

FOREST-BUILDING ATLAS

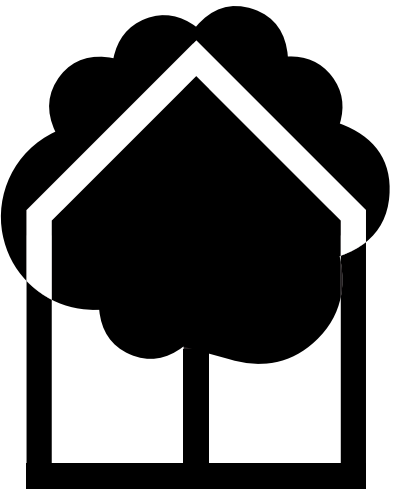
OPEN DATA INFRASTRUCTURE FOR ADAPTIVE TIMBER DESIGN AND CARBON FUTURES

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Climate Adaptation and Building Rehabilitation
Carleton University

Forest and Agriculture Modeling Forum
Session 6: Innovations in bioenergy and the bioeconomy
April 16, 2026

PART 1



FOREST-BUILDING
& BUILDING TRAITS

PART 2



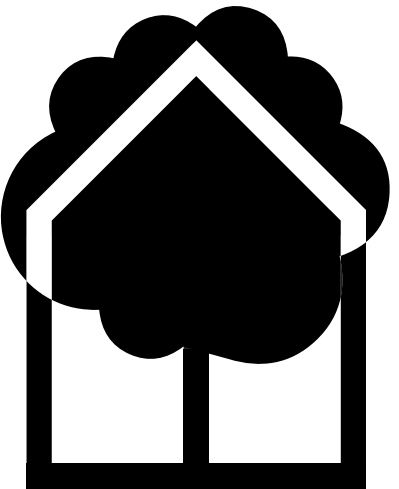
ASSESS THE
RESILIENCE OF
EXISTING WOOD
CONSTRUCTION

PART 3



LAND-BASED FOR-
EST-BUILDING
BIOGENIC CARBON
ASSESSMENT

PART 1



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PNAS Nexus, 2023, **2**, 1–12

<https://doi.org/10.1093/pnasnexus/pgad254>

Advance access publication 29 August 2023

Research Report

A trait-based approach to both forestry and timber building can synchronize forest harvest and resilience

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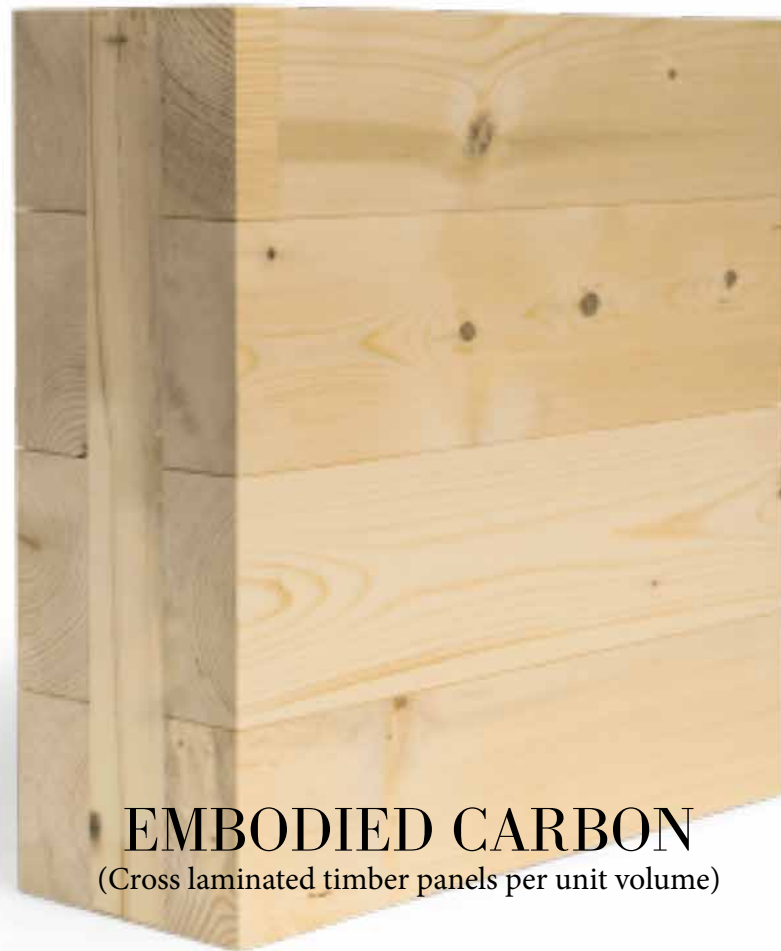
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Edited By: Cristina Amon

THE PUSH AND PULL OF FORESTS AND BUILDINGS

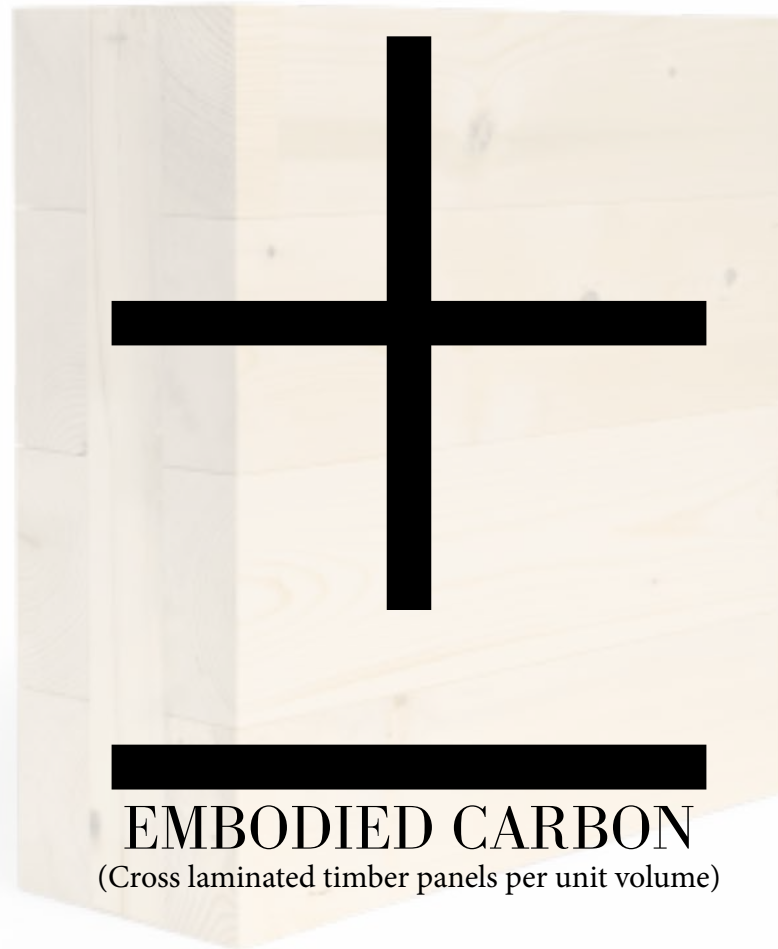
– 417 _{kgCO₂/m³}



EMBODIED CARBON
(Cross laminated timber panels per unit volume)

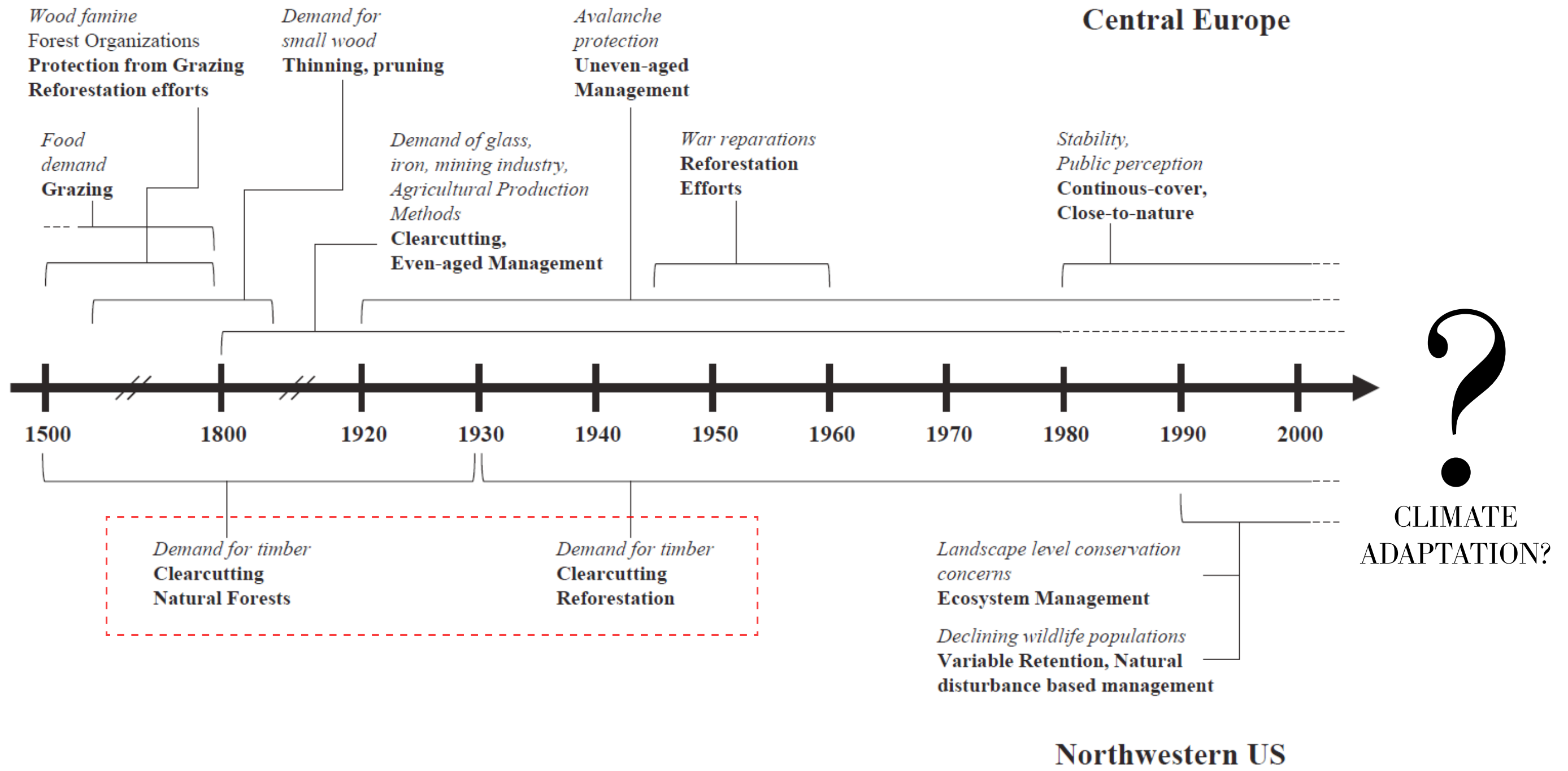
THE PUSH AND PULL OF FORESTS AND BUILDINGS

- 417 kgCO₂/m³



657* kgCO₂/m³

*BASED ON SUSTAINABLE FORESTRY PRACTICES





FORESTS



BUILDINGS

DIAGLOG Archiitects:
Zero Carbon Hybrid Timber
Supertall Prototype
Unlocking a future of
decarbonized urban density

90% BLACK SPRUCE

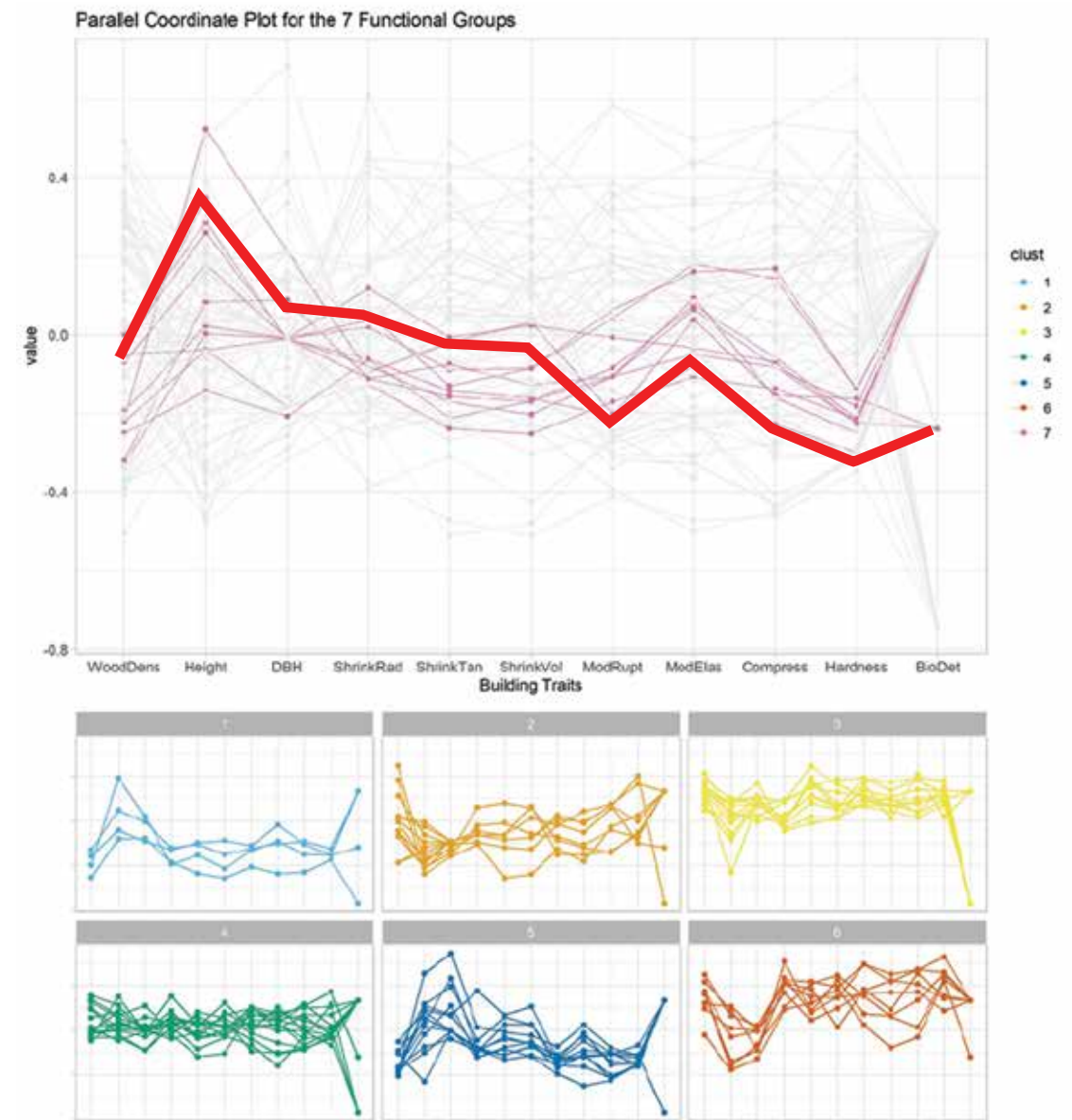
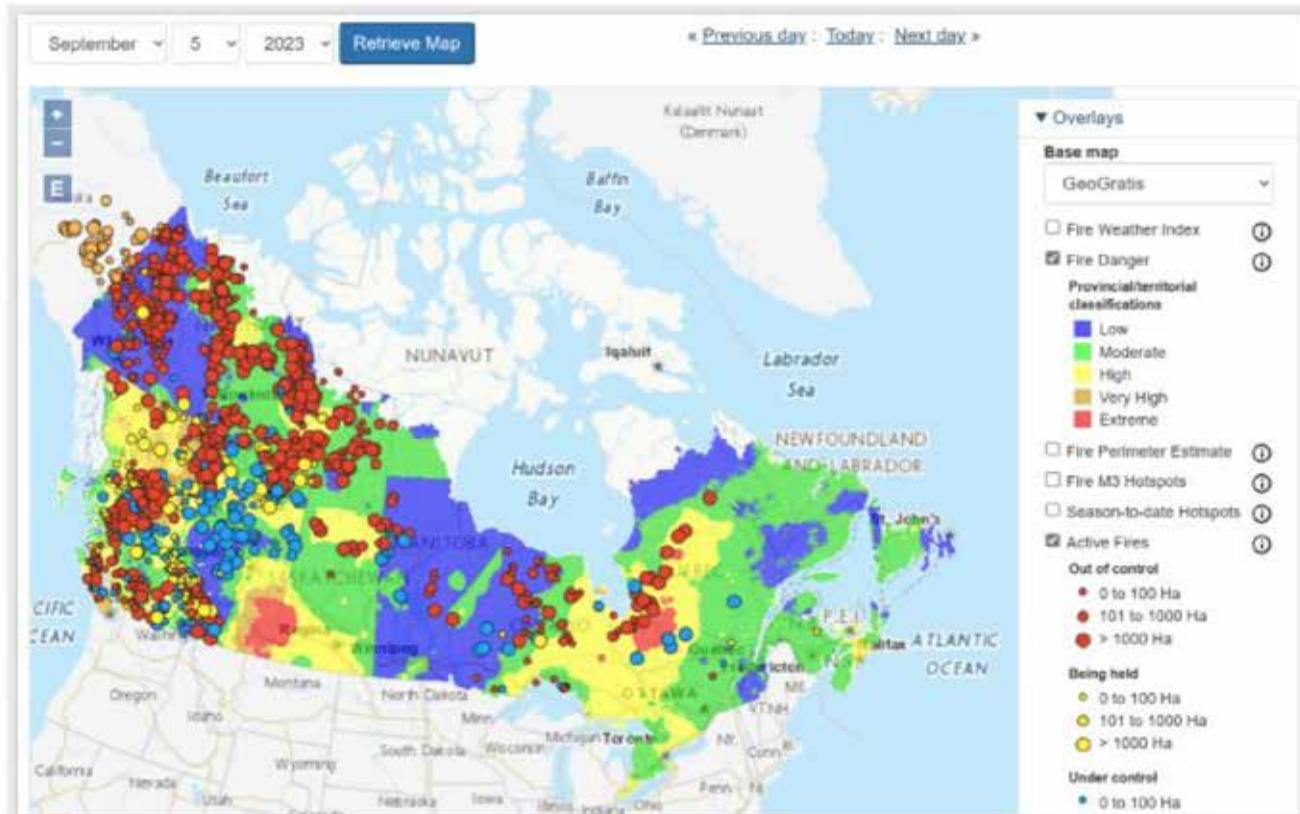


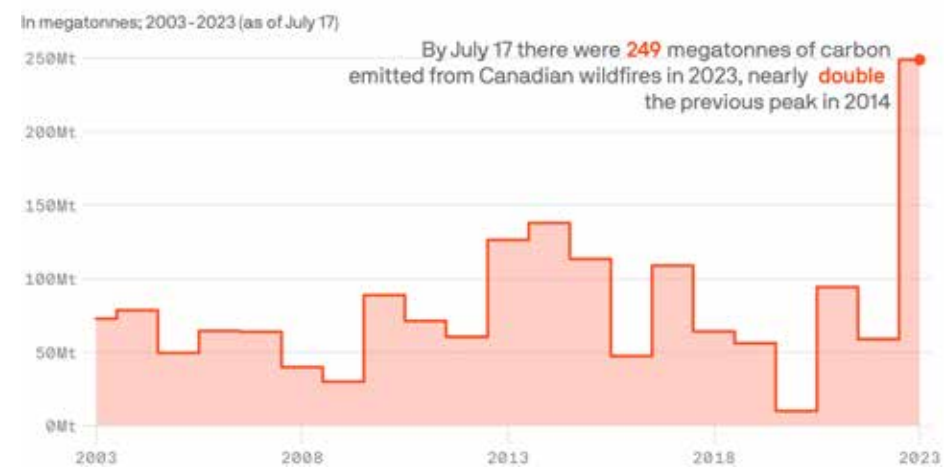
Figure 5. Parallel coordinates chart for eleven building traits showing building group clustering within the possible trait space. See Table 1 for species and summary of key characteristics of building groups.

BLINDSPOT 1: FIRE

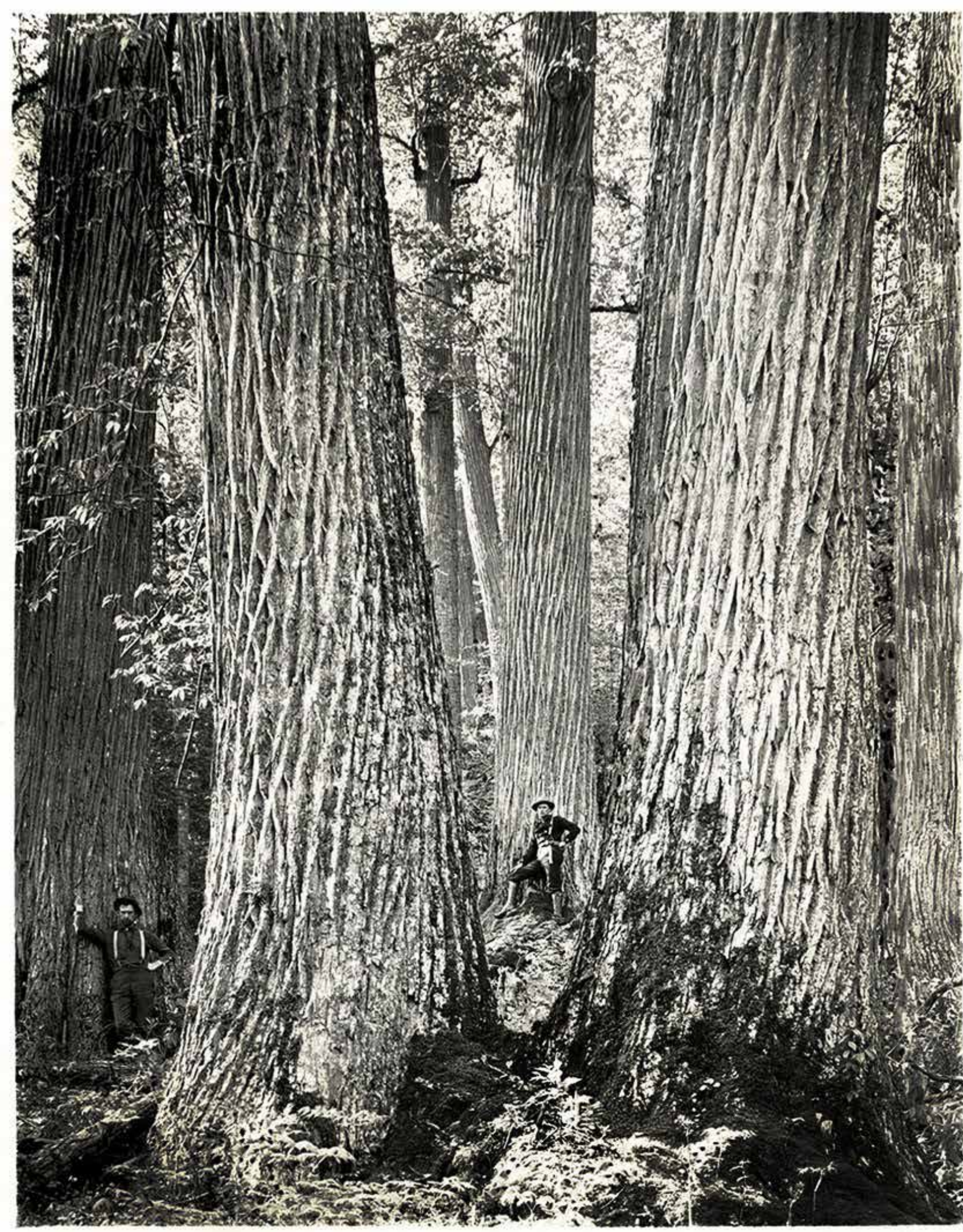
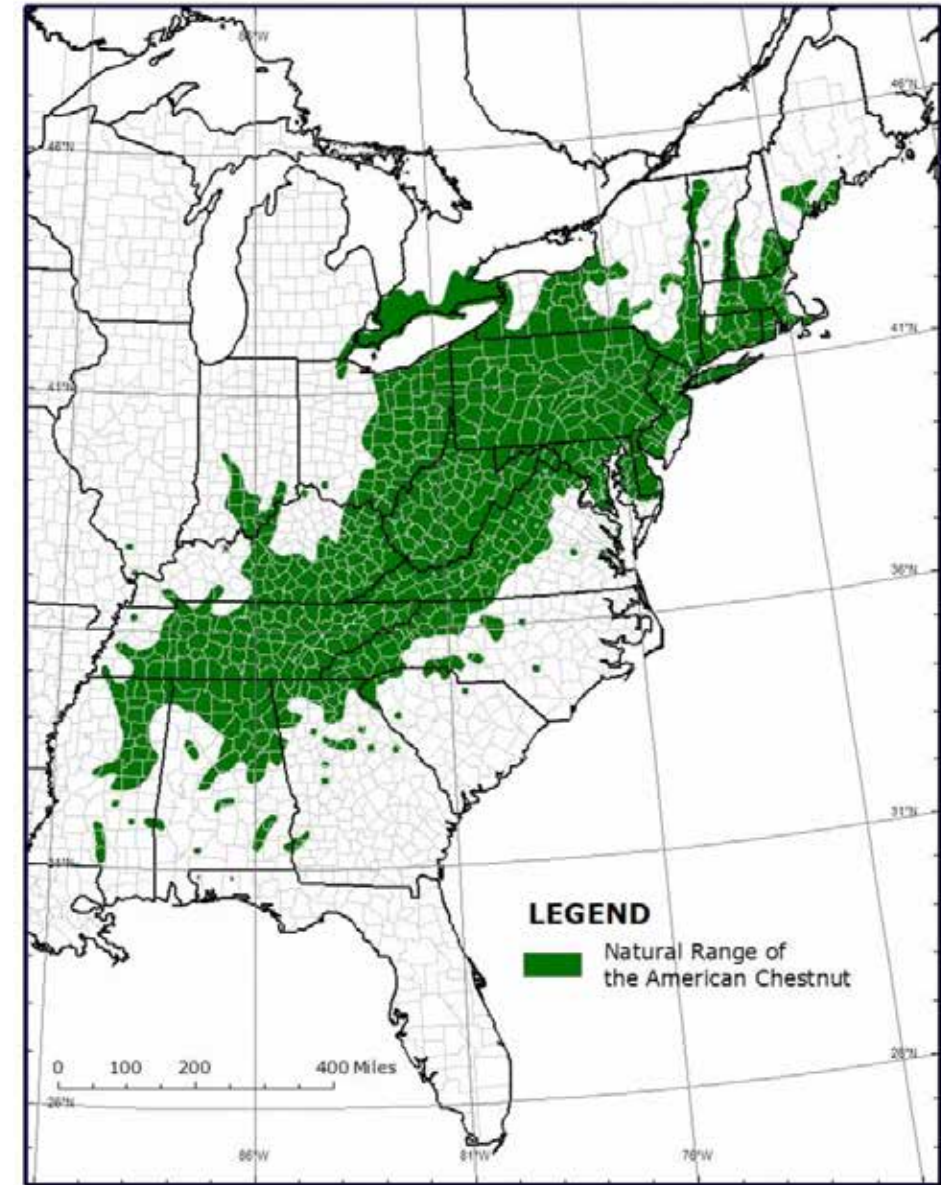


Screen grab from NRCan's [interactive map](#) showing active fires as of September 5, 2023.

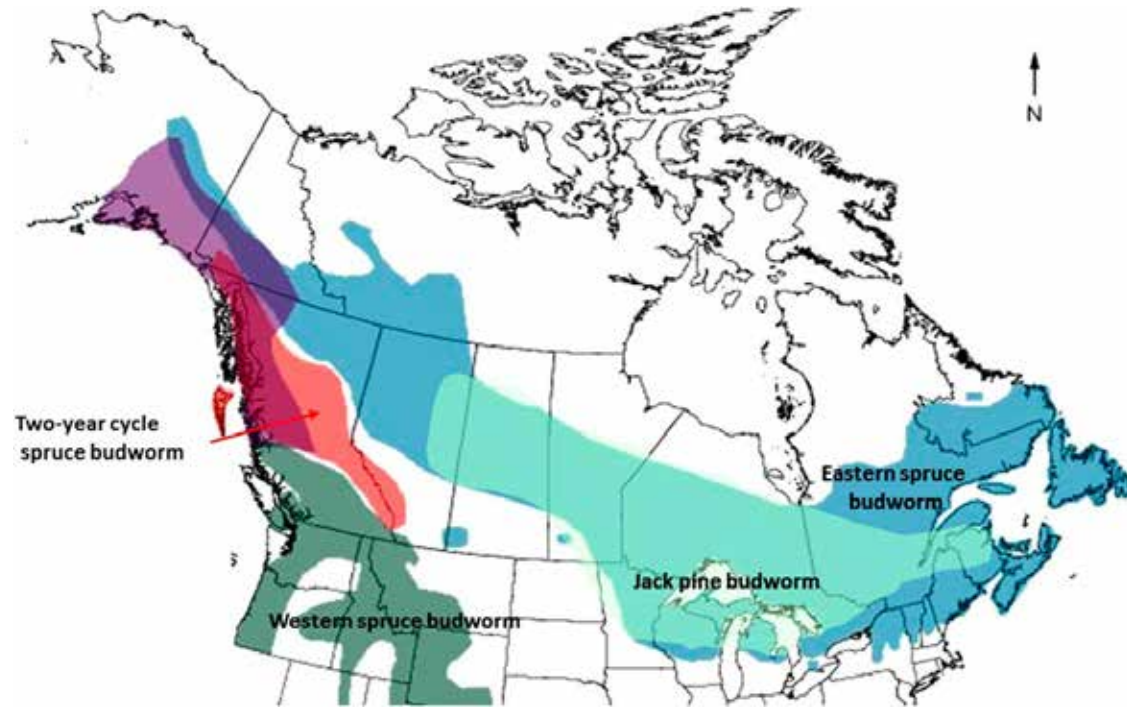
Annual Canada wildfire carbon emissions



BLINDSPOT 2:
DISEASE



BLINDSPOT 3:
INSECTS & PESTS

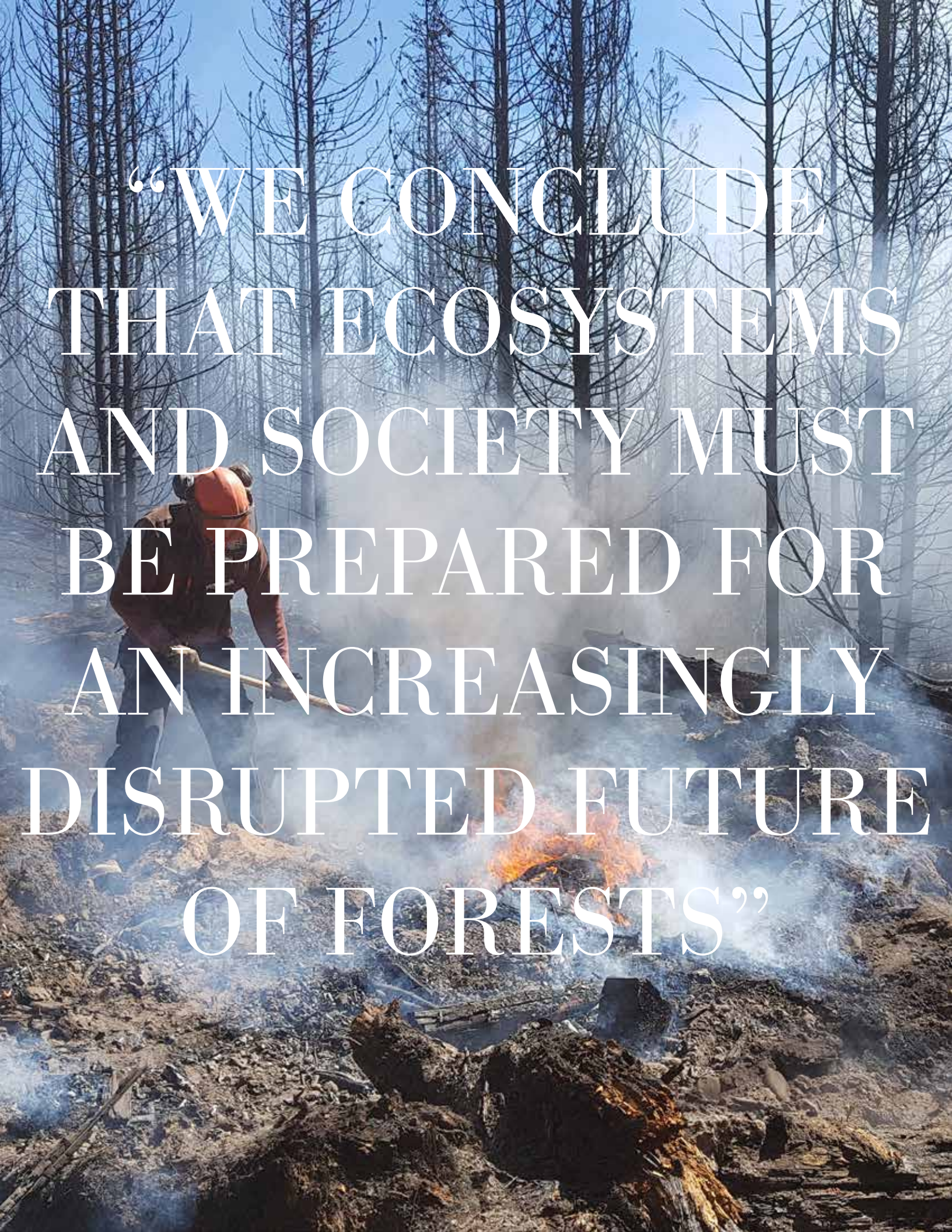


Mountain Pine
Beetle



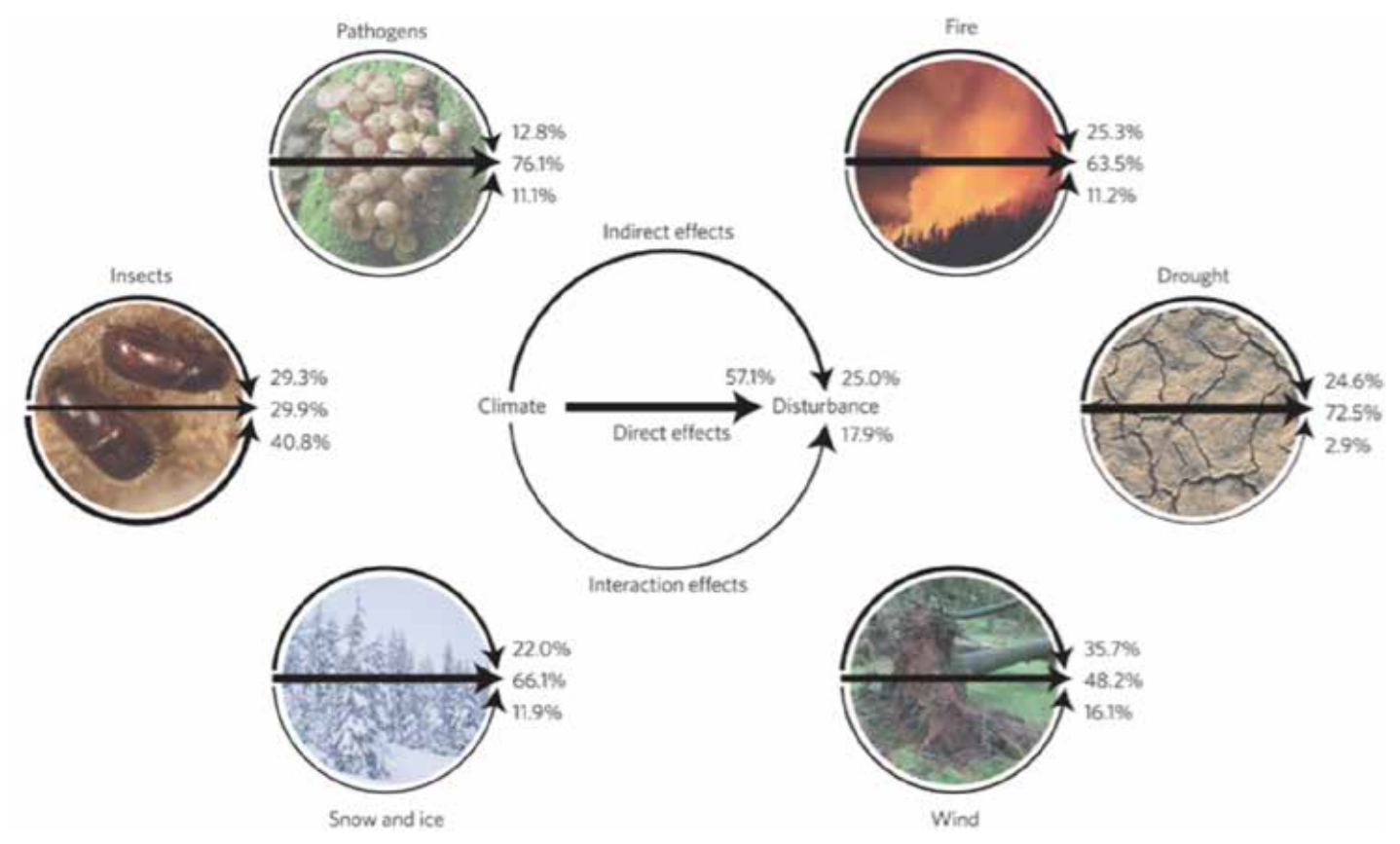
Beetle Kill
Lumber





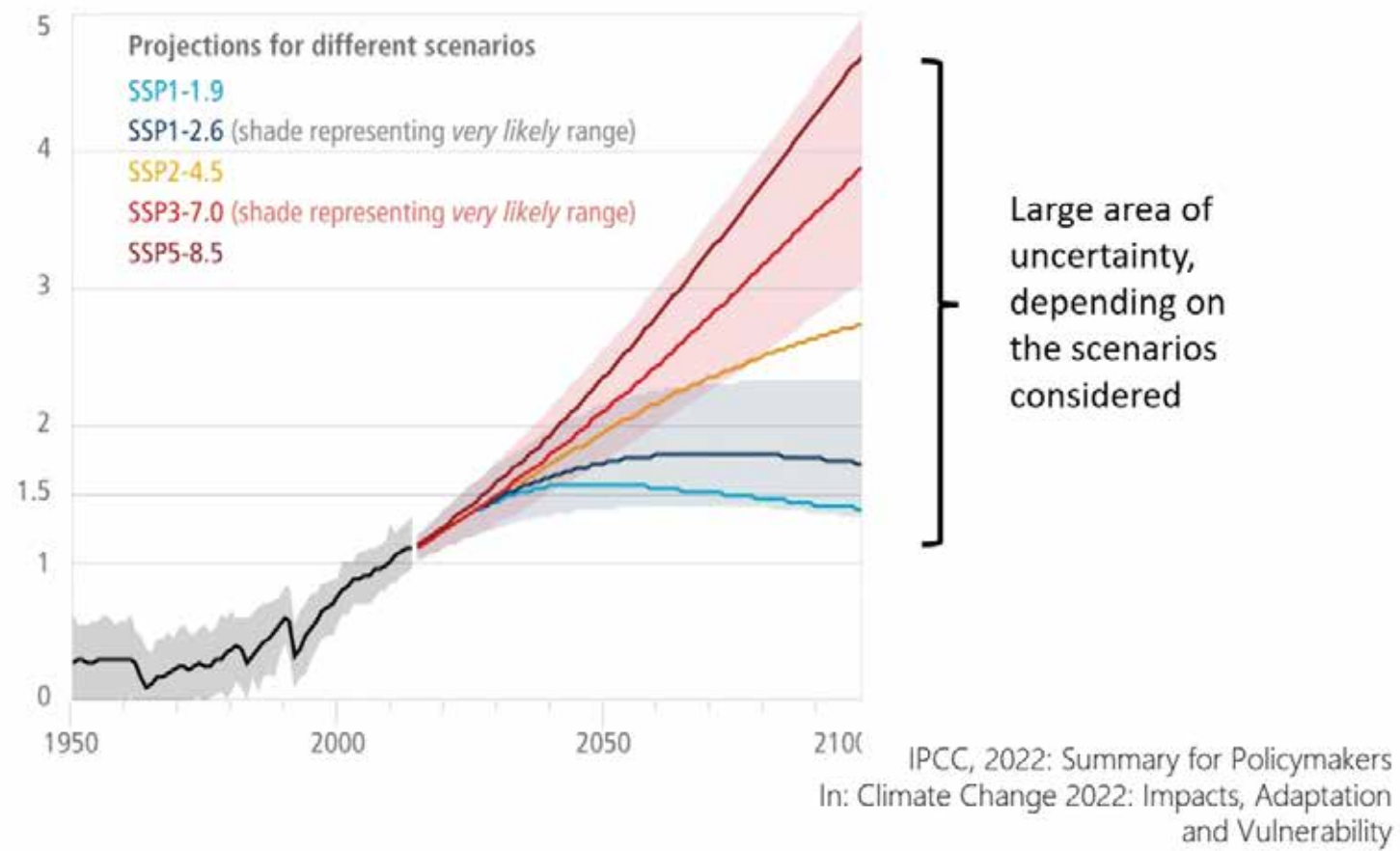
“WE CONCLUDE THAT ECOSYSTEMS AND SOCIETY MUST BE PREPARED FOR AN INCREASINGLY DISRUPTED FUTURE OF FORESTS”

BLINDSPOT 4: CLIMATE CHANGE



R. Seidl, et al., Forest disturbances under climate change. Nature Clim Change 7, 395–402 (2017).

BLINDSPOT 5: UNCERTAINTY



BUILDINGS TUNED TO THE HISTORY & SUCCESSIONAL DYNAMICS OF FORESTS & PLANTATION

BLINDSPOT 6: SUCCESSION

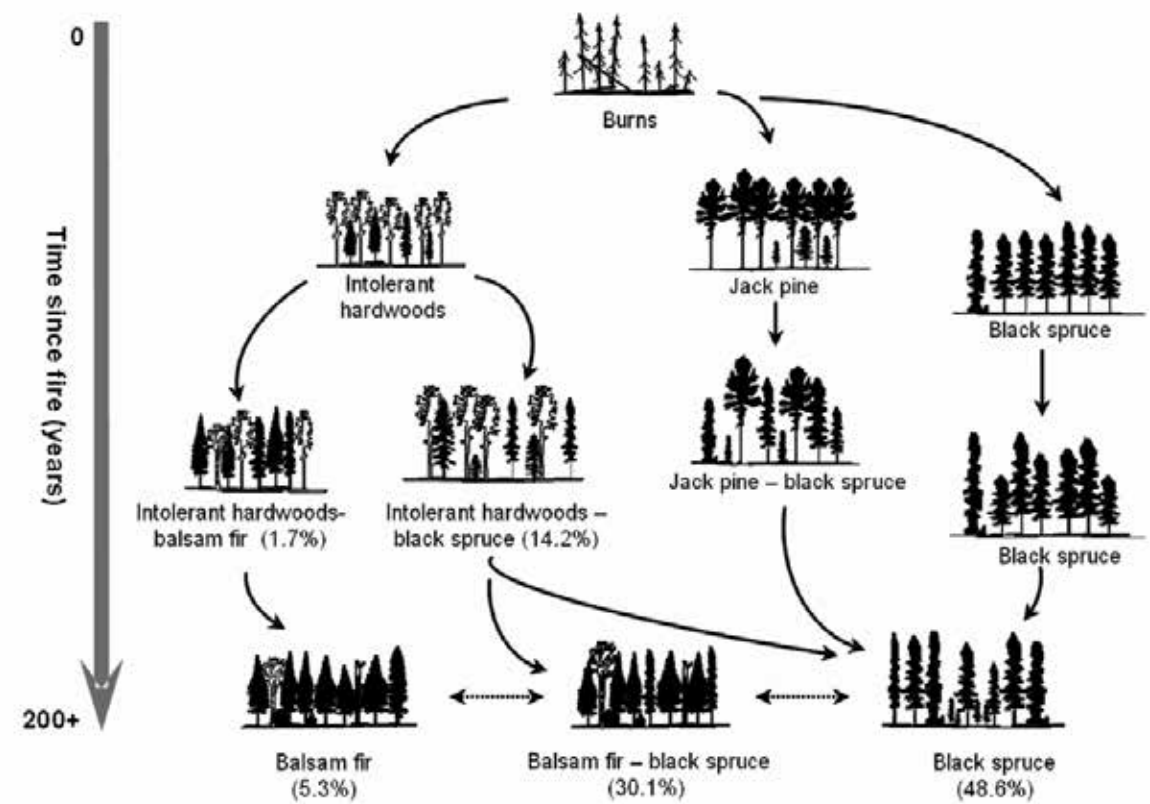
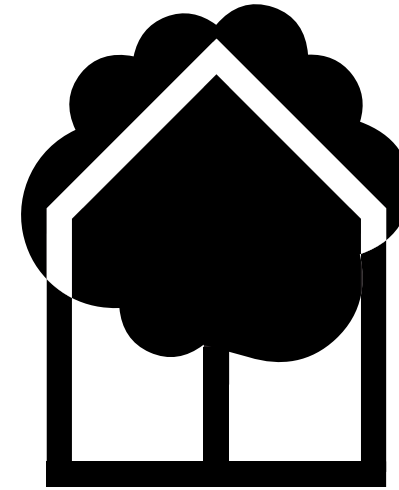
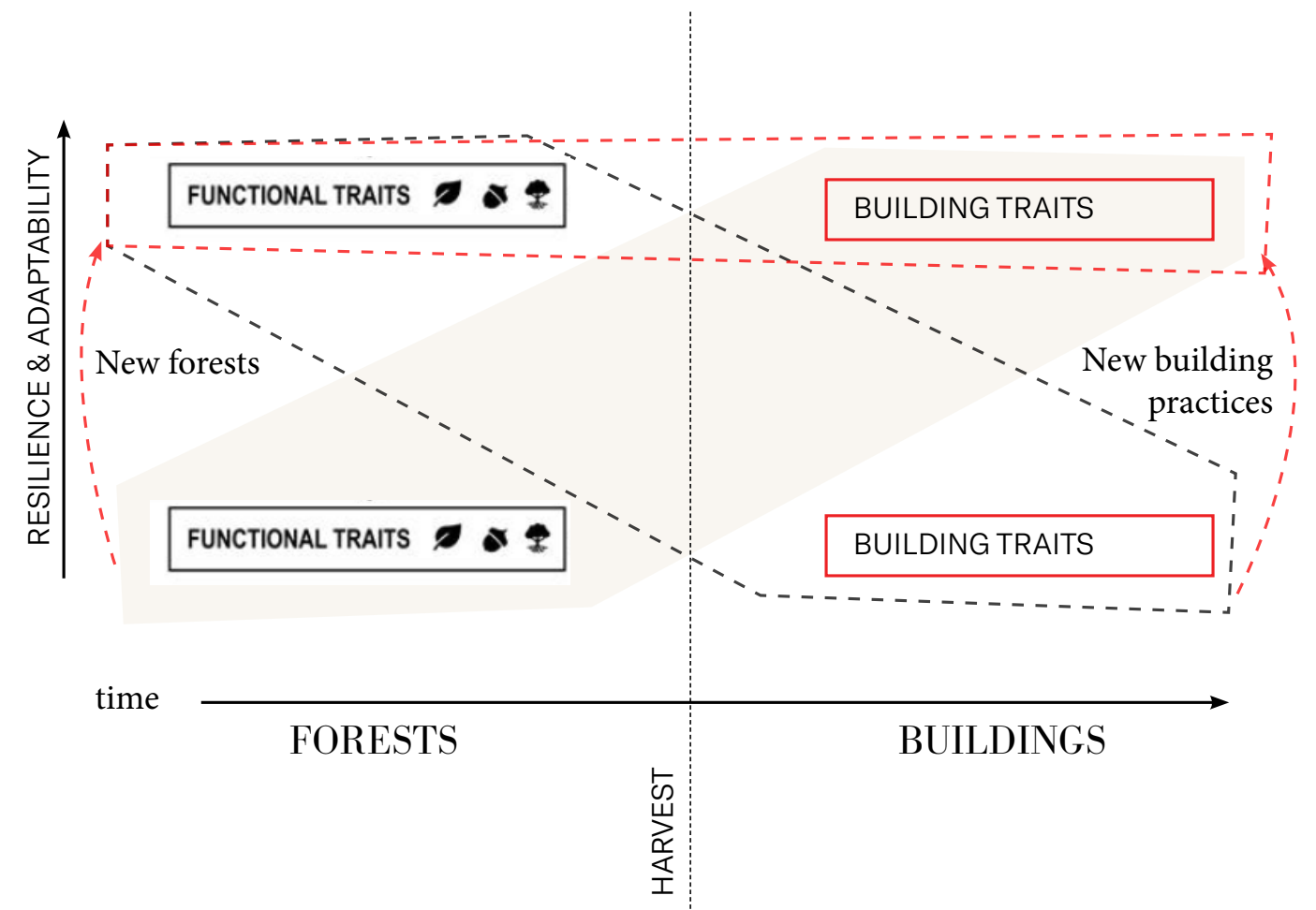


Fig. 8. An example of multiple post-fire successional trajectories in Quebec boreal forest. From De Grandpré et al. (2009); used with permission.



FOREST-BUILDING



EXTENDING THE ECOLOGICAL CONCEPT OF PLANT FUNCTIONAL TRAITS TO BUILDING

Acer saccharum (sugar maple)
Deciduous, shade tolerant,
drought and flood intolerant,
wind dispersed, medium density,
medium max height, medium
diameter, high shrinkage, medi-
um compression and hardness,
medium mechanical strength



Picea mariana (black spruce)
Conifer, shade tolerant, drought and
flood intolerant, wind dispersed, mid
density, average height, low diameter,
medium shrinkage, average compres-
sion and hardness, average mechanical
strength

Liriodendron tulipifera (yellow poplar)
Deciduous, shade tolerant, drought
and flood intolerant, wind dispersed,
low density, low-high max height, mid
diameter, medium shrinkage, low to
medium compression and hardness, low
mechanical strength

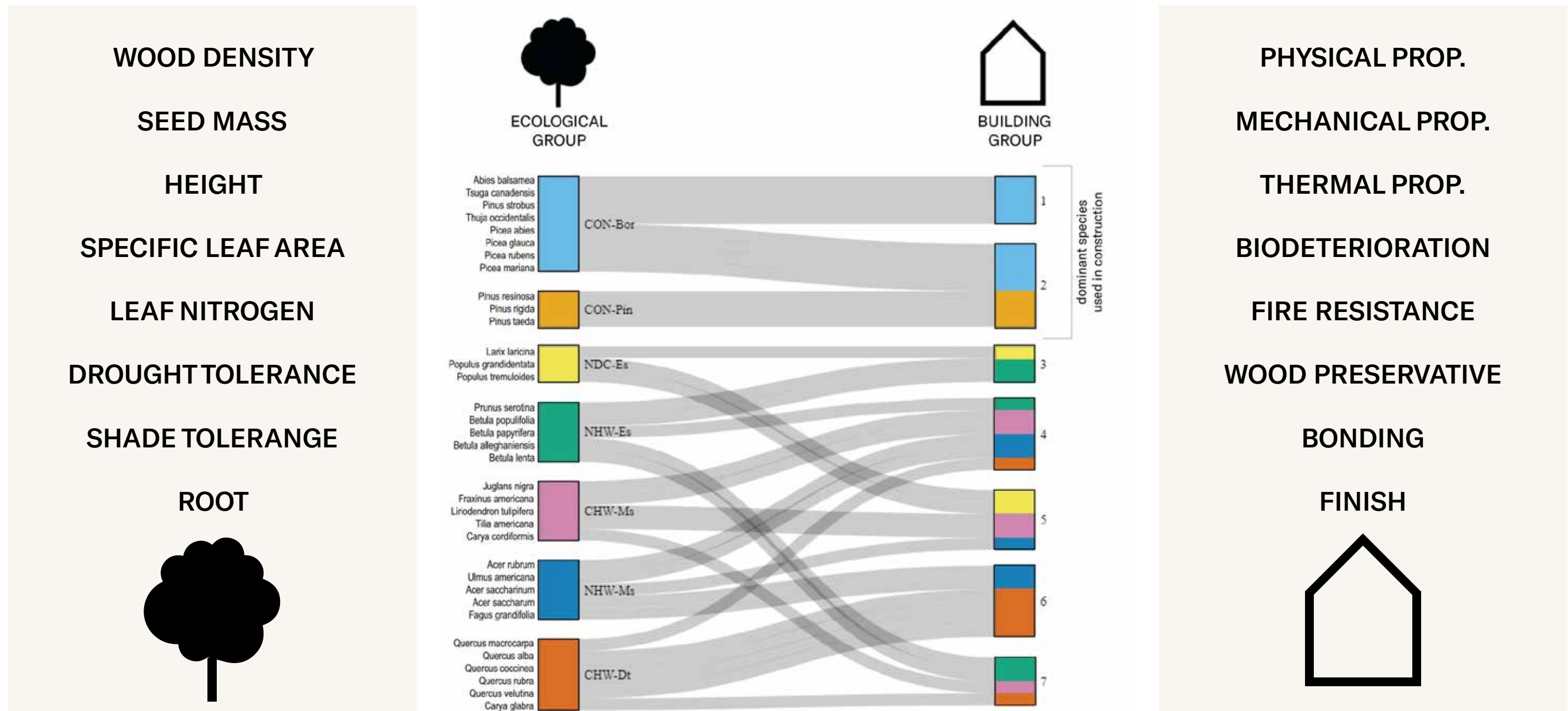
Quercus macrocarpa (white oak)
Deciduous, mid-shade tolerant,
drought tolerant, animal dispersed,
mid-high density, low-mid height,
medium diameter, high shrinkage,
high compression and hardness,
high mechanical strength

forest
traits
building
traits

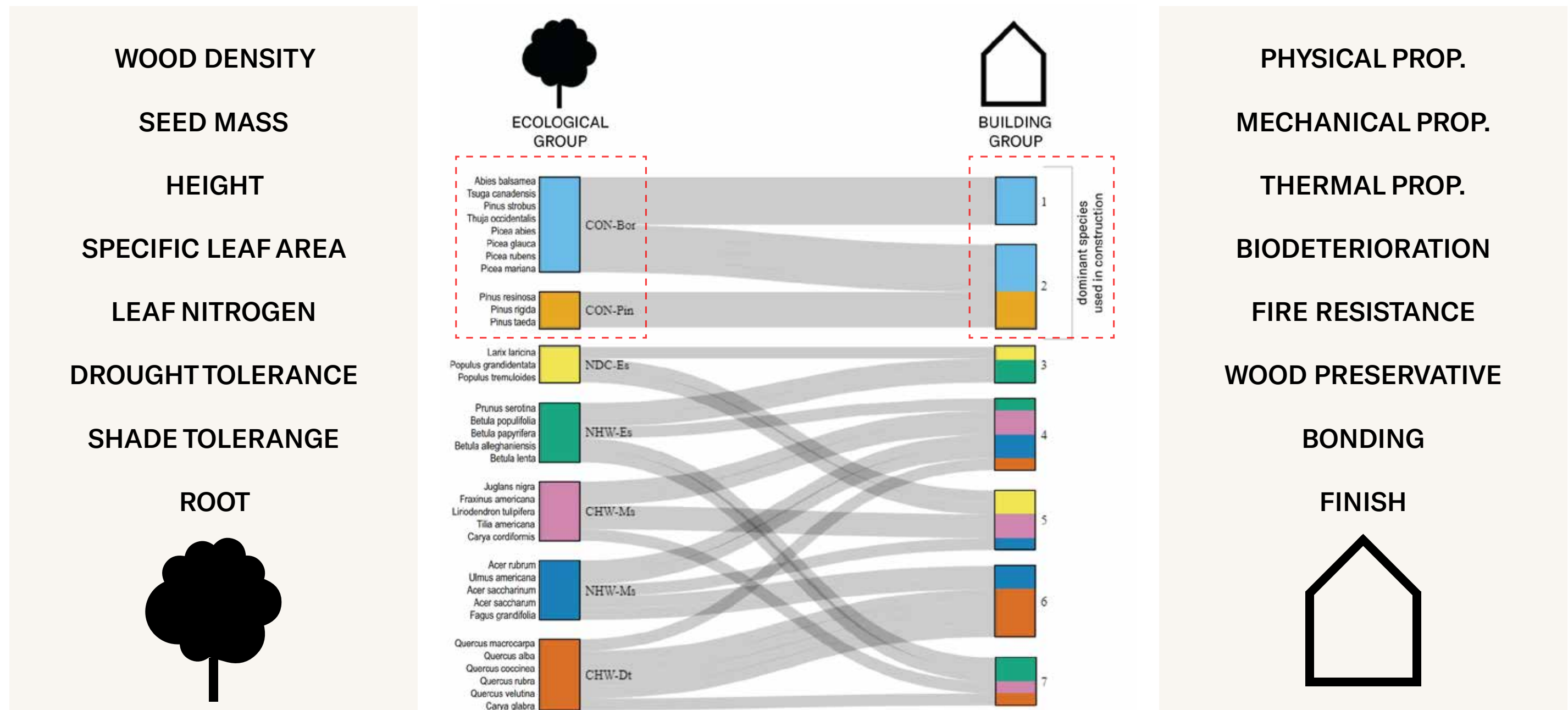
Forest-Building 'Urpflanze (Plant Archetype)'
for a Future Wood Construction



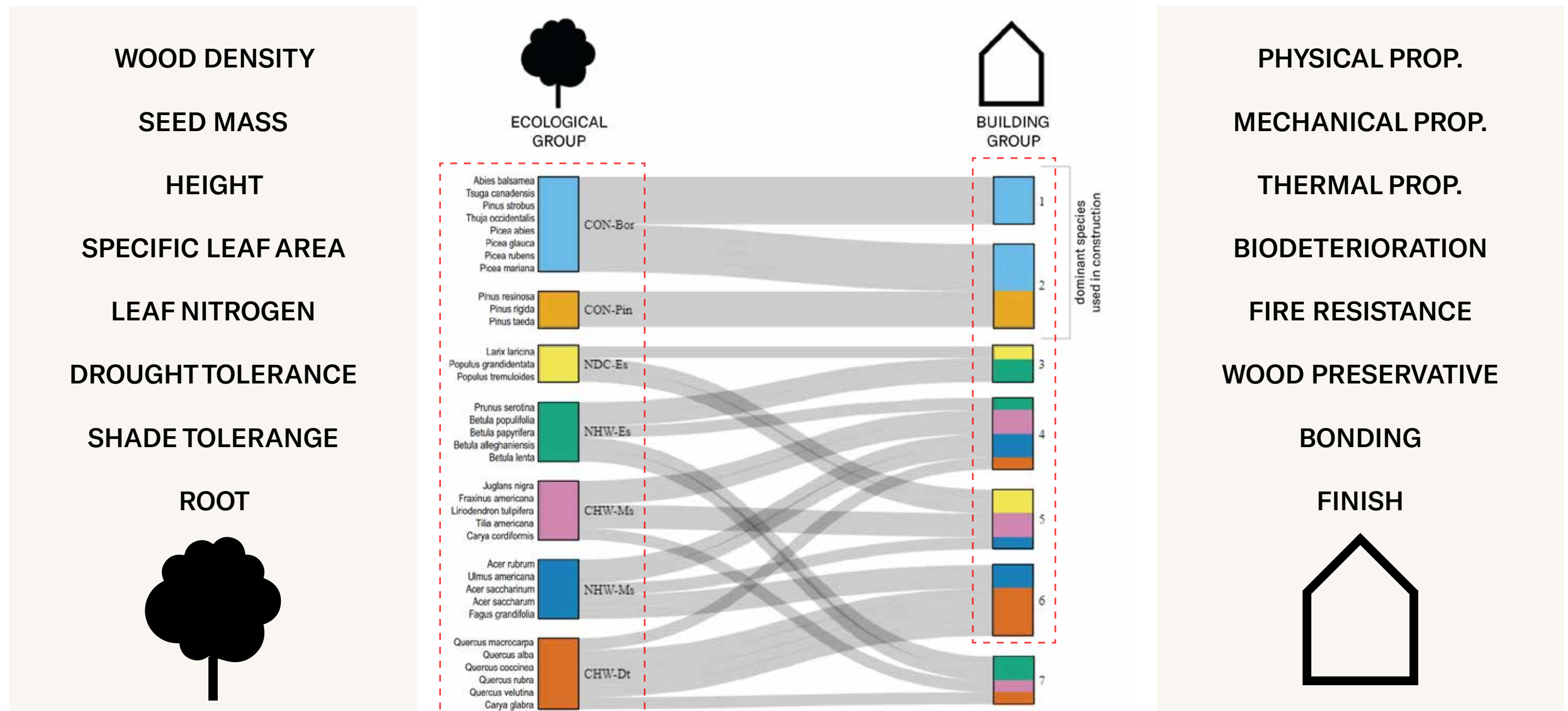
A FUNCTIONAL TRAIT BASED APPROACH TO FORESTS AND BUILDINGS



A FUNCTIONAL TRAIT BASED APPROACH TO FORESTS AND BUILDINGS



A FUNCTIONAL TRAIT BASED APPROACH TO FORESTS AND BUILDINGS



Managing for the unexpected: Building resilient forest landscapes to cope with global change

Marco Mina^{1,2} | Christian Messier^{1,3} | Matthew J. Duveneck^{4,5} | Marie-Josée Fortin⁶ |
Núria Aquilué^{1,7}

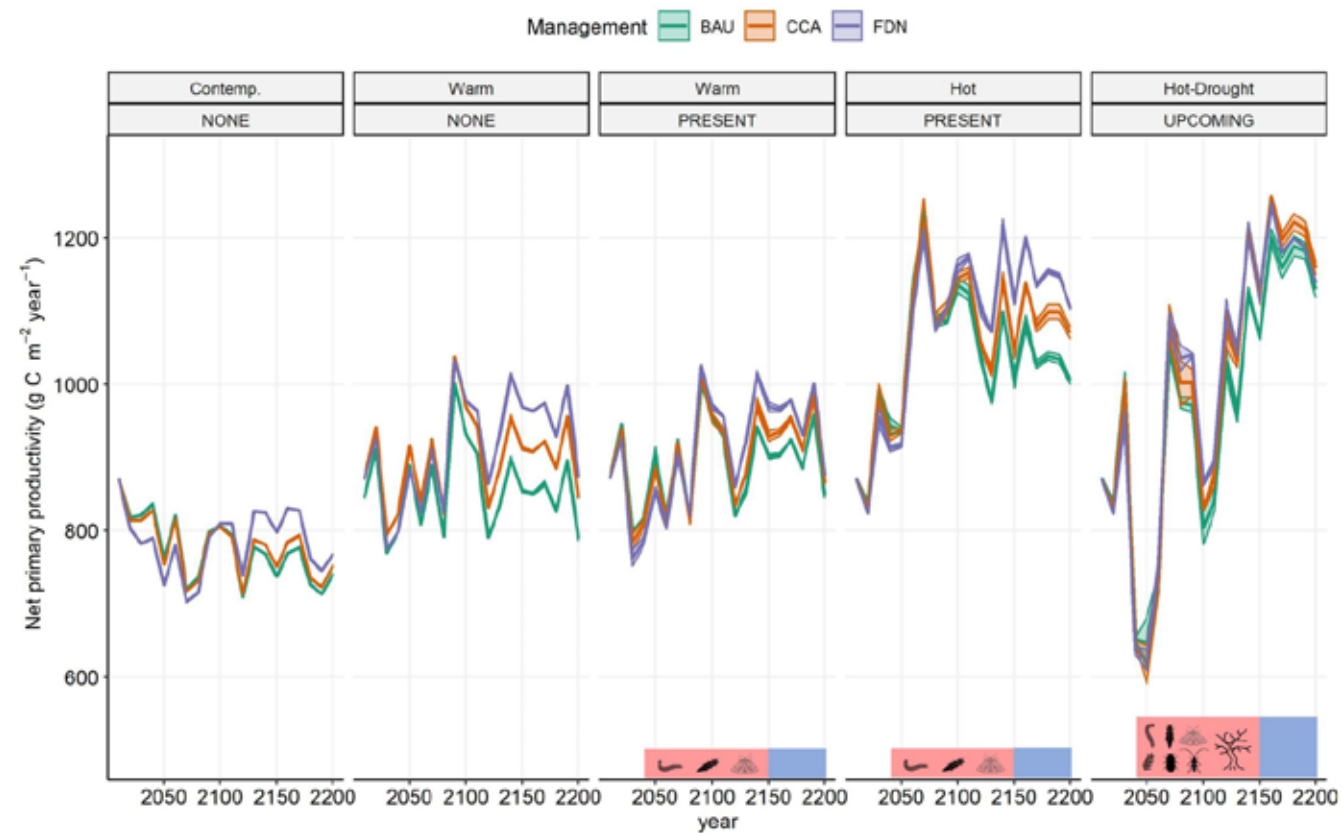


FIGURE 6 Annual net primary productivity as landscape level averages across all forested cells. Ribbons, when visible, show the interquartile range from the median of five replicates. Pale red boxes indicate the period of simulated disturbances (2040–2150; three insects or six insects plus drought) and blue box indicates when the landscape has been left undisturbed to recover (2150–2200)

CENTRE-DU-QUÉBEC STUDY REGION

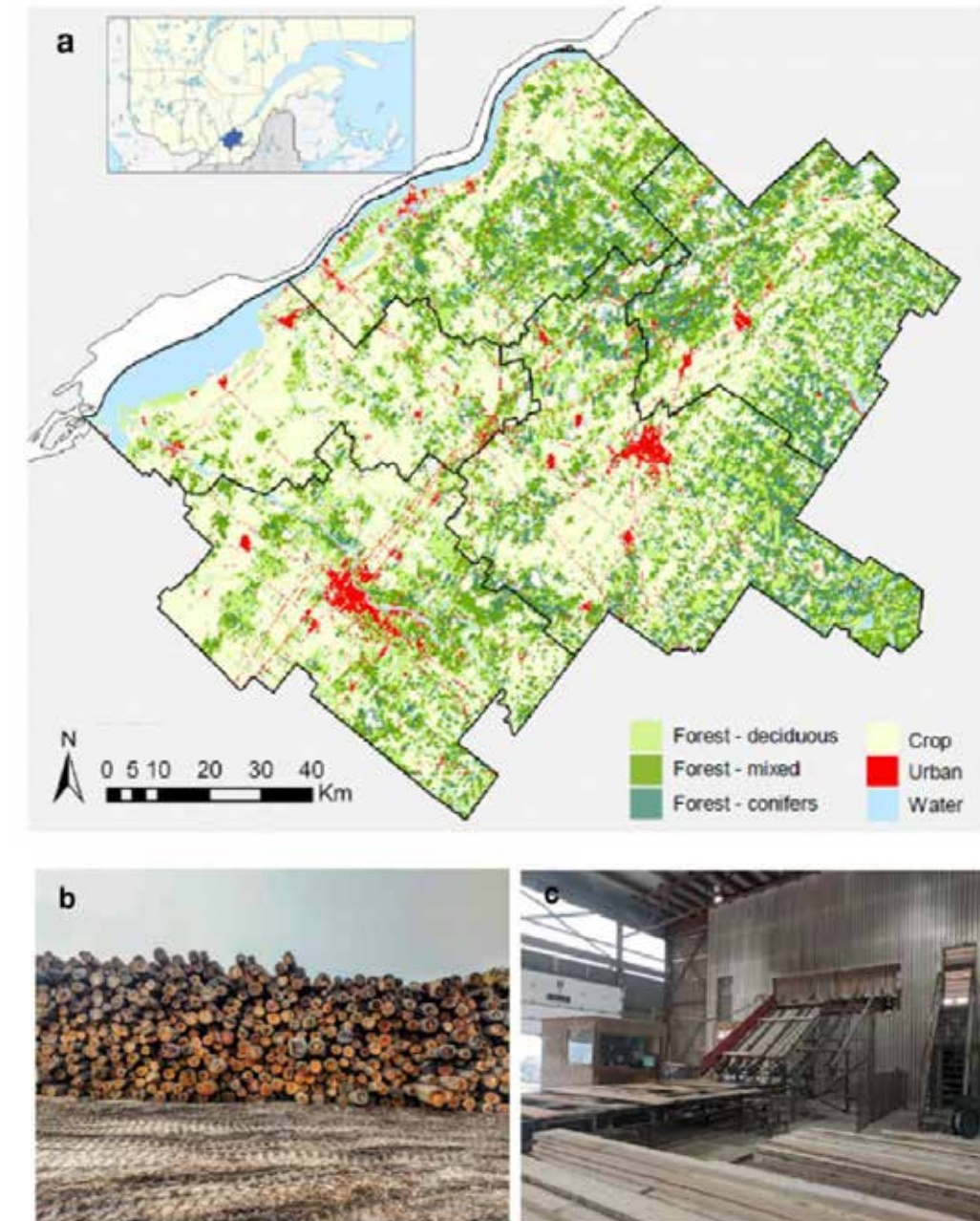


Fig. 5. a) Central Quebec study area in SE Canada. b) Spruce, pine, and fir logs aging before (c) typical softwood milling seen throughout the region (photos: Osborne et al. (48)).



ASSESSING SOCIAL AND ECOLOGICAL IMPACTS OF CHANGE

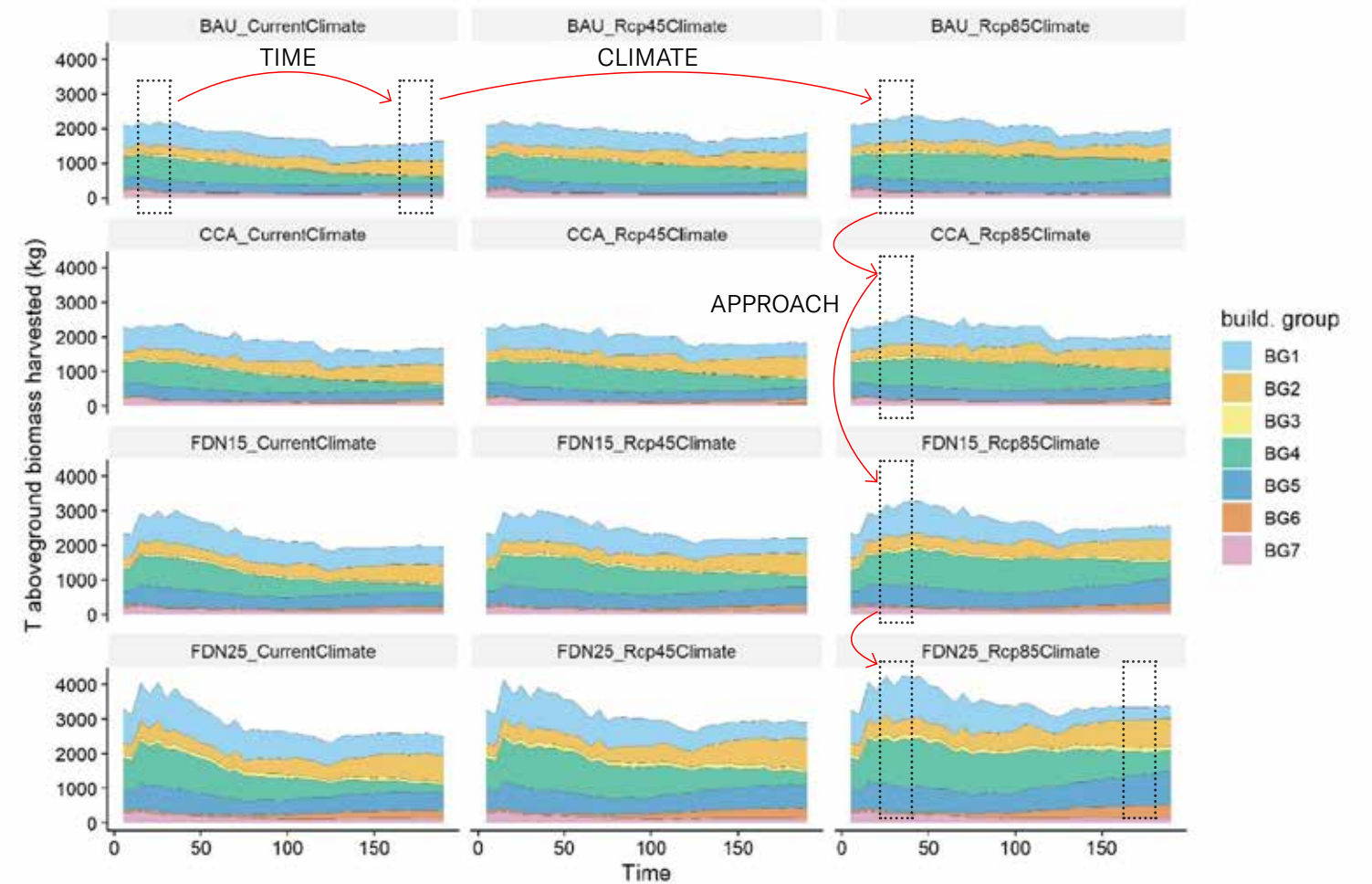
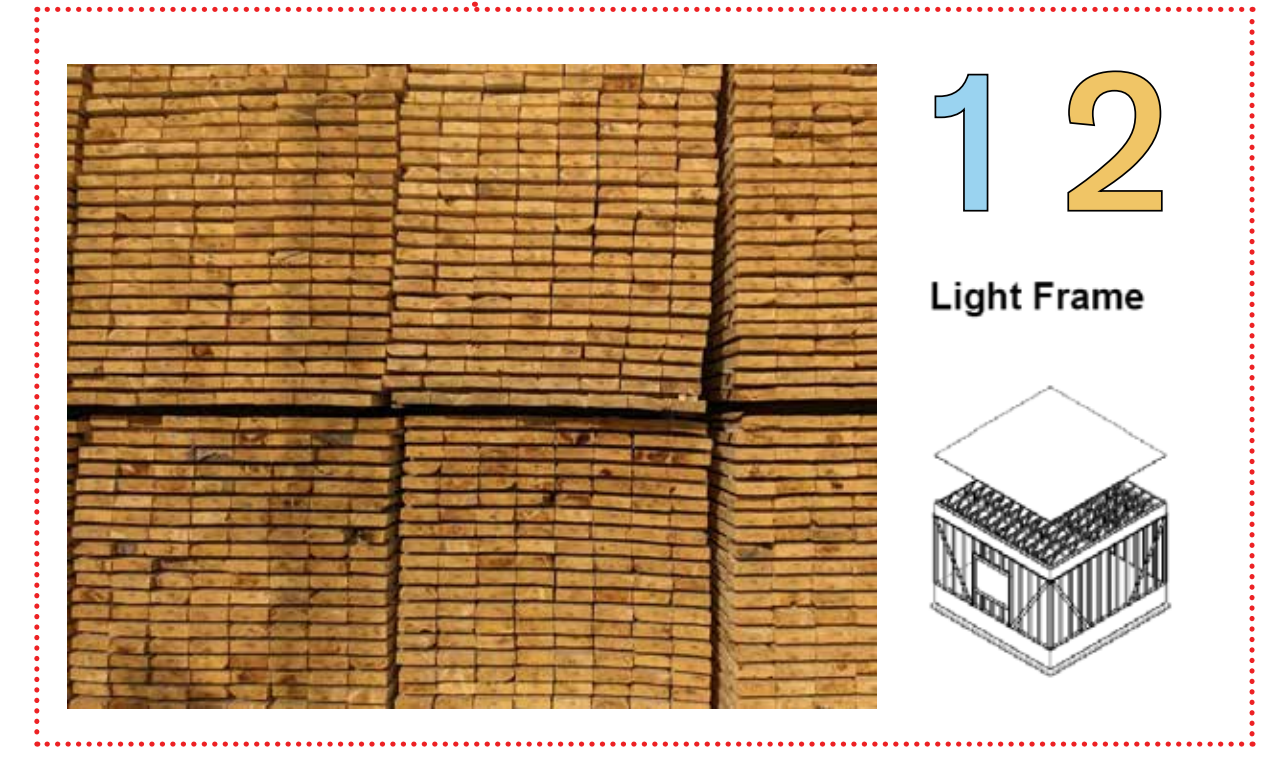
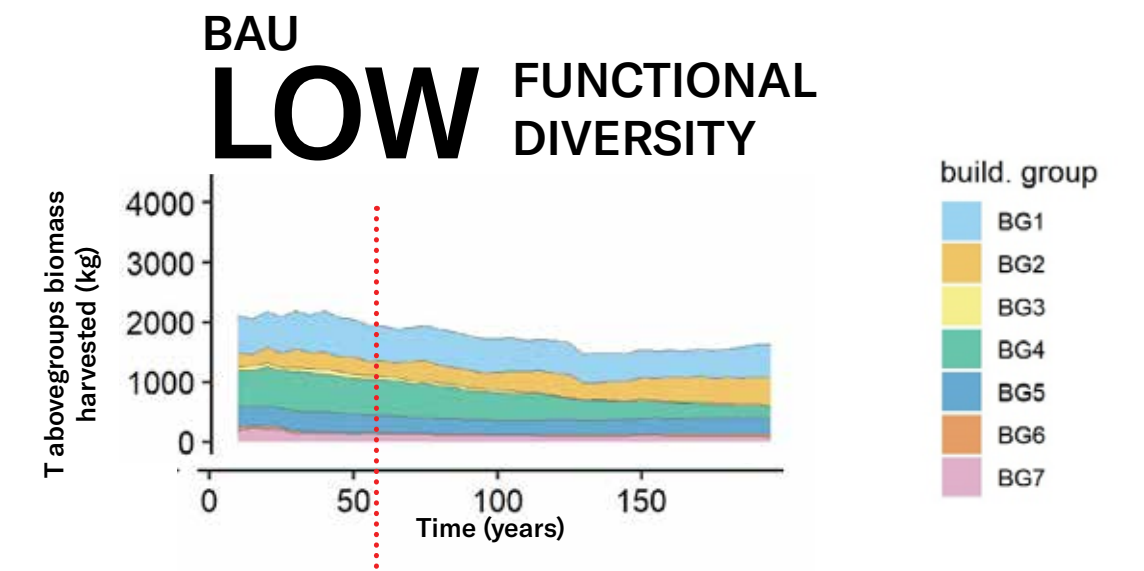


Figure 3. Tons aboveground biomass harvested (kg) by species building functional group (Table1) under the different scenarios (columns: climate; rows: management treatment).

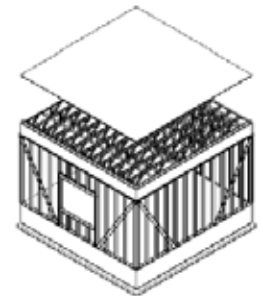


UNDERSTAND
WHEN, WITH
WHAT SPECIES
AND HOW TO
BUILD WITH
WOOD



1 2

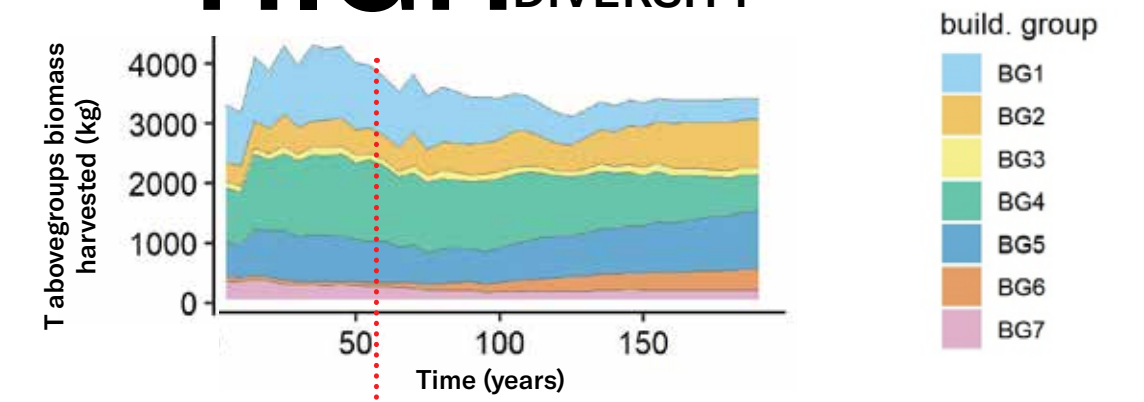
Light Frame





UNDERSTAND
WHEN, WITH
WHAT SPECIES
AND HOW TO
BUILD WITH
WOOD

FDN25 HIGH FUNCTIONAL DIVERSITY



1 2 4 5

Adaptive / Timber Frame

A collage of images related to timber construction, including wood beams, a timber frame structure, and a diagram of an adaptive timber frame. The collage includes: a close-up of a timber joint, three different timber beam profiles, a photograph of a timber frame under construction, a photograph of a stack of timber beams, a photograph of a person working with timber, and a diagram of a timber frame structure with a roof and columns.



FINDING VALUE IN UNDERUTILIZED WOOD SPECIES

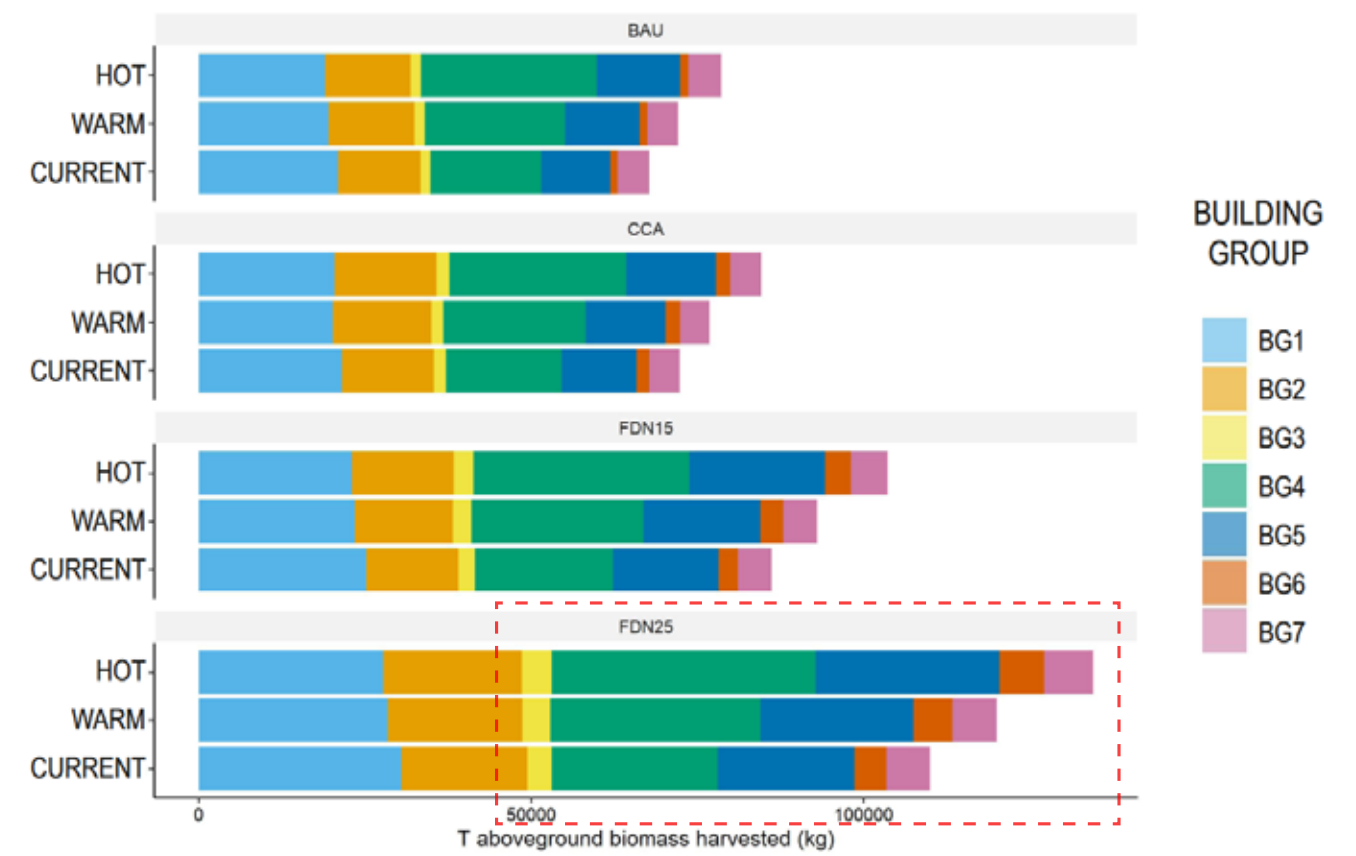
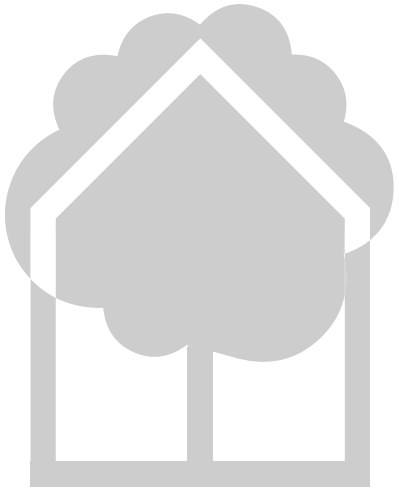


Table 1. List of 35 eastern North American tree species (either present—marked in bold—or with potential in the reference landscape) by building groups, key characteristics, and common uses. Species in bold are those currently present in the region.

Building group	Key characteristics	Species	Common uses
BG1	Conifers, low density, average max height, average diameter at breast height (DBH), low shrinkage, soft and low mechanical strength	A. balsamea , T. canadensis , P. strobus , T. occidentalis	Construction lumber, paper (pulpwood), plywood, and other utility wood purposes
BG2	Conifers, med-high density, average max height, low DBH, medium shrinkage, average compression and hardness, average mechanical strength	P. abies , P. taeda , P. rigida , P. glauca , P. rubens , P. mariana , P. resinosa	Utility poles, posts, railroad ties, paper (pulpwood), and construction lumber
BG3	Deciduous, medium density, average max height, medium DBH, high shrinkage, high compression and hardness, high mechanical strength	Larix laricina , Prunus serotina , Betula populifolia	Utility poles, posts, rough lumber, boxes/crates, and paper (pulpwood)
BG4	Deciduous, medium density, medium max height, medium DBH, high shrinkage, medium compression and hardness, medium mechanical strength	A. rubrum , U. americana , B. papyrifera , Q. macrocarpa , F. americana , J. nigra	Veneer, paper (pulpwood), boxes, crates/pallets, musical instruments, turned objects, and other small specialty wood items
BG5	Deciduous, low density, low to high max height, medium to high DBH, medium shrinkage, low to medium compression and hardness, low mechanical strength	Acer saccharinum , Populus tremuloides , Populus grandidentata , Tilia americana , Liriodendron tulipifera	Boxes/crates, veneer, plywood, and various utility purposes
BG6	Deciduous, medium to high density, low to medium max height, average DBH, high shrinkage, high compression and hardness, high mechanical strength	Quercus rubra , Quercus velutina , A. saccharum , Fagus grandifolia , Quercus alba , Quercus coccinea	Cabinetry, furniture, interior trim, flooring, and veneer
BG7	Deciduous, low density, medium to high max height, average DBH, medium shrinkage, medium compression and hardness, low mechanical strength	B. alleghaniensis , Betula lenta , Carya cordiformis , Carya glabra	Veneer, plywood, interior trim, furniture, and paneling.

PART 1



FOREST-BUILDING
& BUILDING TRAITS

PART 2



ASSESS THE
RESILIENCE OF
EXISTING WOOD
CONSTRUCTION

PART 3



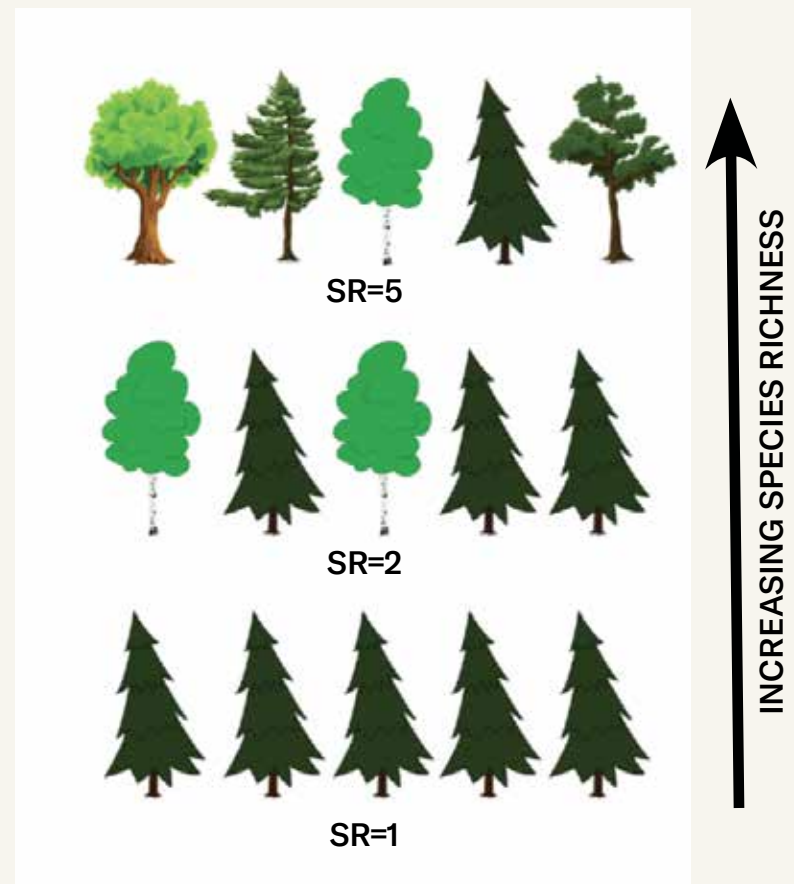
LAND-BASED FOR-
EST-BUILDING
BIOGENIC CARBON
ASSESSMENT

The background of the image consists of several large stacks of light-colored, rectangular wooden planks or beams, arranged in neat rows. The perspective is from a slightly elevated angle, showing the top and side surfaces of the stacks. The wood has a natural, slightly textured appearance with visible grain patterns.

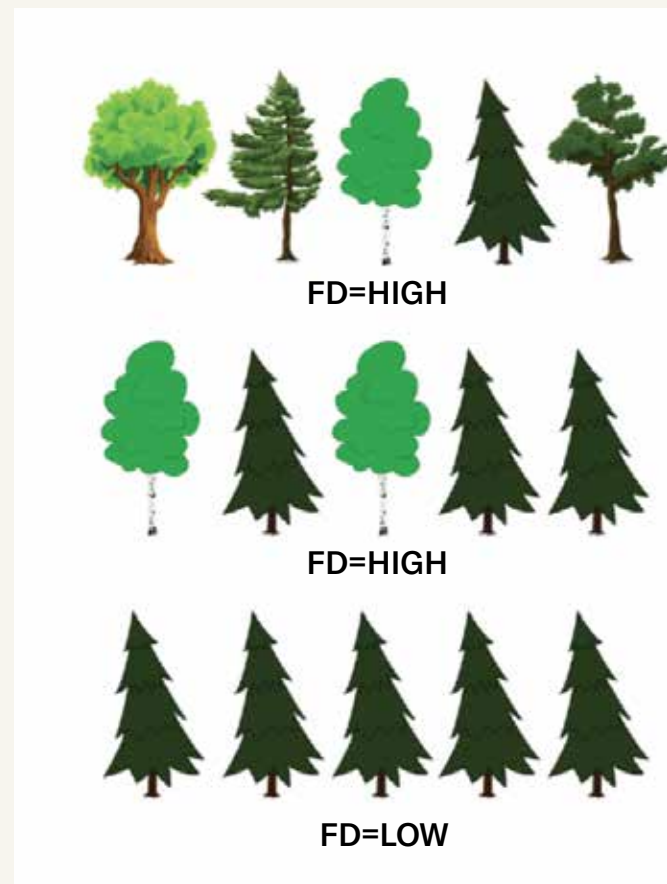
**WOOD IN TRANSITION:
DIVERSIFYING WOOD CONSTRUCTION TO
COPE WITH FOREST CHANGE**

INDICATORS OF ECOLOGICAL RESILIENCE

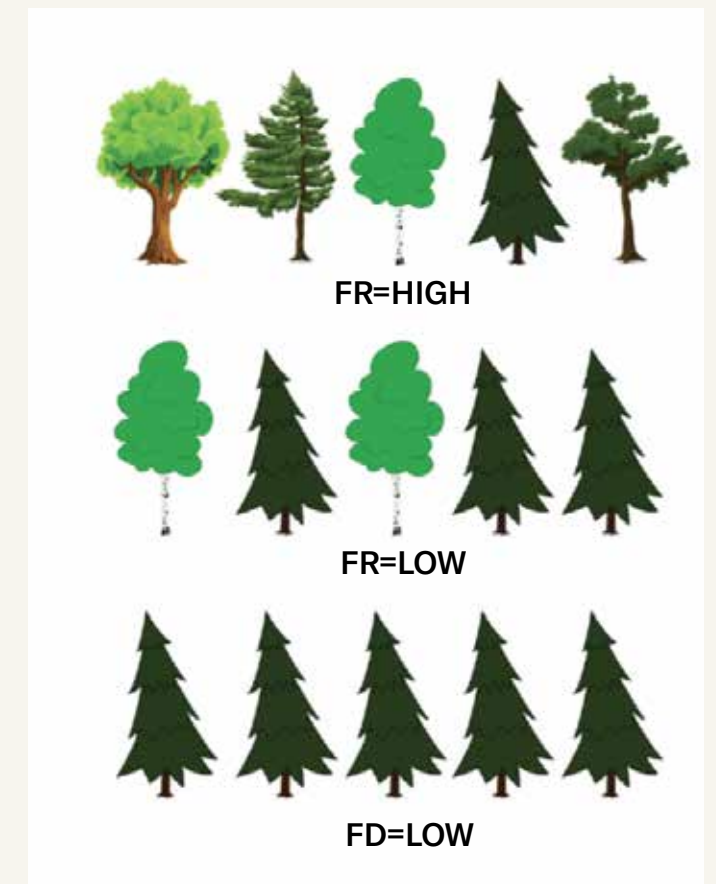
SPECIES RICHNESS



FUNCTIONAL DIVERSITY

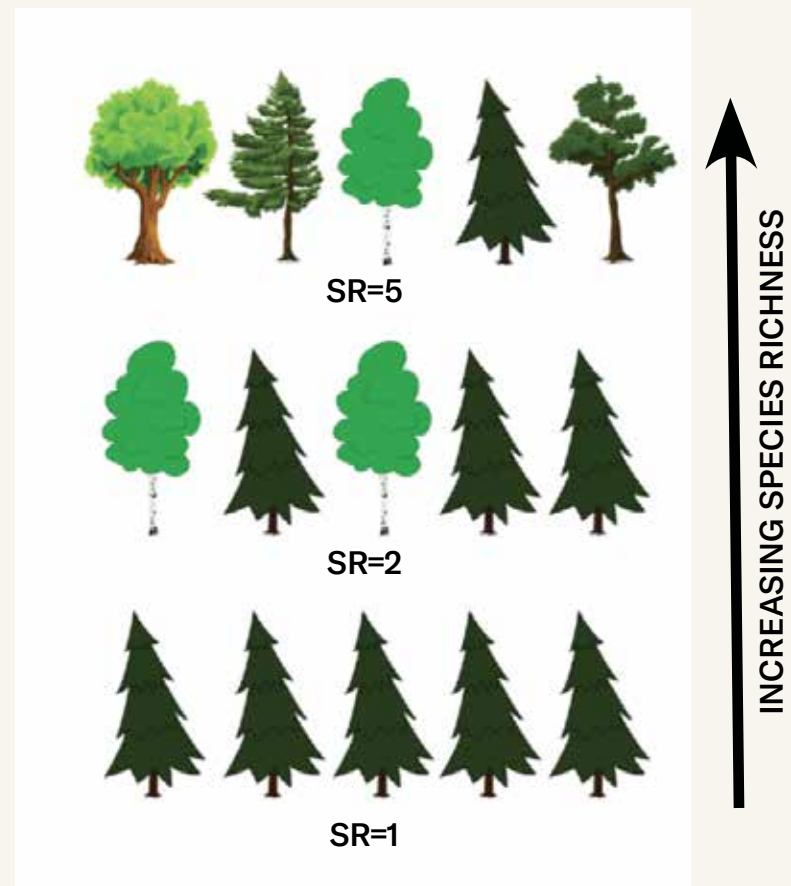


FUNCTIONAL REDUDANCY

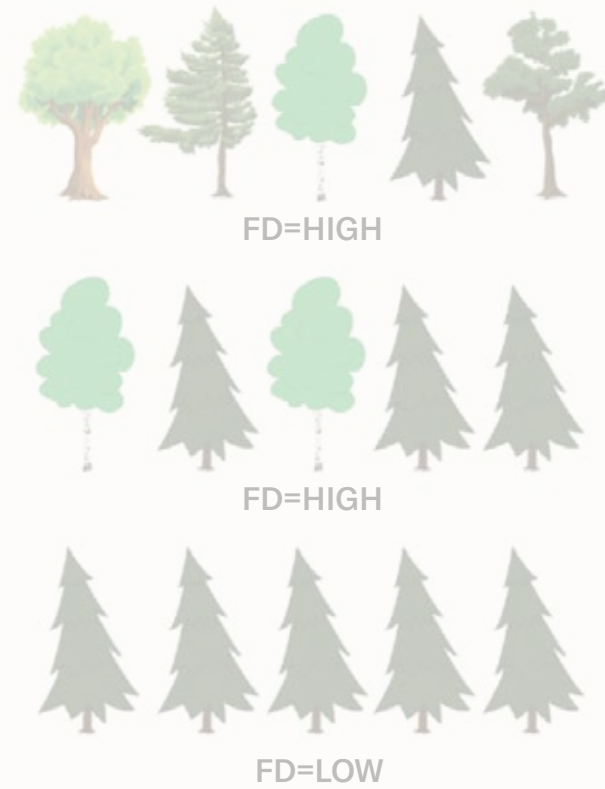


INDICATORS OF ECOLOGICAL RESILIENCE

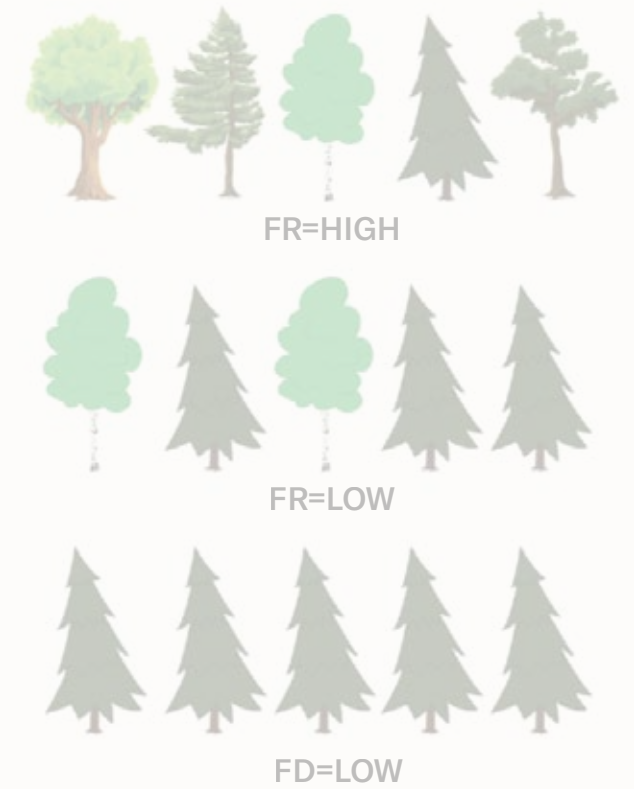
SPECIES RICHNESS



FUNCTIONAL DIVERSITY



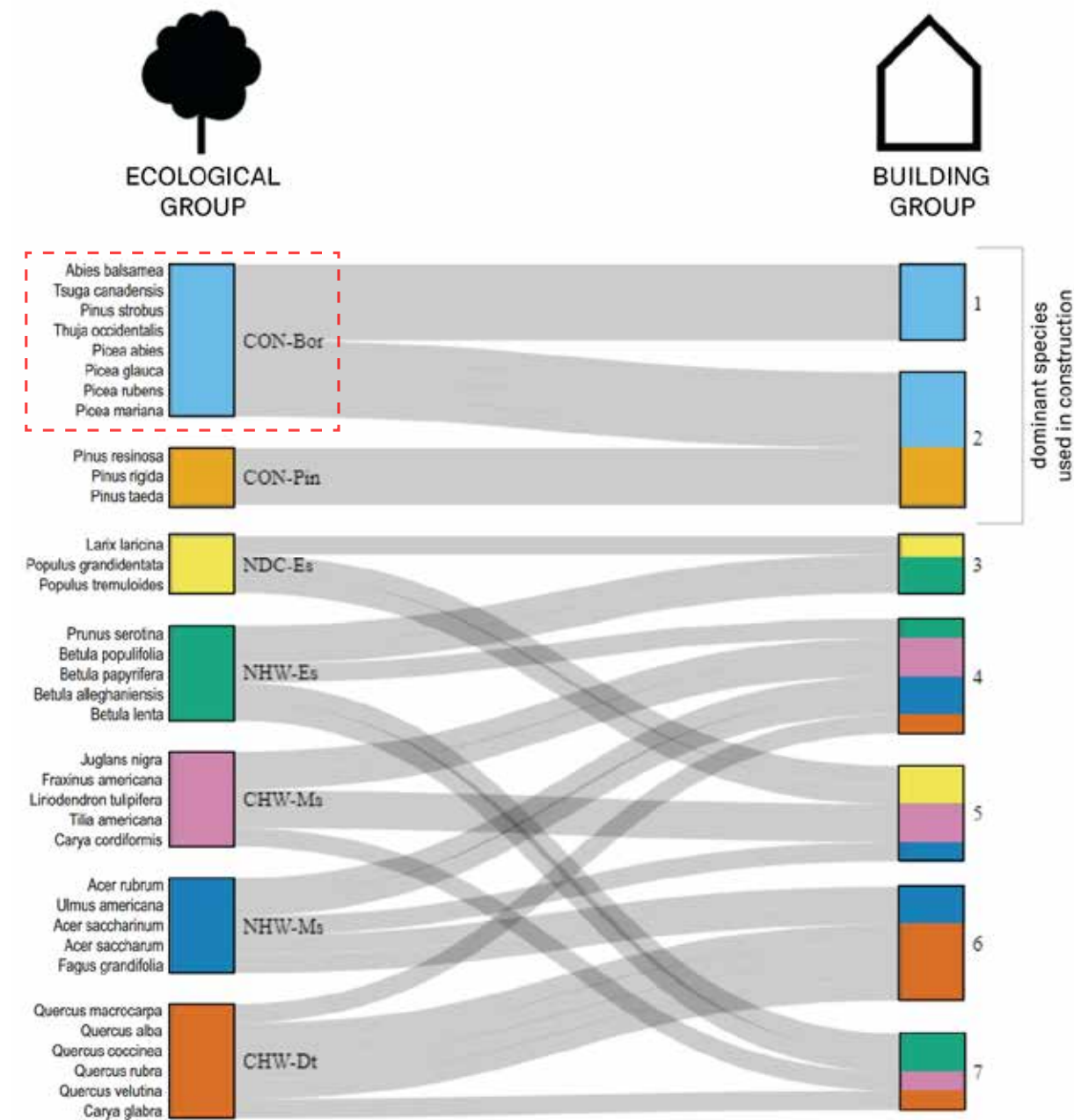
FUNCTIONAL REDUNDANCY





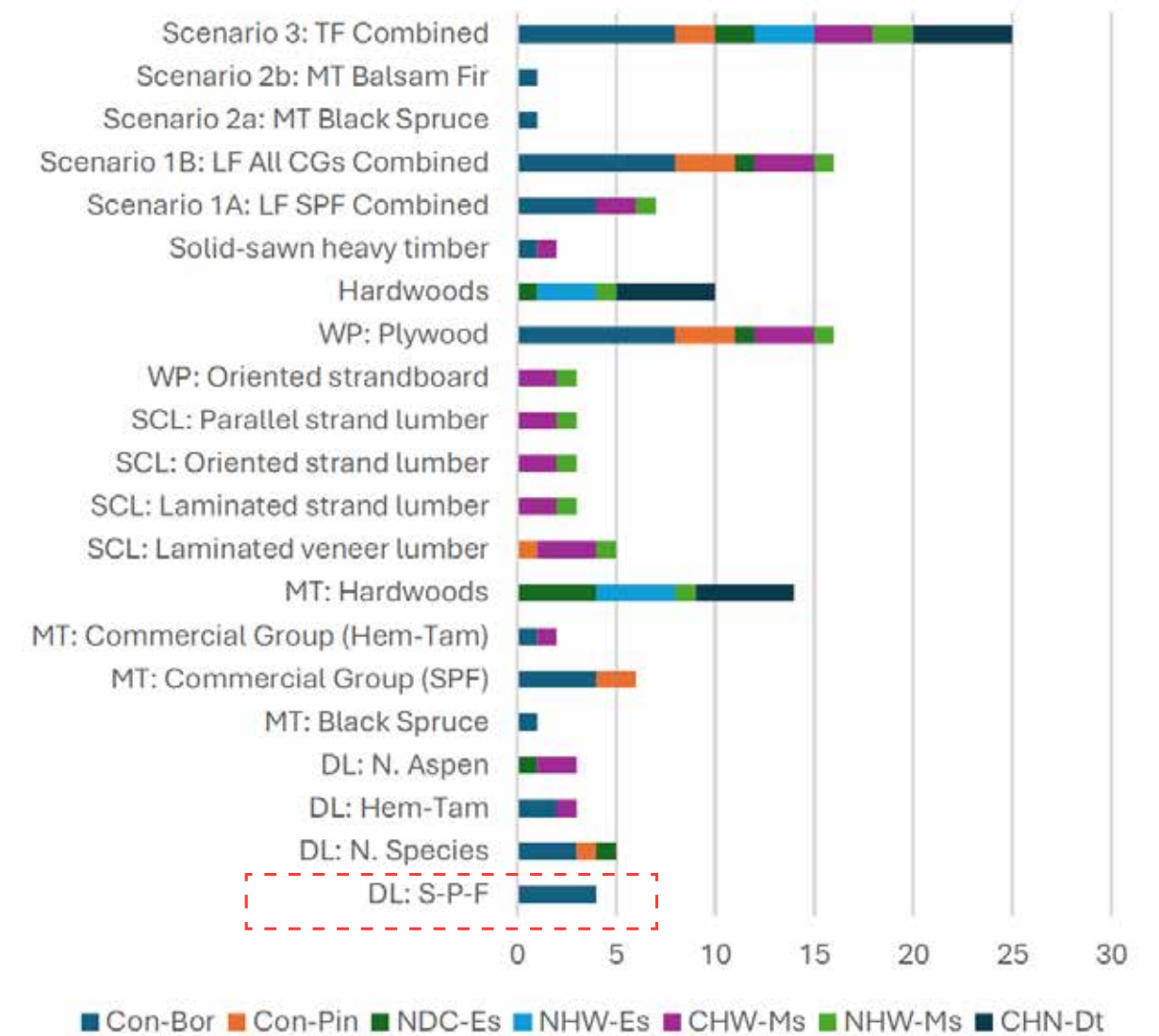
DIMENSIONAL LUMBER

COMMERCIAL GROUP (S-P-F)



SPECIES RICHNESS

SPECIES RICHNESS BY ECOLOGICAL GROUP

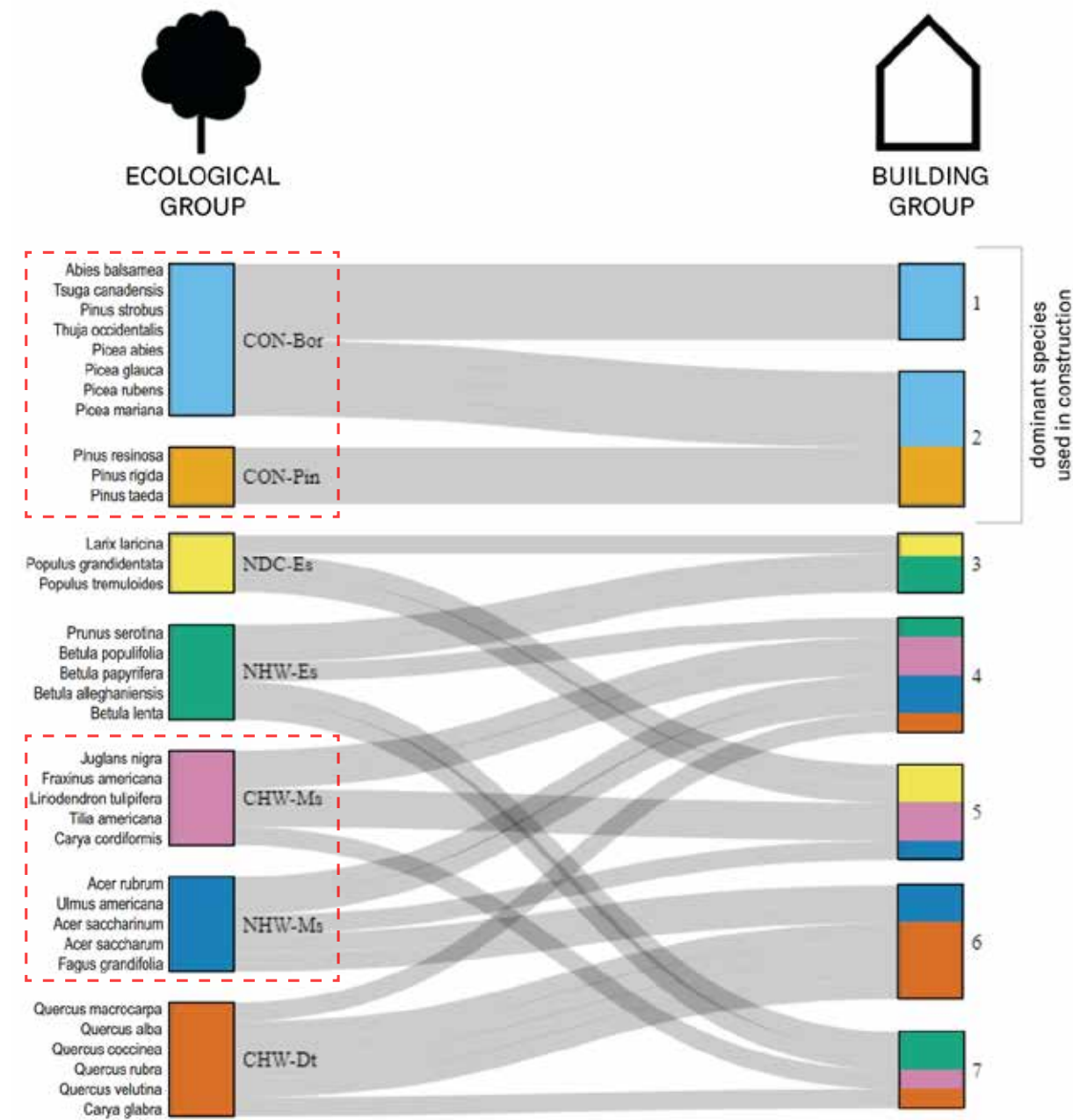


Forthcoming: Osborne et al (2026) Wood in transition: diversifying wood construction to cope with forest change



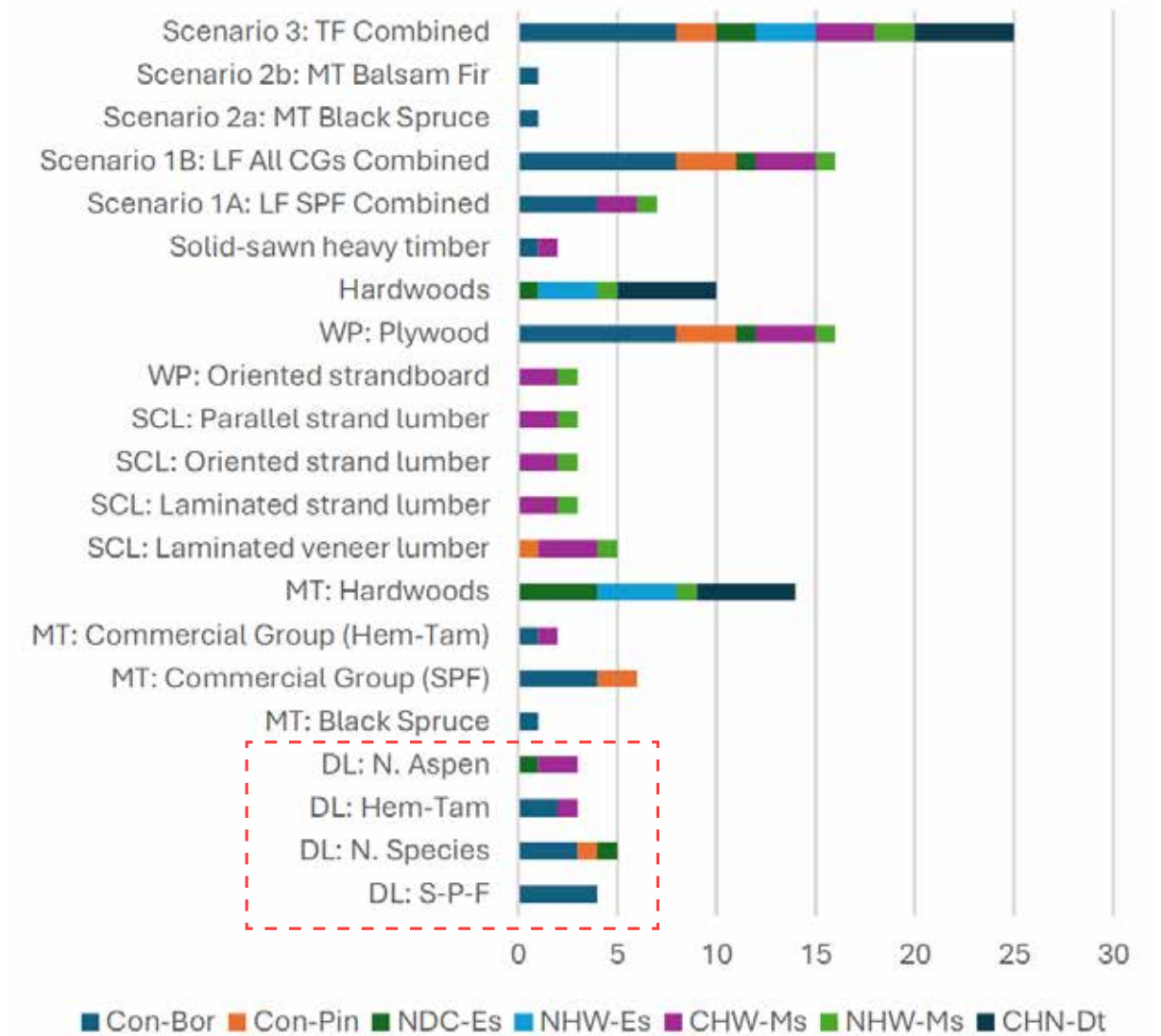
DIMENSIONAL LUMBER

ALL COMMERCIAL GROUPS



SPECIES RICHNESS

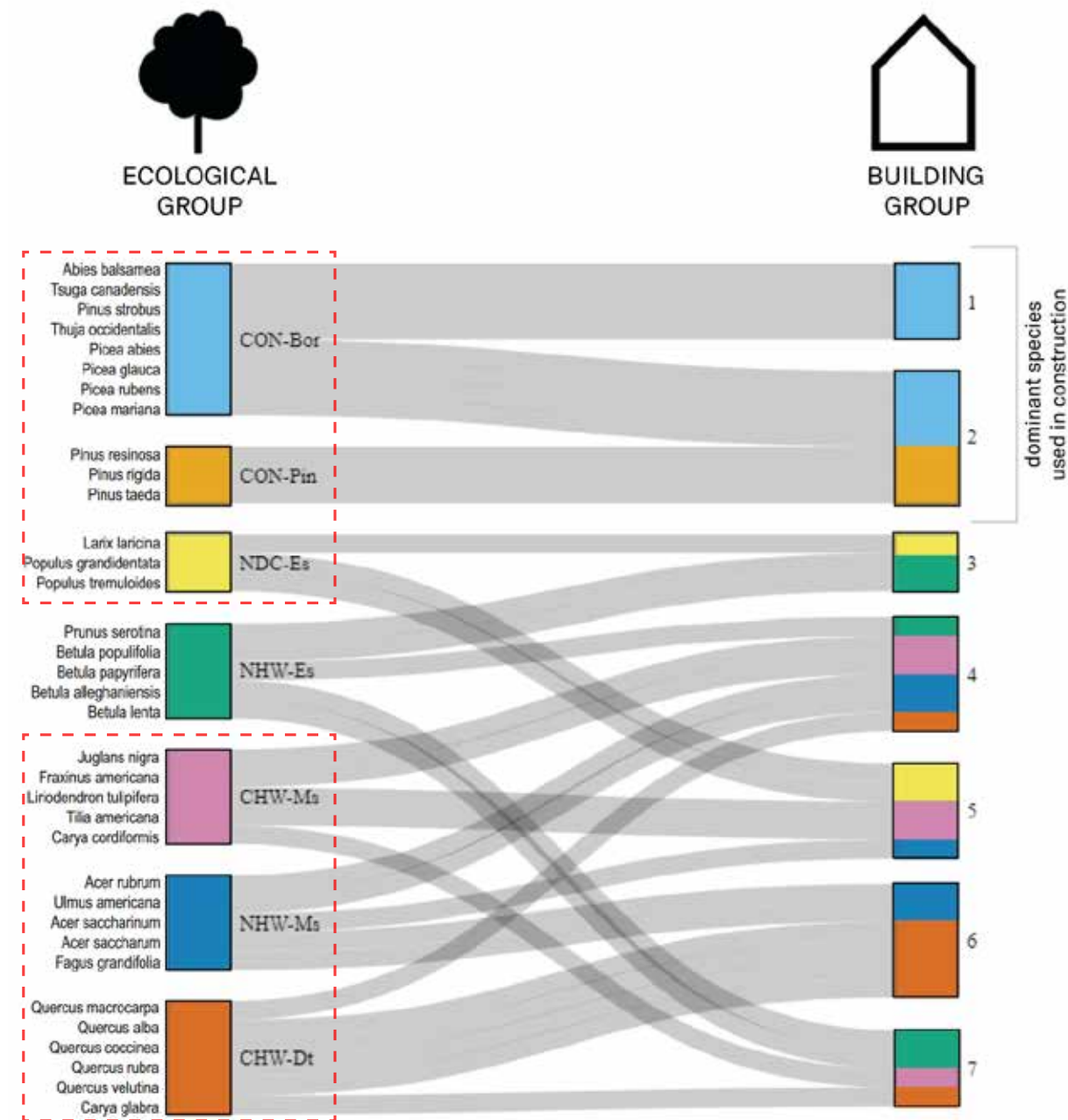
SPECIES RICHNESS BY ECOLOGICAL GROUP



Forthcoming: Osborne et al (2026) Wood in transition: diversifying wood construction to cope with forest change

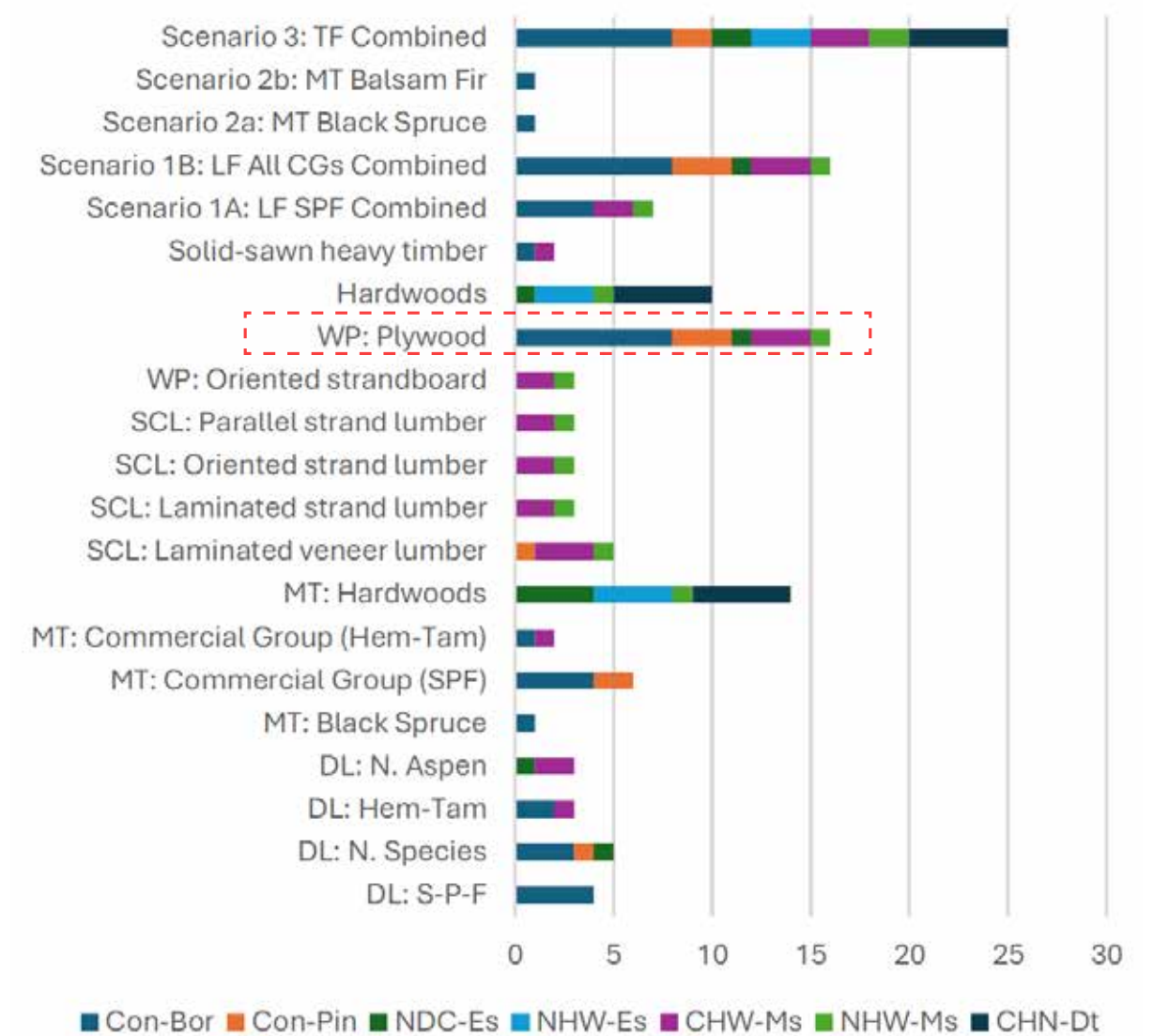


WOOD PANELS: PLYWOOD



SPECIES RICHNESS

SPECIES RICHNESS BY ECOLOGICAL GROUP

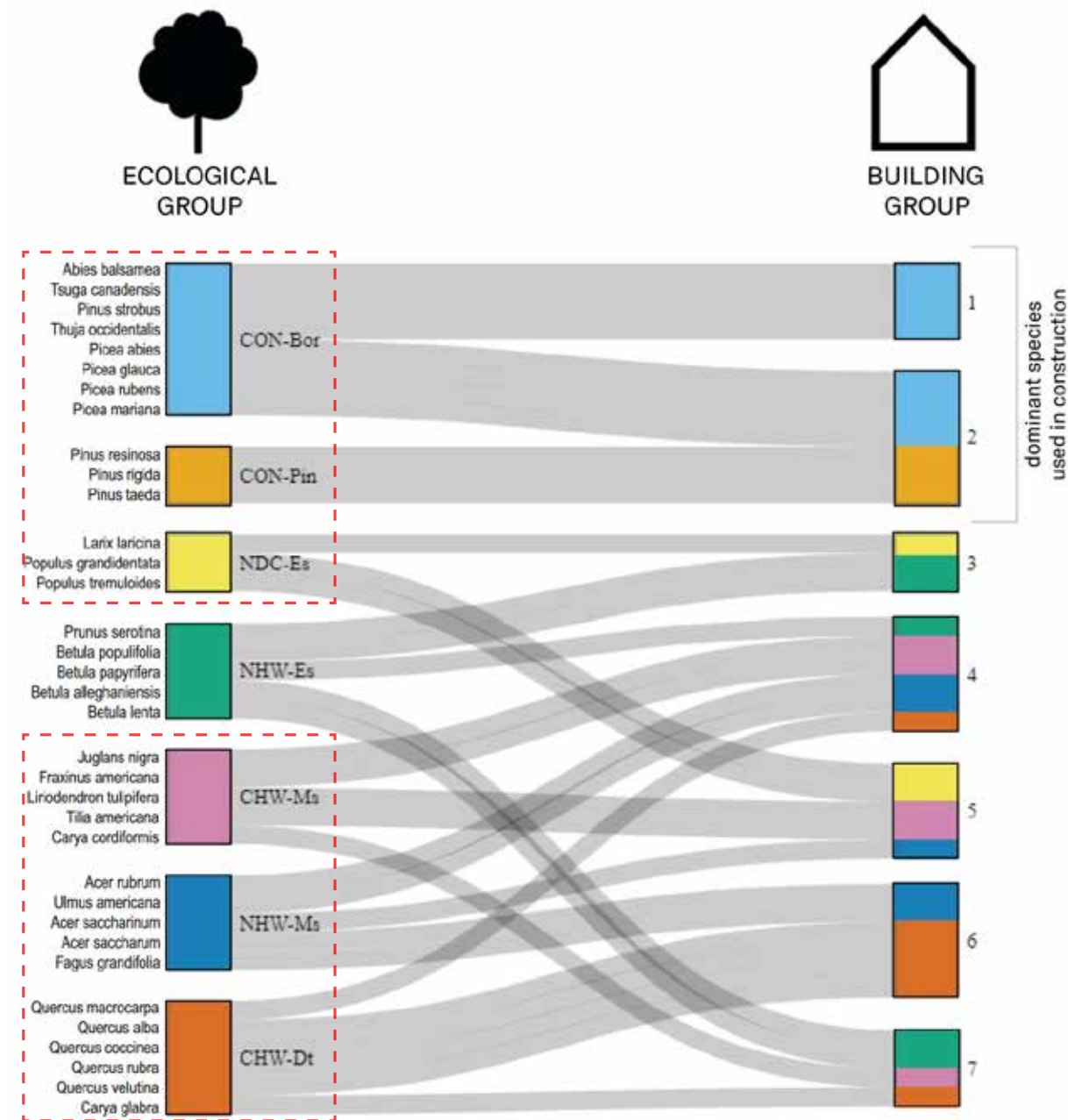


Forthcoming: Osborne et al (2026) Wood in transition: diversifying wood construction to cope with forest change



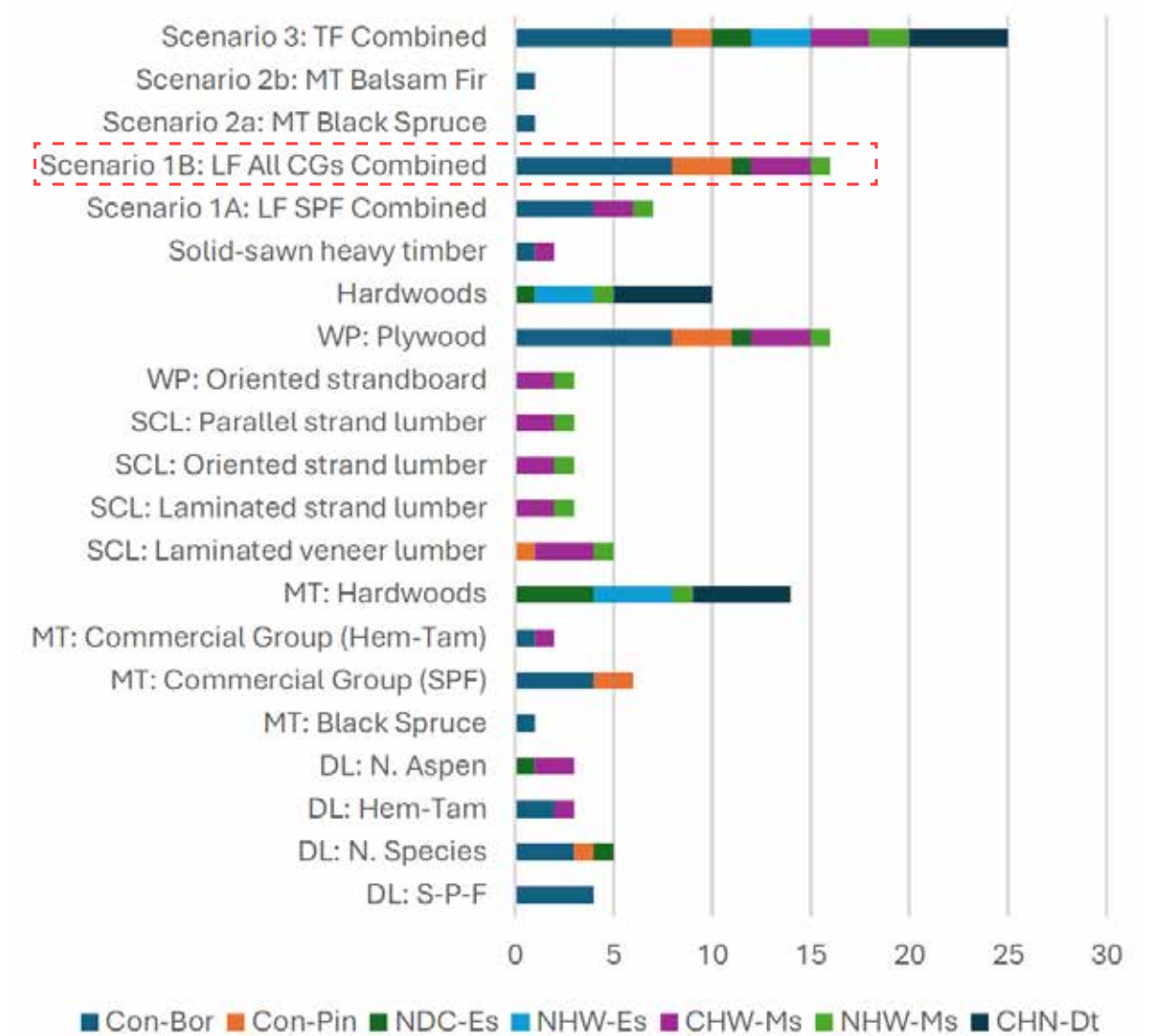
LIGHT FRAME BUILDING

ALL COMMERCIAL GROUPS



SPECIES RICHNESS

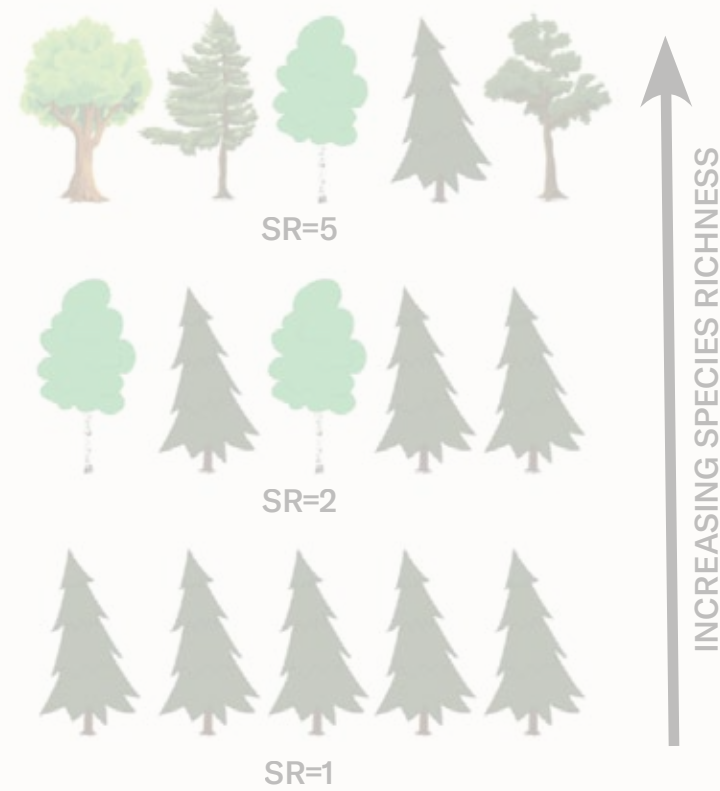
SPECIES RICHNESS BY ECOLOGICAL GROUP



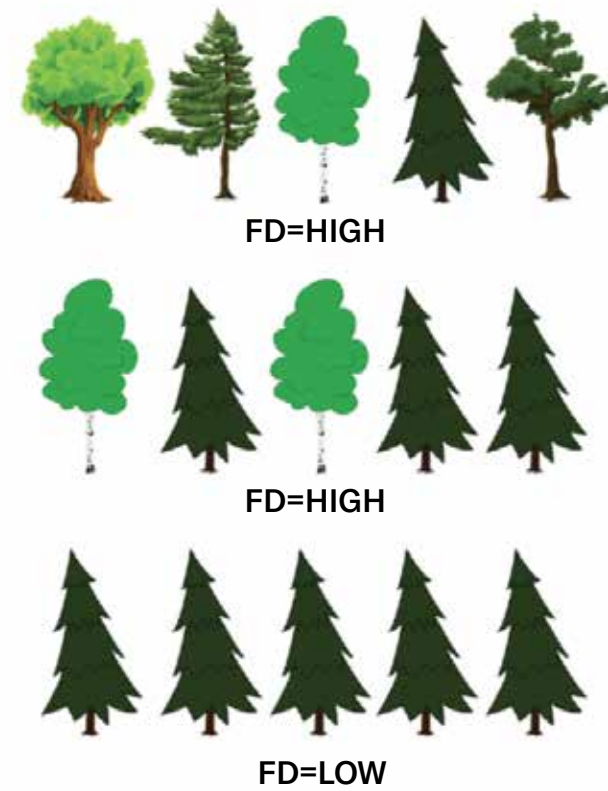
Forthcoming: Osborne et al (2026) Wood in transition: diversifying wood construction to cope with forest change

INDICATORS OF ECOLOGICAL RESILIENCE

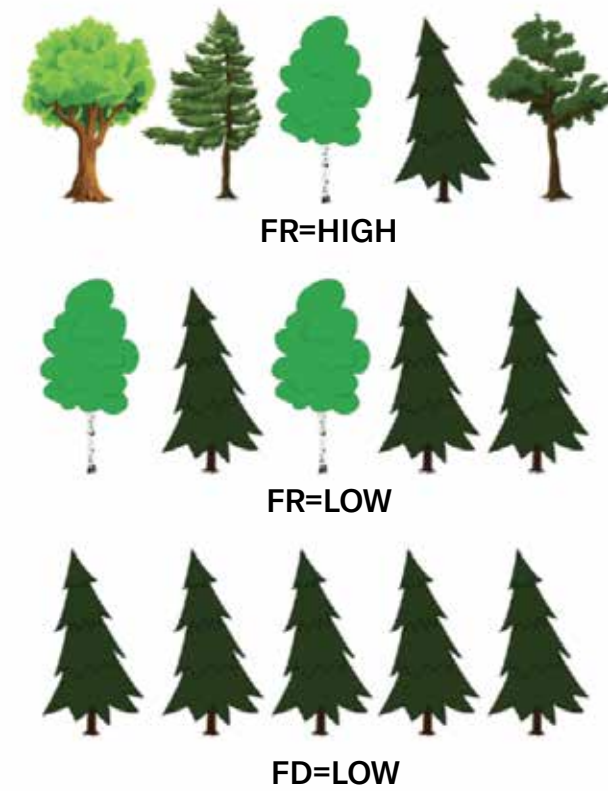
SPECIES RICHNESS



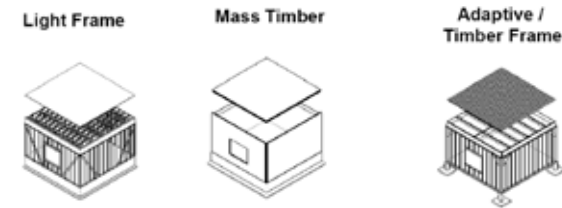
FUNCTIONAL DIVERSITY



FUNCTIONAL REDUNDANCY



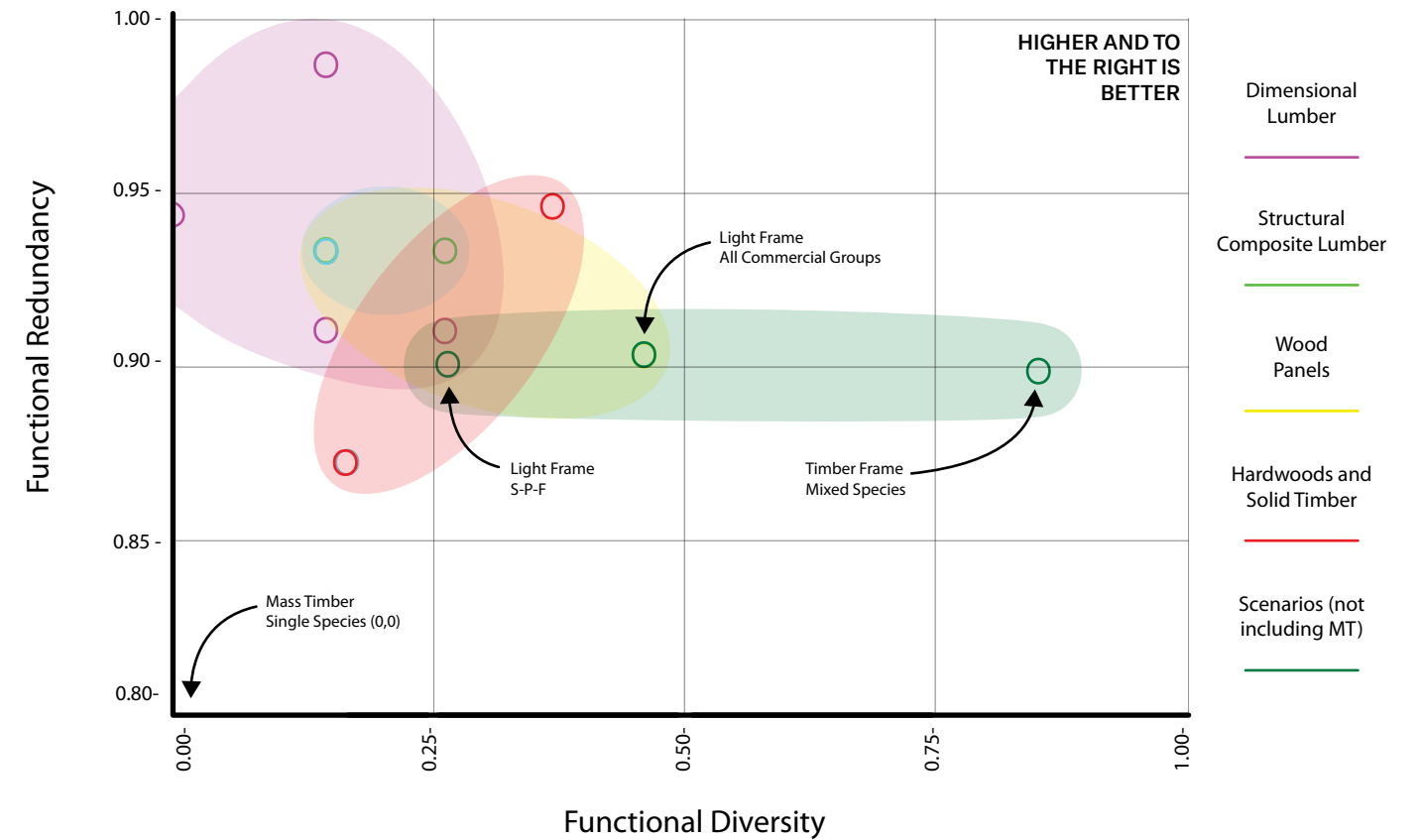
WOOD CONSTRUCTION APPROACH



Botanical Name	Commercial Name	Ecological Group	Building Group	Commercial Species ID	Species Commercial Group	Scenario 1a: Light Frame (S-P-F)		Scenario 1b: Light Frame (All commercial groups)		Scenario 2: Mass Timber (Single Species)		Scenario 3: Post and beam	
						Commercial Group (SFF)	Scenario 1a of SFF Combined	Scenario 1b of SFF Combined	Scenario 2a: Single Species Black Spruce	Scenario 2b: All Black Spruce	Scenario 2c: All Black Spruce +	Scenario 3a: Light Frame (S-P-F)	Scenario 3b: Light Frame (All commercial groups)
Aster balsameus	Fir, Balsam	Con-Bor	1	B-Fir (F)	SFF	1	1	1	1	1	1	1	1
Acer rubrum	Maple, Red	NHW-Es	4										
Acer saccharinum	Maple, Silver	NHW-Es	5										
Acer saccharum	Maple, Sugar	NHW-Es	6										
Betula alleghaniensis	Birch, Yellow	NDC-Es	7										
Betula lenta	Birch, Sweet	NDC-Es	7										
Betula papyrifera	Birch, Paper	NDC-Es	4	W-Birch	N, Species		1	1	1			1	1
Betula populifolia	Birch, Gray	NDC-Es	3										
Carya cordiformis	Hickory, pecan, Bitternut	NHW-Hs	7										
Carya alba	Hickory, true, Pignut	CHN-DI	7										
Fagus grandifolia	Beech, American	NHW-Es	6										
Fraxinus americana	Ash, White	NHW-Hs	4										
Juglans nigra	Walnut, black	NHW-Hs	4										
Larix laricina	Tamarac	CHW-Hs	3	Tam (F)	Hem-Etn		1	1	1			1	1
Liriodendron tulipifera	Yellow-poplar	NHW-Hs	5			1	1	1	1			1	1
Picea abies	Spruce, Norway	Con-Bor	2	N Spr (F)	N, Species		1	1	1			1	1
Picea glauca	Spruce, White	Con-Bor	2	W Spr (F)	SFF	1	1	1	1			1	1
Picea mariana	Spruce, Black	Con-Bor	2	B Spr (F)	SFF	1	1	1	1	1		1	1
Picea rubens	Spruce, Red	Con-Bor	2	R Spr (F)	SFF	1	1	1	1			1	1
Pinus resinosa	Pine, Red	Con-Pin	2	R Pine	N, Species		1	1	1			1	1
Pinus strobus	Pine, Eastern White	Con-Bor	1	EW Pine (F)	N, Species			1	1			1	1
Pinus taeda	Pine, Loblolly	Con-Pin	2		South		1	1	1			1	1
Populus grandidentata	Aspen, Bigtooth	CHW-Hs	5	Aspen (F)	N, Aspen	1	1	1	1			1	1
Populus tremuloides	Aspen, Quaking	CHW-Hs	5	Aspen (F)	N, Aspen	1	1	1	1			1	1
Prunus serotina	Cherry, black	NDC-Es	3									1	1
Quercus alba	Oak, white, White	CHN-DI	6									1	1
Quercus coccoloba	Oak, red, Scarlet	CHN-DI	6									1	1
Quercus macrocarpa	Oak, white, Bur	CHN-DI	4									1	1
Quercus rubra	Oak, red, Northern red	CHN-DI	6									1	1
Quercus velutina	Oak, red, Black	CHN-DI	6									1	1
Thuja occidentalis	Cedar, Northern white	Con-Bor	1	EW Cedar (F)	N, Species			1	1			1	1
Tilia americana	Basswood, American	NHW-Hs	5									1	1
Thuja canadensis	Hemlock, Eastern	Con-Bor	1	E Hem (F)	Hem-Etn		1	1	1			1	1
Ulmus americana	elm, American	NHW-Es	4										

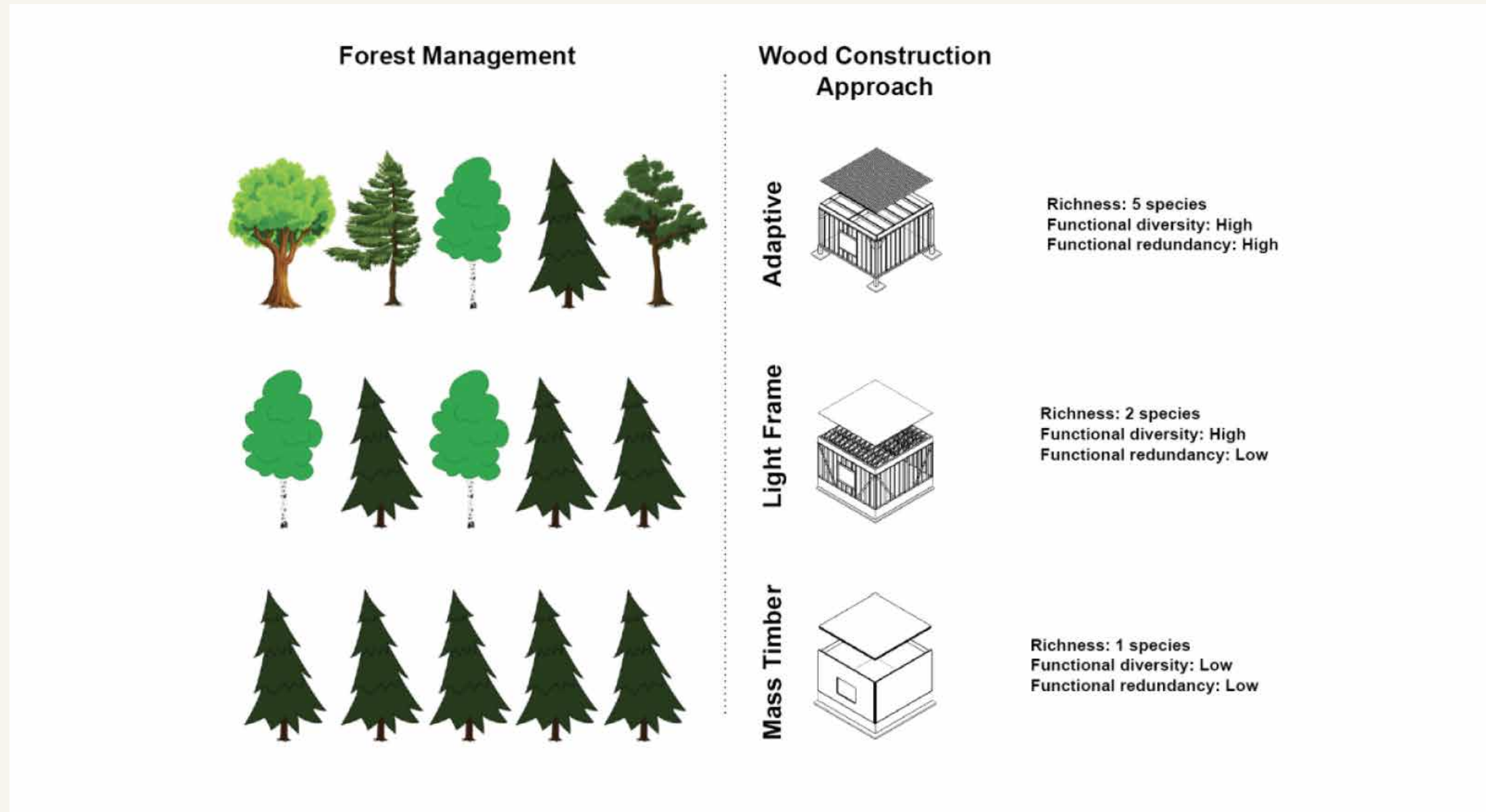
FUNCTIONAL RESILIENCE

RESILIENCY AND ADAPTABILITY OF WOOD PRODUCT CATEGORIES AND CONSTRUCTION APPROACHES



Forthcoming: Osborne et al (2026) Wood in transition: diversifying wood construction to cope with forest change

FUNCTIONALLY RESILIENT FOREST-BUILDING SYSTEMS



Defining Custom CLT Grade Utilizing Low-Value Ponderosa Pine
Research Team: Dr. Lech Muszynski, Dr. Mariapaola Riggo, Dr. Rakesh Gupta, Dr. Jeff Morrell (USC, Australia)

ENHANCING FOREST

Exploratory Study of Salvaged Lumber as Feedstock for CLT
Research Team: Dr. Laurence Schimleck

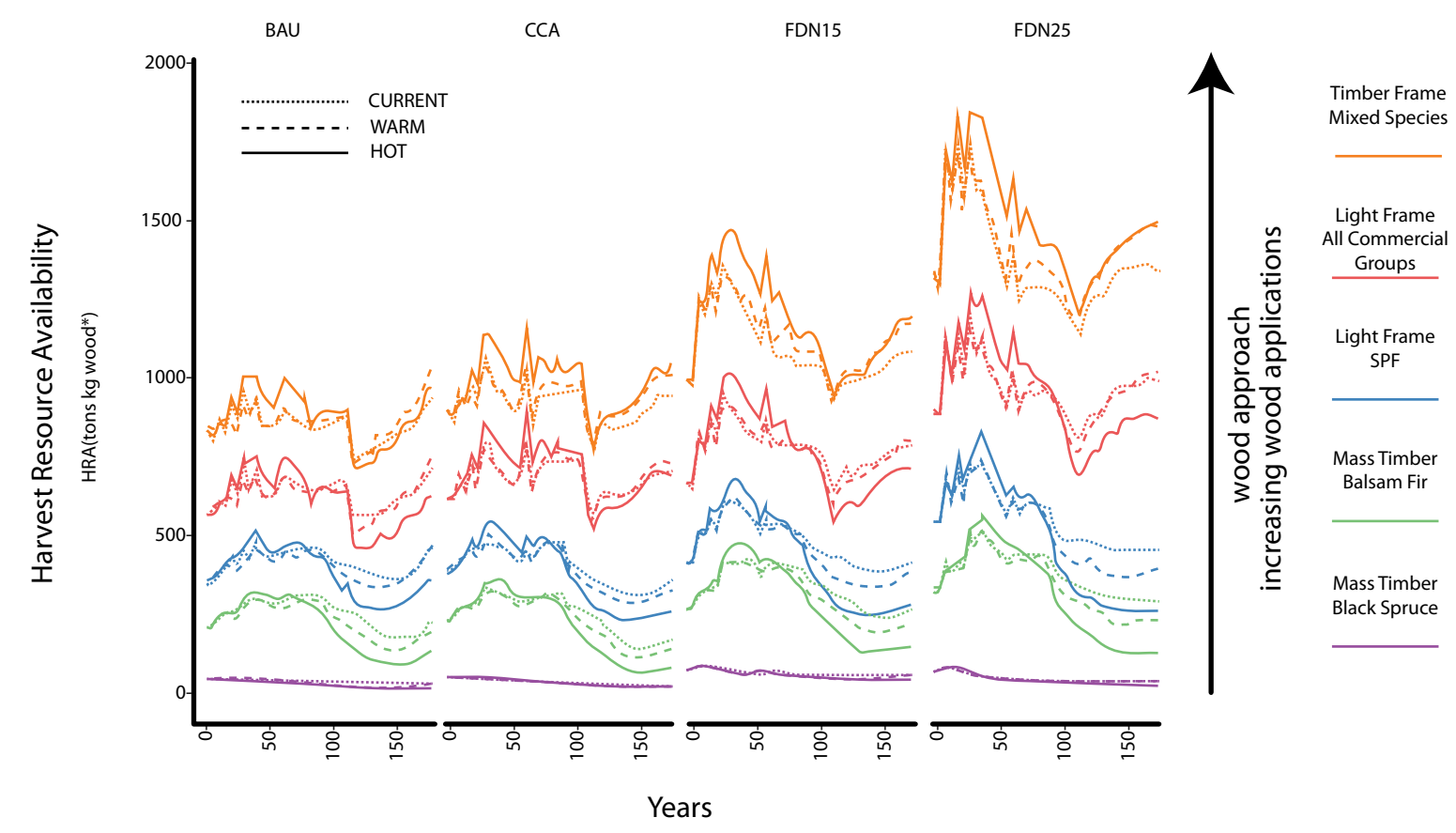
ECOLOGICAL RESILIENCE & COMBINED

PerfoStruct
Harvard Graduate School of Design with Spyridon Amparavos and Nicole Bakker
Advisor: Sawako Kajima

FOREST-BUILDING CARBON POOLING

ASSESS

HARVEST RESOURCE AVAILABILITY AND DIVERSION POTENTIAL OF WOOD CONSTRUCTION APPROACHES



Forthcoming: Osborne et al (2026) Wood in transition: diversifying wood construction to cope with forest change

Wood Construction Approaches



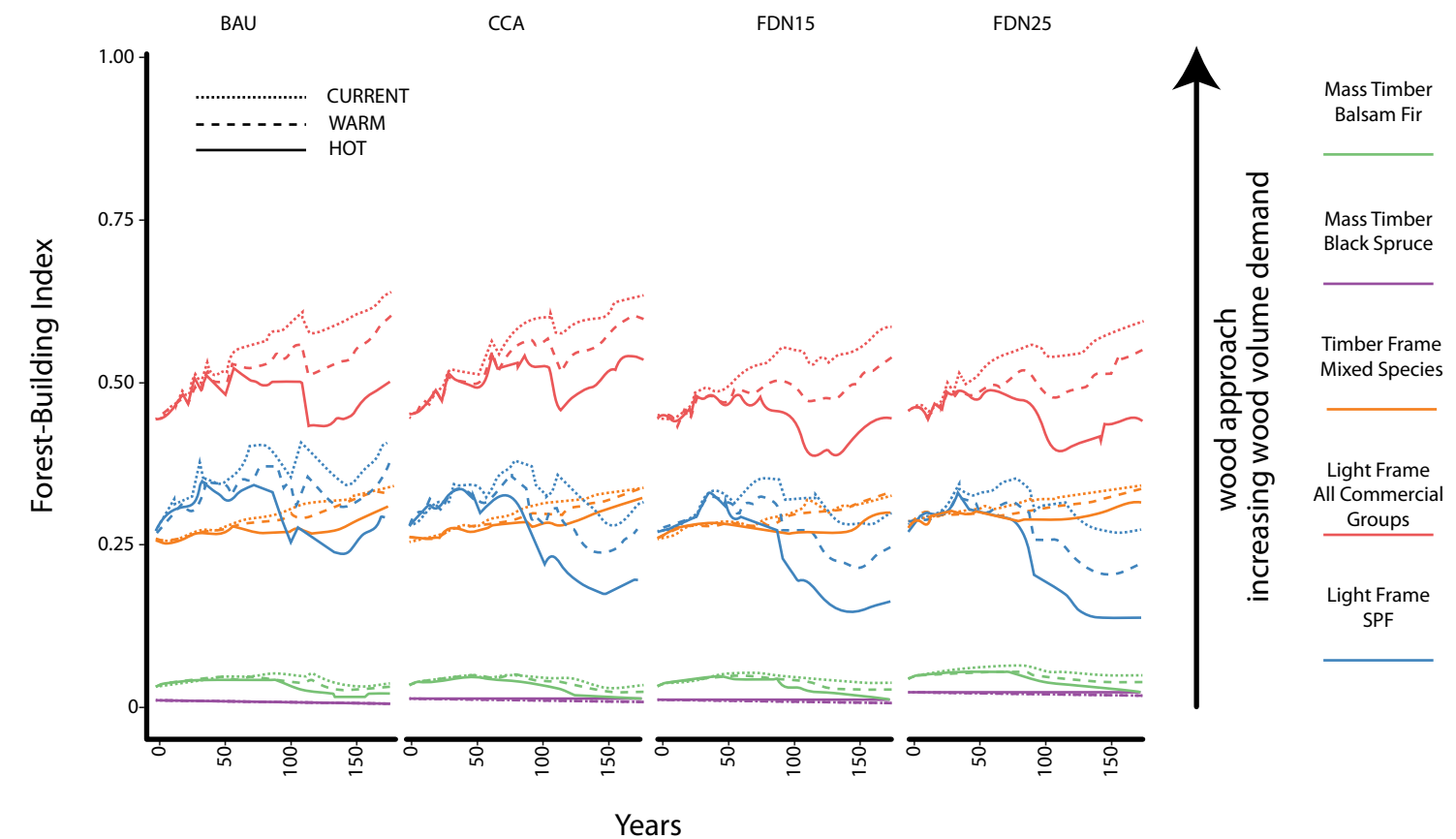
Figure 32 Axonometric section of different wood construction scenarios.

Table 5 - Wood construction approaches used in this study.

Scenario	Functional Diversity	Wood Utilization	Wood Subassemblies
1a Light Frame	Low	Low (100%)	DL – SPF, WP – OSB
1b Light Frame	Medium	Low (100%)	DL – All, WP – OSB/Plywood
2 Mass Timber (CLT)	Low	High (550%)	MT – CLT Single Species (a:black spruce, b: balsam fir)
3 Timber Frame	High	Medium (245%)	TF – DL – All, SCL – All, Hardwood, Solid-Sawn Timber

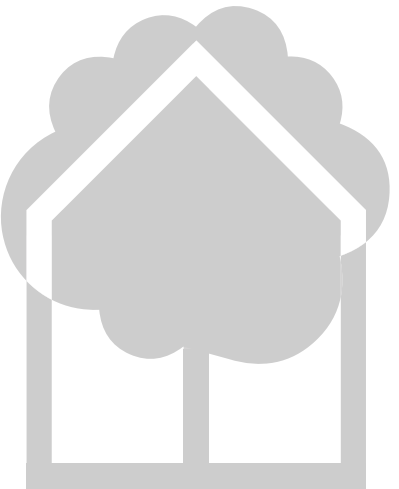
BUILD

RESILIENT AND ADAPTABLE FOREST-BUILDING RELATIONSHIPS



Forthcoming: Osborne et al (2026) Wood in transition: diversifying wood construction to cope with forest change

PART 1



FOREST-BUILDING
& BUILDING TRAITS

PART 2



ASSESS THE
RESILIENCE OF
EXISTING WOOD
CONSTRUCTION

PART 3



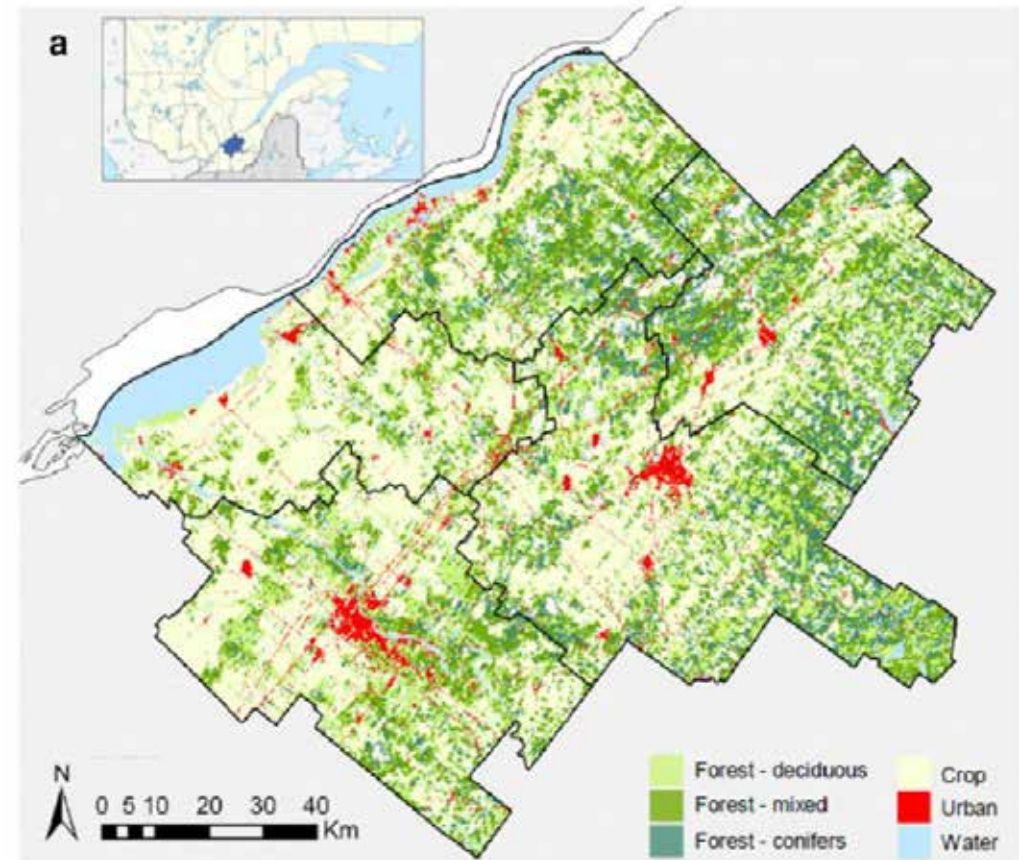
LAND-BASED FOR-
EST-BUILDING
BIOGENIC CARBON
ASSESSMENT



**ENHANCING FOREST CARBON SINKS
THROUGH FUNCTIONALLY ADAPTIVE WOOD
CONSTRUCTION**

WHAT IS THE
IMPACT OF
FUNCTIONALLY
ADAPTIVE BUILDING
PRACTICES ON THE
LAND-BASED
CARBON POOLING
POTENTIAL OF
BUILDINGS?

CENTRE-DU-QUÉBEC STUDY REGION



SPECIES LEVEL FOREST CARBON MODEL

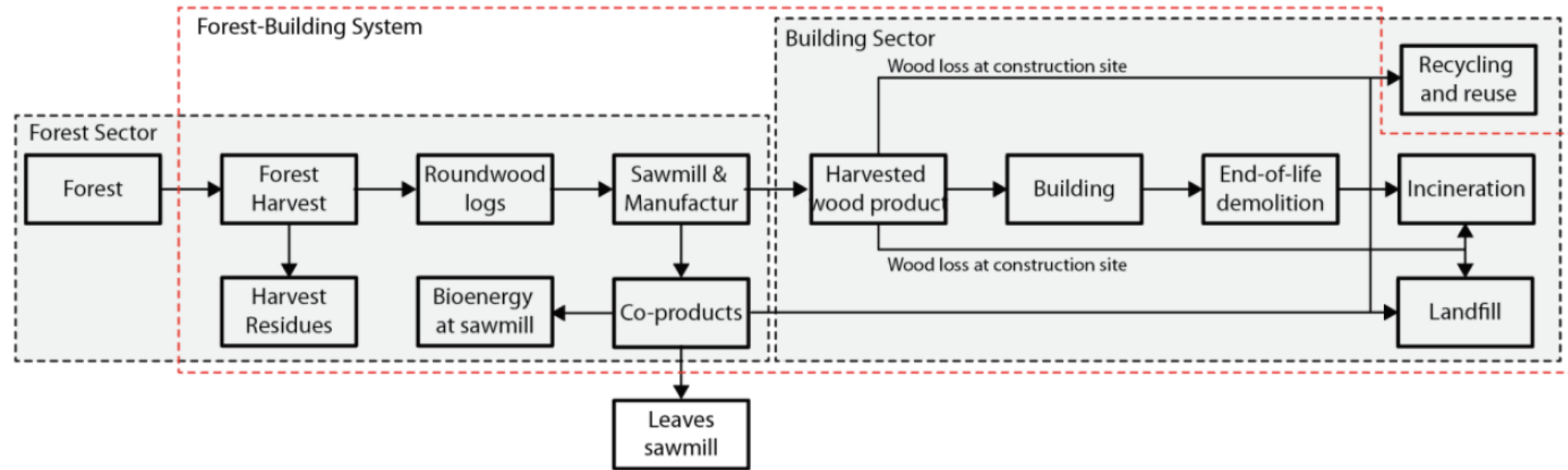
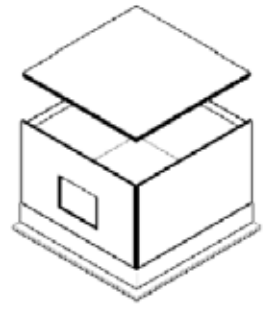


Figure 38 - System boundaries for wood product carbon flows. The processes contained within the red dotted line describe the combined forest-building system and are tracked in the model. The forest ecosystem and upstream forest harvest activities are developed in a previous study (Mina et al. 2022). The implementation of the model treats the “Leaves sawmill” and “Recycling and reuse” processes as being outside the system scope but we have tracked the carbon pools throughout the study.. The figure only includes the biogenic carbon contained within the wood



MASS TIMBER



Roundwood Utilization Rate by Scenario and Construction Approach

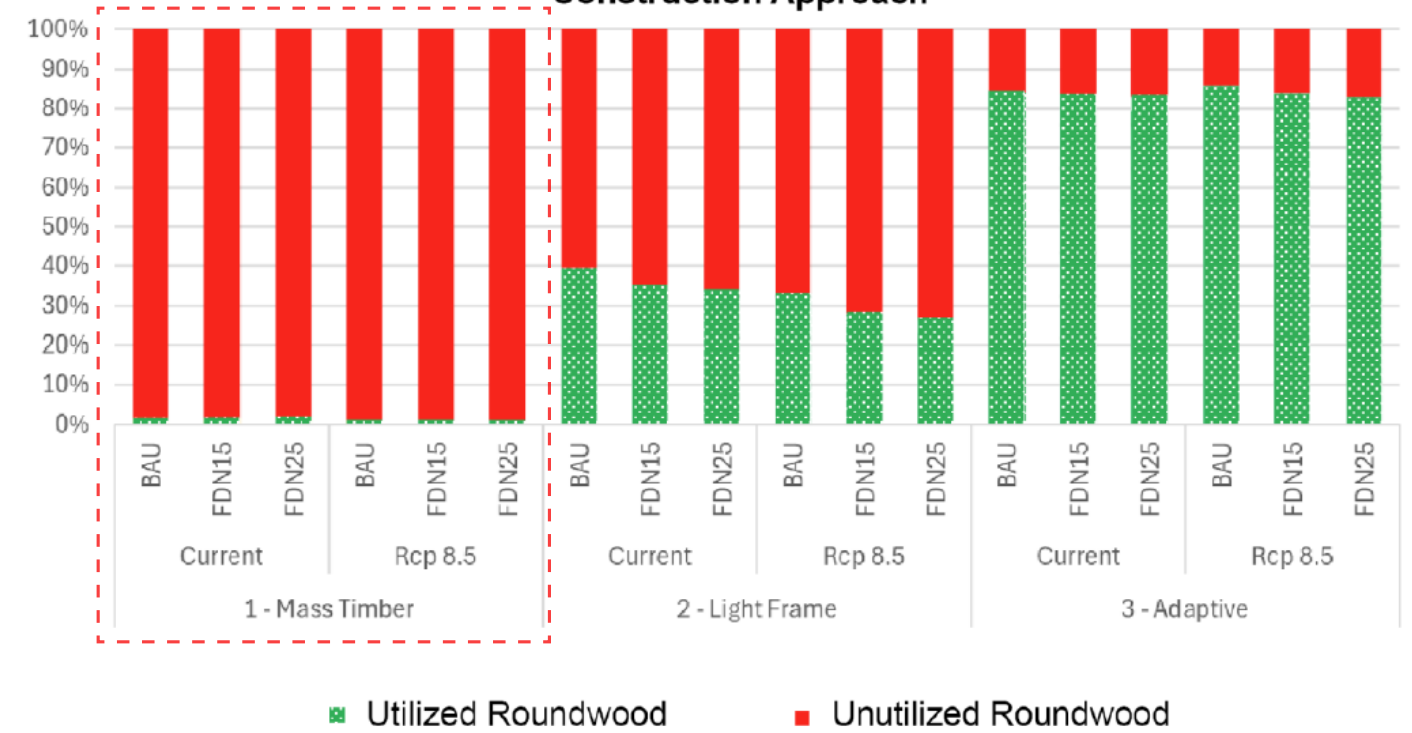
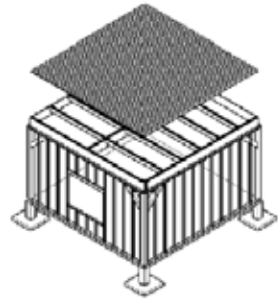


Figure 43 – Comparing the percentage of roundwood utilization by construction approach. 1 – Mass timber showed < 3% wood utilization. 2 – Light frame approach with dimensional lumber and OSB utilized between 25-40%. 3 – The Adaptive approach utilized the most species and therefore had the highest utilization of 82-85% of roundwood. For more details on the construction approach and species, see Section 5.3.3.



ADAPTIVE WOOD CONSTRUCTION



BAU
FUNCTIONAL DIVERSITY
LOW

FDN25
FUNCTIONAL DIVERSITY
HIGH

Total Species, Building and Ecological Group Carbon

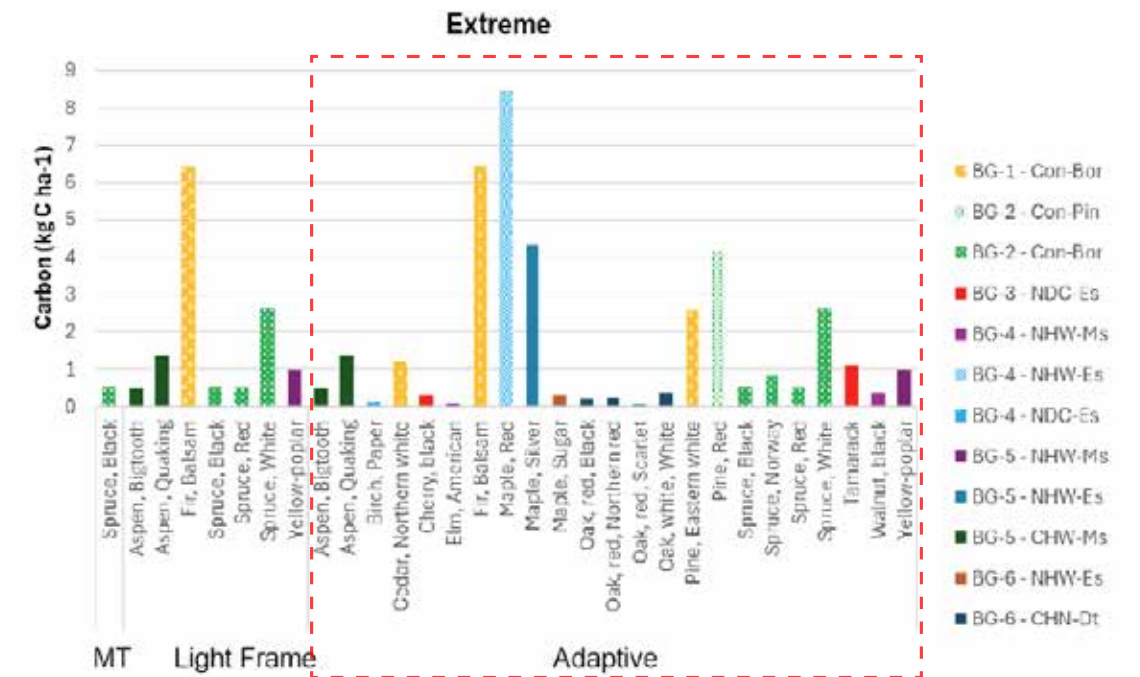
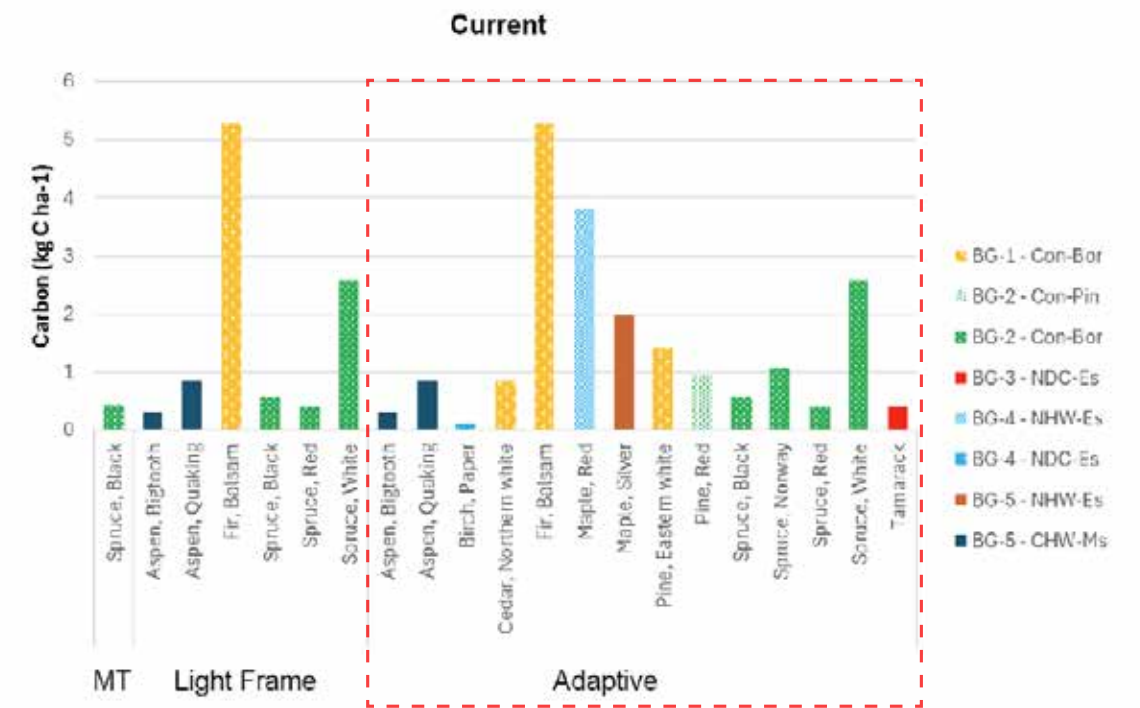


Figure 44 – Total building and ecological group carbon pools per hectare (kg C ha⁻¹) comparing construction approaches across the 190 year simulation. Top: BAU forest management and Current climate. Bottom: FDN25 forest management and RCP 8.5 climate change scenarios shown. The adaptability of the Adaptive approach is illustrated by the increased number of species and building-ecological group combinations present in the Extreme scenario.

USEABLE WOOD OVER TIME

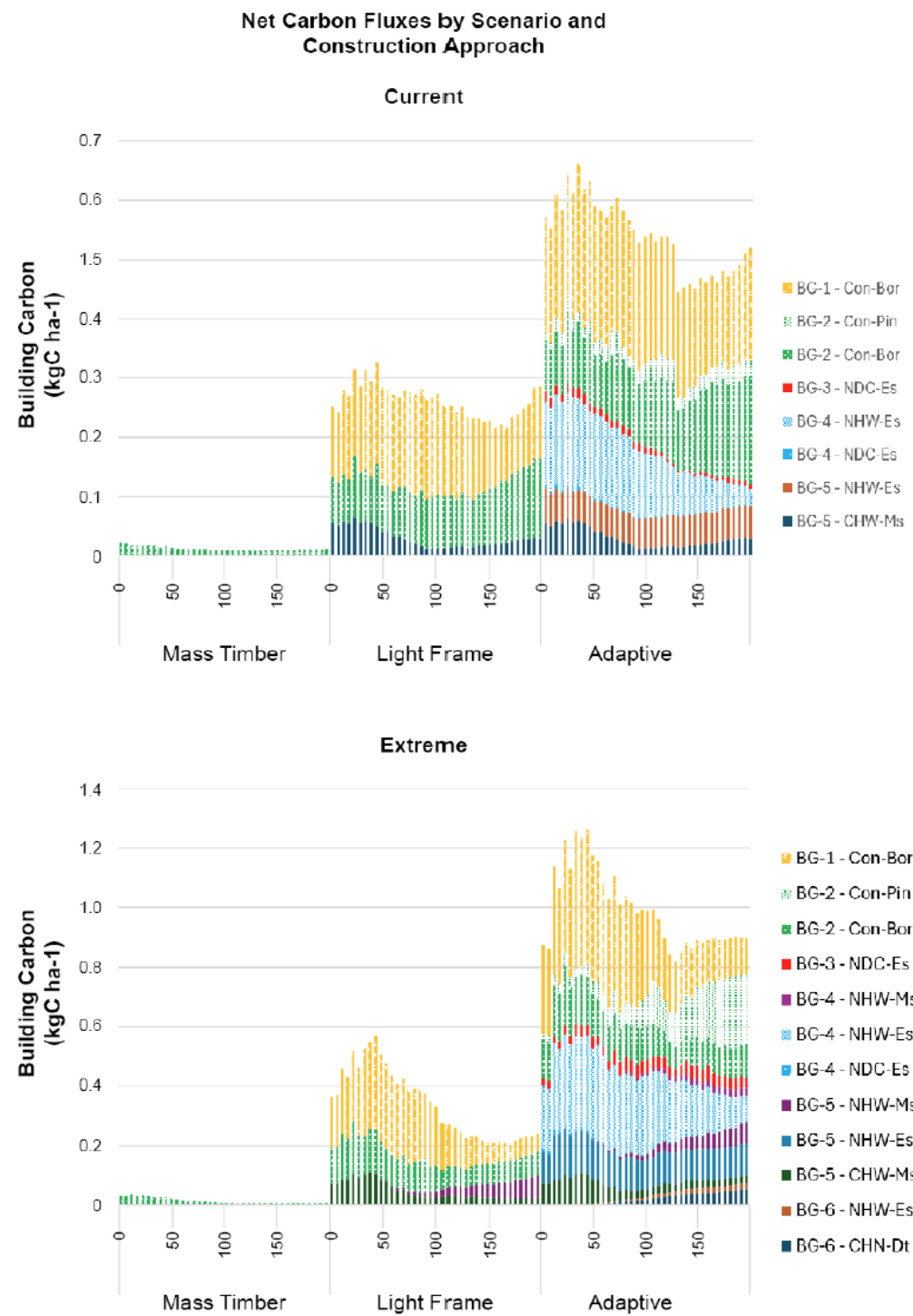


Figure 45 – Net carbon fluxes per hectare (kg C/ha) of wood in building describing what building and ecological groups will be useable by each construction approach for the 190 year simulation period. Top: BAU forest management and Current climate. Bottom: FDN25 forest management and RCP 8.5 climate change scenarios shown. Note the different scale in the axis. The adaptive approach is least affected by the increasing ecological diversity, and resultant building group diversity in the Extreme scenario (bottom). In contrast, the light frame scenario declines by nearly half from its peak around year 50.

TOTAL WOOD IN THE BUILT ENVIRONMENT

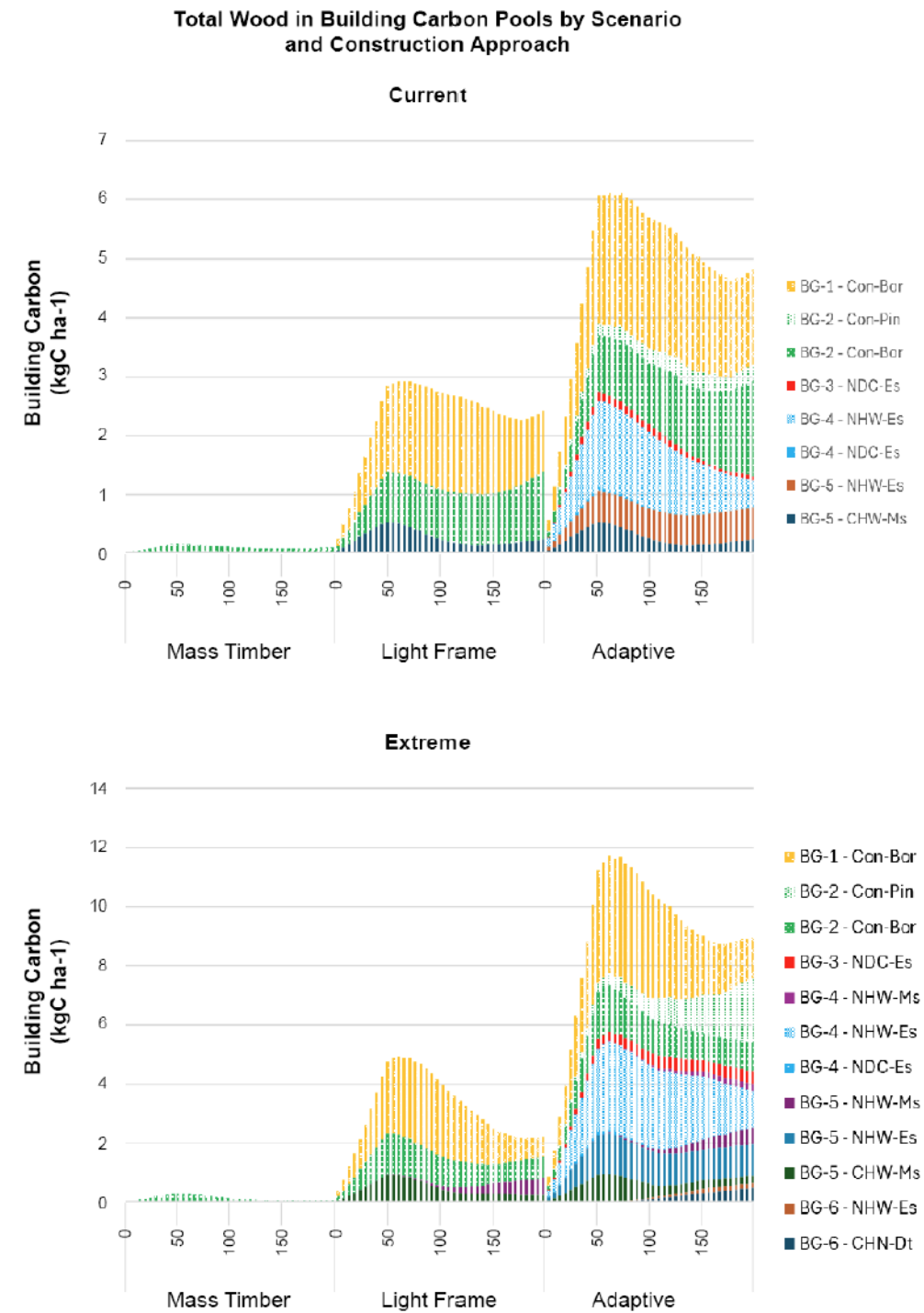


Figure 46 – Total carbon pools of wood in building per hectare (kg C/ha) showing the building and ecological group composition of buildings constructed throughout the 190 year simulation period. Top: BAU forest management and Current climate. Bottom: FDN25 forest management and RCP 8.5 climate change scenarios shown. The results illustrate a two to four times greater building carbon pooling potential by adapting our current approaches to construction (e.g. Light Frame). Note the cumulative impact of the declining wood in building carbon pools around year 50 when the first demolitions occur in the model and harvest rates begin to decline (see Figure 45).

PERCENTAGE USEABLE STEM WOOD

80%

SOFTWOOD

45%

HARDWOOD

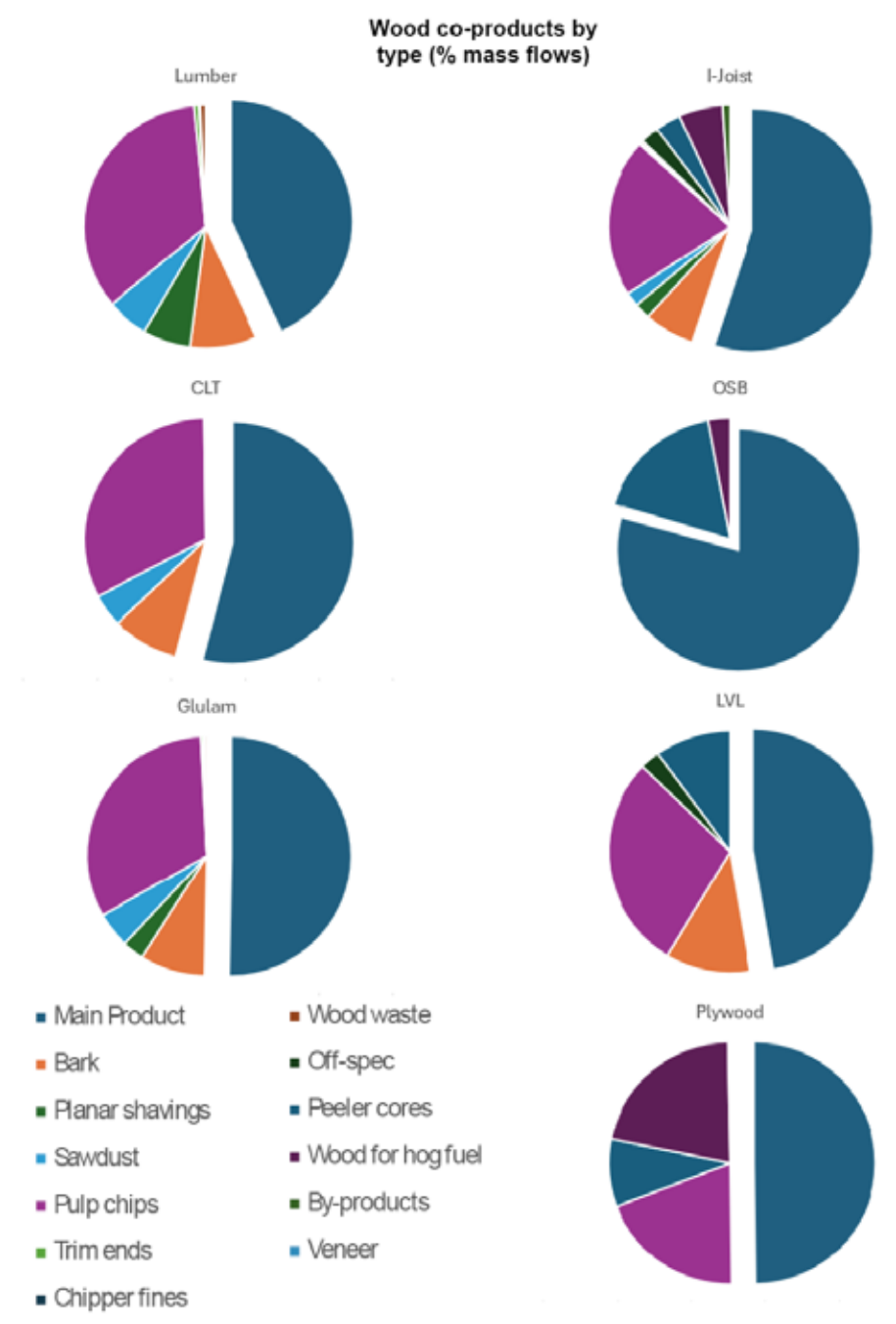


Figure 39 - Co-product outputs of for seven wood product types studied (% mass flows). Oriented Strand Board (OSB) stands out from the other wood products by having 79.3% of wood inputs directed towards the primary product. In contrast, dimensional lumber has the lowest quantity of wood directed towards the main products. See Table 7 for detailed information. Source: Athena Reports (ASMI 2012a-d; 2013a-c; 2018a-c)

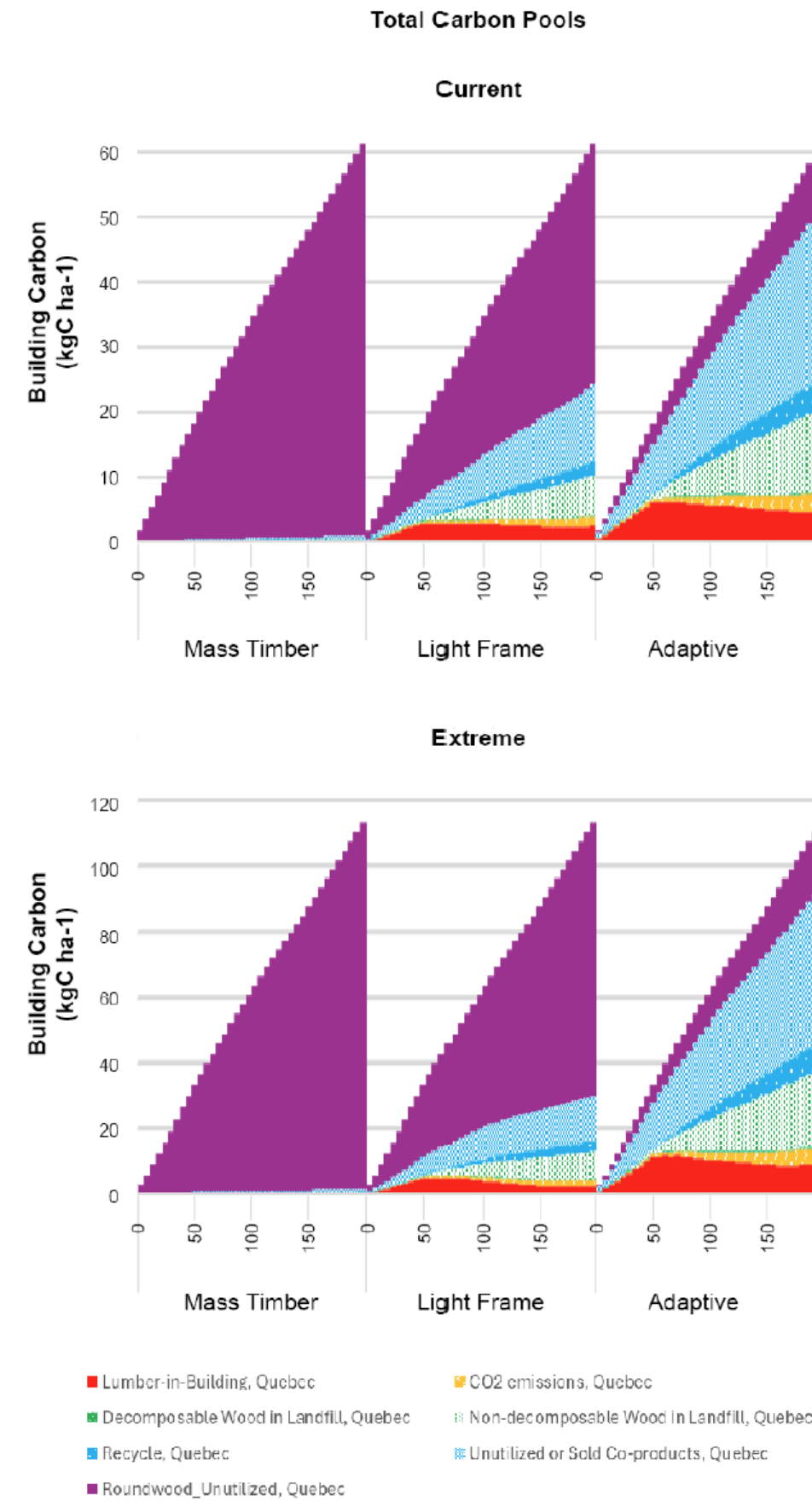
+ 105%

CURRENT CLIMATE AND BAU

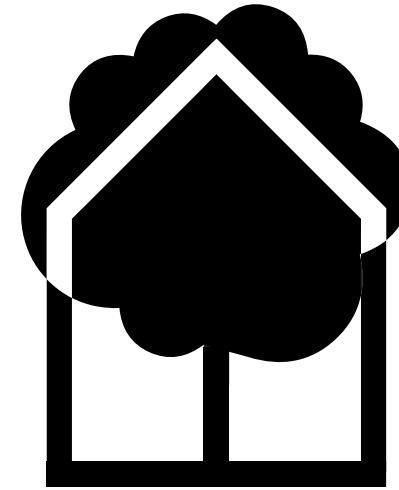
+ 295%

EXTREME CLIMATE AND FND25

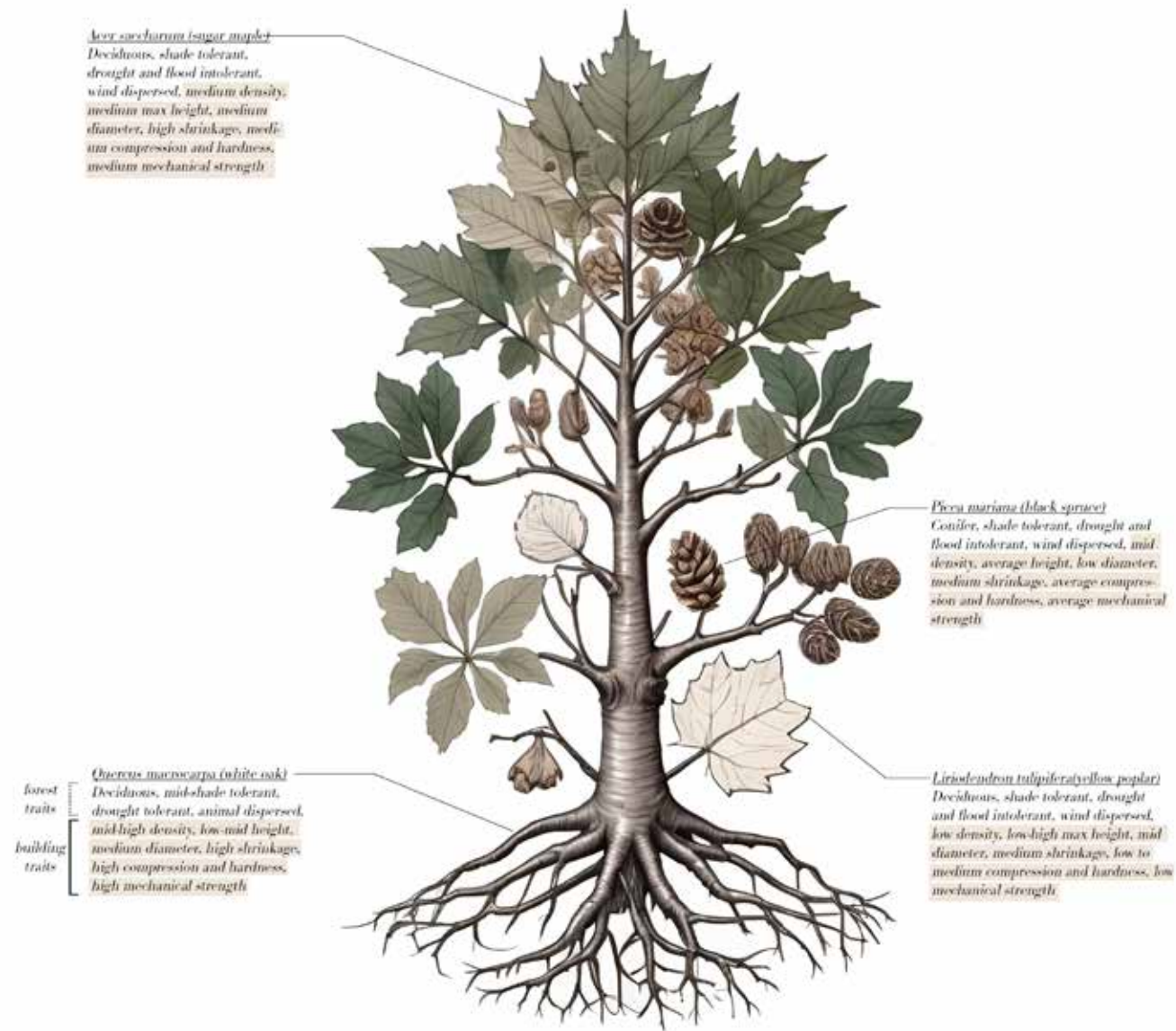
INCREASE LAND-BASED CARBON POOLING POTENTIAL OF FUNCTIONALLY ADAPTIVE WOOD CONSTRUCT APPROACH



Forthcoming: Osborne et al (2026) Enhancing forest carbon sinks through functionally adaptive wood construction



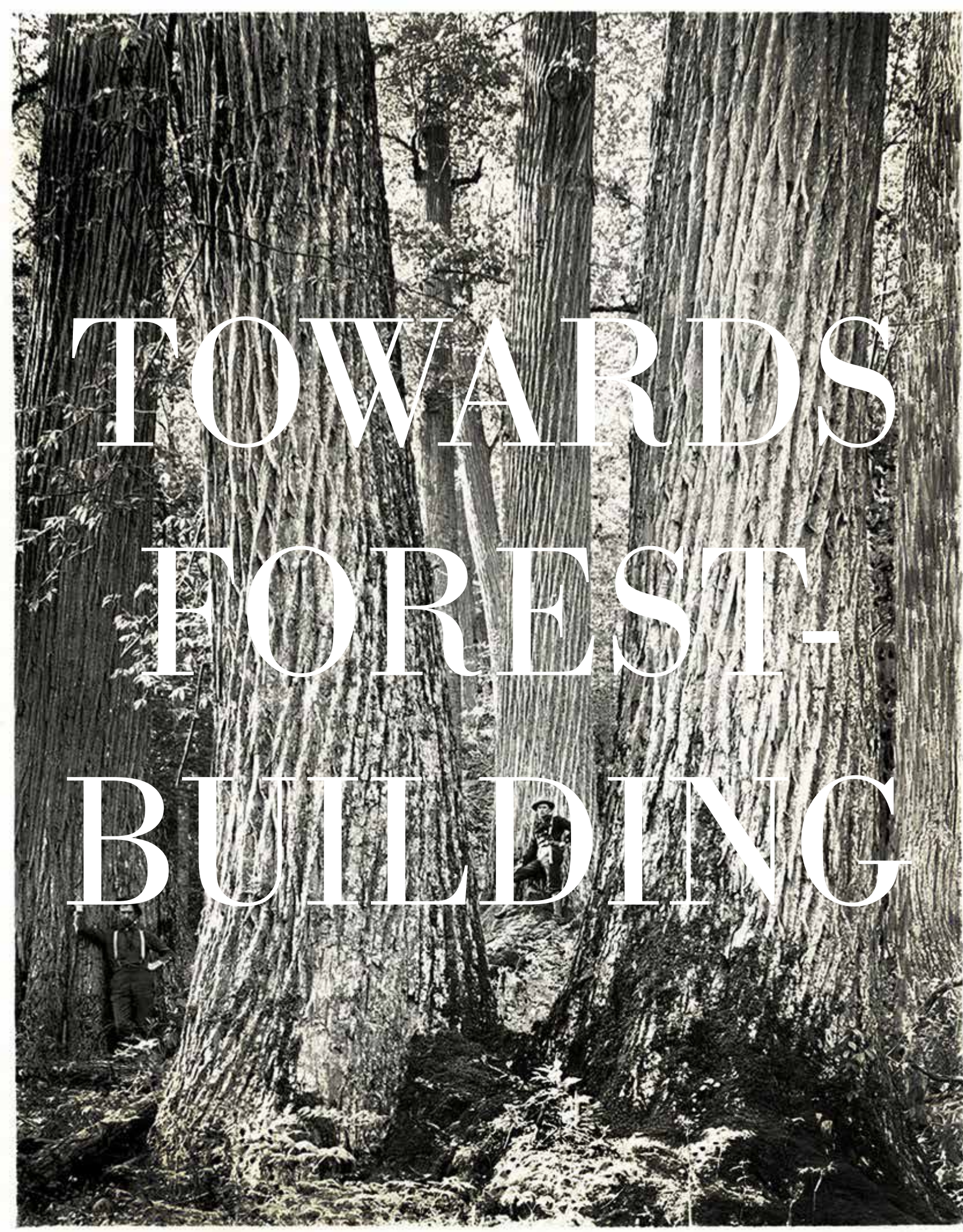
FOREST-BUILDING LAB



*Forest-Building 'Urpflanze (Plant Archetype)'
for a Future Wood Construction*

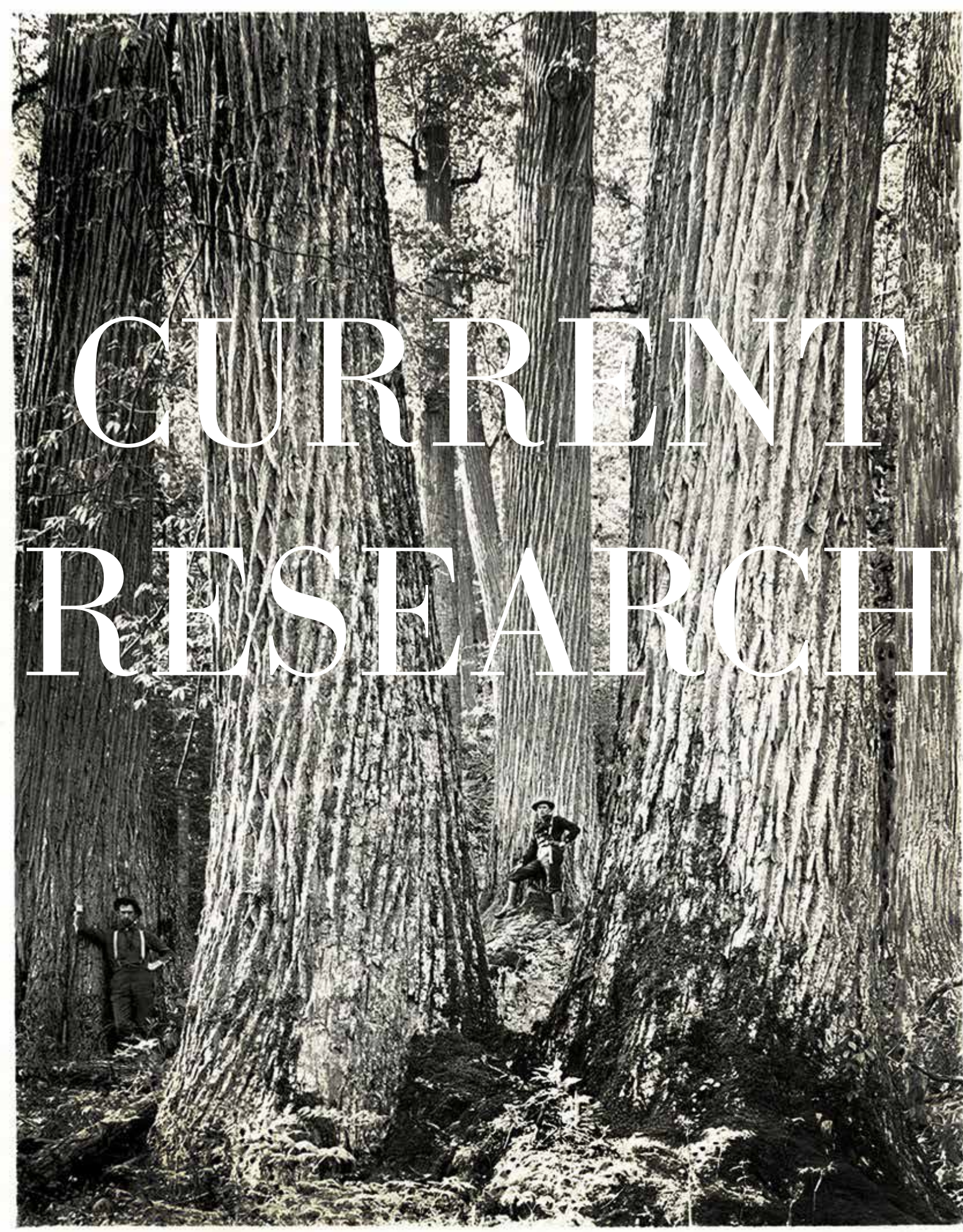
Mission:

Synchronize forests and buildings as a coupled, adaptive system that increases ecological resilience, diversifies timber economies, and expands land based carbon sinks through trait based design, adaptive wood products, and evidence based policy.



TOWARDS FOREST- BUILDING

- 1 Trait Translation:** How do we robustly translate ecological response traits into building traits/specs and vice versa at product, building, and regional scales?
- 2 Resilience Metrics in Practice:** How can SR/FD/FR and HRA/HRI/FBI be embedded in design, procurement, and manufacturing decisions?
- 3 Carbon—Whole System:** How do adaptive construction approaches change land based carbon pools under realistic climate & management scenarios?
- 4 Standards & Markets:** What standards, policy levers, and business models enable mixed species and underutilized species adoption without compromising safety or economics?
- 5 Equity & Stewardship:** How do Forest Building decisions affect Indigenous rights, rural livelihoods, and biodiversity—and how do we design for co benefits?



CURRENT RESEARCH

Data & Models: Forest Building Observatory

Integrate LANDIS II (or equivalent) with ANSE/CBM HW to deliver regional forecasts of harvest outputs, construction suitability, and land-based forest-building carbon pools.

Materials & Manufacturing: Trait to Product Mill

Develop mixed species and underutilized species products (CLT/LVL/OSB/Glulam/TF components), with standardized building trait tests (strength, shrinkage, bonding, durability, fire).

Prototypes & Living Labs: Adaptive Buildings in Regions

Co design harvested wood product and building pilots with forest managers and mills; monitor performance, reuse pathways, and carbon over time.

Standards, Policy & Markets: From Insight to Adoption

Develop trait based specification methods, contribute to CSA/NBCC pathways, create procurement toolkits for adaptive, region fit wood construction.

WP1—Global Building Trait Library (GBTL) establishes the foundational data infrastructure: an open dataset of building traits for 150–250 species—including common and underutilized resources—cross-walked to ecological traits.

WP2—Forest Building Coupled Simulator (FBCS) integrates forest dynamics, harvested wood product flows, dynamic LCA, and resilience metrics (e.g., Functional Diversity/Redundancy, Harvest Resource Availability, Forest Building Integration) into a user facing toolkit. The simulator stress tests policies and procurement choices with uncertainty bands and scenario discovery.

WP3—Adaptive Product Development (APD) translates trait insights into engineered timber systems—mixed species CLT, LVL, OSB, glulam, and hardwood forward timber frame components—defining variance aware design values, adhesive compatibility, durability, and fire envelopes to derisk certification.

WP4—Regional Living Labs (RLL) demonstrate three region fit building typologies per site—light frame all commercial groups, adaptive timber frame, and mixed species mass timber—codesigned with forest managers and mills. Instrumented prototypes generate longitudinal evidence on carbon pools, moisture, acoustics, thermal performance, and cost/schedule benchmarks.

WP5—Carbon Pools & Cascading Co Products maximizes land based carbon storage by channeling co products into long lived uses (e.g., fiber insulation, panel cores, millwork, furniture stock) and modeling reuse/recycling and landfill dynamics with end of life pathways integrated into regional scenarios.

WP6—Standards & Specification Pathways codifies trait to spec methods and resilience KPIs within CSA/NBCC and allied standards, advancing performance based routes for mixed species products and “design for substitution” in specifications and procurement.

WP7—Equity, Stewardship & Sustainable Forest Operations (SFO) co develops silviculture plus building prescriptions with Indigenous nations and rural communities, embedding rights based agreements, ergonomics and safety metrics, and social life cycle assessment to deliver distributional co benefits.

WP8—Education & Workforce (Forest Building Studio) builds shared literacy across architecture, forestry, ecology, and manufacturing through studios, micro credentials, and maker foundry modules (CNC, lamination, testing), alongside an open pattern language for adaptive assemblies.

WP9—Forest Building & Data Atlas publishes a public, versioned atlas that visualizes harvest forecasts, trait layers, suitability overlays, and FBI/HRI maps—linking WPs 1–5 to decision makers and facilitates region fit wood construction.

FOREST BUILDING ATLAS

PROJECT LOCATION

La Tuque, Quebec

SEARCH OBJECTIVE

- Final Product 2x8 Lumber
- Manufacturing Site

DISTANCE FROM PROJECT SITE



CLIMATE CHANGE SCENARIO

+1.5°C

FOREST MANAGEMENT

Functional Diversification

SPECIFIC SPECIES

Select tree species.

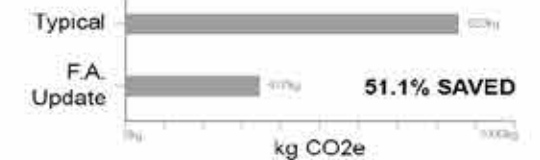
- | | |
|---|--|
| <input type="checkbox"/> Amabilis fir | <input type="checkbox"/> Red spruce |
| <input type="checkbox"/> Balsam fir | <input type="checkbox"/> Sitka spruce |
| <input type="checkbox"/> Subalpine fir | <input type="checkbox"/> Whitebark pine |
| <input type="checkbox"/> Bigleaf maple | <input type="checkbox"/> Jack pine |
| <input type="checkbox"/> Red maple | <input type="checkbox"/> L. eximius pine |
| <input type="checkbox"/> Sugar maple | <input type="checkbox"/> Ponderosa pine |
| <input type="checkbox"/> Gray alder | <input type="checkbox"/> Red pine |
| <input type="checkbox"/> Red alder | <input type="checkbox"/> Eastern white pine |
| <input type="checkbox"/> Yellow birch | <input type="checkbox"/> Balsam poplar |
| <input type="checkbox"/> White birch | <input type="checkbox"/> Largetooth aspen |
| <input type="checkbox"/> Yellow-cedar | <input type="checkbox"/> Trembling aspen |
| <input type="checkbox"/> Black ash | <input type="checkbox"/> Douglas-fir |
| <input type="checkbox"/> Tamarack | <input type="checkbox"/> Red oak |
| <input type="checkbox"/> Western larch | <input type="checkbox"/> Eastern white-cedar |
| <input type="checkbox"/> Norway spruce | <input type="checkbox"/> Western redcedar |
| <input type="checkbox"/> Engelmann spruce | <input type="checkbox"/> Eastern hemlock |
| <input type="checkbox"/> White spruce | <input type="checkbox"/> Western hemlock |
| <input type="checkbox"/> Black spruce | <input type="checkbox"/> Mountain hemlock |

SPECIES SUBSTITUTION

Filter desired traits.



CARBON SAVINGS



POTENTIAL MANUFACTURING SITE

Location:
47.925405371163194,
-72.78714172693657

Proximate tree species:

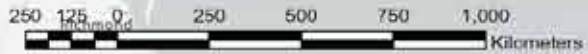
- Eastern white pine
- Jack pine
- Red maple
- Yellow birch

Potential Products:

- OSB
- Timber
- Wood Beam
- Plywood
- Lumber

MAP GEOGRAPHIC SCALE

- National: Canada
- Province: Ontario
- City: Ottawa



Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community

FOREST BUILDING ATLAS

PROJECT LOCATION

La Tuque, Quebec

SEARCH OBJECTIVE

- Final Product: 2x8 Lumber
- Manufacturing Site

DISTANCE FROM PROJECT SITE



CLIMATE CHANGE SCENARIO

+1.5°C

FOREST MANAGEMENT

Functional Diversification

CARBON SAVINGS

Tailored Species + Transportation



SPECIFIC SPECIES

Select tree species.

- | | |
|------------------|---------------------|
| Amabilis fir | Red spruce |
| Balsam fir | Sitka spruce |
| Subalpine fir | Whitebark pine |
| Bigleaf maple | Jack pine |
| Red maple | L. eximius pine |
| Sugar maple | Ponderosa pine |
| Gray alder | Red pine |
| Red alder | Eastern white pine |
| Yellow birch | Balsam poplar |
| White birch | Large-tooth aspen |
| Yellow-cedar | Trembling aspen |
| Black ash | Douglas-fir |
| Tamarack | Red oak |
| Western larch | Eastern white-cedar |
| Norway spruce | Western redcedar |
| Engelmann spruce | Eastern hemlock |
| White spruce | Western hemlock |
| Black spruce | Mountain hemlock |

SPECIES SUBSTITUTION

Filter desired traits.

- Workability: Excellent
- Stem Clarity: Good
- Paintability: Excellent
- Max Height: 20m
- Diameter @ Breast Height: 15cm
- Growth Rate: 1.5m/yr
- Compressive Strength: 45MPa
- Dimensional Stability: Good
- Density: 400kg/m³

POTENTIAL MANUFACTURING SITE

Location:
47.92540537 116.3194
-72.78714172693657

Proximate tree species:

- Eastern white pine
- Jack pine
- Red maple
- Yellow birch

Potential Products:

- OSB
- Timber
- Wood Beam
- Plywood
- Lumber

MAP GEOGRAPHIC SCALE

- National: Canada
- Province: Ontario
- City: Ottawa



Sources: Eri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community

FOREST BUILDING ATLAS

PROJECT LOCATION

La Tuque, Quebec

SEARCH OBJECTIVE

- Final Product: 2x6 Lumber
- Manufacturing Site

DISTANCE FROM PROJECT SITE



CLIMATE CHANGE SCENARIO

+1.5°C

FOREST MANAGEMENT

Functional Diversification

SPECIFIC SPECIES

Select tree species.

- | | |
|---|--|
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| <input type="checkbox"/> Balsam fir | <input type="checkbox"/> Sitka spruce |
| <input type="checkbox"/> Subalpine fir | <input type="checkbox"/> Whitebark pine |
| <input type="checkbox"/> Bigleaf maple | <input type="checkbox"/> Jack pine |
| <input type="checkbox"/> Red maple | <input type="checkbox"/> L. oxigripes pine |
| <input type="checkbox"/> Sugar maple | <input type="checkbox"/> Ponderosa pine |
| <input type="checkbox"/> Gray alder | <input type="checkbox"/> Red pine |
| <input type="checkbox"/> Red alder | <input type="checkbox"/> Eastern white pine |
| <input type="checkbox"/> Yellow birch | <input type="checkbox"/> Balsam poplar |
| <input type="checkbox"/> White birch | <input type="checkbox"/> Largetooth aspen |
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| <input type="checkbox"/> Black ash | <input type="checkbox"/> Douglas-fir |
| <input type="checkbox"/> Tamarack | <input type="checkbox"/> Red oak |
| <input type="checkbox"/> Western larch | <input type="checkbox"/> Eastern white-cedar |
| <input type="checkbox"/> Norway spruce | <input type="checkbox"/> Western redcedar |
| <input type="checkbox"/> Engelmann spruce | <input type="checkbox"/> Eastern hemlock |
| <input type="checkbox"/> White spruce | <input type="checkbox"/> Western hemlock |
| <input type="checkbox"/> Black spruce | <input type="checkbox"/> Mountain hemlock |

SPECIES SUBSTITUTION

Filter desired traits.

- Workability: [Slider]
- Stem Clarity: [Slider]
- Paintability: [Slider]
- Max Height: [Slider]
- Diameter @ Breast Height: [Slider]
- Growth Rate: [Slider]
- Compressive Strength: [Slider]
- Dimensional Stability: [Slider]
- Density: [Slider]

CARBON SAVINGS



POTENTIAL MANUFACTURING SITE

Location:
47.925405371163194,
-72.78714172693657

Proximate tree species:

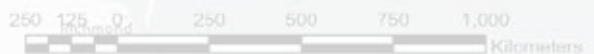
- Eastern white pine
- Jack pine
- Red maple
- Yellow birch

Potential Products:

- OSB
- Timber
- Wood Beam
- Plywood
- Lumber

MAP GEOGRAPHIC SCALE

- National: Canada
- Province: Ontario
- City: Ottawa



Sources: Enr, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community

FOREST BUILDING ATLAS

PROJECT LOCATION

La Tuque, Quebec

SEARCH OBJECTIVE

- Final Product: 2x6 Lumber
- Manufacturing Site

DISTANCE FROM PROJECT SITE



CLIMATE CHANGE SCENARIO

+1.5°C

FOREST MANAGEMENT

Functional Diversification

SPECIFIC SPECIES

Select tree species

- | | |
|------------------|---------------------|
| Amabilis fir | Red spruce |
| Balsam fir | Sitka spruce |
| Subalpine fir | Whitebark pine |
| Bigleaf maple | Jack pine |
| Red maple | Laricina pine |
| Sugar maple | Ponderosa pine |
| Gray alder | Red pine |
| Red alder | Eastern white pine |
| Yellow birch | Balsam poplar |
| White birch | Large-tooth aspen |
| Yellow-cedar | Trembling aspen |
| Black ash | Douglas-fir |
| Tamarack | Red oak |
| Western larch | Eastern white-cedar |
| Norway spruce | Western redcedar |
| Engelmann spruce | Eastern hemlock |
| White spruce | Western hemlock |
| Black spruce | Mountain hemlock |

SPECIES SUBSTITUTION

Filter desired traits



CARBON SAVINGS



POTENTIAL MANUFACTURING SITE

Location: 47.92540537 116.3194, -72.78714172693657

Proximate tree species:

- Eastern white pine
- Jack pine
- Red maple
- Yellow birch

Potential Products:

- OSB
- Timber
- Wood Beam
- Plywood
- Lumber

MAP GEOGRAPHIC SCALE

- National: Canada
- Province: Ontario
- City: Ottawa



Sources: Eri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community

FOREST BUILDING ATLAS

PROJECT LOCATION

La Tuque, Quebec

SEARCH OBJECTIVE

- Final Product: 2x6 Lumber
- Manufacturing Site

DISTANCE FROM PROJECT SITE



CLIMATE CHANGE SCENARIO

+1.5°C

FOREST MANAGEMENT

Functional Diversification

SPECIFIC SPECIES

Select tree species

- | | |
|------------------|---------------------|
| Amabilis fir | Red spruce |
| Balsam fir | Sitka spruce |
| Subalpine fir | Whitebark pine |
| Bigleaf maple | Jack pine |
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| Black ash | Douglas-fir |
| Tamarack | Red oak |
| Western larch | Eastern white-cedar |
| Norway spruce | Western redcedar |
| Engelmann spruce | Eastern hemlock |
| White spruce | Western hemlock |
| Black spruce | Mountain hemlock |

SPECIES SUBSTITUTION

Filter desired traits

- Workability: Excellent
- Stem Clarity: Excellent
- Paintability: Excellent
- Max Height: 20m
- Diameter @ Breast Height: 15cm
- Growth Rate: 1.5m/yr
- Compressive Strength: 45MPa
- Dimensional Stability: Excellent
- Density: 400kg/m³

CARBON SAVINGS

Tailored Species + Transportation



POTENTIAL MANUFACTURING SITE

Location:
47.925405371163194, -72.78714172693657

Proximate tree species:

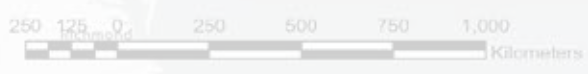
- Eastern white pine
- Jack pine
- Red maple
- Yellow birch

Potential Products:

- OSB
- Timber
- Wood Beam
- Plywood
- Lumber

MAP GEOGRAPHIC SCALE

- National: Canada
- Province: Ontario
- City: Ottawa



Sources: Eri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community

FOREST BUILDING ATLAS

PROJECT LOCATION

La Tuque, Quebec

SEARCH OBJECTIVE

- Final Product 2x6 Lumber
- Manufacturing Site

DISTANCE FROM PROJECT SITE



CLIMATE CHANGE SCENARIO

+1.5°C

FOREST MANAGEMENT

Functional Diversification

SPECIFIC SPECIES

Select tree species

- | | |
|---|--|
| <input type="checkbox"/> Amabilis fir | <input type="checkbox"/> Red spruce |
| <input type="checkbox"/> Balsam fir | <input type="checkbox"/> Sitka spruce |
| <input type="checkbox"/> Subalpine fir | <input type="checkbox"/> Whitebark pine |
| <input type="checkbox"/> Bigleaf maple | <input type="checkbox"/> Jack pine |
| <input type="checkbox"/> Red maple | <input type="checkbox"/> L. eximius pine |
| <input type="checkbox"/> Sugar maple | <input type="checkbox"/> Ponderosa pine |
| <input type="checkbox"/> Gray alder | <input type="checkbox"/> Red pine |
| <input type="checkbox"/> Red alder | <input type="checkbox"/> Eastern white pine |
| <input type="checkbox"/> Yellow birch | <input type="checkbox"/> Balsam poplar |
| <input type="checkbox"/> White birch | <input type="checkbox"/> Largetooth aspen |
| <input type="checkbox"/> Yellow-cedar | <input type="checkbox"/> Trembling aspen |
| <input type="checkbox"/> Black ash | <input type="checkbox"/> Douglas-fir |
| <input type="checkbox"/> Tamarack | <input type="checkbox"/> Red oak |
| <input type="checkbox"/> Western larch | <input type="checkbox"/> Eastern white-cedar |
| <input type="checkbox"/> Norway spruce | <input type="checkbox"/> Western redcedar |
| <input type="checkbox"/> Engelmann spruce | <input type="checkbox"/> Eastern hemlock |
| <input type="checkbox"/> White spruce | <input type="checkbox"/> Western hemlock |
| <input type="checkbox"/> Black spruce | <input type="checkbox"/> Mountain hemlock |

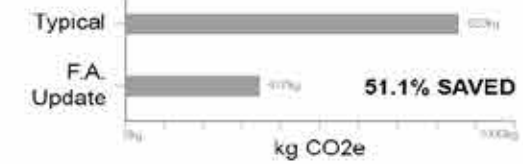
SPECIES SUBSTITUTION

Filter desired traits

- Workability** (0 - Excellent)
- Stem Clarity** (0 - Very Good / Good / Poor)
- Paintability** (0 - Poor / Average / Good)
- Max Height** (0 - 100m - 200m)
- Diameter @ Breast Height** (0 - 10cm - 20cm)
- Growth Rate** (0 - 1cm/yr - 3cm/yr)
- Compressive Strength** (0 - 10MPa - 20MPa)
- Dimensional Stability** (0 - 10% - 20%)
- Density** (0 - 100kg/m³ - 200kg/m³)

CARBON SAVINGS

Tailored Species + Transportation



POTENTIAL MANUFACTURING SITE

Location:
47.925405371163194,
-72.78714172693657

Proximate tree species:

- Eastern white pine
- Jack pine
- Red maple
- Yellow birch

Potential Products:

- OSB
- Timber
- Wood Beam
- Plywood
- Lumber

MAP GEOGRAPHIC SCALE

- National Canada
- Province Ontario
- City Ottawa



Sources: Eri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community

FOREST BUILDING ATLAS

PROJECT LOCATION

La Tuque, Quebec

SEARCH OBJECTIVE

- Final Product 2x8 Lumber
- Manufacturing Site

DISTANCE FROM PROJECT SITE



CLIMATE CHANGE SCENARIO

+1.5°C

FOREST MANAGEMENT

Functional Diversification

SPECIFIC SPECIES

Select tree species.

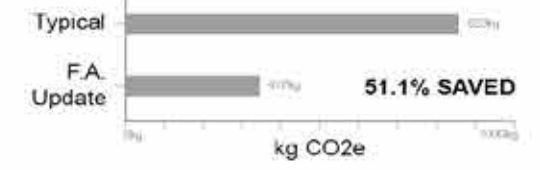
- | | |
|---|--|
| <input type="checkbox"/> Amabilis fir | <input type="checkbox"/> Red spruce |
| <input type="checkbox"/> Balsam fir | <input type="checkbox"/> Sitka spruce |
| <input type="checkbox"/> Subalpine fir | <input type="checkbox"/> Whitebark pine |
| <input type="checkbox"/> Bigleaf maple | <input type="checkbox"/> Jack pine |
| <input type="checkbox"/> Red maple | <input type="checkbox"/> L. eximius pine |
| <input type="checkbox"/> Sugar maple | <input type="checkbox"/> Ponderosa pine |
| <input type="checkbox"/> Gray alder | <input type="checkbox"/> Red pine |
| <input type="checkbox"/> Red alder | <input type="checkbox"/> Eastern white pine |
| <input type="checkbox"/> Yellow birch | <input type="checkbox"/> Balsam poplar |
| <input type="checkbox"/> White birch | <input type="checkbox"/> Largetooth aspen |
| <input type="checkbox"/> Yellow-cedar | <input type="checkbox"/> Trembling aspen |
| <input type="checkbox"/> Black ash | <input type="checkbox"/> Douglas-fir |
| <input type="checkbox"/> Tamarack | <input type="checkbox"/> Red oak |
| <input type="checkbox"/> Western larch | <input type="checkbox"/> Eastern white-cedar |
| <input type="checkbox"/> Norway spruce | <input type="checkbox"/> Western redcedar |
| <input type="checkbox"/> Engelmann spruce | <input type="checkbox"/> Eastern hemlock |
| <input type="checkbox"/> White spruce | <input type="checkbox"/> Western hemlock |
| <input type="checkbox"/> Black spruce | <input type="checkbox"/> Mountain hemlock |

SPECIES SUBSTITUTION

Filter desired traits.



CARBON SAVINGS



POTENTIAL MANUFACTURING SITE

Location:
47.925405371163194,
-72.78714172693657

Proximate tree species:

- Eastern white pine
- Jack pine
- Red maple
- Yellow birch

Potential Products:

- OSB
- Timber
- Wood Beam
- Plywood
- Lumber

MAP GEOGRAPHIC SCALE

- National: Canada
- Province: Ontario
- City: Ottawa



Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community

FOREST BUILDING ATLAS

PROJECT LOCATION

La Tuque, Quebec

SEARCH OBJECTIVE

- Final Product: 2x6 Lumber
- Manufacturing Site

DISTANCE FROM PROJECT SITE



CLIMATE CHANGE SCENARIO

+1.5°C

FOREST MANAGEMENT

Functional Diversification

SPECIFIC SPECIES

Select tree species.

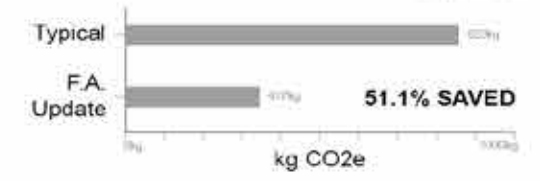
- | | |
|---|--|
| <input type="checkbox"/> Balsam fir | <input type="checkbox"/> Black spruce |
| <input type="checkbox"/> Fir (balsam) | <input type="checkbox"/> White spruce |
| <input type="checkbox"/> Spruce (white) | <input type="checkbox"/> Jack pine |
| <input type="checkbox"/> Spruce (black) | <input type="checkbox"/> Loblolly pine |
| <input type="checkbox"/> Spruce (red) | <input type="checkbox"/> Red pine |
| <input type="checkbox"/> Fir (white) | <input type="checkbox"/> Eastern white pine |
| <input type="checkbox"/> Fir (red) | <input type="checkbox"/> White pine |
| <input type="checkbox"/> Fir (yellow) | <input type="checkbox"/> Loblolly spruce |
| <input type="checkbox"/> Fir (black) | <input type="checkbox"/> Trembling aspen |
| <input type="checkbox"/> Fir (white) | <input type="checkbox"/> Sugar maple |
| <input type="checkbox"/> Fir (black) | <input type="checkbox"/> Black oak |
| <input type="checkbox"/> Fir (white) | <input type="checkbox"/> Eastern white-cedar |
| <input type="checkbox"/> Fir (black) | <input type="checkbox"/> Western red-cedar |
| <input type="checkbox"/> Fir (white) | <input type="checkbox"/> Eastern hemlock |
| <input type="checkbox"/> Fir (black) | <input type="checkbox"/> Western hemlock |
| <input type="checkbox"/> Fir (white) | <input type="checkbox"/> Sitka spruce |
| <input type="checkbox"/> Fir (black) | <input type="checkbox"/> Sitka spruce |

SPECIES SUBSTITUTION

Filter desired traits.

- Workability: 1 - POOR, 2 - FAIR, 3 - GOOD, 4 - EXCELLENT
- Stem Clarity: 1 - VERY KNOTTY, 2 - FEW KNOTS, 3 - FEW, 4 - MANY KNOTS
- Paintability: 1 - POOR ADHESION, 2 - FAIR, 3 - GOOD, 4 - EXCELLENT
- Max Height: 1 - SMALL (1-10m), 2 - MEDIUM (11-20m), 3 - TALL (21-30m)
- Diameter @ Breast Height: 1 - SMALL (10cm), 2 - MEDIUM (11-15cm), 3 - TALL (16-20cm)
- Growth Rate: 1 - SLOW, 2 - MEDIUM, 3 - FAST
- Compressive Strength: 1 - weak (10 MPa), 2 - MEDIUM (15-20 MPa), 3 - very strong (25 MPa)
- Dimensional Stability: 1 - very poor (more than 1%), 2 - average (less than 1%), 3 - excellent (very stable, less than 0.5%)
- Density: 1 - very light (400 kg/m³), 2 - MEDIUM (500-600 kg/m³), 3 - very heavy (700 kg/m³)

CARBON SAVINGS



PRODUCT PROFILE

Location: 47.925405371163194, -72.78714172893857

Useable tree species:

- Balsam fir
- Eastern white pine
- Eastern white-cedar
- Eastern hemlock

Building Group # 1

Desired Product:

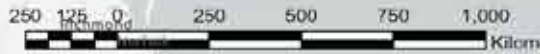
Lumber

Potential Product(s):

- OSB
- Timber
- Wood Beam
- Plywood

MAP GEOGRAPHIC SCALE

- National: Canada
- Province: Ontario
- City: Ottawa



Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community