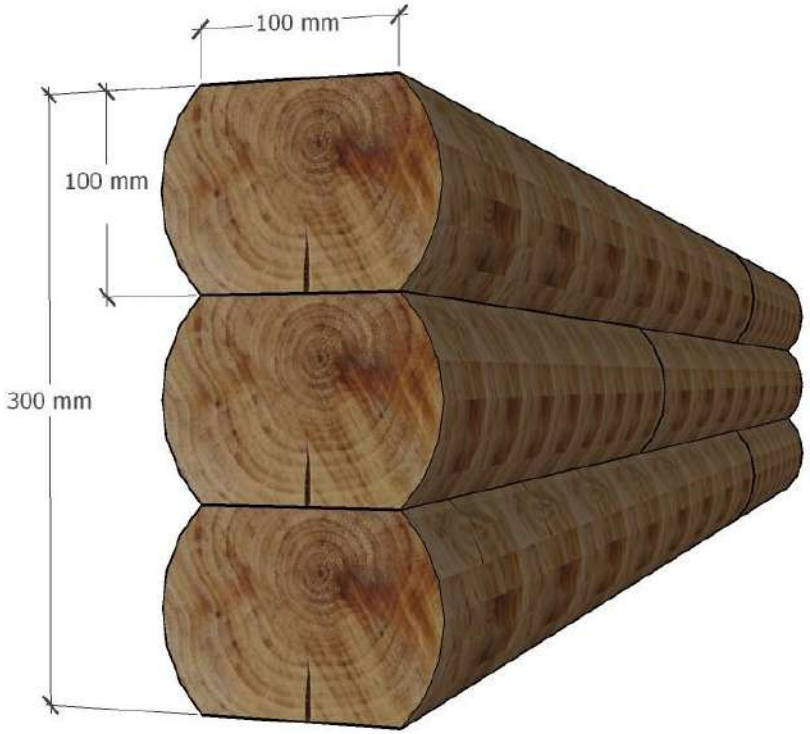
Hasslacher HQ : Birch Glulam Glass Curtain Wall

Belgian Birch Ressource Overview
Profile of volume and stems by diameter

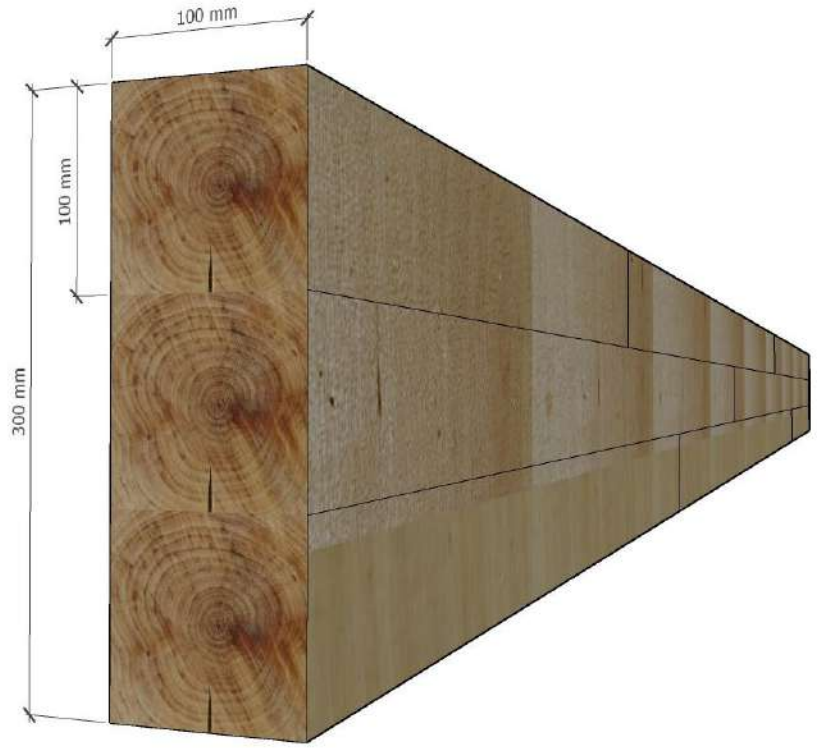


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nEWPs
Beam Prototypes from Small Diameter Trees



ROWOBI
round wood birches

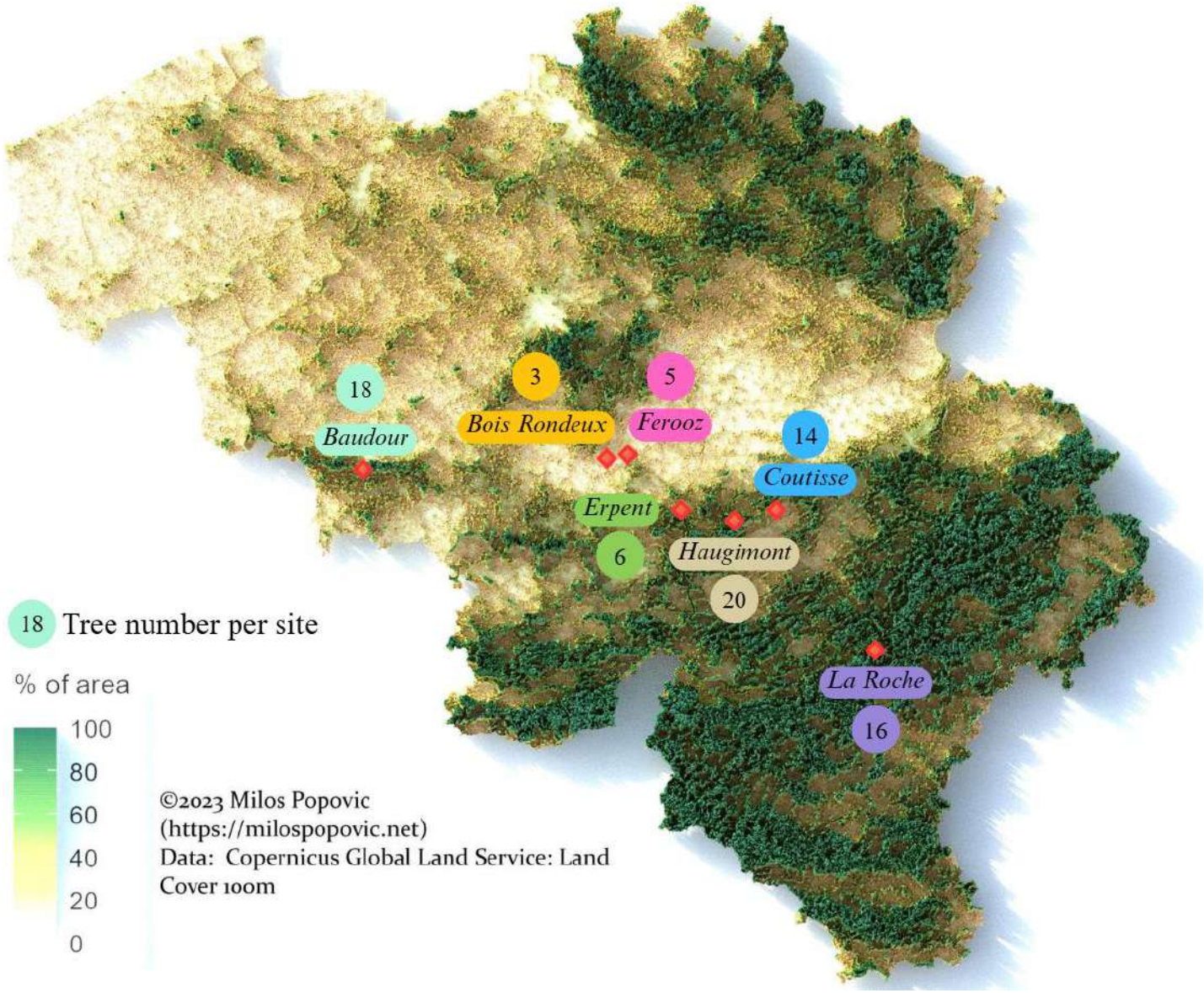


TRIBIR
Triple Birches

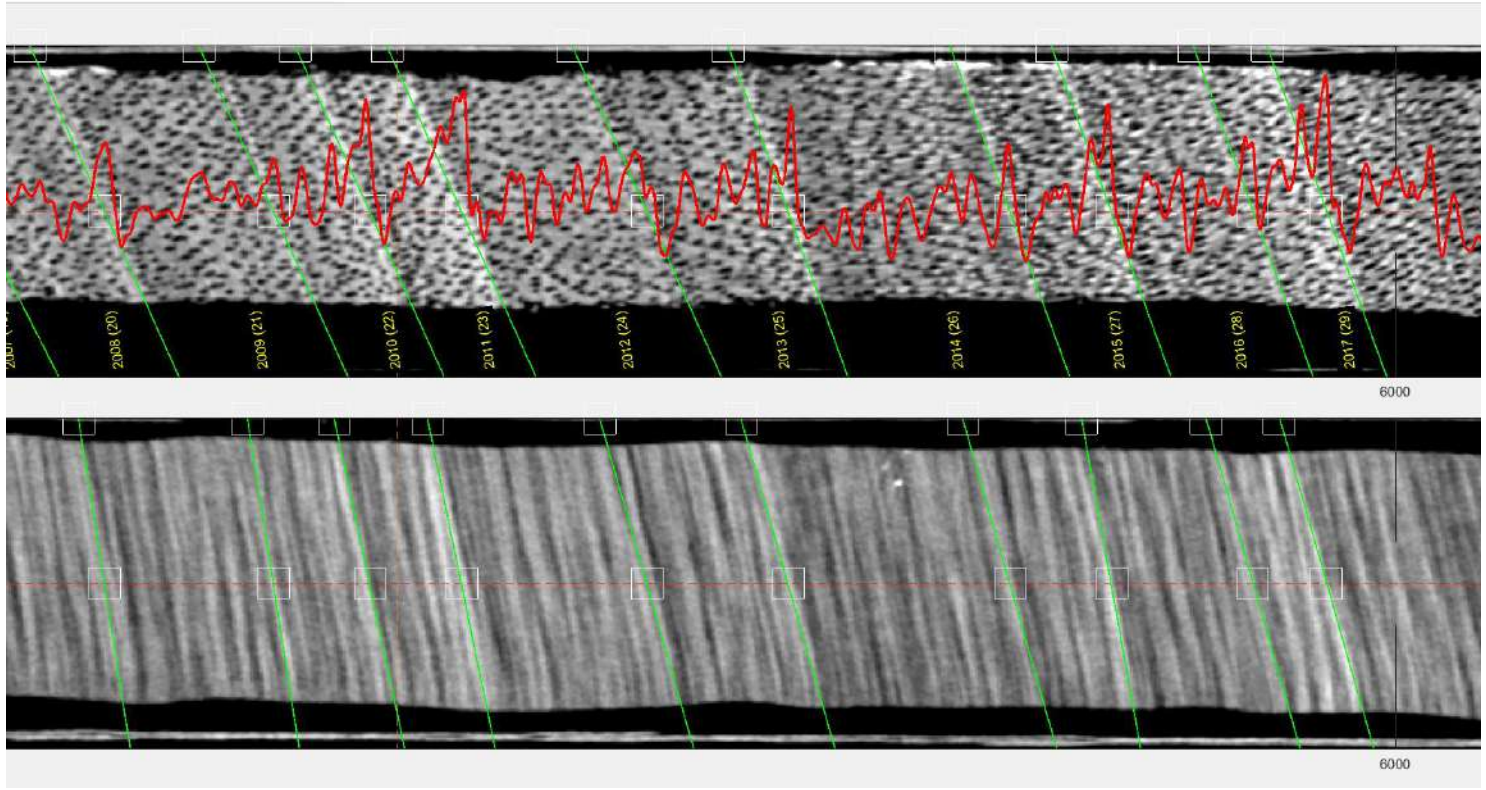
Materials
Sourcing sites

Harvested trees origin and main characteristics

Site	N_{trees}	$D150_{range}$	$D150_{mean}$ (cm)	Tree Height $_{mean}$ (m)
Ferooz	5	22.28 - 14.16 cm	18.26	n.d.
Coutisse	14	19.74 - 9.87 cm	13.42	n.d.
Rondeux	3	29.28 - 12.73 cm	16.88	21.19
Haugimont	20	21.33 - 13.37 cm	16.58	17.35
Erpent	6	22.60 - 12.73 cm	17.16	19.69
La Roche	16	28.97 - 12.1 cm	20.13	19.72
Baudour	18	46.15 - 12.41 cm	21.98	20.83
	82	9.87 - 46.15 cm	17.77	19.76



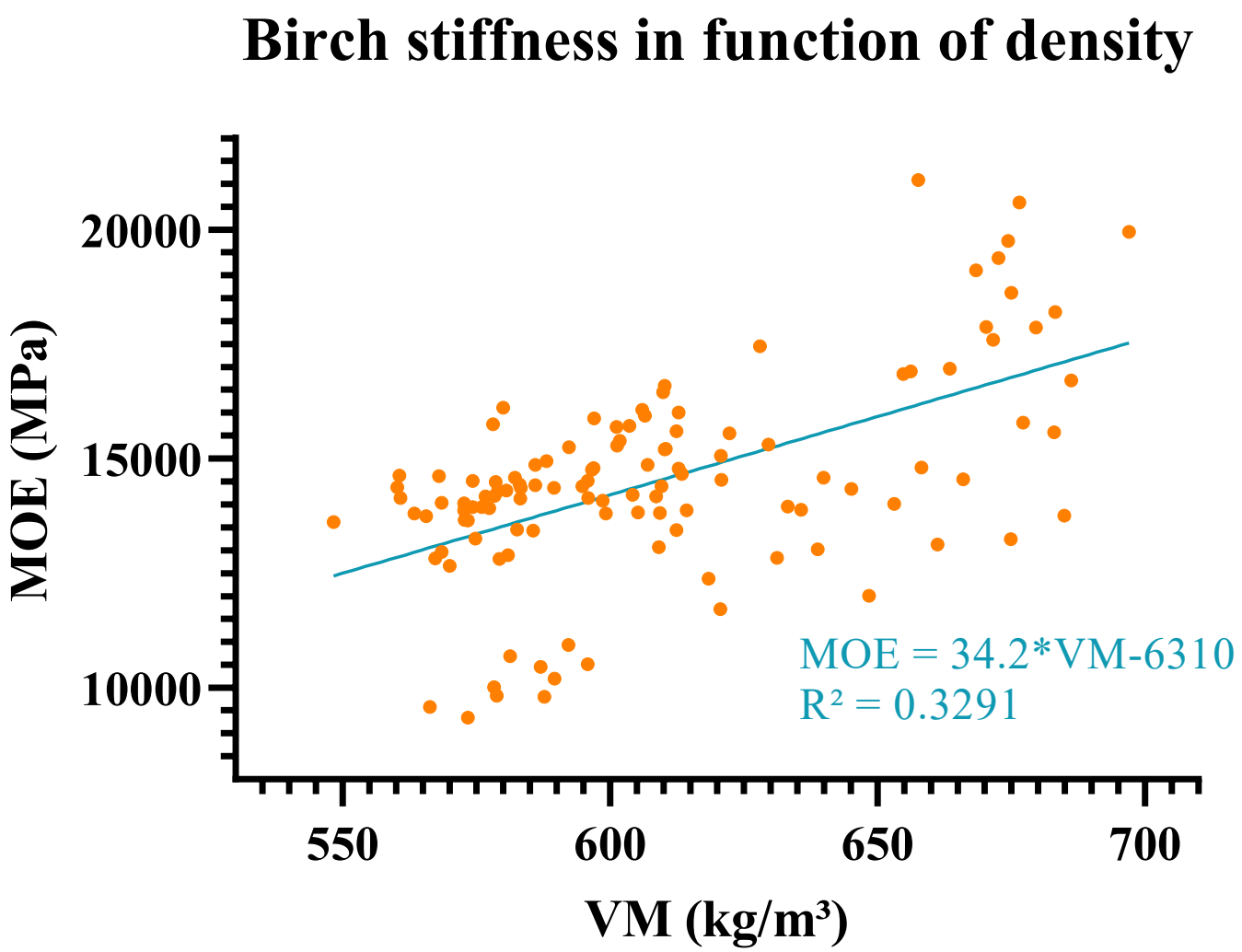
CT Scan of Sample Cores
Radial Variation of the Density



Core Sample Analysis – Density Profile at 30µm



HAUPERBO
E Module from small diameter birches



Specimen size of 20x20x380mm

Number of n = 118 samples

Specimen sized based on NF B51-016 "Defect Clear Small Specimen"

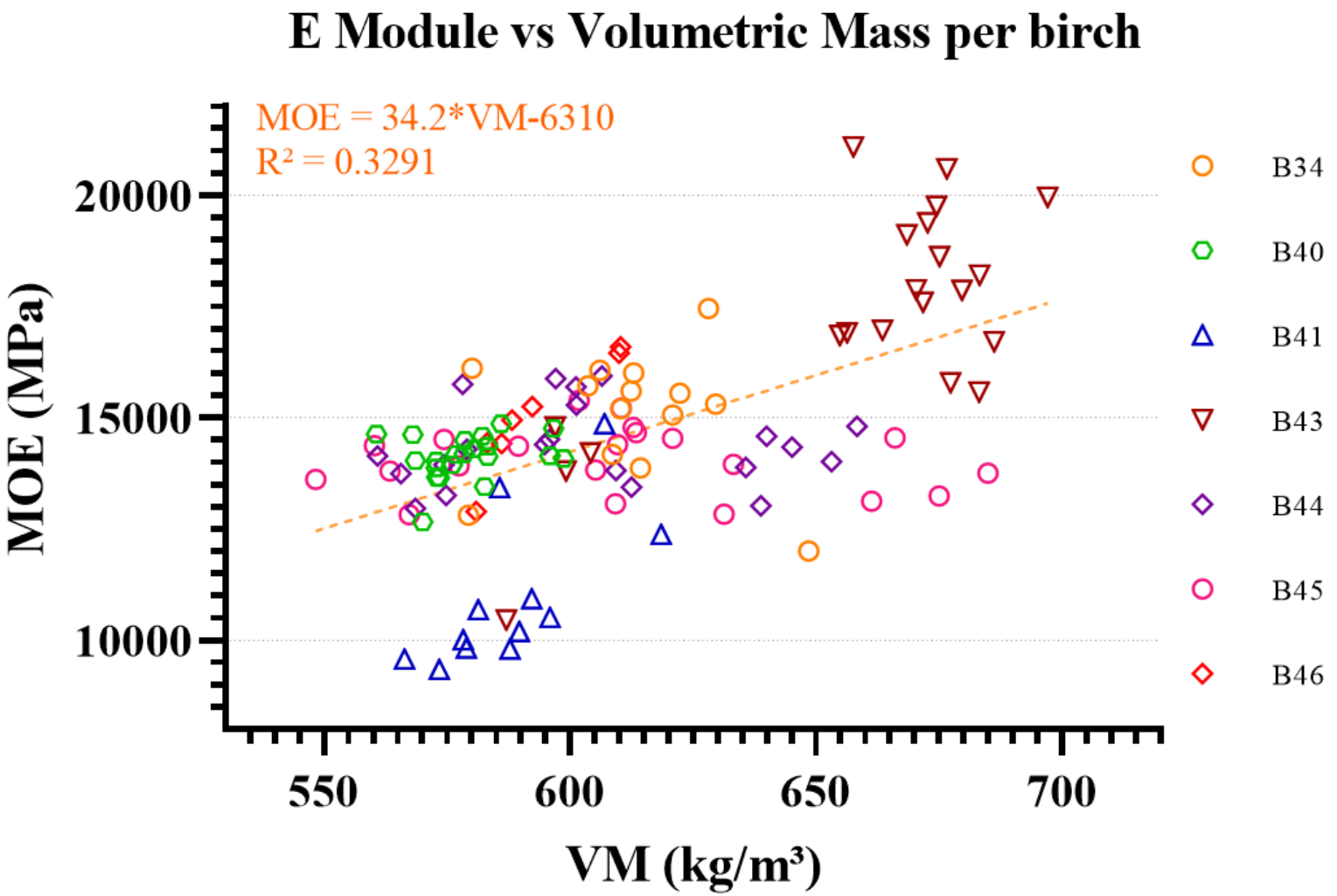
-> But with defect : non

MOE measure based on EN 408

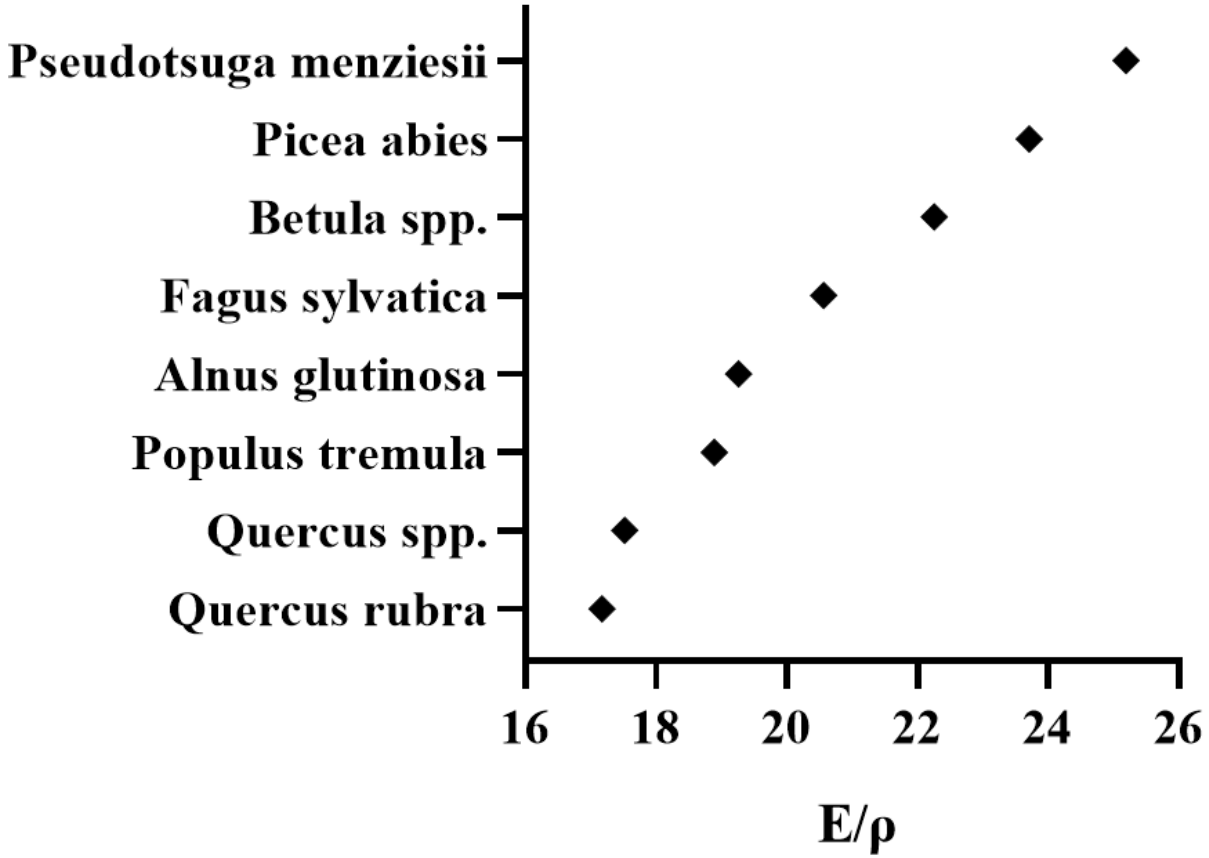
Study from Marlene Cramer & Dan Rilley Ellis (Nappier University) on the same subjects

→ Dataset in common

HAUPERBO
E Module from small diameter birches

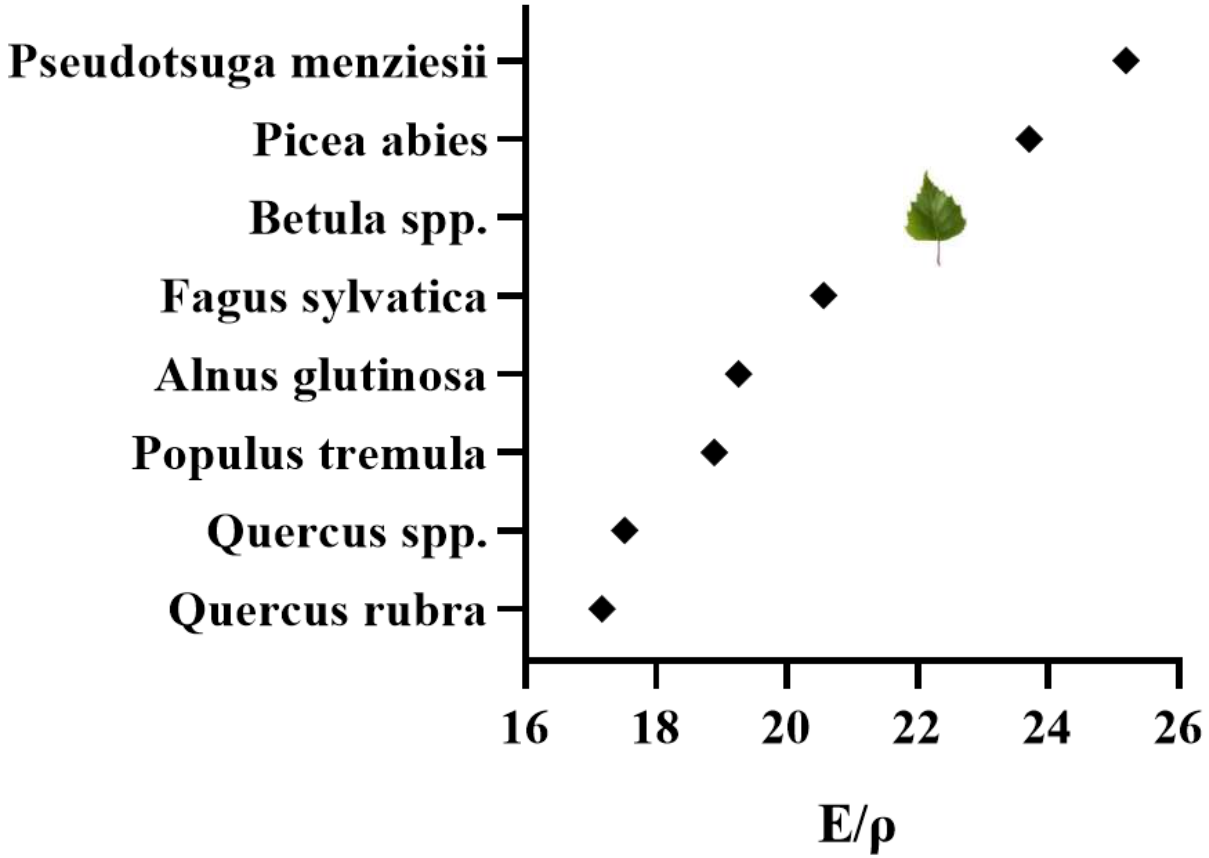


Ashby method
Stiffness-to-density ratio



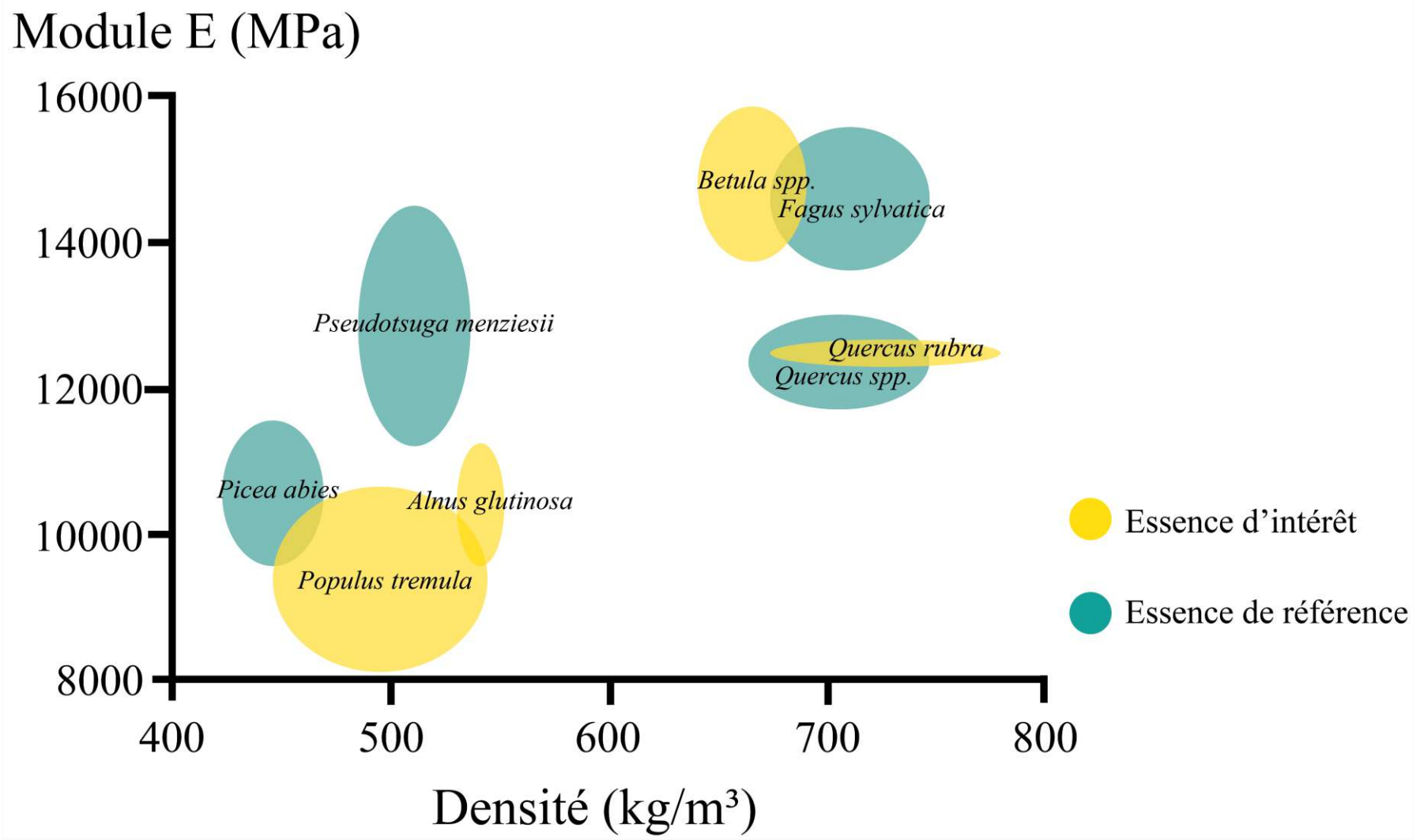
Specie	E/ρ (mean ± SD)
Pseudotsuga menziesii	25.2 ± 7.86
Picea abies	23.71 ± 10.57
Betula spp.	22.26 ± 13.87
Fagus sylvatica	20.56 ± 15.01
Alnus glutinosa	19.26 ± 12.4
Populus tremula	18.89 ± 7.57
Quercus spp.	17.52 ± 18.71
Quercus rubra	17.17 ± 61.65

Ashby method
Stiffness-to-density ratio

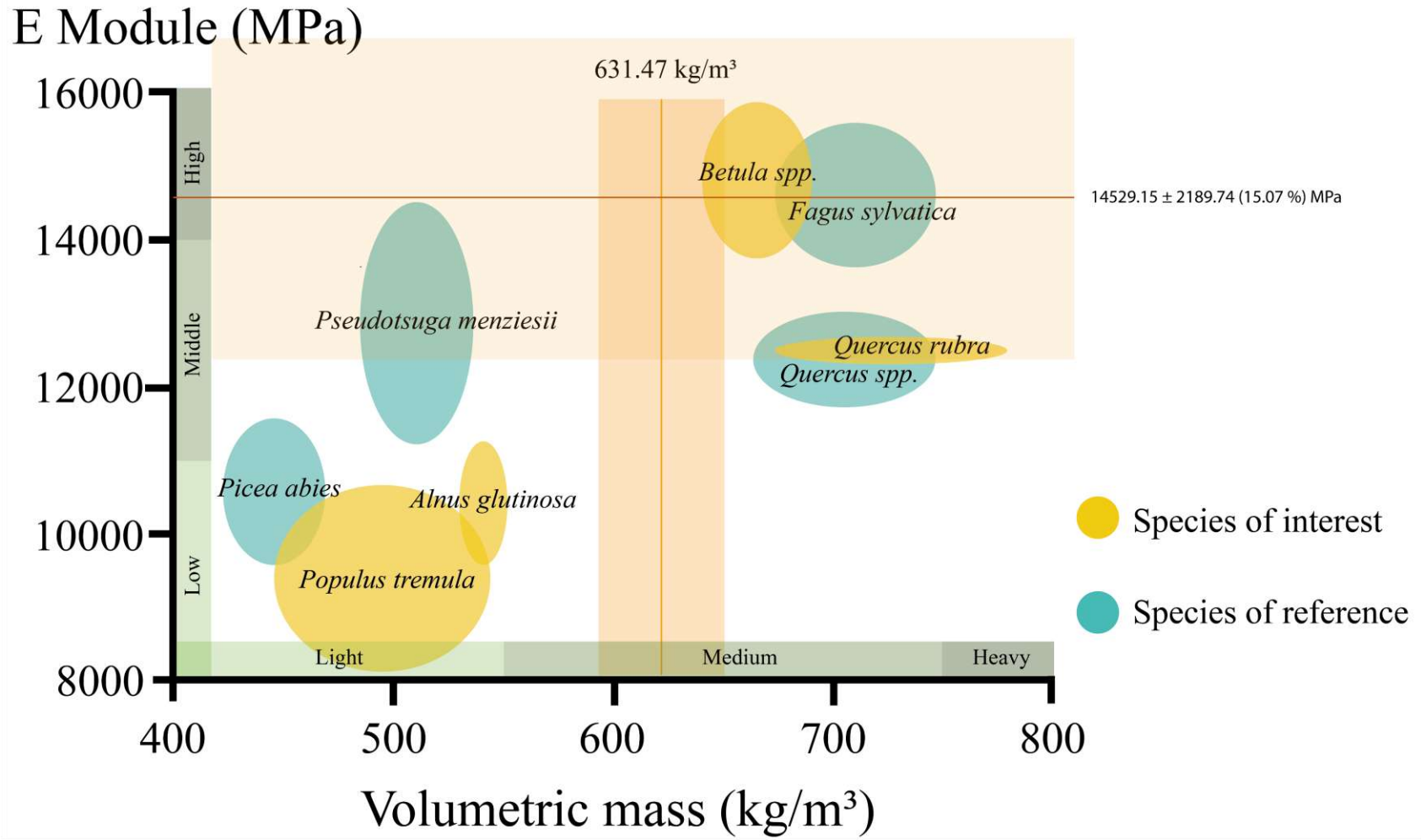


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Ashby diagram (MOE vs Density) for species of interest



HAUPERBO
Results compare to litterature



Ongoing Birch Research
Relating wood growth to mechanical properties



Random Tree (RT) vs Selected Tree (ST)
Arbre Non Géré (NG) vs Arbre Objectif (AO)

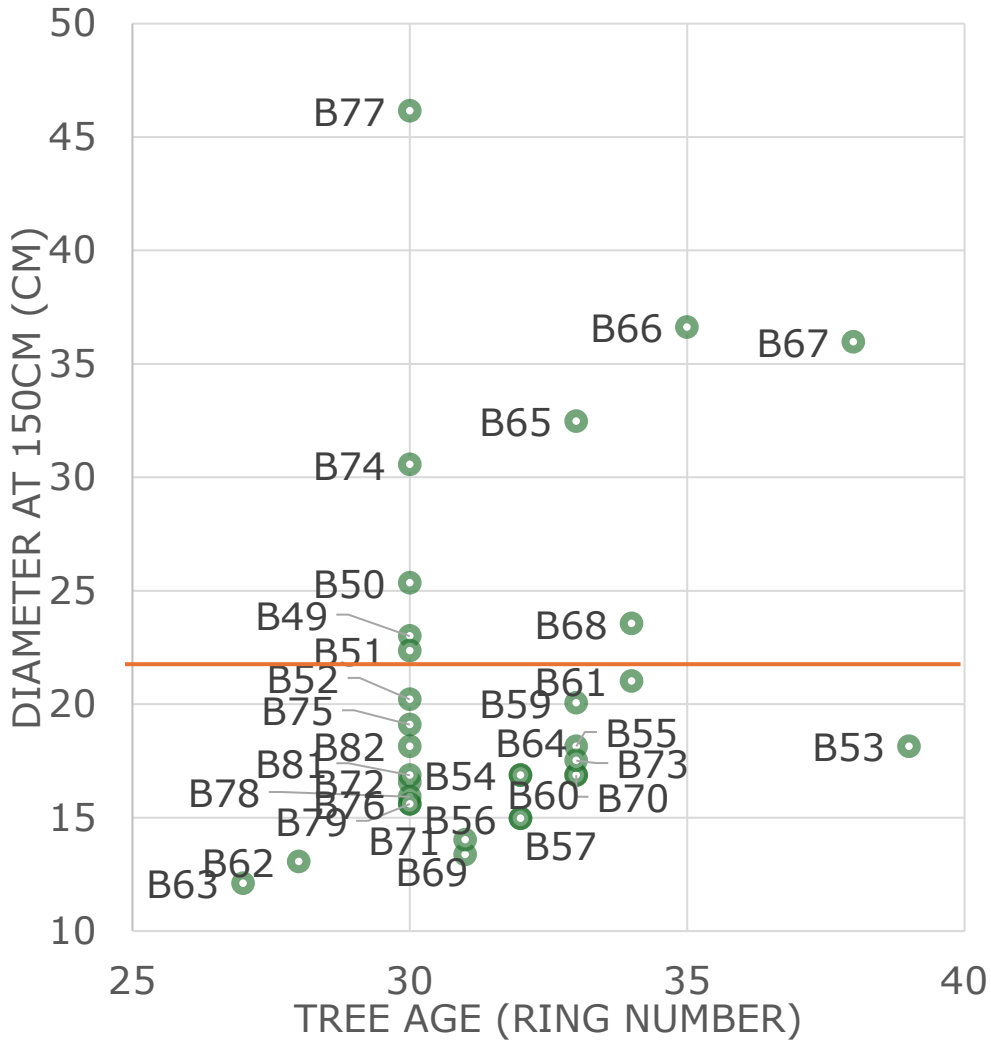
Approx. 500 samples of 2x6x115cm will be tested in bending (MOE, MOR)

Each tree has been cored
On each sample will be measured
MC, density, fm, MOE, RPC
Knots, cracks among other visual grading caracteristics

La Roche	n trees	D150 range
AO/ST	4	26-30cm
NG/RT	12	12-22cm
Baudour	n trees	D130 range
AO/ST	5	32-46cm
NG/RT	13	13-19cm



Diameter to tree age
Two groups



Two distinct group

RT / NG : below 20cm in diameter

ST / AO : above

La Roche	n trees	$D150_{range}$	$D150_{mean}$ (cm)
AO/ST	4	26-30 cm	28.25
NG/RT	12	12-22 cm	17.08

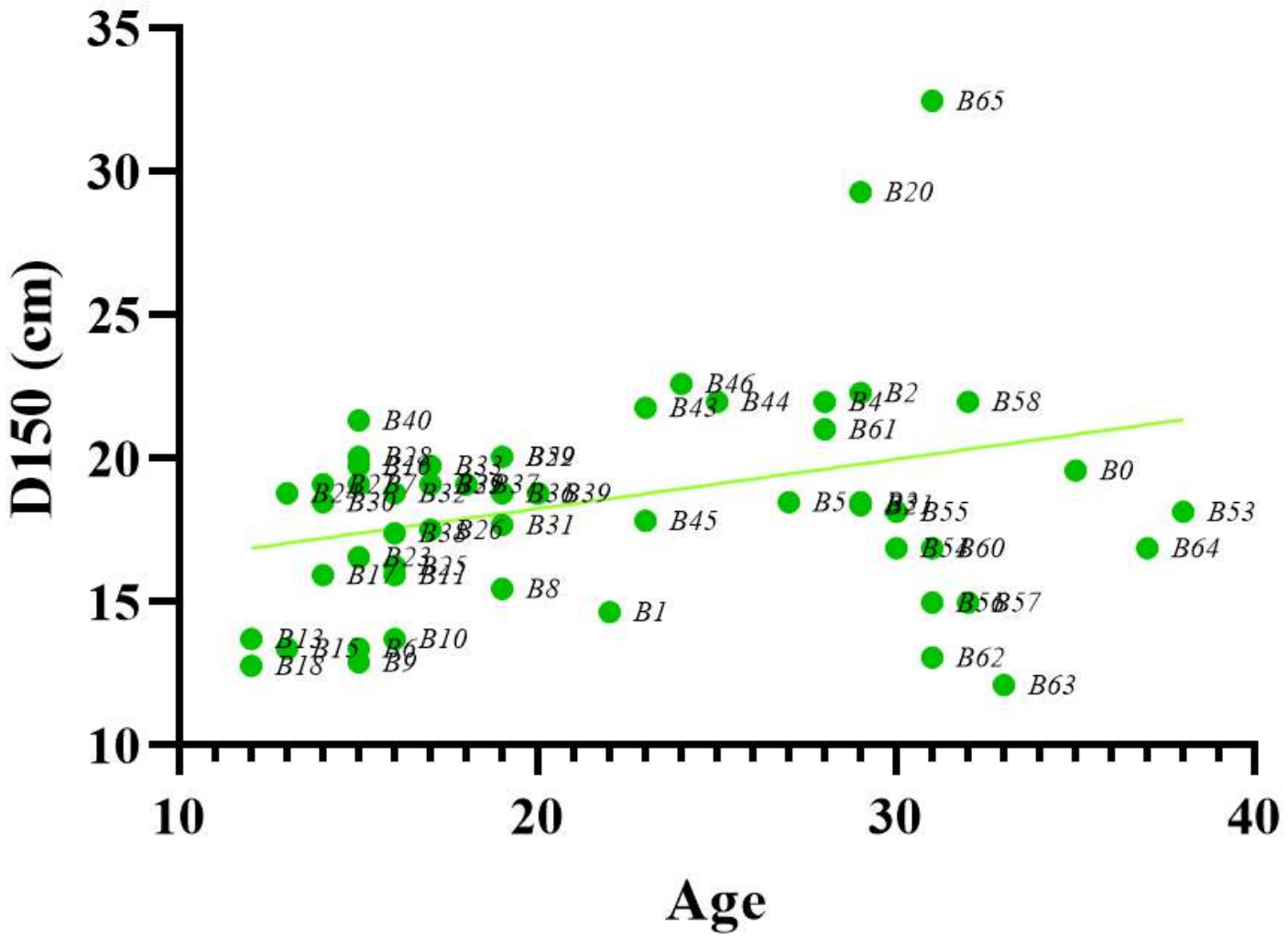
Baudour	n trees	$D150_{range}$	$D150_{mean}$ (cm)
AO/ST	5	32-46 cm	36.35
NG/RT	13	13-19 cm	16.92

Total	n trees	$D150_{range}$	$D150_{mean}$ (cm)
AO/ST	9	32-46 cm	32.30
NG/RT	25	13-19 cm	17.00
Total	34	13-46 cm	24.65

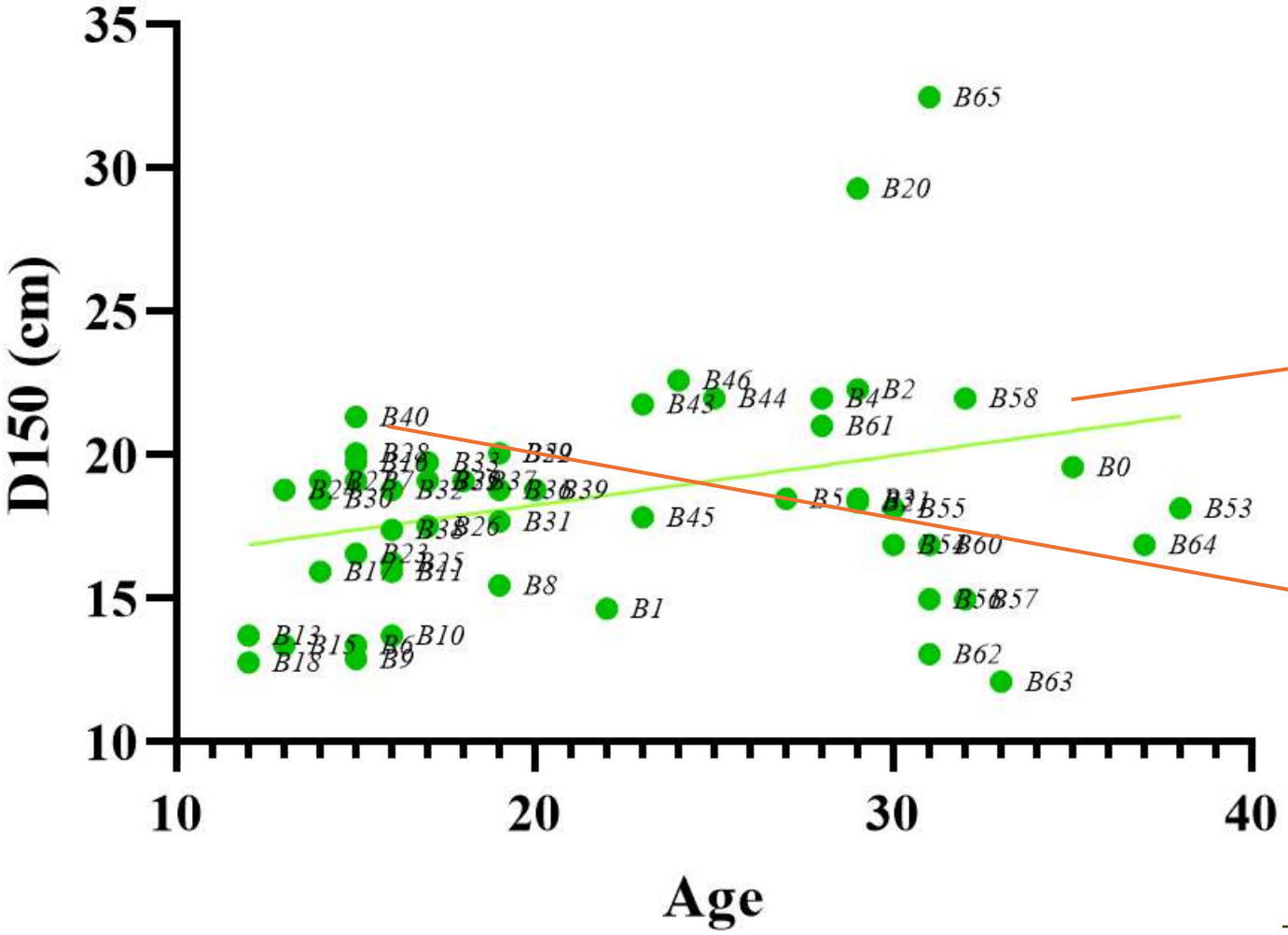
Projected : having two distinct fm, MOE for each group, with significant difference

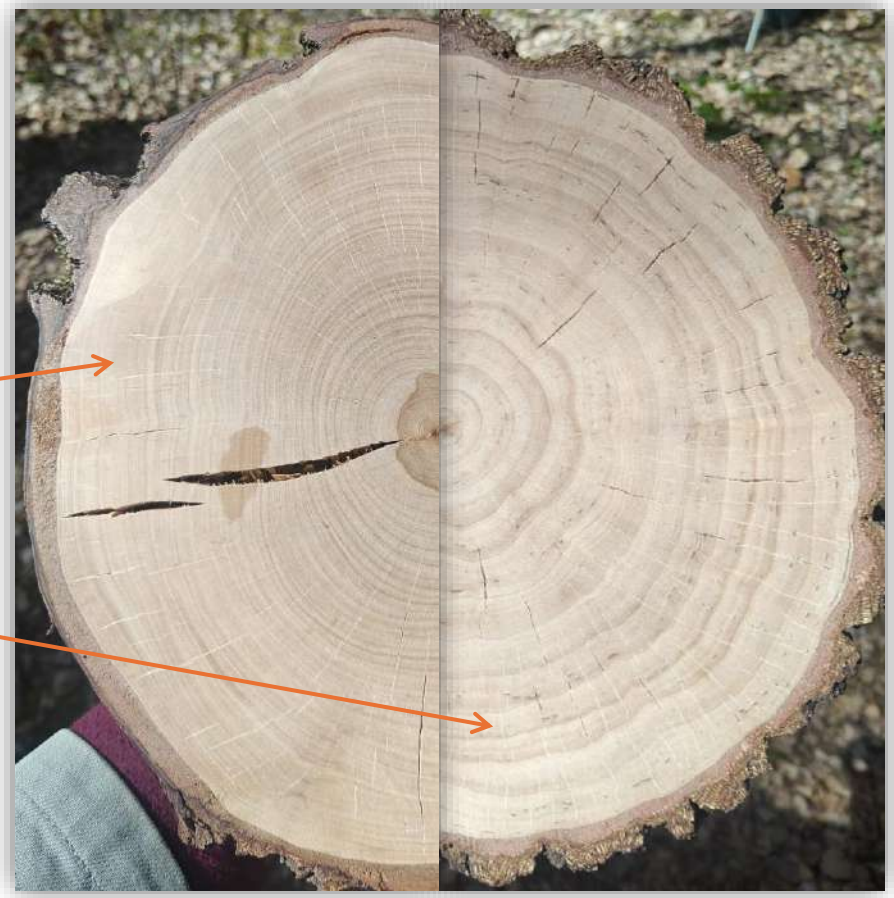
→ Impact of ring width (thus growth rate) on mechanical properties

Ongoing birch research
Relating Tree Age (ring number) and Diameter at 150cm (cm)



Ongoing birch research
Relating Tree Age (ring number) and Diameter at 150cm (cm)





Thanks for your attention

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Tom Mortelmans
Wood Engineering PhD Student

