

# CONSTRUCTING a TIMBER FUTURE for URBAN and RURAL SETTLEMENT

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FORESTRIES and FISHERIES  
TOKYO, JAPAN  
APRIL 24, 2023



ECONOMY



# TECHNIQUE



GOA CONSTRUCTING A TIMBER FUTURE FOR URBAN AND RURAL SETTLEMENTS. GARA/GRANSCH. MAP: TOWN © 24 APRIL 2023

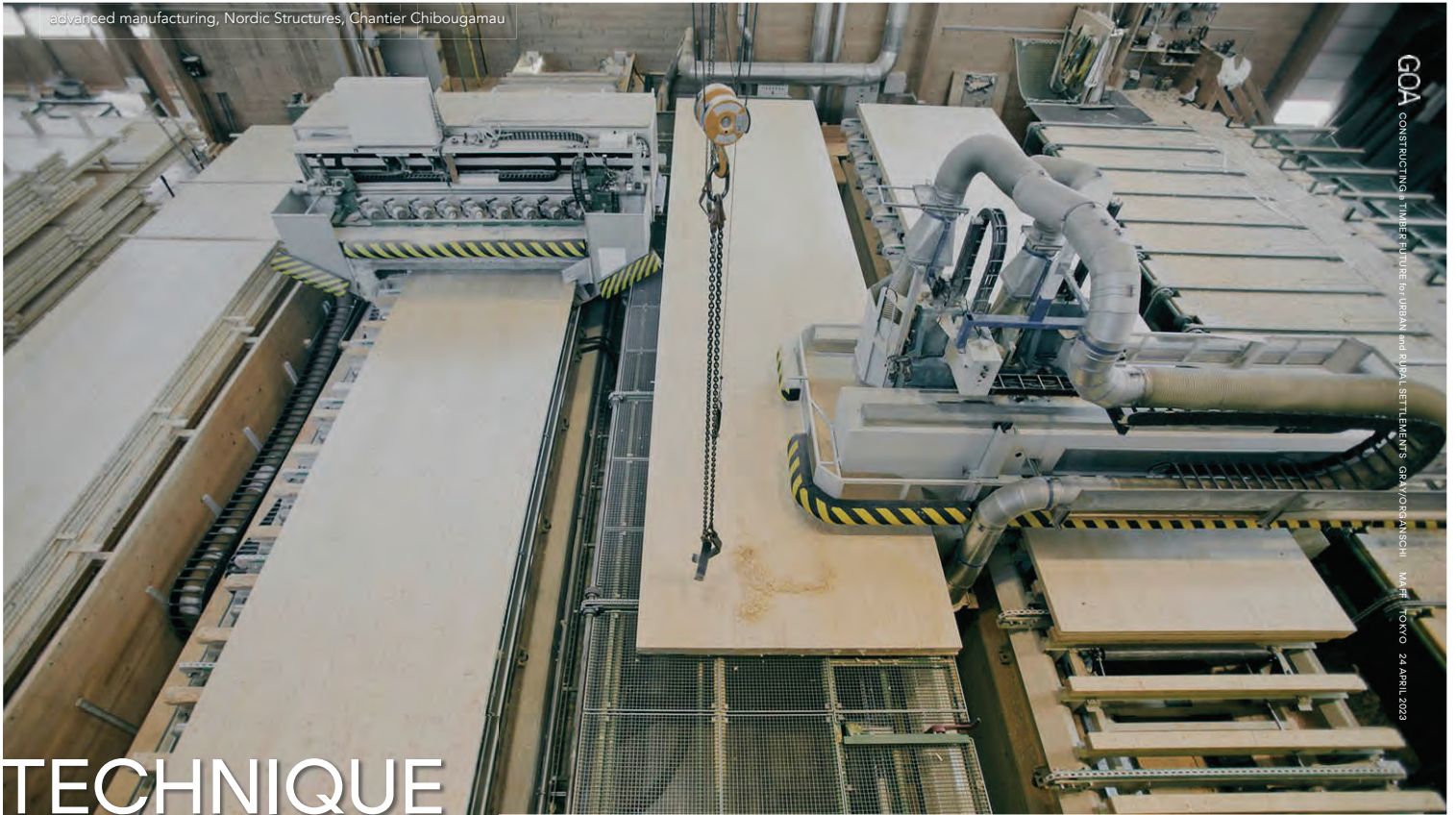


# MORPHOLOGY

GOA CONSTRUCTING A TIMBER FUTURE FOR URBAN AND RURAL SETTLEMENTS. GARA/GRANSCH. MAP: TOWN © 24 APRIL 2023



# ECONOMY



advanced manufacturing, Nordic Structures, Chantier Chibougamau

# TECHNIQUE



# TECHNIQUE

Mjøstårnet Tower, Brumunddal, Norway



# MORPHOLOGY?

# OUR GLOBAL (BUILDING) CHALLENGE

2,300,000,000

urban population growth by 2050

3

factor increase in land area

56,282

square miles of building footprint

97,000,000,000,000

construction value in dollars

40

% CO<sub>2e</sub> emissions by building sector

49

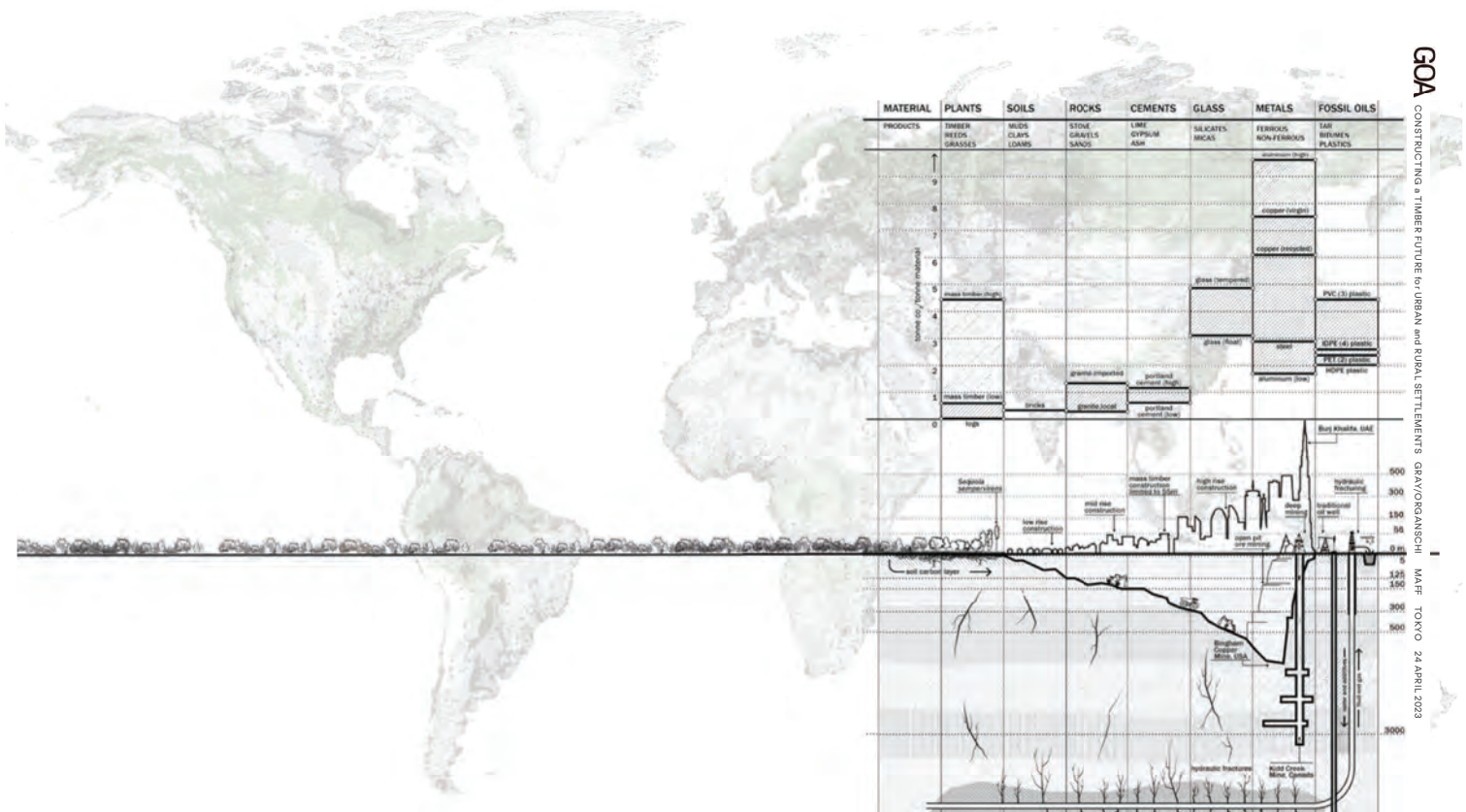
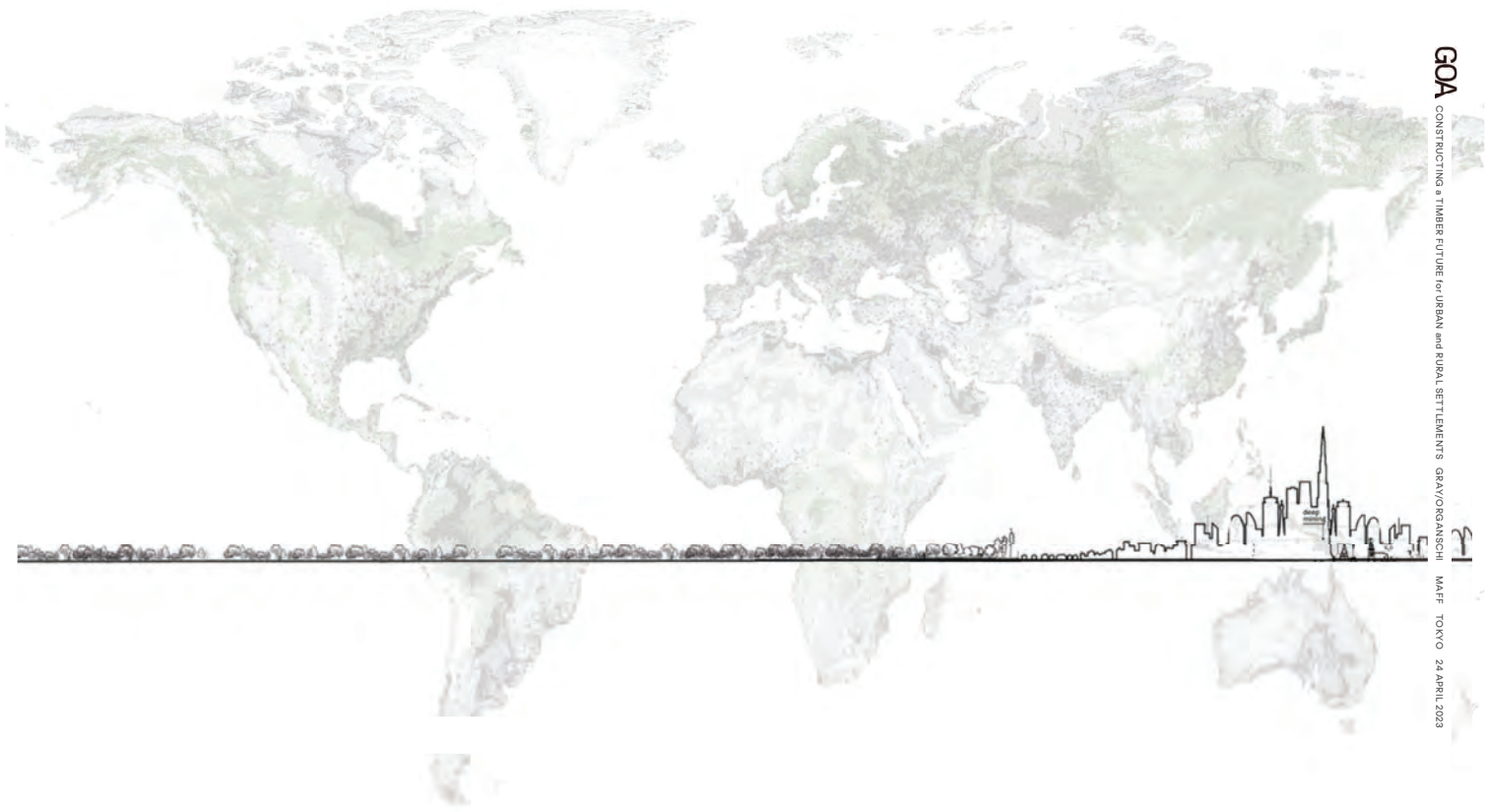
% sector emissions that are embodied at 2050

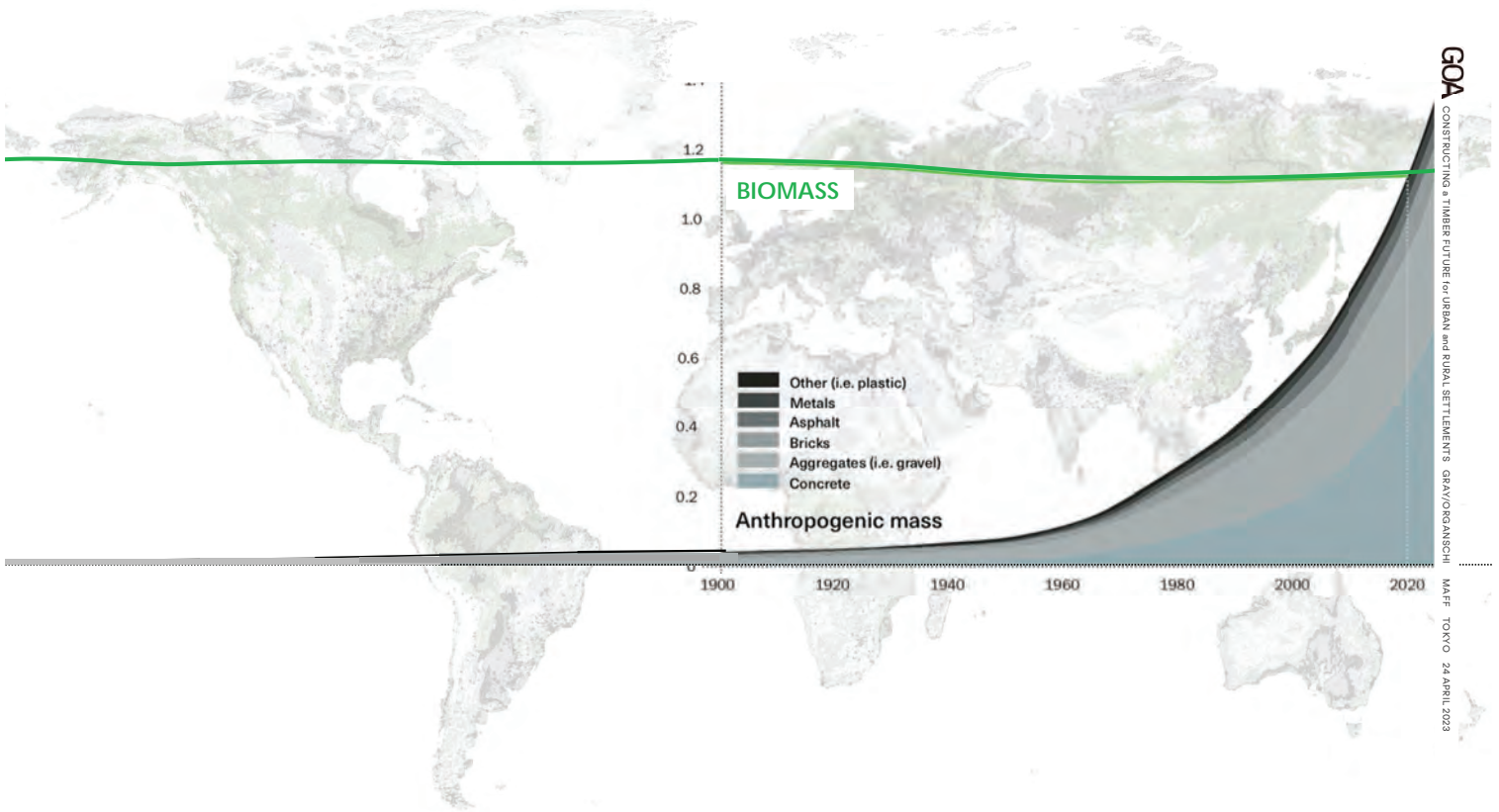
MINERAL SCENARIO +71,000,000,000

tons emitted by 2050 (mineral based scenario)

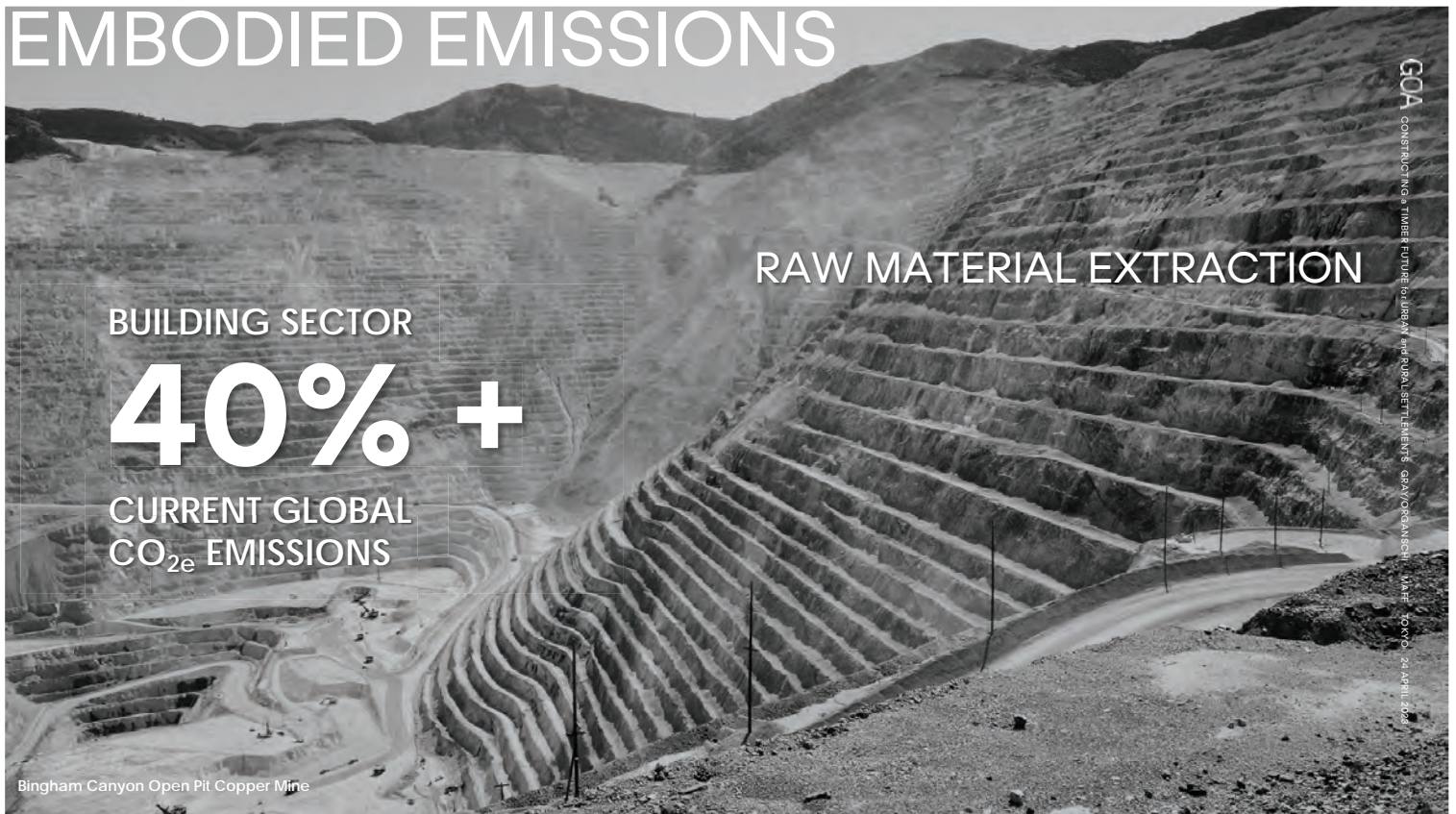
BIOMASS SCENARIO -48,400,000,000

tons emissions avoided, CO<sub>2</sub> sequestered, carbon stored





# EMBODIED EMISSIONS



# EMBODIED EMISSIONS

BUILDING SECTOR

**40% +**

CURRENT GLOBAL  
CO<sub>2e</sub> EMISSIONS

RAW MATERIAL EXTRACTION  
MATERIAL HANDLING AND TRANSPORT

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# EMBODIED EMISSIONS

BUILDING SECTOR

**40% +**

CURRENT GLOBAL  
CO<sub>2e</sub> EMISSIONS

RAW MATERIAL EXTRACTION  
MATERIAL HANDLING AND TRANSPORT  
PROCESSING AND MANUFACTURE

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Charging an Open Hearth Furnace in a Steel Mill  
David Plowden, 1979



# EMBODIED EMISSIONS

BUILDING SECTOR

**40% +**

CURRENT GLOBAL  
CO<sub>2e</sub> EMISSIONS

RAW MATERIAL EXTRACTION  
MATERIAL HANDLING AND TRANSPORT  
PROCESSING AND MANUFACTURE  
CONSTRUCTION MAINTANENCE REPAIR

# EMBODIED EMISSIONS

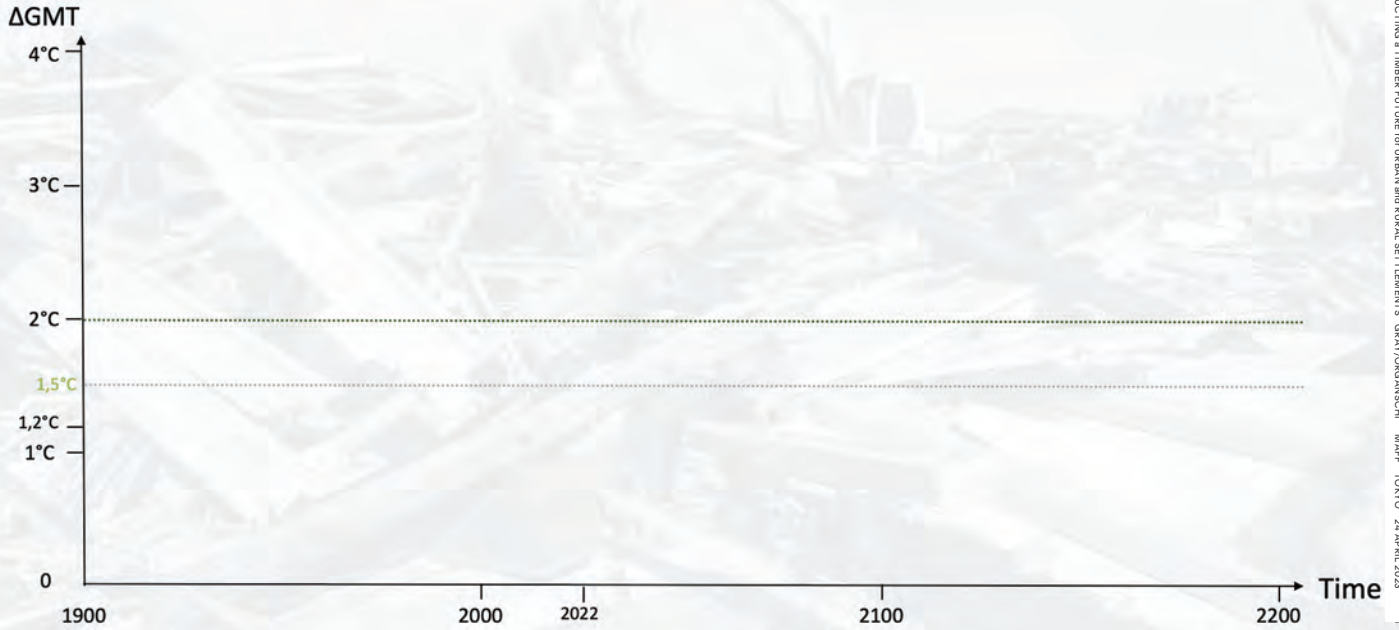
BUILDING SECTOR

**40% +**

CURRENT GLOBAL  
CO<sub>2e</sub> EMISSIONS

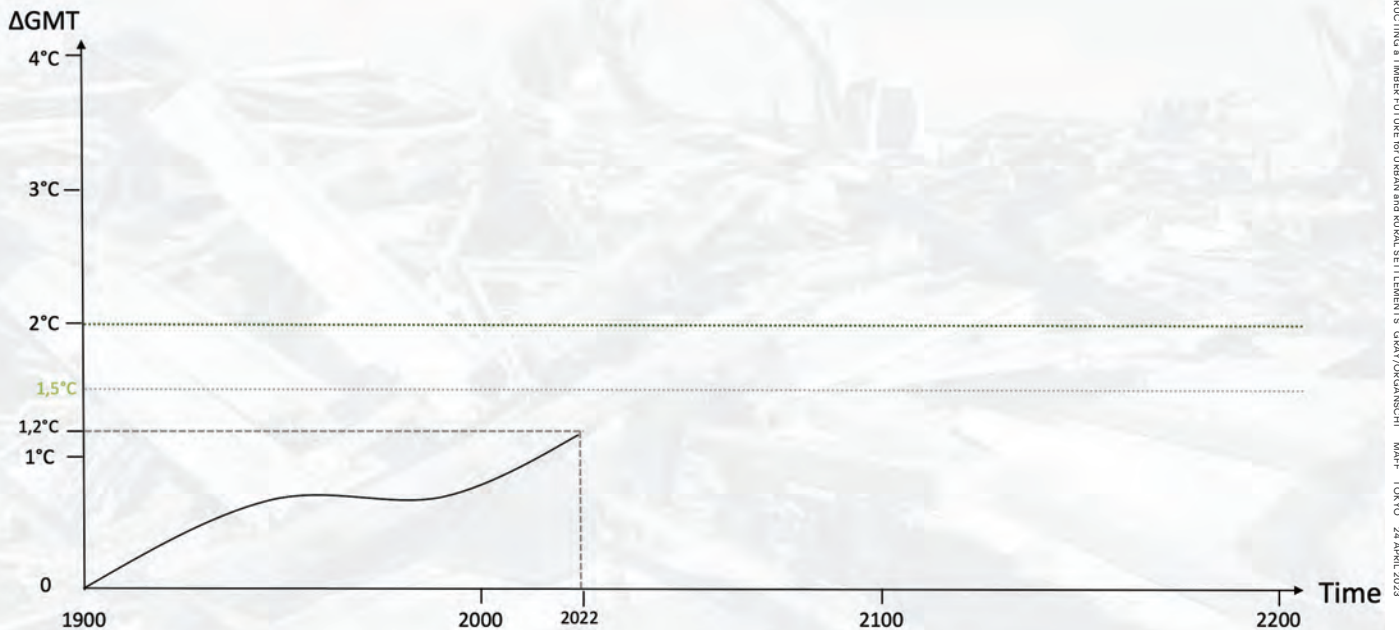
RAW MATERIAL EXTRACTION  
MATERIAL HANDLING AND TRANSPORT  
PROCESSING AND MANUFACTURE  
CONSTRUCTION MAINTANENCE REPAIR  
DEMOLITION AND DISPOSAL

# CLIMATE STRATEGY



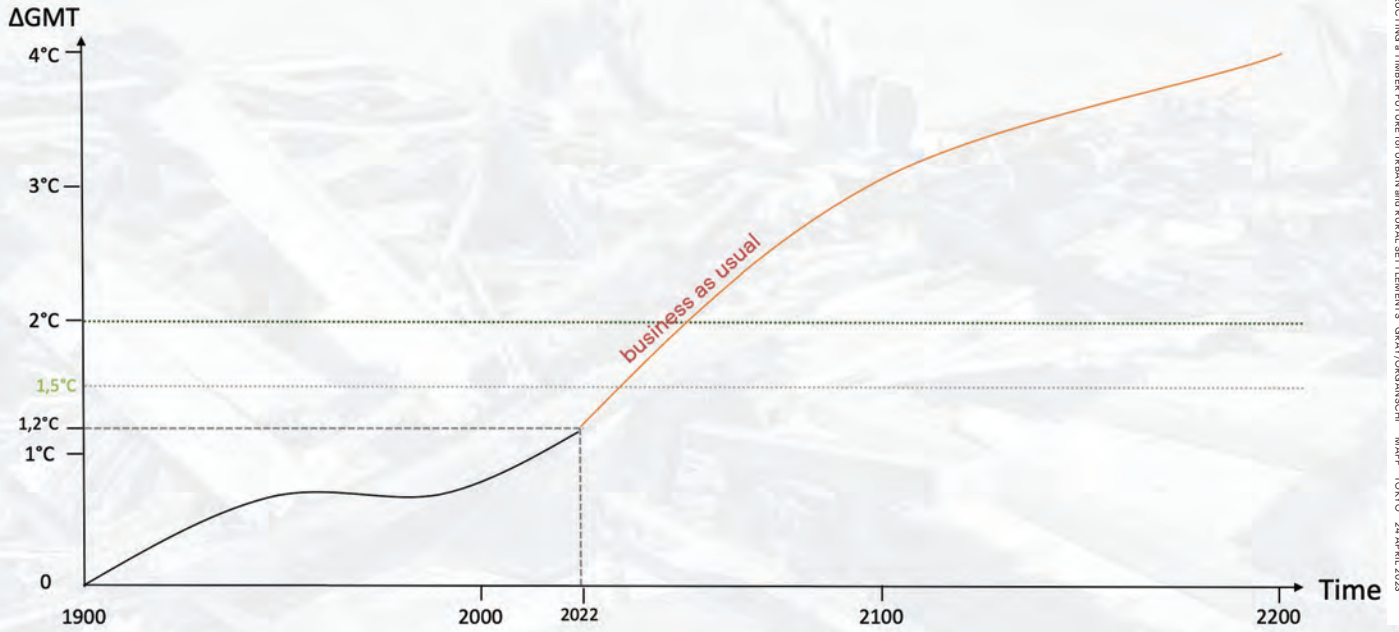
Schellnhuber & Köllner 2022 (unpublished)

# CLIMATE STRATEGY



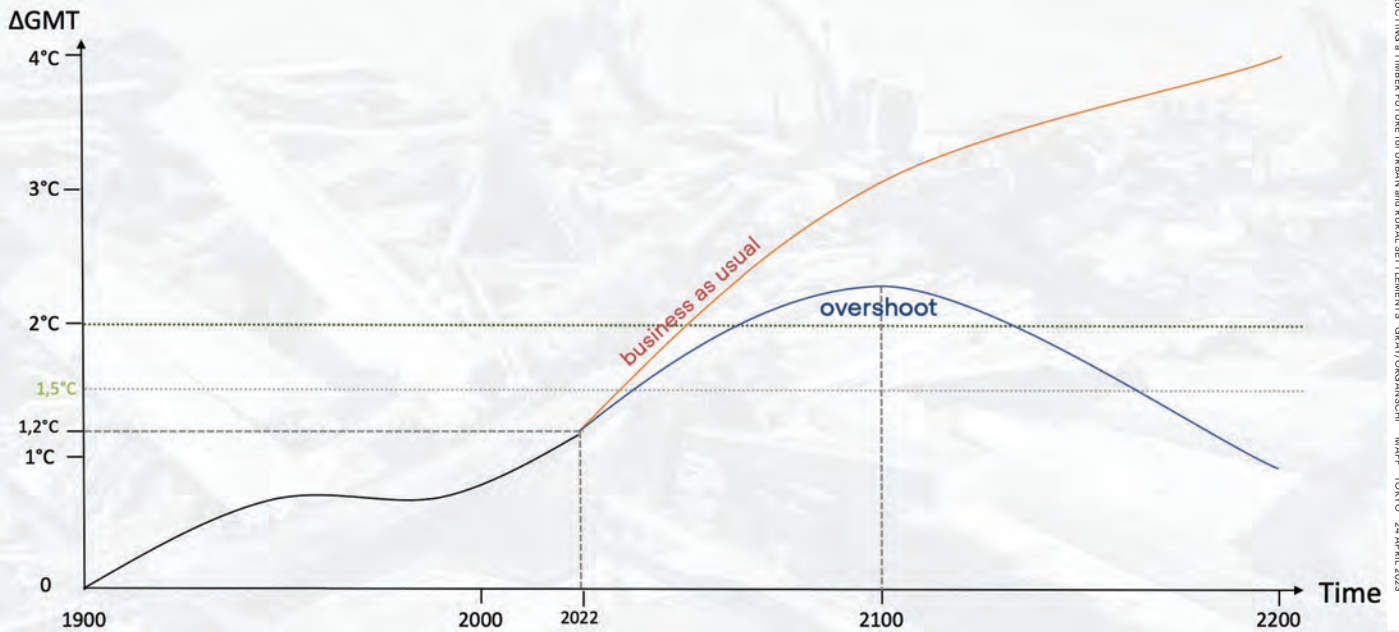
Schellnhuber & Köllner 2022 (unpublished)

# CLIMATE STRATEGY



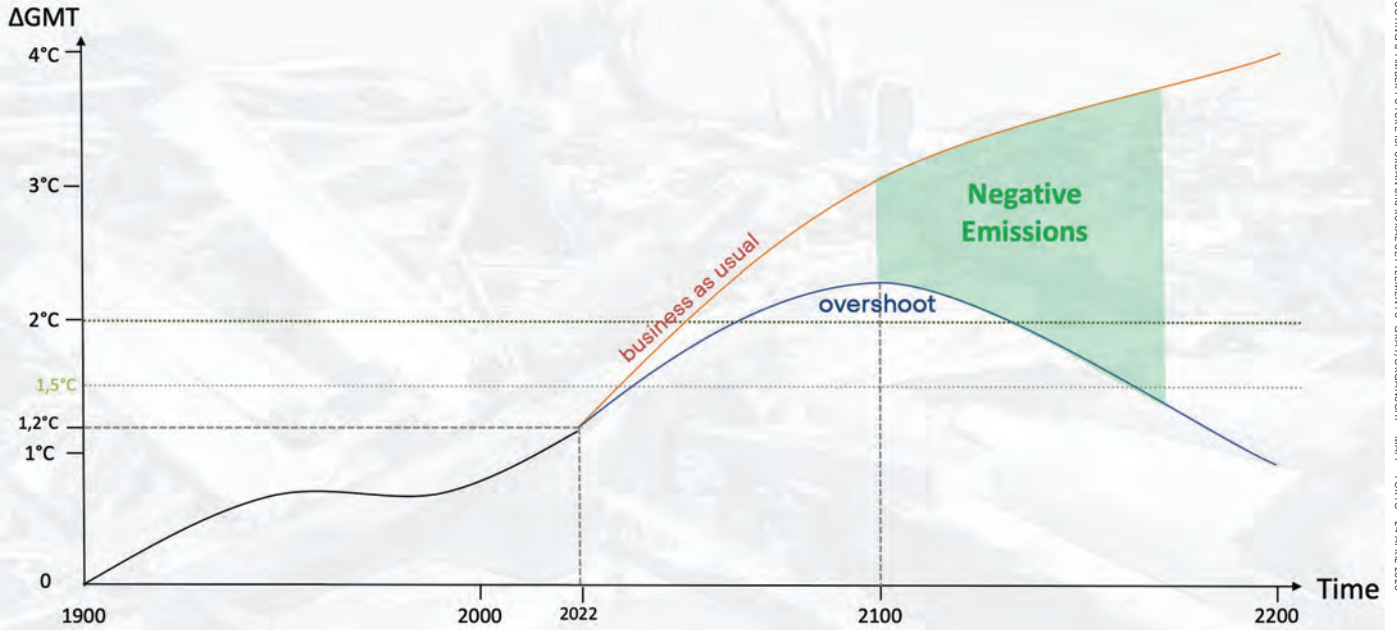
Schellnhuber & Köllner 2022 (unpublished)

# CLIMATE STRATEGY

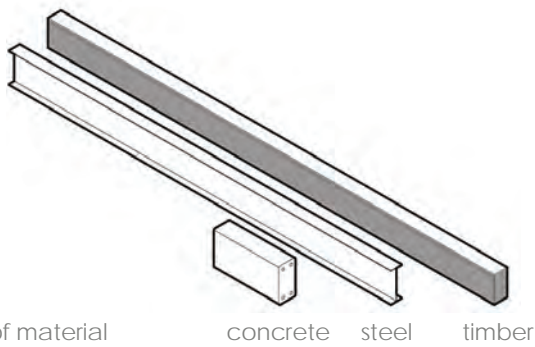


Schellnhuber & Köllner 2022 (unpublished)

# CLIMATE STRATEGY



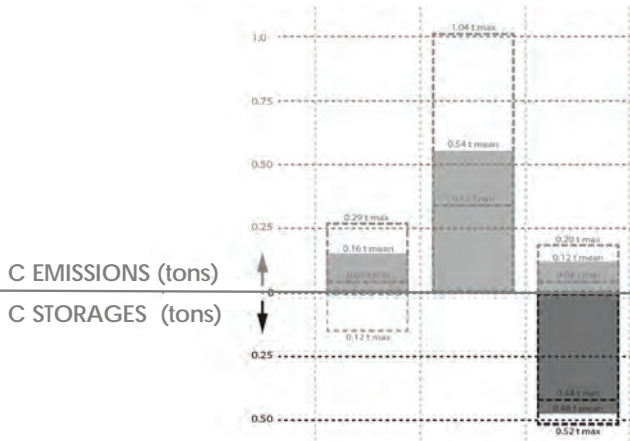
Schellnhuber & Köllner 2022 (unpublished)



1 ton of material

concrete steel timber

1 mT timber stores 1.5 mT CO<sub>2</sub>



comparative emissions by weight  
carbon storage by weight

# GEO-TECHNOLOGY?



Brock Commons  
Fast + Epp, Acton Ostry

metabolic  
circular  
regenerative

# GEO-TECHNOLOGY?



metabolic  
circular  
regenerative

Construction vehicle bridge, 1997  
Gray Organschi Architecture/UNALAM

# OUR PRACTICE

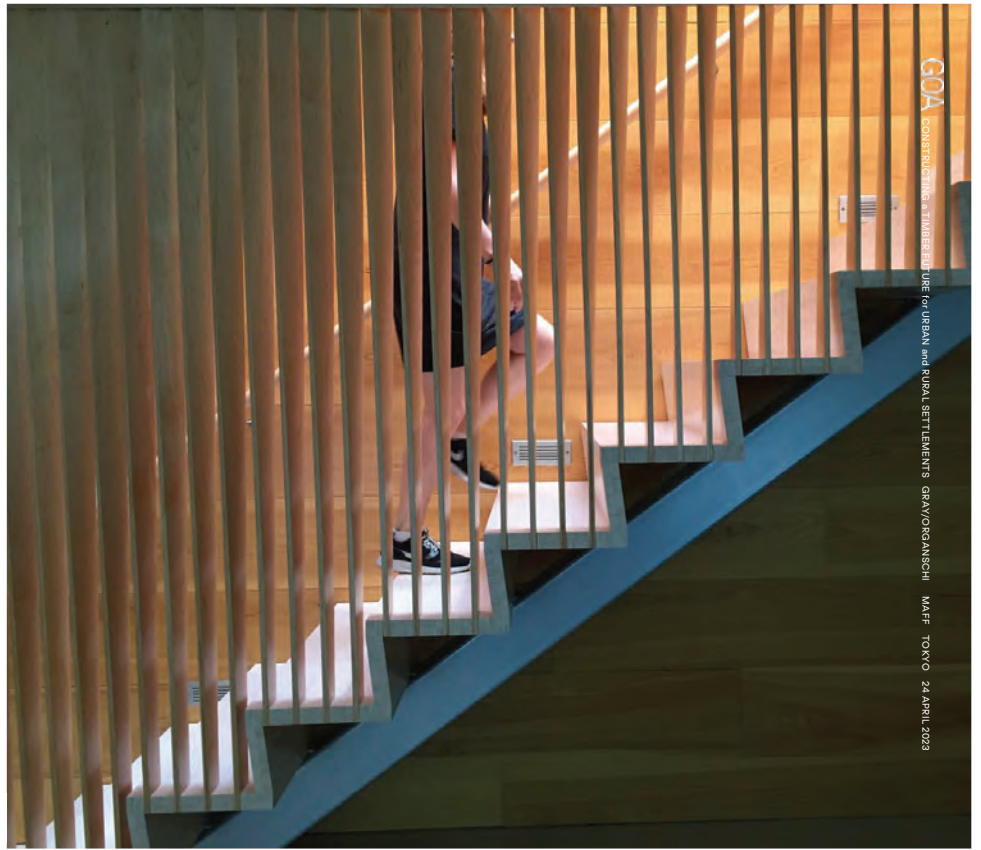
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TOKYO  
24 APRIL 2023



Laminated maple stairguard, Quarry House  
Gray Organschi Architecture/JIGdesignbuild

## Quarry House

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Bentwood maple screen  
Gray Organschi Architecture/JIGdesignbuild



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Quarry House, Gray Organschi Architecture/JIGdesignbuild



# Nauset Beach House

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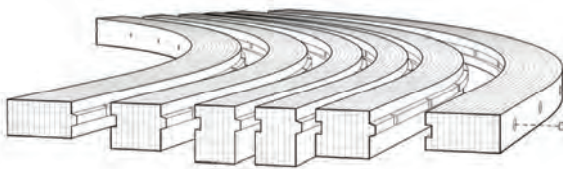
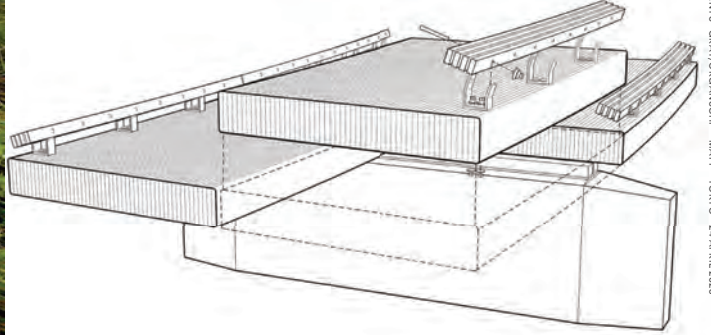




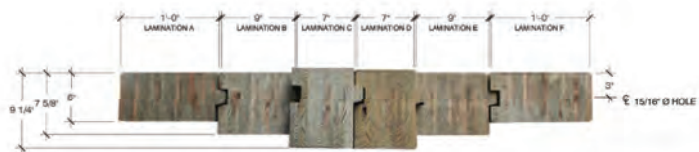
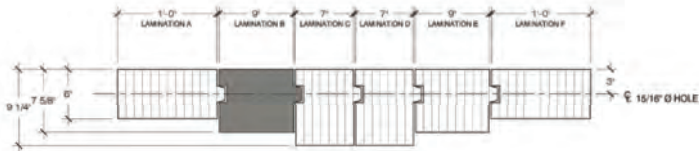
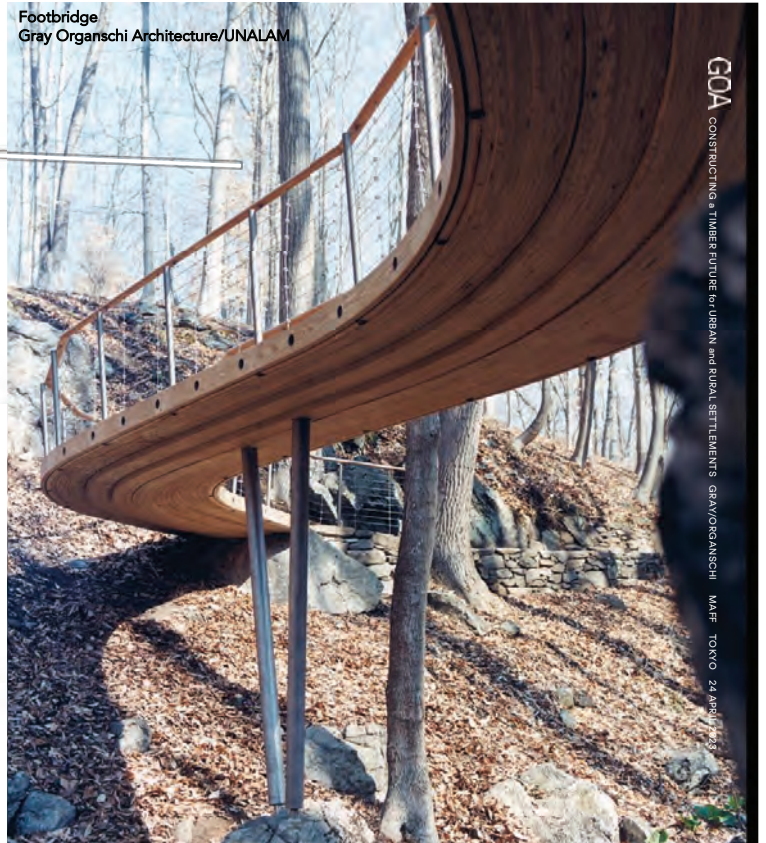


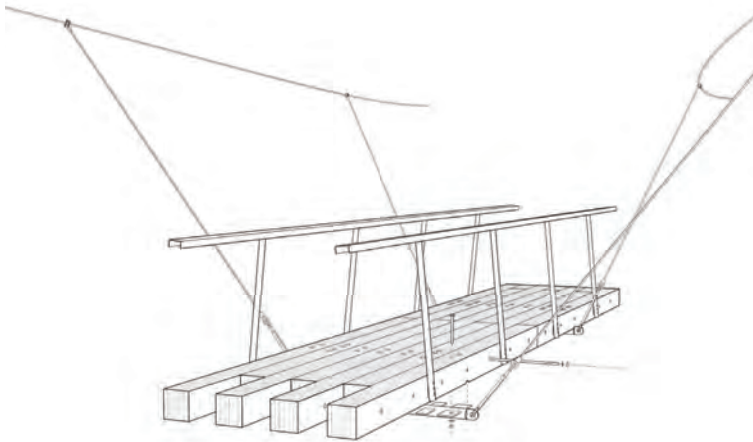
Construction vehicle bridge, curb rail terminus  
Gray Organschi Architecture/UNALAM

## 4 mass timber bridges



Footbridge  
Gray Organschi Architecture/UNALAM





Thoreau Footbridge  
Gray Organschi Architecture/UNALAM/JIG Design Build

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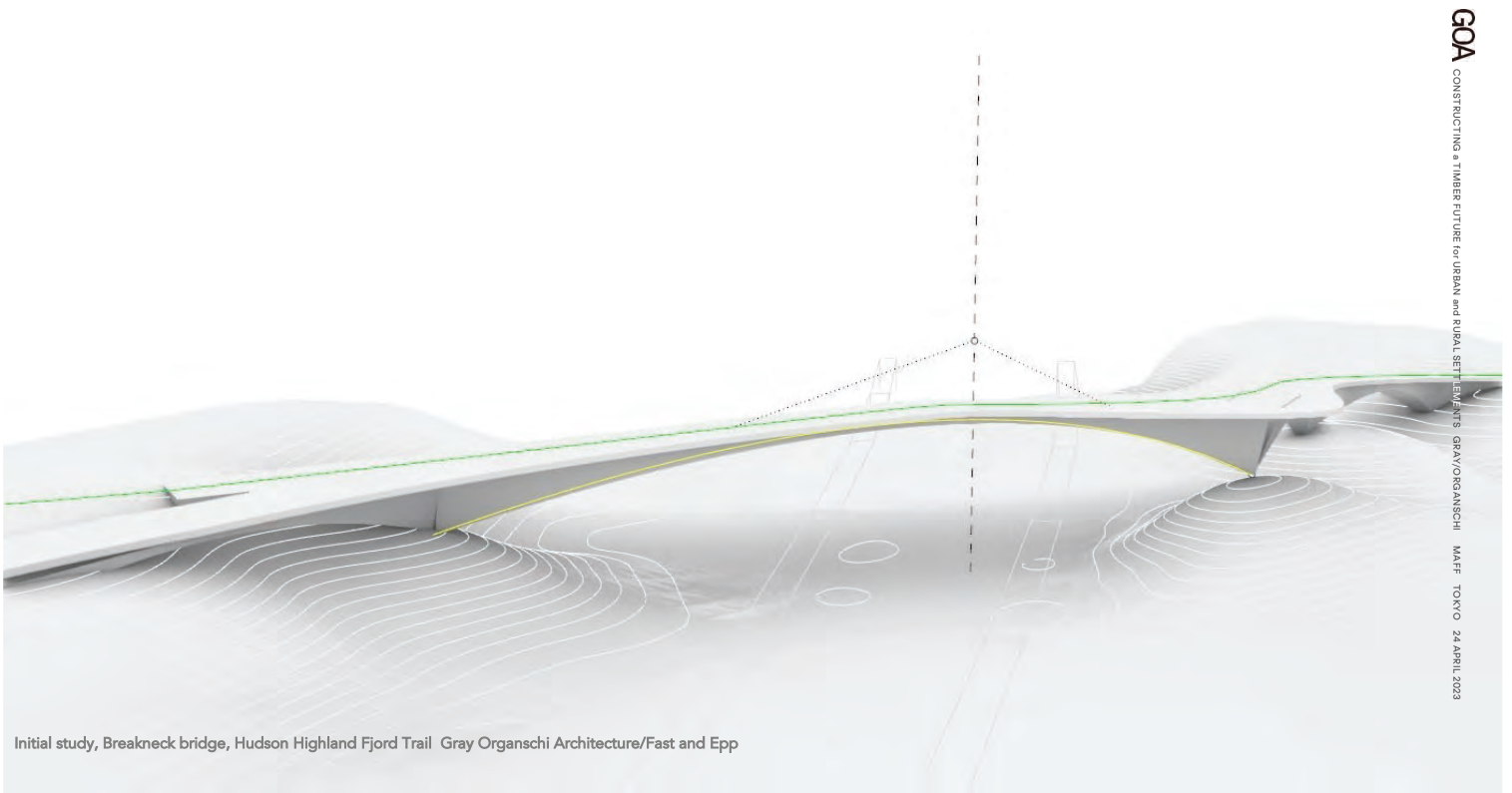
Thoreau Footbridge  
Gray Organschi Architecture/UNALAM/JIG Design Build



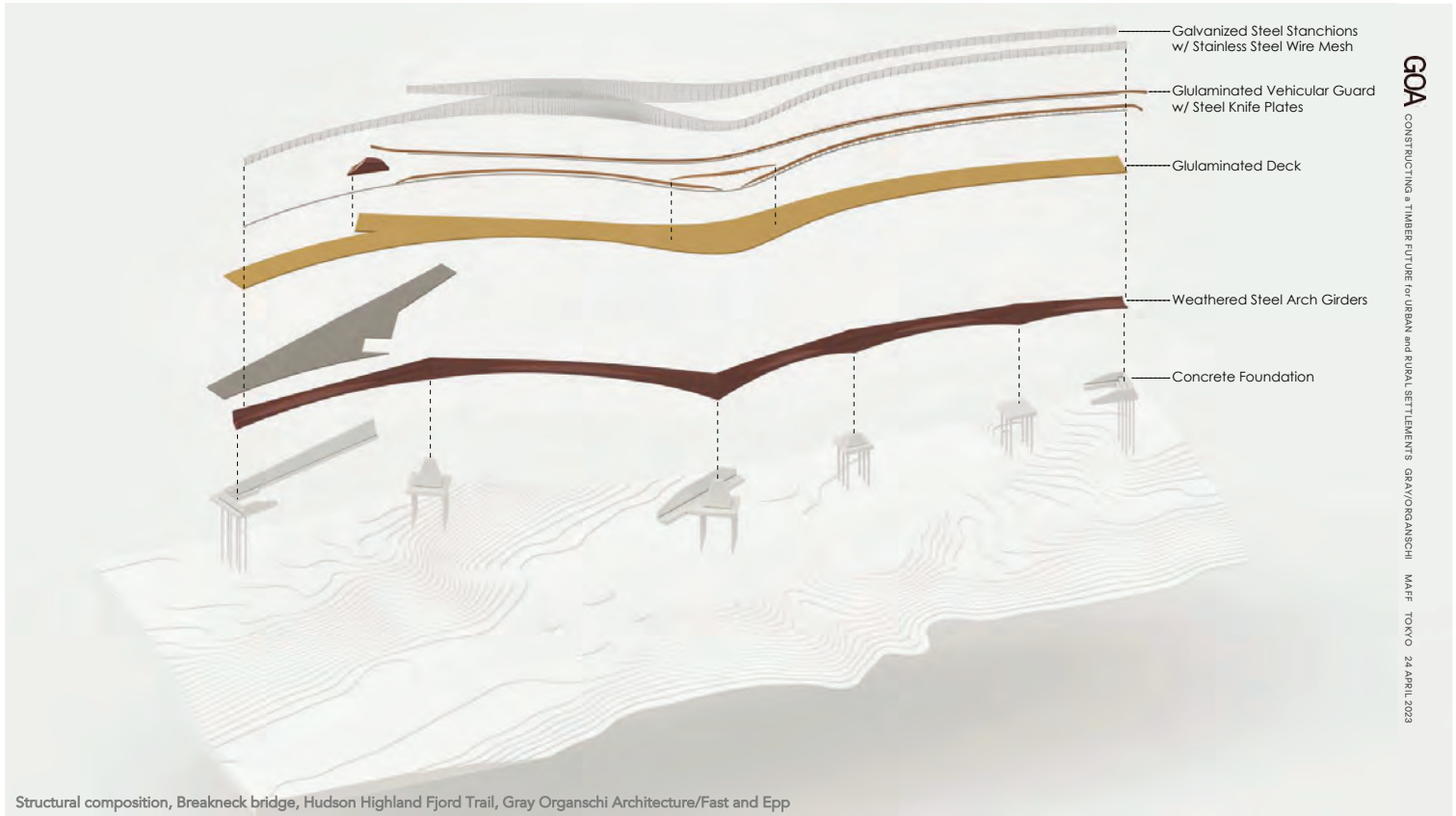
GOA CONSULTING INC. A TIMBER FUTURE FOR URBAN AND RURAL SETTLEMENTS GRAY ORGANSCHI MAFF TOKYO 24 APRIL 2023



Thoreau Footbridge  
Gray Organschi Architecture/UNALAM/JIG Design Build



Initial study, Breakneck bridge, Hudson Highland Fjord Trail Gray Organschi Architecture/Fast and Epp





# Joseph Verdino Grandstand

Glue-lamination of structural bents, South Shore Little League  
Gray Organschi Architecture

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South Shore Little League  
Gray Organschi Architecture

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South Shore Little League  
Gray Organschi Architecture

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Cupola, Mill River Carousel Building- Under construction  
Gray Organschi Architecture/Structure Fusion

# Mill River Carousel Pavilion

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Mill River Carousel Pavilion  
Gray Organschi Architecture/Structure Fusion



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# Anthony Timberlands Center

Anthony Timberlands Center, University of Arkansas, competition  
WTGO design consortium

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# Common Ground School

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Common Ground High School  
Gray Organschi Architecture/Bensonwood



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Common Ground High School  
Gray Organschi Architecture/Bensonwood





Common Ground High School, Gray Organschi Architecture, Bensonwood



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Common Ground High School  
Gray Organschi Architecture, Bensonwood

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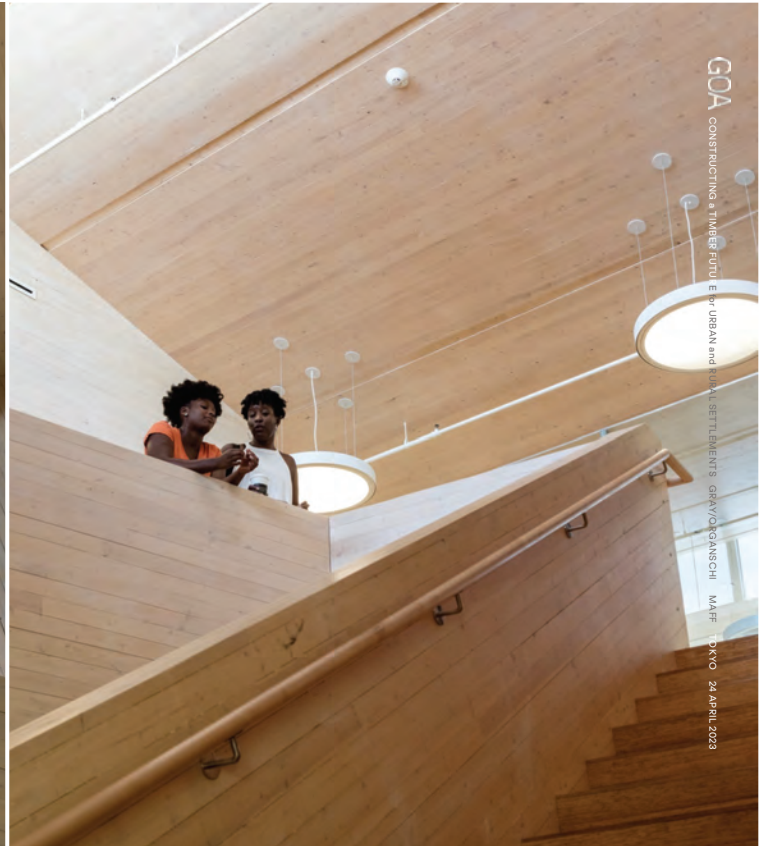
Common Ground High School, Gray Organschi Architecture, Bensonwood



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CLT Stair Hall and Core, Common Ground High School, Gray Organschi Architecture/Bensonwood



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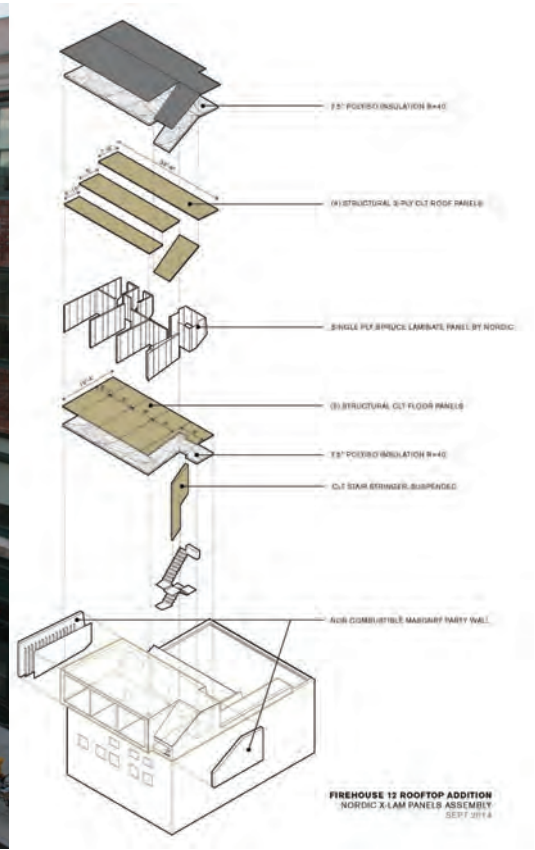
Common Ground High School,  
Gray Organschi Architecture/Bensonwood



## Musicians' Hostel Firehouse 12



Musicians' Hostel, Firehouse 12  
Gray Organschi Architecture/JIG Design Build



glulam stair structure, Musicians hostel, Firehouse 12  
Gray Organschi Architecture/JIG Design Build



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Musicians' Hostel, Firehouse 12  
Gray Organschi Architecture/JIG Design Build



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Musicians' Dormitory, Firehouse 12  
Gray Organschi Architecture/JIG Design Build

# Acme Lofts

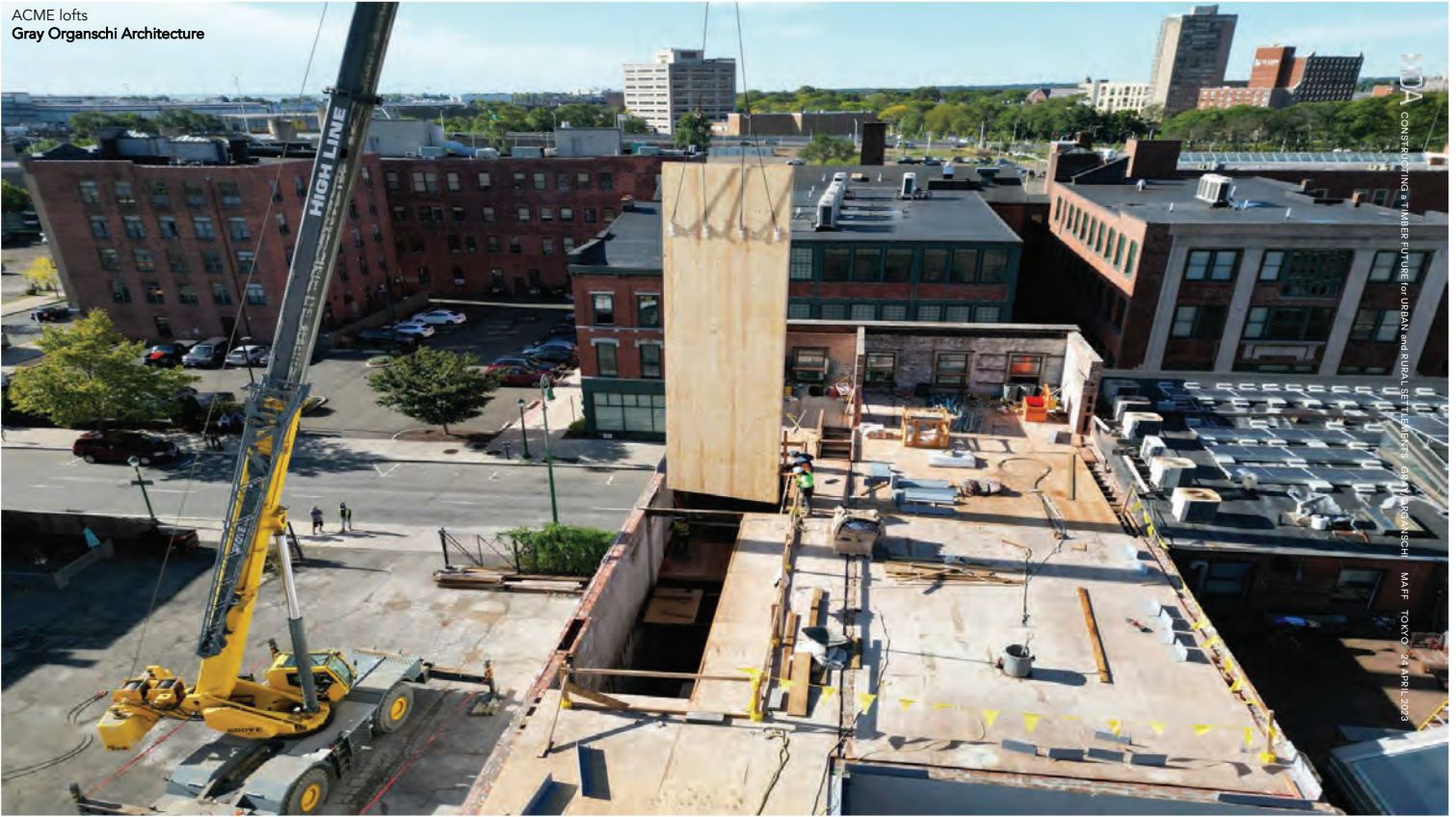


ACME lofts  
Gray Organschi Architecture



ACME lofts  
Gray Organschi Architecture

ACME lofts  
Gray Organschi Architecture



COA CONSTRUCTING A TIMBER-FUTURE OF URBAN AND RURAL SETTLEMENTS GRAY ORGANSCHI MAFF TOKYO 24 APRIL 2023

ACME Lofts, unreinforced masonry retrofit with CLT overbuild, Gray Organschi Architecture



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ACME lofts, Gray Organschi Architecture



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## North Greeley Avenue

North Greeley Avenue  
Chappaqua, NY  
Gray Organschi Architecture



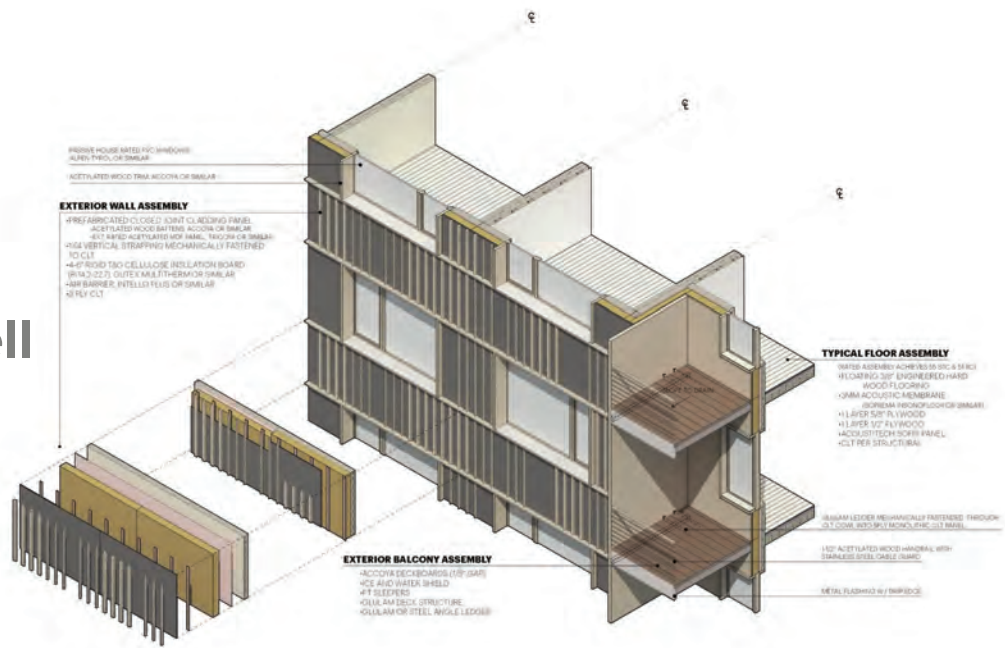
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# 340+ Dixwell





340+ Dixwell  
Gray Organschi Architecture/SSA

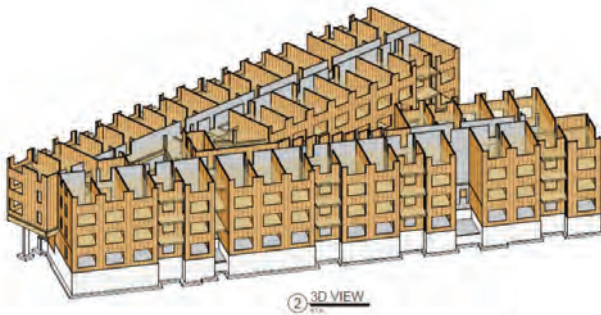
**Figure 7. Cost comparison – mass timber and light frame multifamily**

**340+ DIXWELL  
MASS TIMBER VS LIGHT FRAME COST COMPARISON**

NOTE - GENERAL CONTRACTOR ADD ONS - GC, INSURANCE, BOND, FEE ARE REFLECTED PROPORTIONATELY  
NOTE - COST DIFFERENCES IN THE 0% PERCENTAGE COLUMN ARE DUE TO ROUNDING

BUILDING GROSS SF 86,807

CATEGORY	MASS TIMBER (MT) (\$)	LIGHT FRAME (LF) (\$)	MT PERCENTAGE OF LF (%)
GENERAL REQUIREMENTS	678,927	720,541	-5.78%
SITWORK	885,870	894,752	0%
FOUNDATION	627,196	633,450	0%
MASONRY	124,375	401,891	-69.05%
METALS	380,692	599,767	-36.53%
WOOD STRUCTURE & PLASTICS	4,592,849	2,384,866	92.58%
THERMAL & MOSITURE	2,390,586	2,108,925	0%
DOORS & WINDOWS	983,251	993,056	0%
FINISHES	1,370,747	1,861,678	73.63%
SPECIALTIES	78,395	79,180	0%
EQUIPMENT	237,577	239,948	0%
FURNISHINGS	308,454	311,529	0%
CONVEYING SYSTEMS	502,332	507,341	0%
FIRE PROTECTION	467,385	472,045	0%
PLUMBING	1,037,884	1,048,232	0%
HVAC	1,546,477	1,561,897	0%
ELECTRICAL	1,631,961	1,648,233	0%
<b>SUBTOTAL</b>	<b>17,844,958</b>	<b>16,467,331</b>	<b>108.37%</b>
CONSTRUCTION PERIOD INTEREST (2 MO)	-80,000		-80,000
NET RENT COLLECTION (2 MO)	-20,000		-20,000
<b>SUBTOTAL COST OFFSET</b>	<b>-100,000</b>		<b>-100,000</b>
TOTAL COST WITH OFFSET	17,744,958		
<b>COST/SF</b>	<b>205.57</b>	<b>189.70</b>	<b>15.87</b>
OFFSETTING NET REVENUE	-1.15		-1.15
<b>TOTAL COST/SF</b>	<b>204.42</b>	<b>189.70</b>	<b>14.72</b>



340 Dixwell Avenue, New Haven,  
Gray Organschi Architecture/Selnau Schadler Architects



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340 Dixwell Avenue, New Haven,  
Gray Organschi Architecture/Selnau Schadler Architects



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# DENSITY



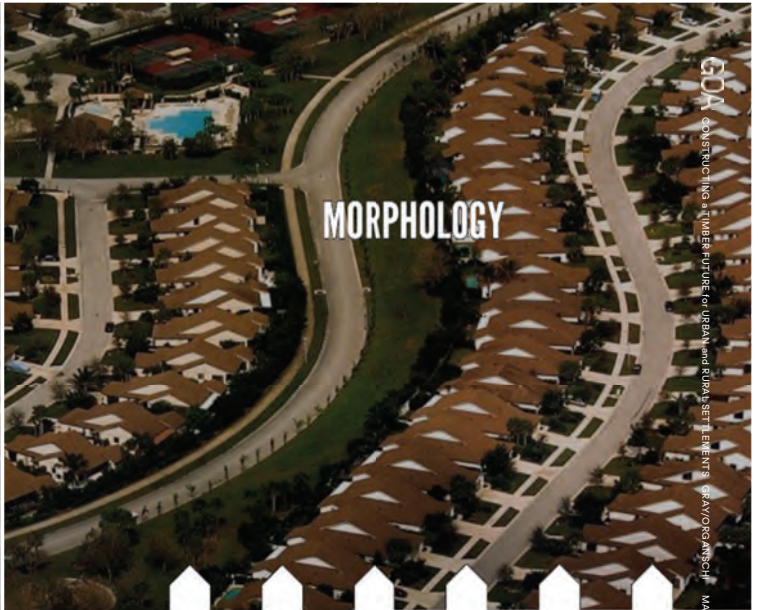
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DEMOGRAPHIC DEVELOPMENT FACTORS, land conversion for human settlement, Levittown, New York

Realigning production and urban morphology  
Timber City Research Initiative,  
Gray Organschi Architecture



## EXTRACTION METHOD



## MORPHOLOGY

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**RENEWABLE LOW IMPACT**

**LOW DENSITY ENERGY INTENSIVE HOUSING**

## EXTRACTION METHOD

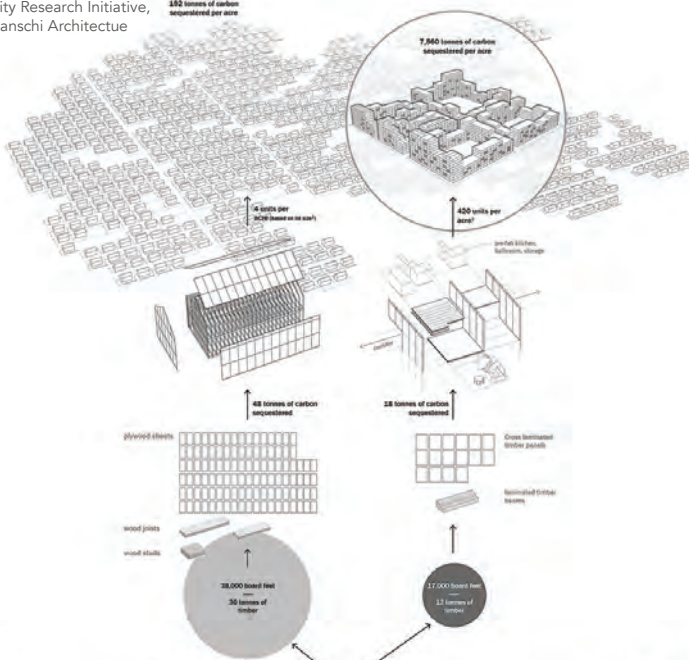


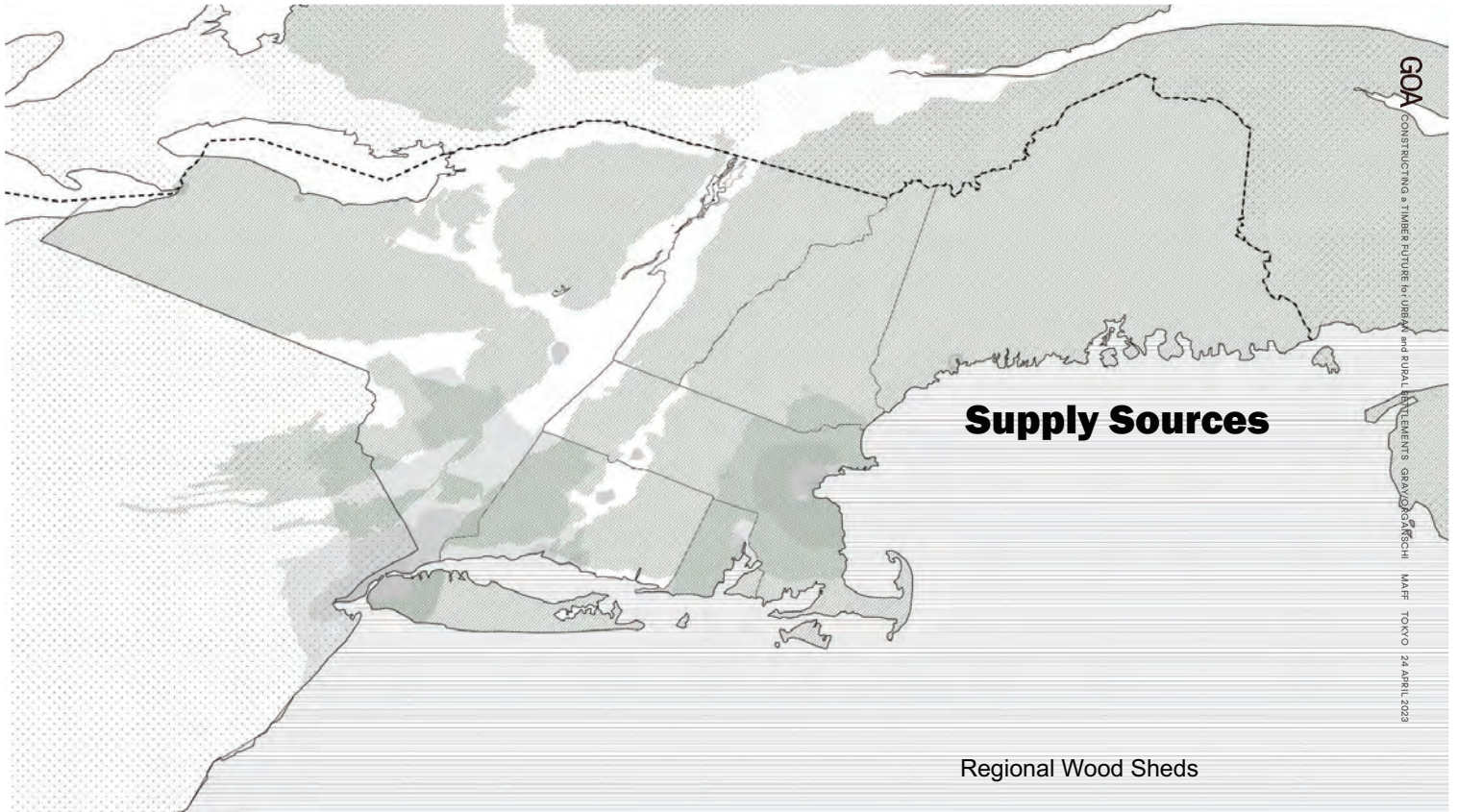
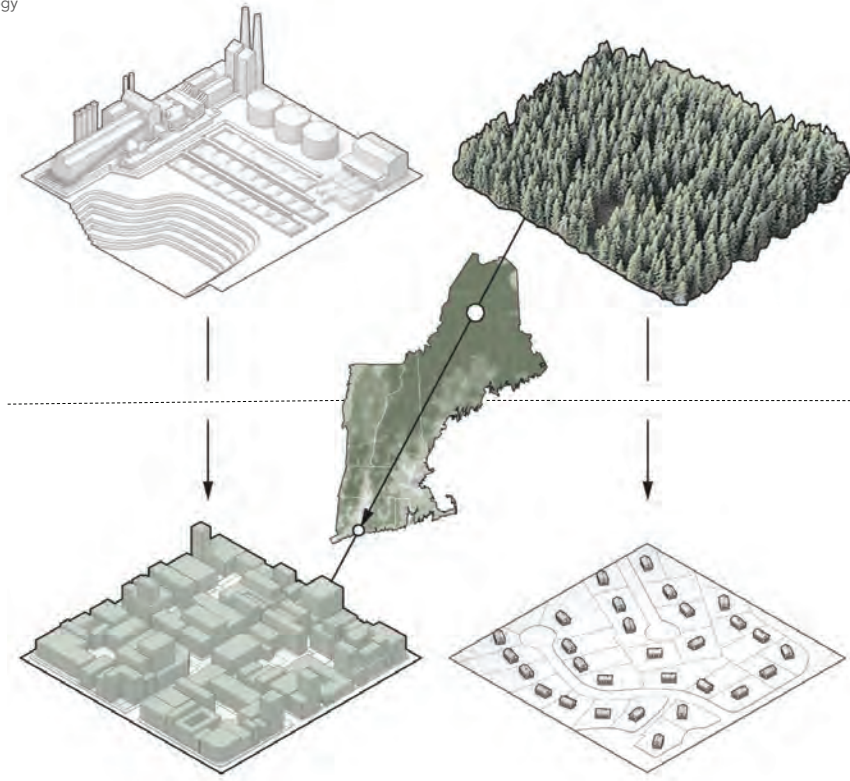
## INTENSIVE HIGH IMPACT

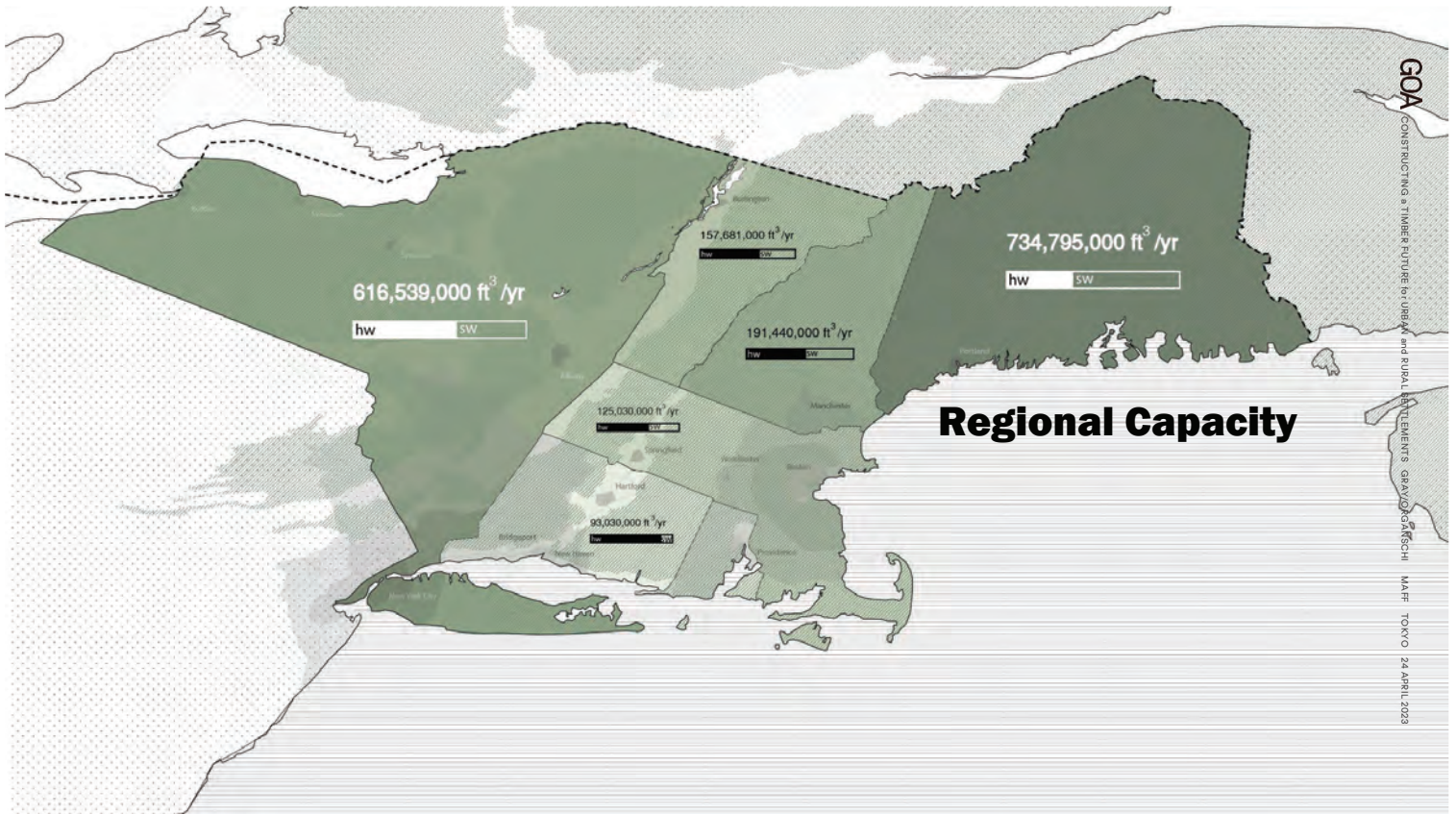
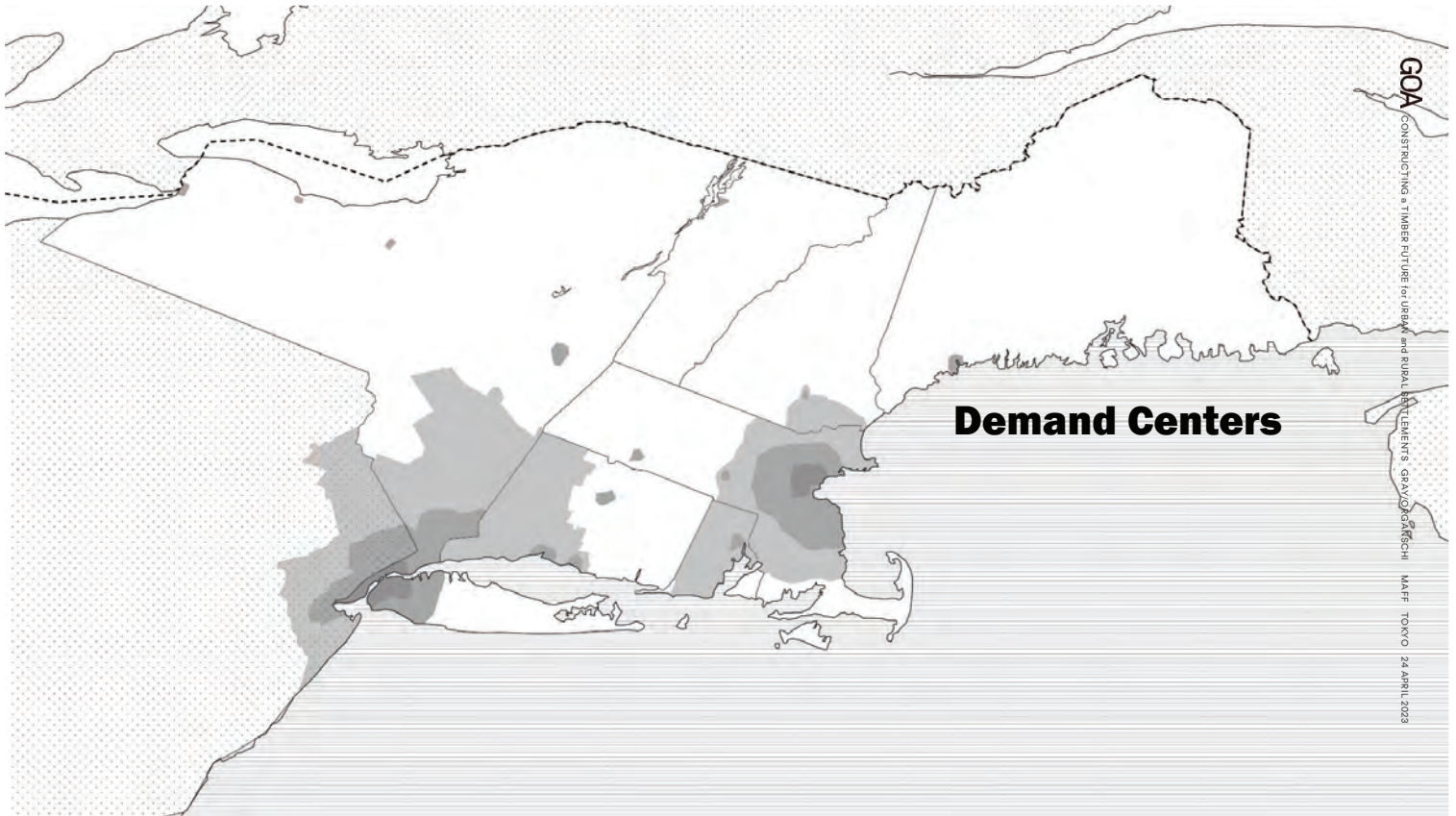
## MORPHOLOGY



## HIGH-DENSITY OPTIMUM-RISE HOUSING









STAND DISTURBANCE



0-1 YEARS

STAND INITIATION



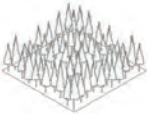
2-10 YEARS

STEM EXCLUSION



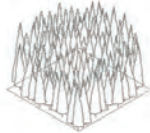
11-25 YEARS

UNDERSTORY REINITIATION

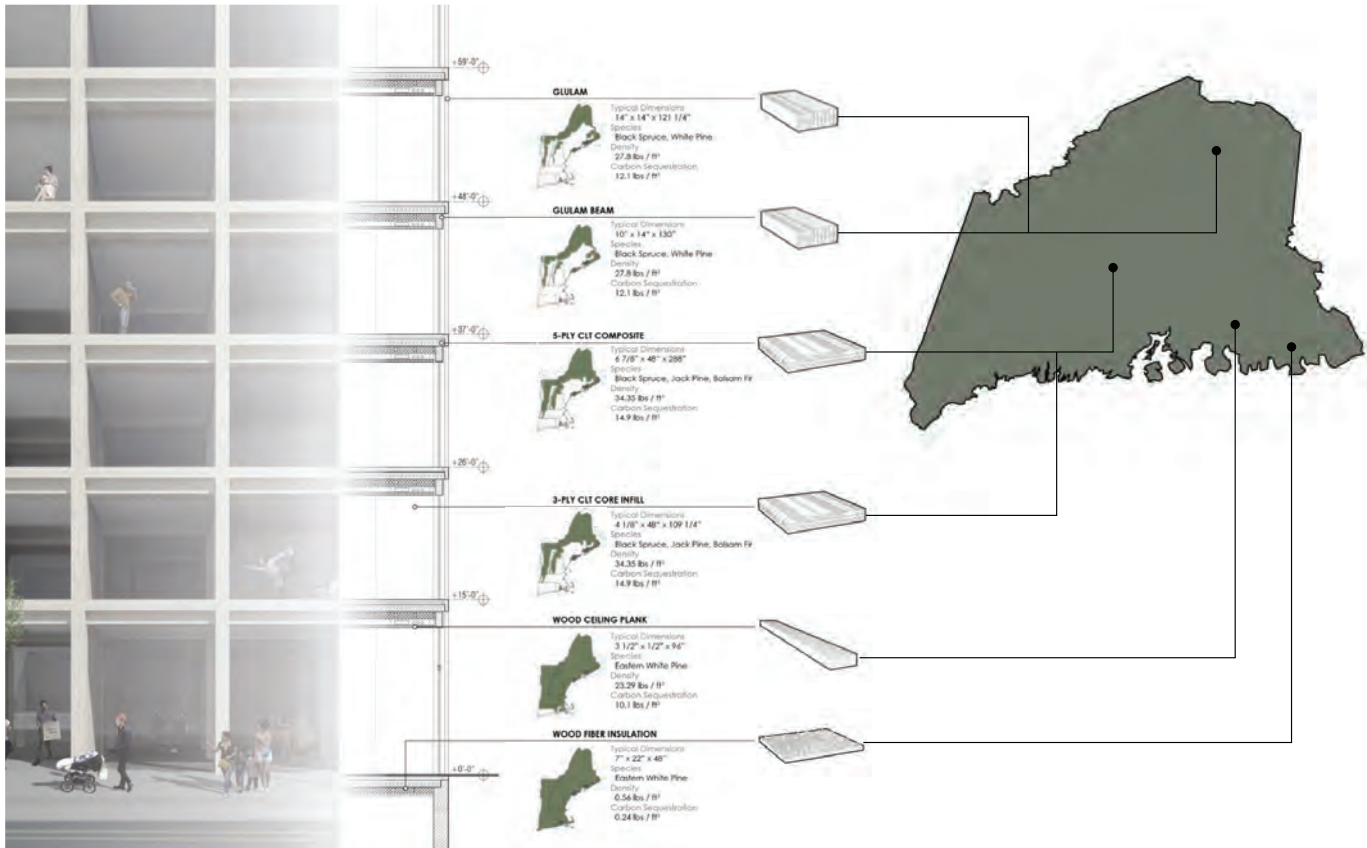
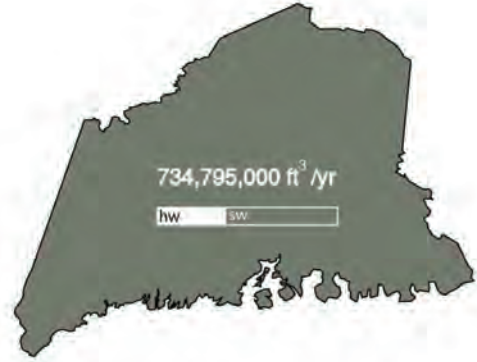


26-40 YEARS

MATURE FOREST

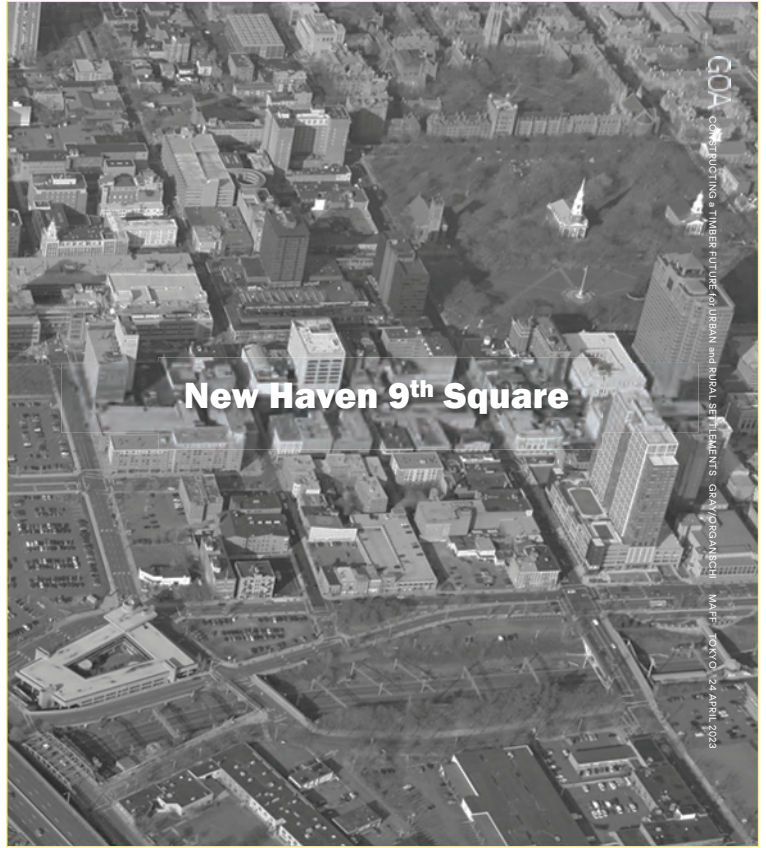


40-45 YEARS



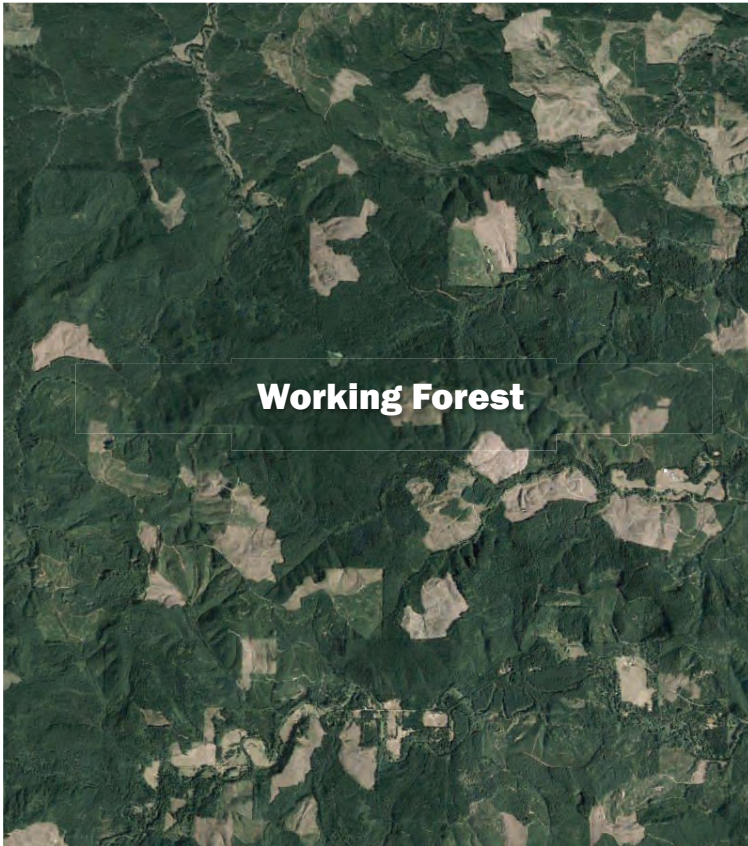


**Working Forest**

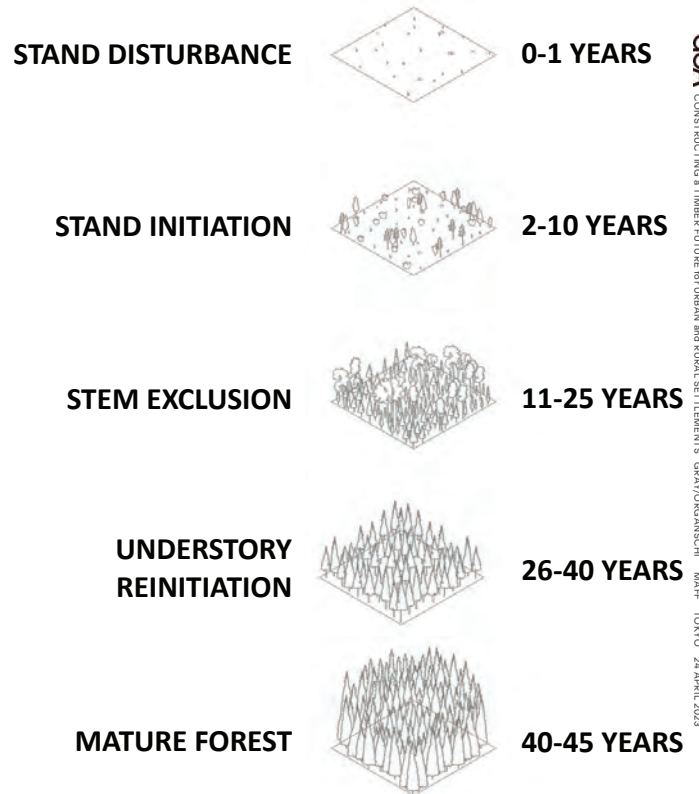


**New Haven 9th Square**

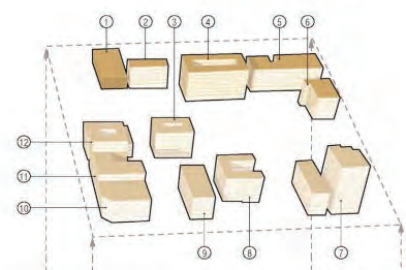
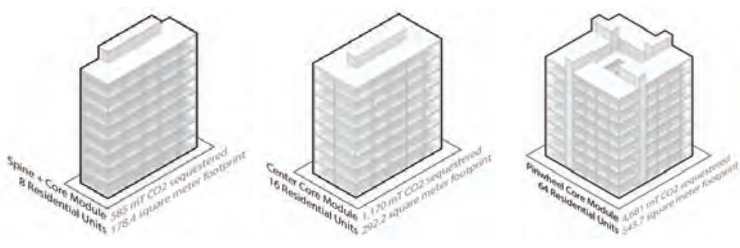
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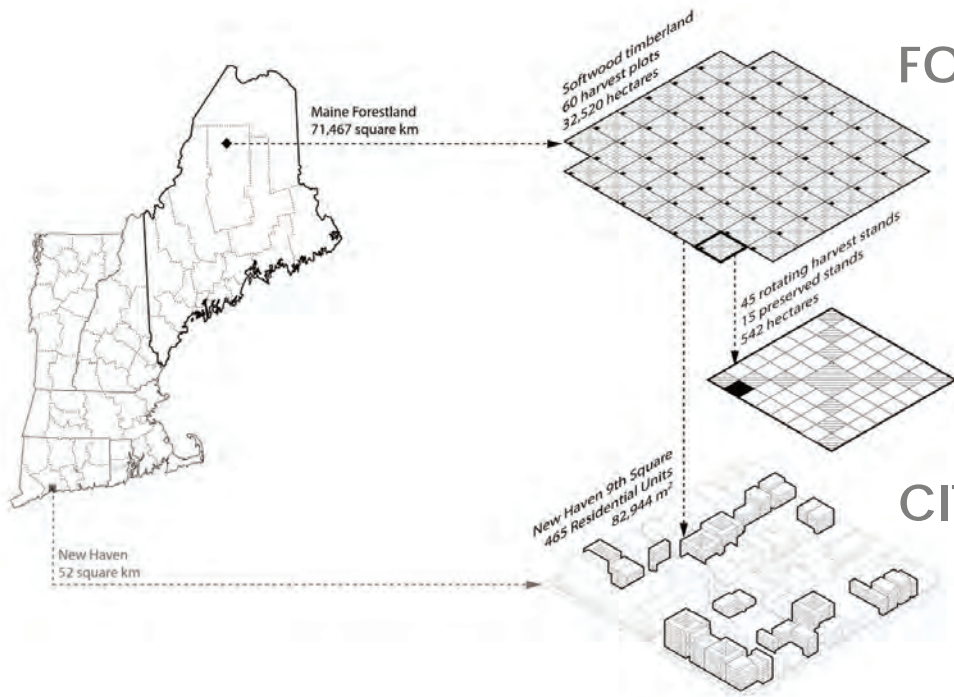
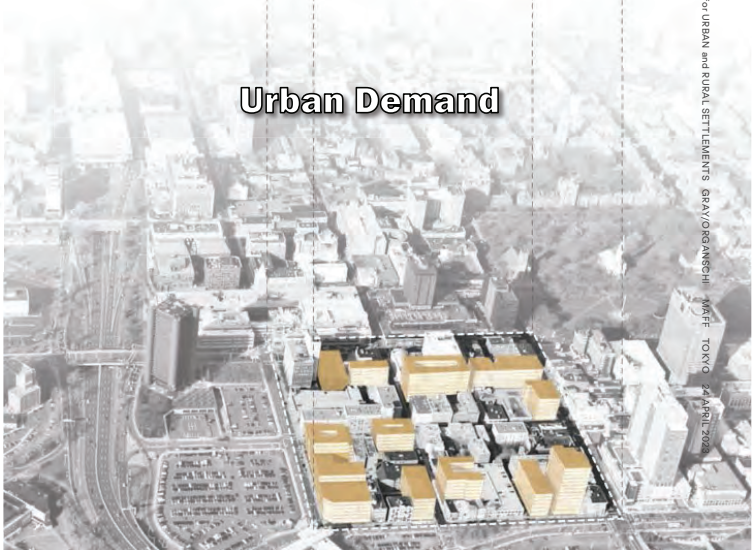
**Working Forest**



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GRAY/ORGANSCH  
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**Urban Demand**



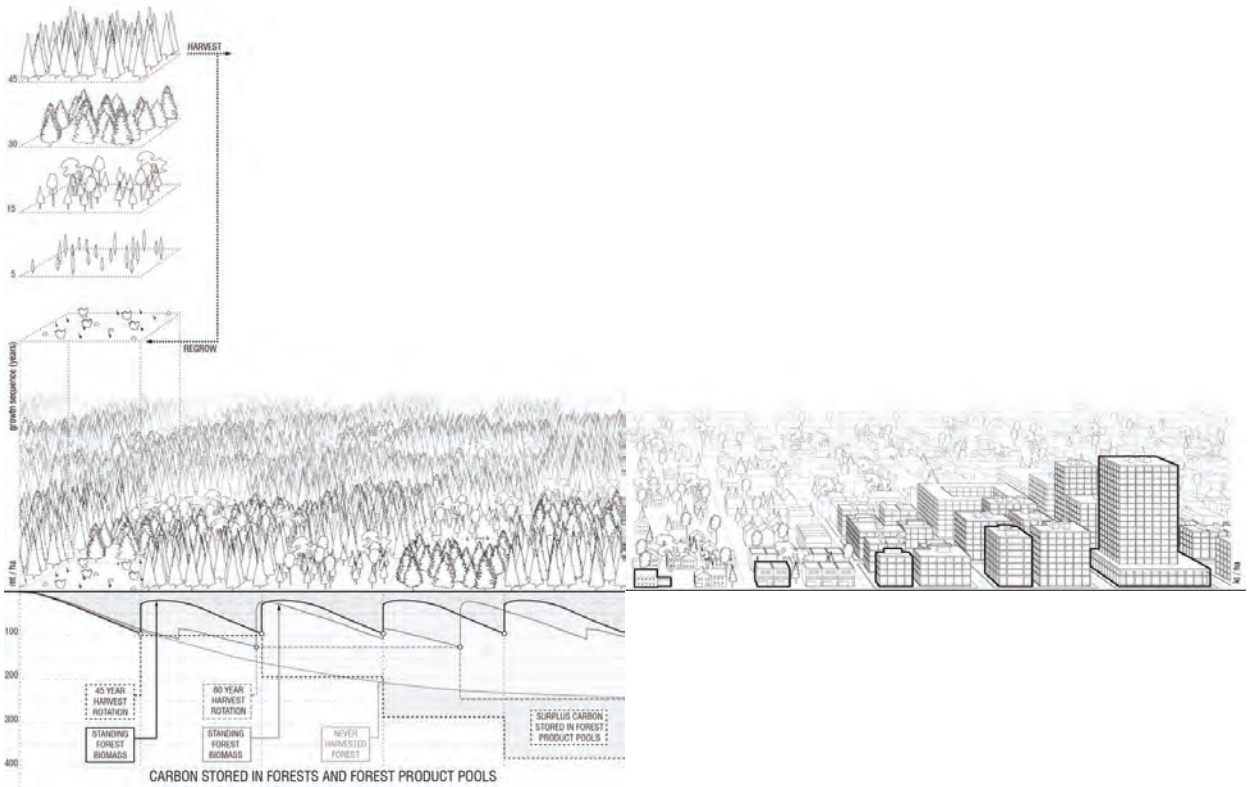
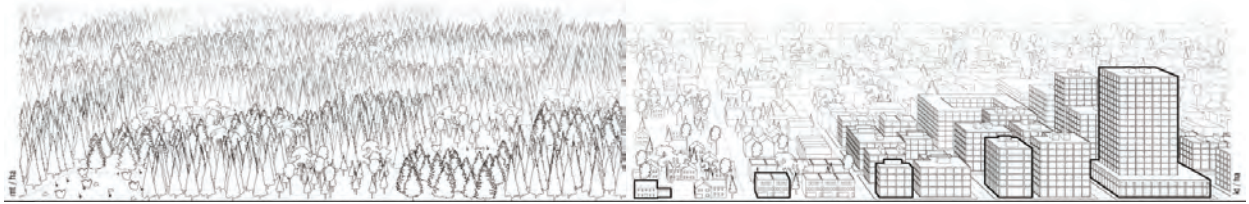
**FOREST:** 114,000 mT CO<sub>2</sub> PRESERVED

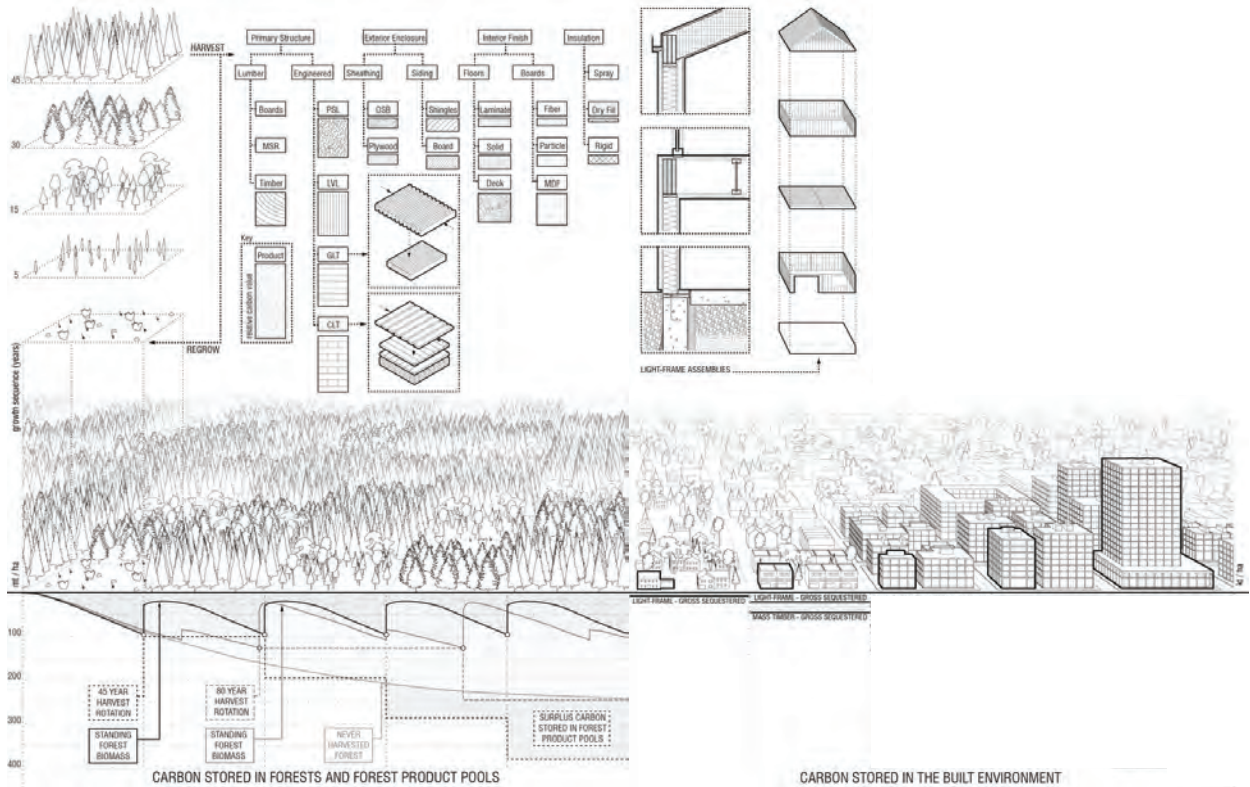
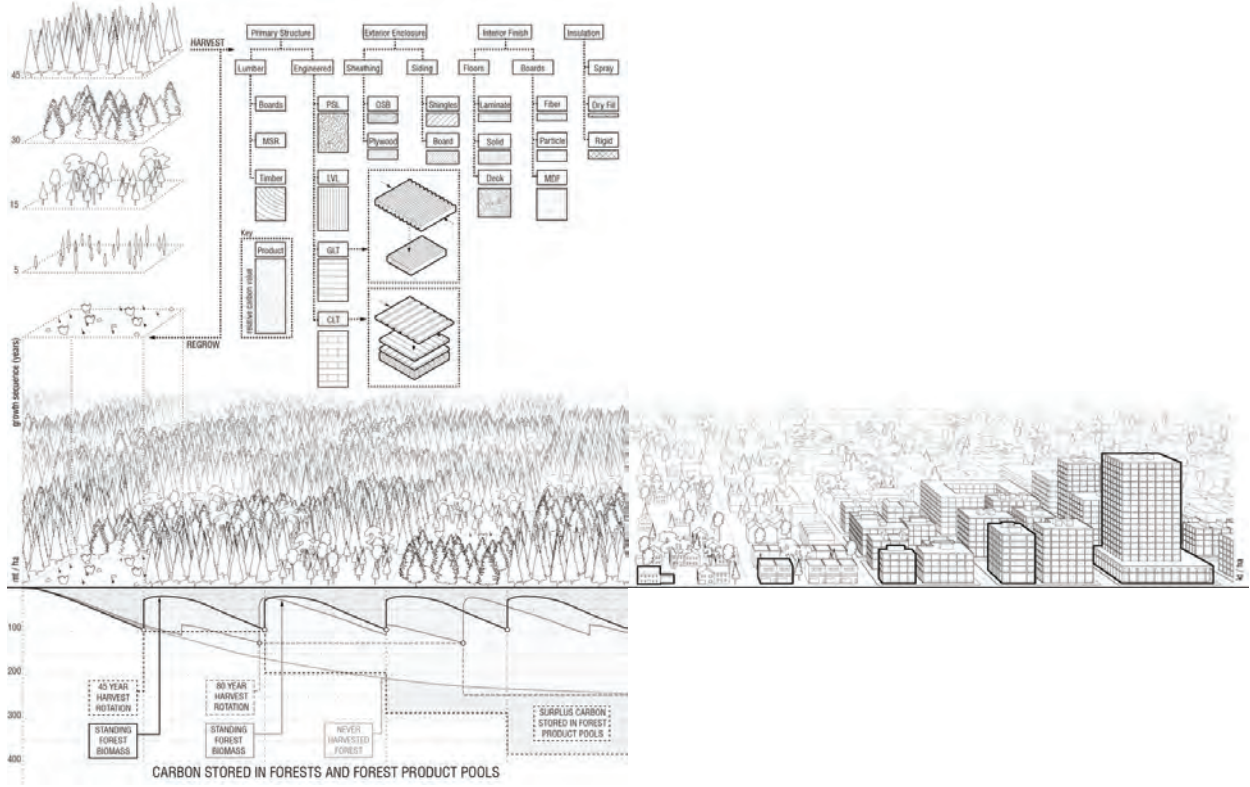
51,000 mT CO<sub>2</sub> REABSORBED

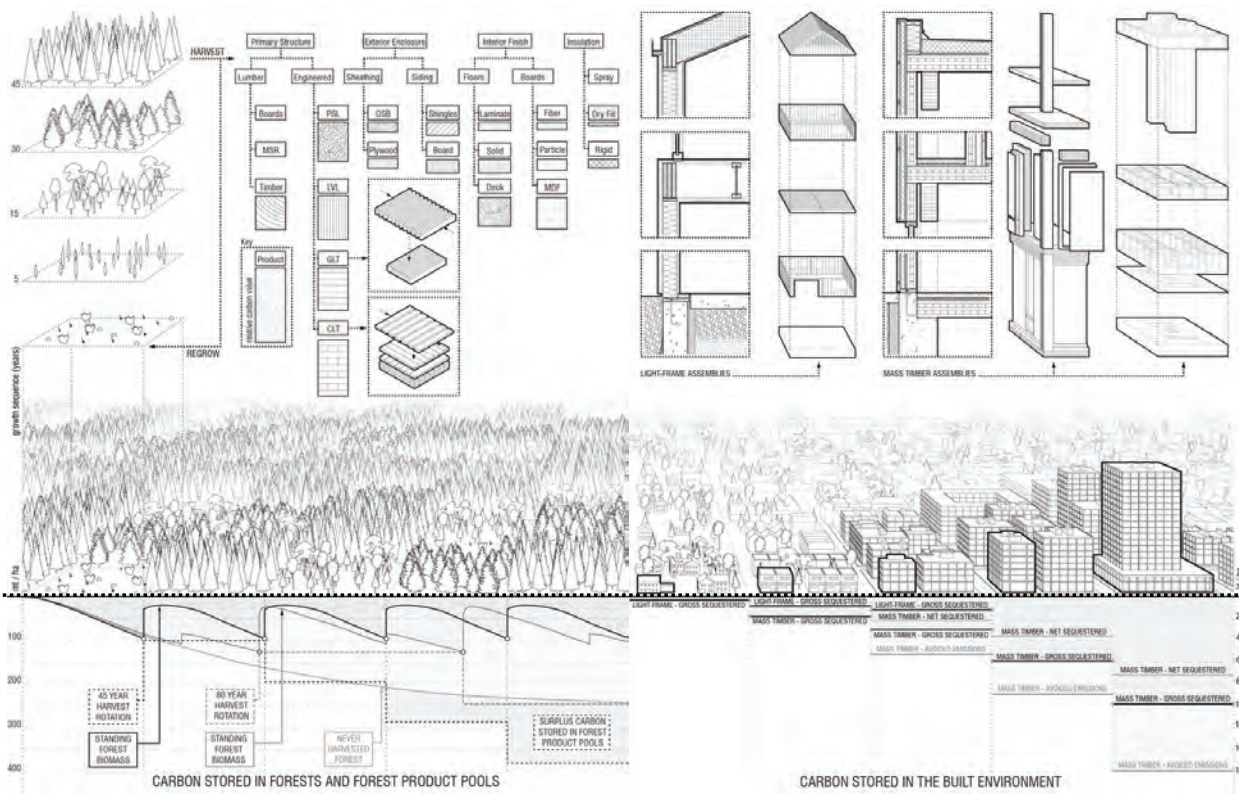
**282,000 mT CO<sub>2</sub>**

**CITY:** 34,010 mT CO<sub>2</sub> STORED

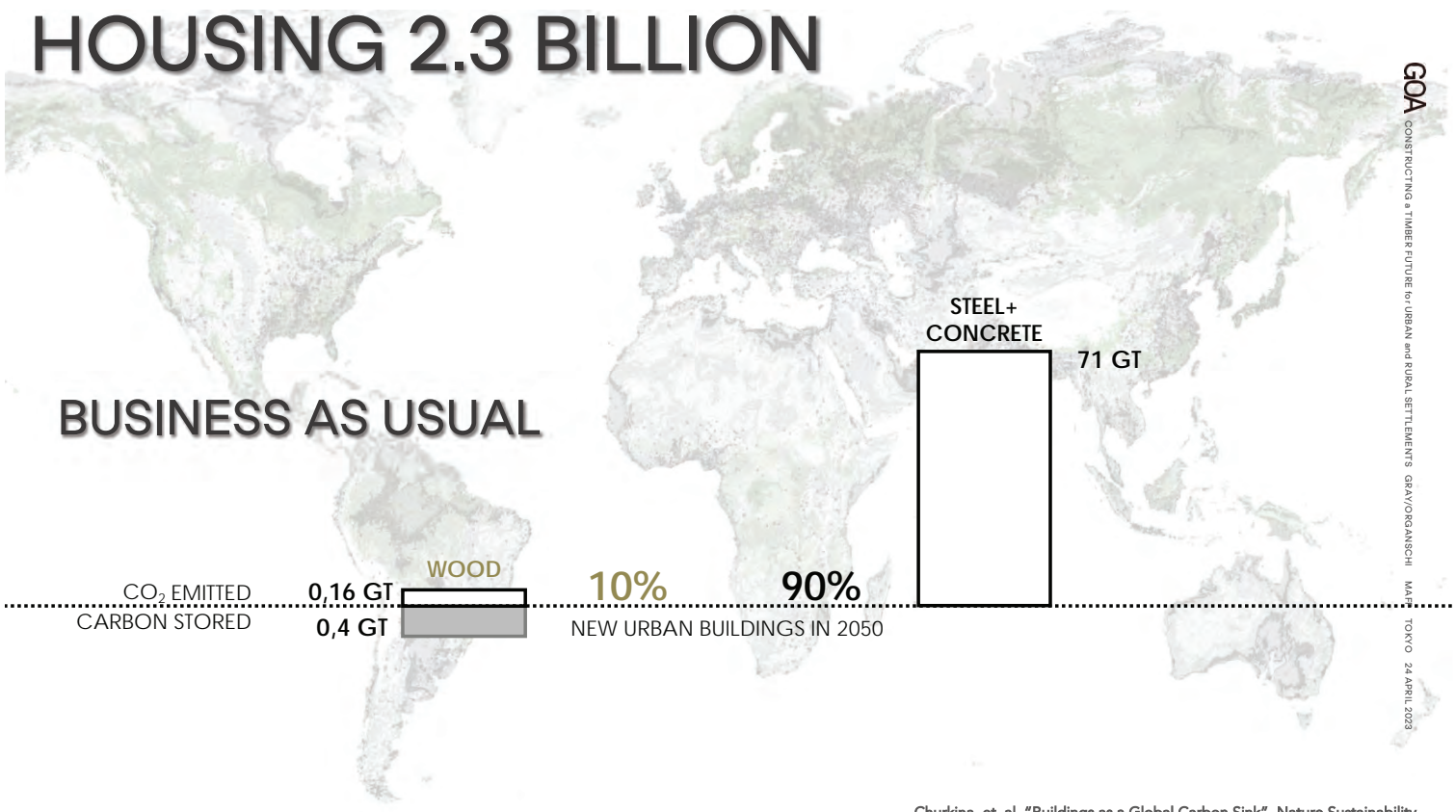
83,070 mT CO<sub>2</sub> AVOIDED







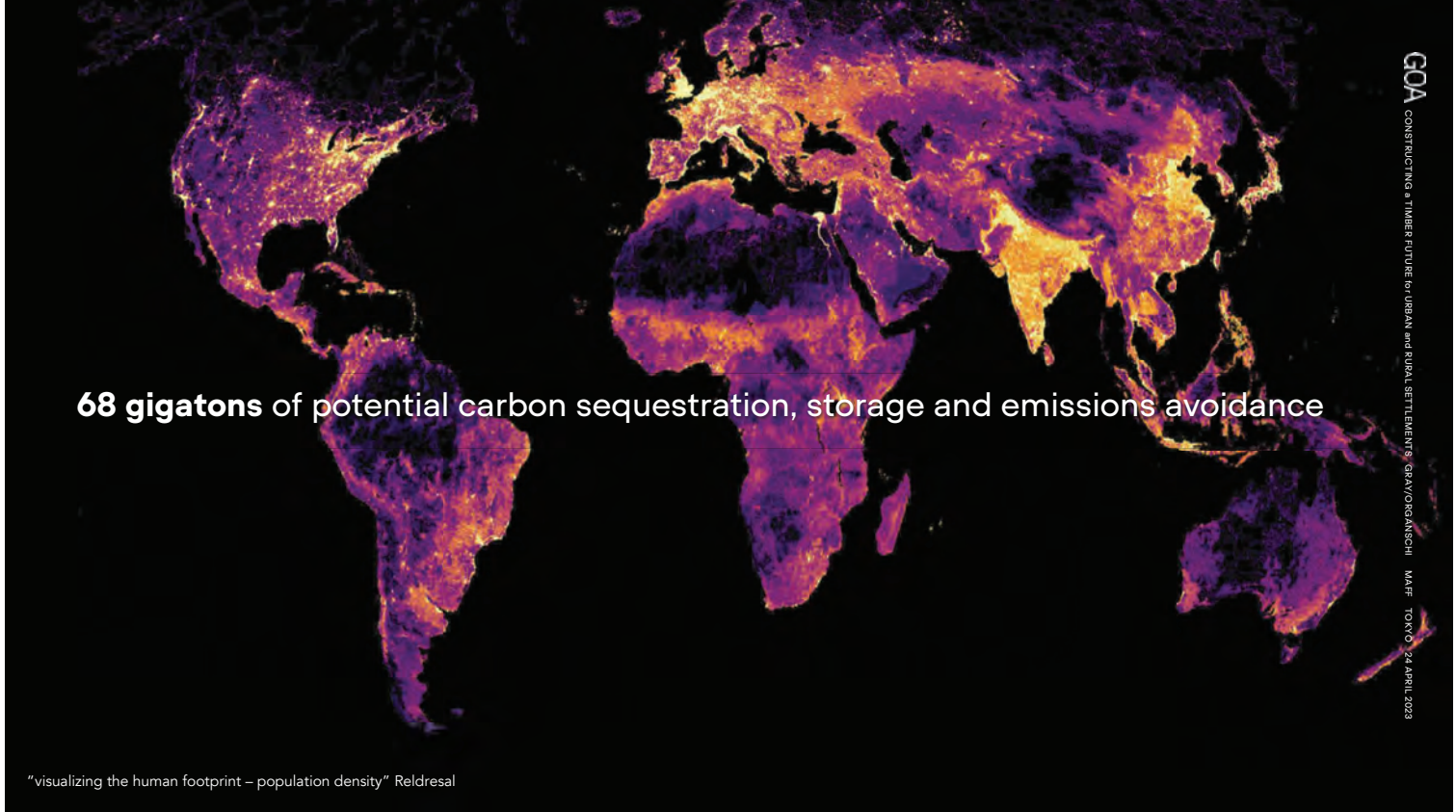
# HOUSING 2.3 BILLION

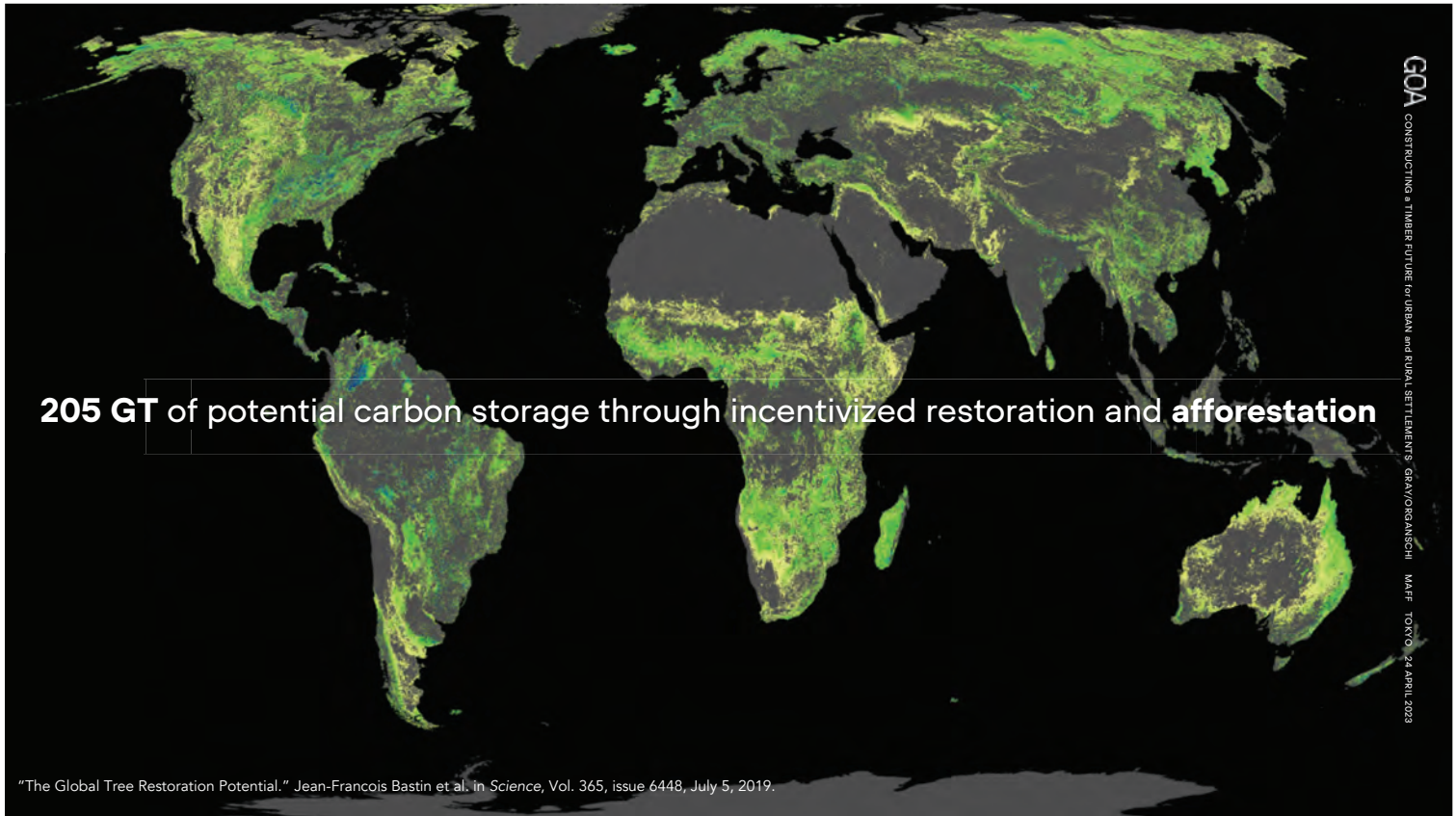


Churkina, et. al. "Buildings as a Global Carbon Sink", Nature Sustainability

# HOUSING 2.3 BILLION

## A BIOMASS SCENARIO





205 GT of potential carbon storage through incentivized restoration and **afforestation**

"The Global Tree Restoration Potential." Jean-Francois Bastin et al. in Science, Vol. 365, issue 6448, July 5, 2019.



# ECOSYSTEM






# INDUSTRIAL FORESTRY

GDA CONSTRUCTING A TIMBER FUTURE FOR URBAN AND RURAL SETTLEMENTS GRAY/OKRAVANSCHI MAFF TOKYO 24 APRIL 2023



# ECOLOGICAL SILVICULTURE

GDA CONSTRUCTING A TIMBER FUTURE FOR URBAN AND RURAL SETTLEMENTS GRAY/OKRAVANSCHI MAFF TOKYO 24 APRIL 2023



*"We need to stop telling  
the forest what we want  
and instead ask it what it  
can offer us..."*



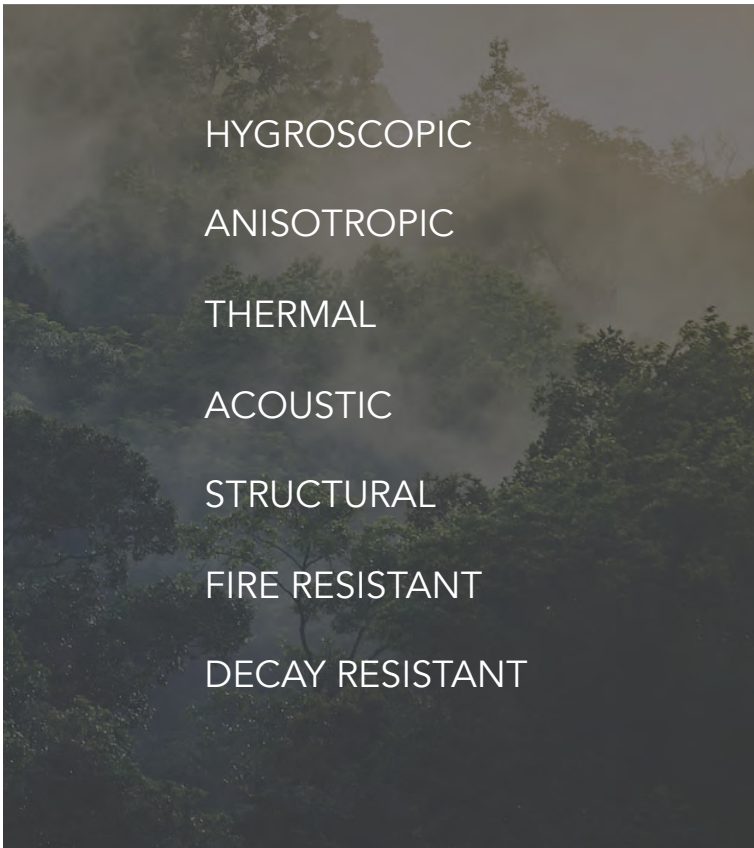
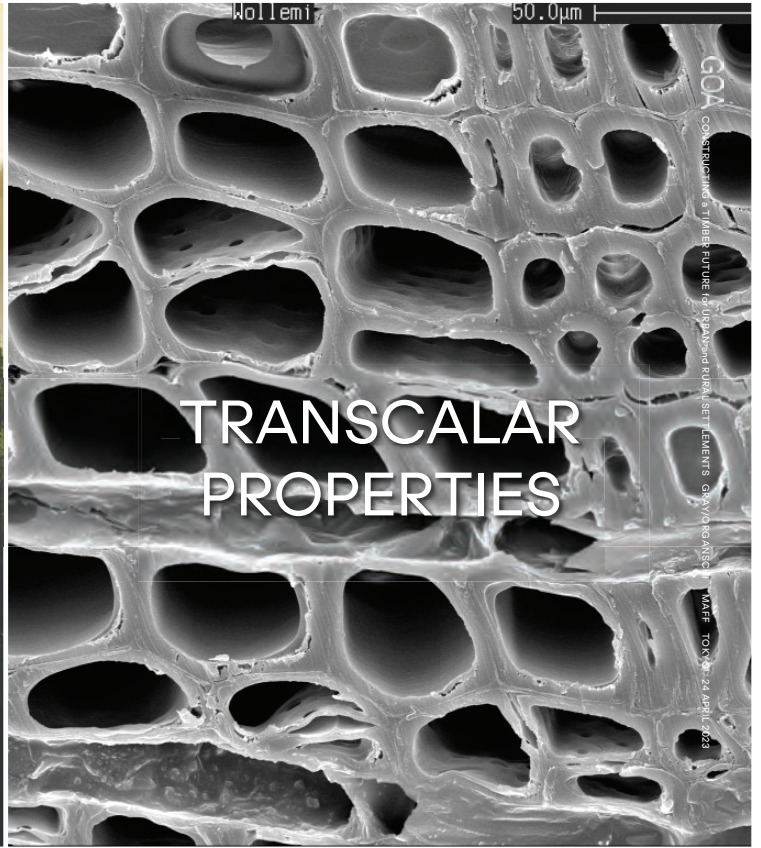
## ECOLOGICAL SILVICULTURE



HABITAT AND BIODIVERSITY  
PATHOGEN CONTROL  
WILDFIRE MITIGATION  
CARBON STORAGE  
WATER QUALITY  
INVASIVE SPECIES CONTROL  
SOIL REMEDIATION



## ECOLOGICAL SILVICULTURE



HYGROSCOPIC

ANISOTROPIC

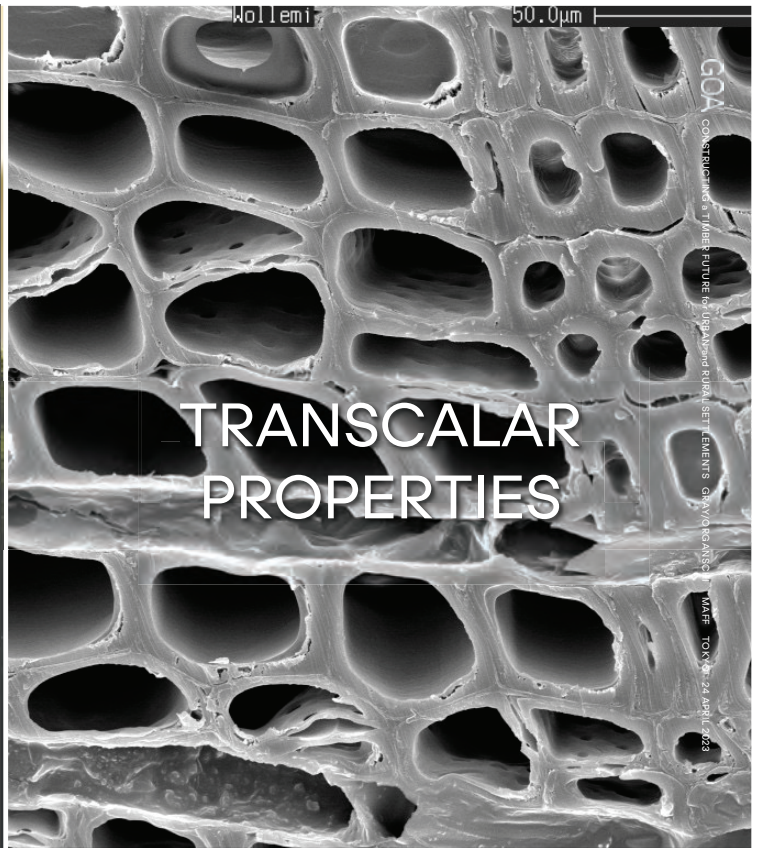
THERMAL

ACOUSTIC

STRUCTURAL

FIRE RESISTANT

DECAY RESISTANT

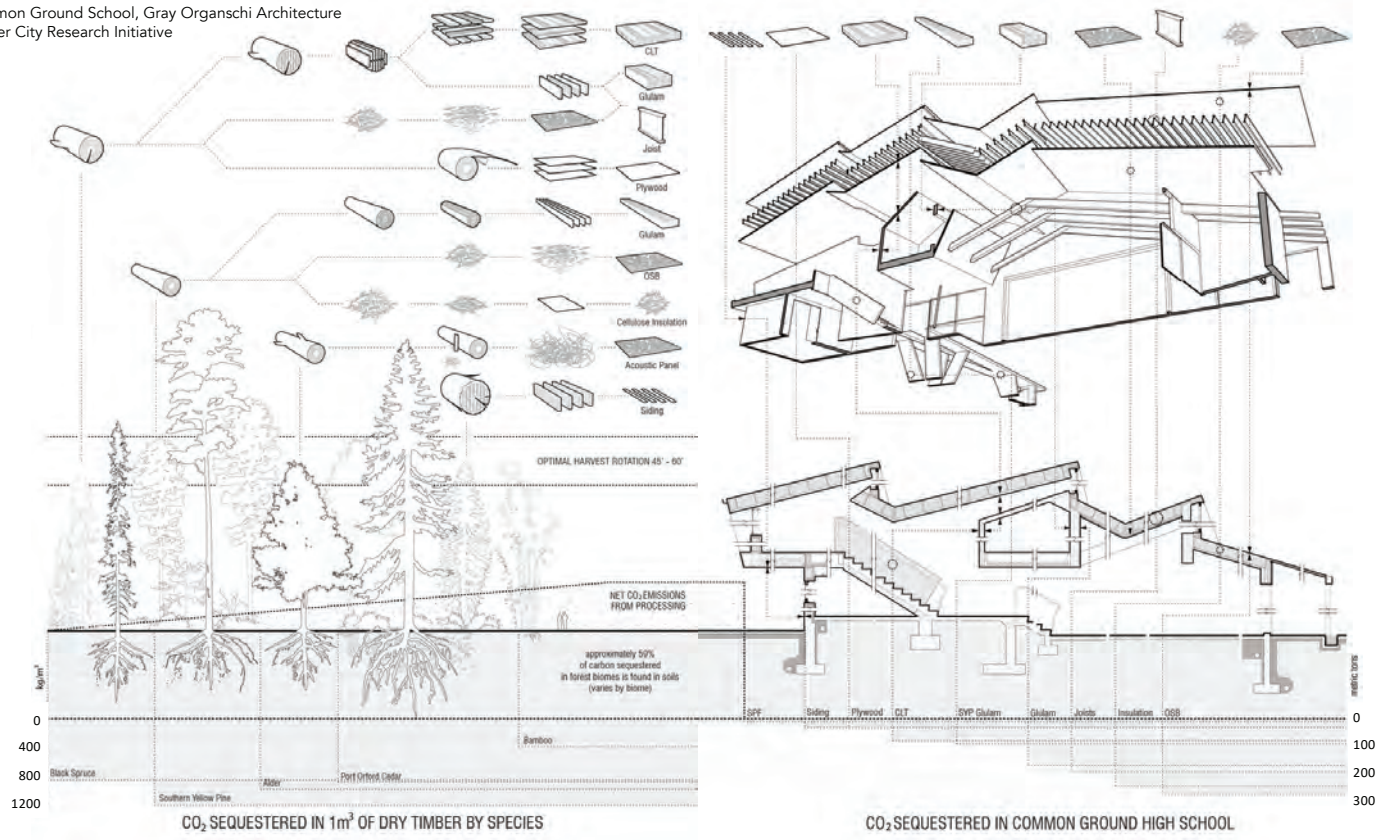




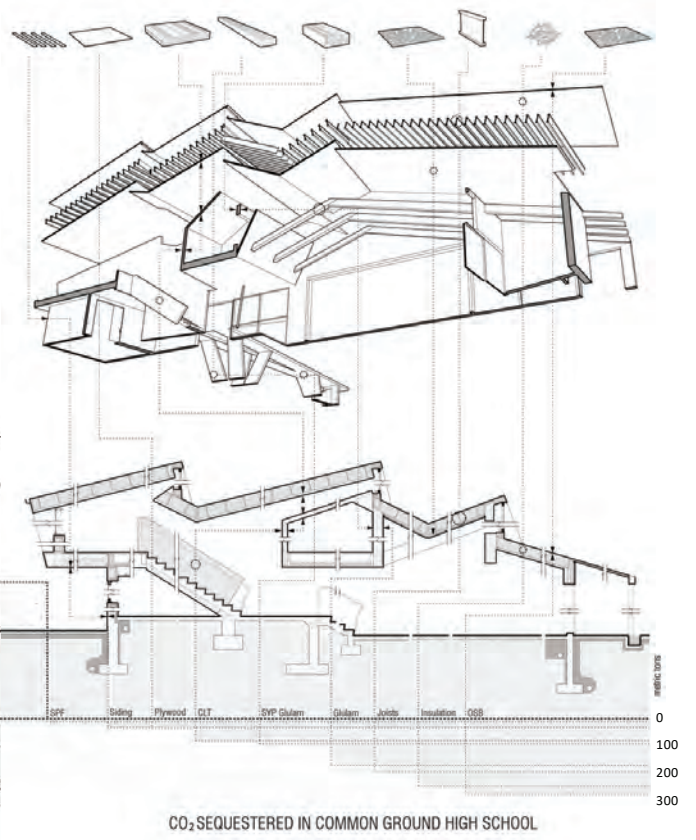
HYGROSCOPIC  
ANISOTROPIC  
THERMAL  
ACOUSTIC  
STRUCTURAL  
FIRE RESISTANT  
DECAY RESISTANT



CLIMATIC  
ECOLOGICAL  
SOCIAL  
CHEMICAL  
GEOLOGICAL  
POLITICAL  
ECONOMIC  
PLANETARY



CO<sub>2</sub> SEQUESTERED IN 1m<sup>3</sup> OF DRY TIMBER BY SPECIES



CO<sub>2</sub> SEQUESTERED IN COMMON GROUND HIGH SCHOOL



REUSE

# REUSE



Coastal Research Station for the Peabody Museum of Natural History.  
Yale Regenerative Building Lab, Yale School of Architecture

GOA CONSTRUCTING A TIMBER FUTURE FOR URBAN AND RURAL SETTLEMENTS. GRAY/ORGANSCH - MAF - TOKYO 24 APRIL 2023

# SILVACULTURE



Coastal Research Station for the Peabody Museum of Natural History.  
Yale Regenerative Building Lab, Yale School of Architecture



GOA CONSTRUCTING A TIMBER FUTURE FOR URBAN AND RURAL SETTLEMENTS. GRAY/ORGANSCH - MAF - TOKYO 24 APRIL 2023



Coastal Research Station for the Peabody Museum of Natural History.  
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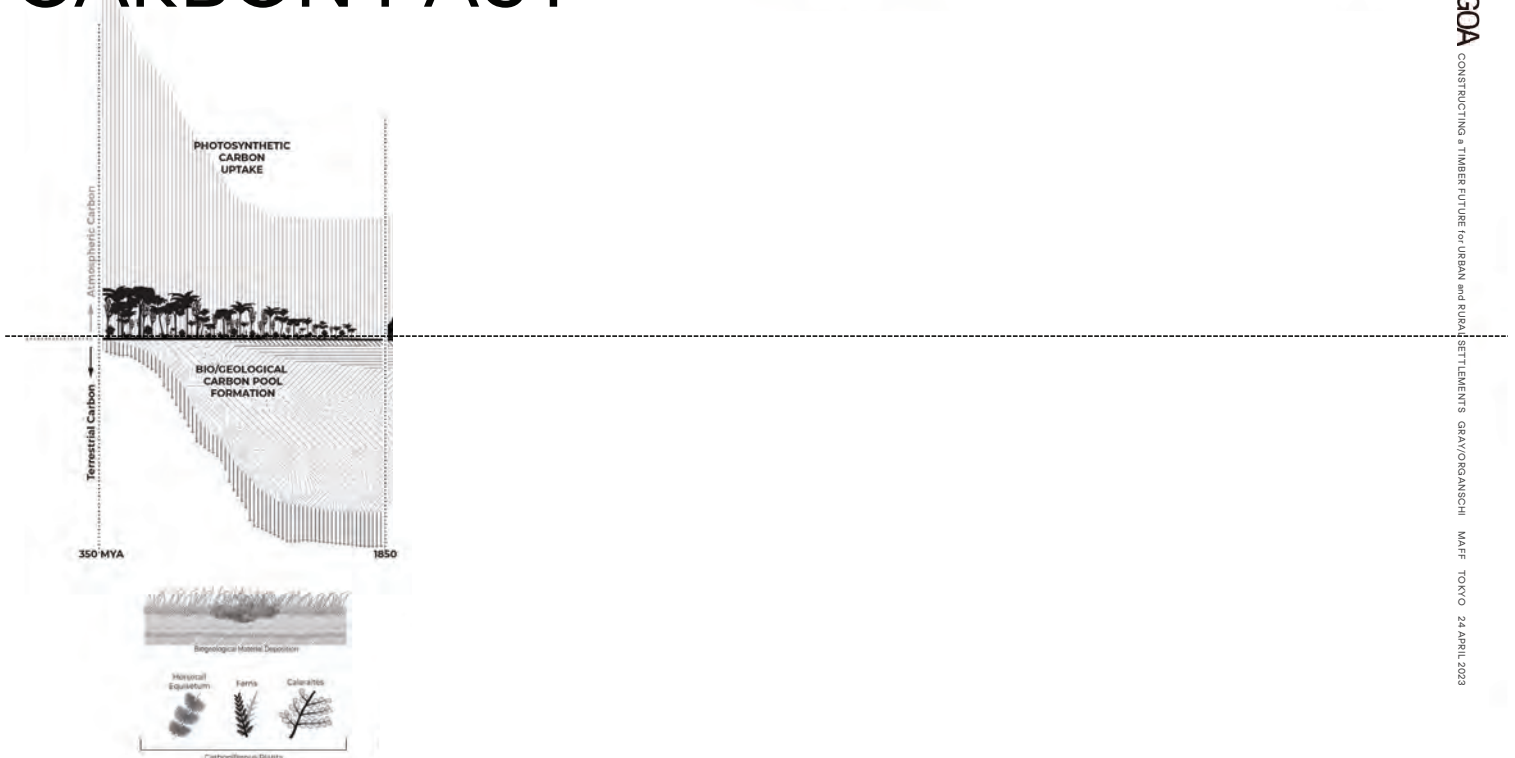
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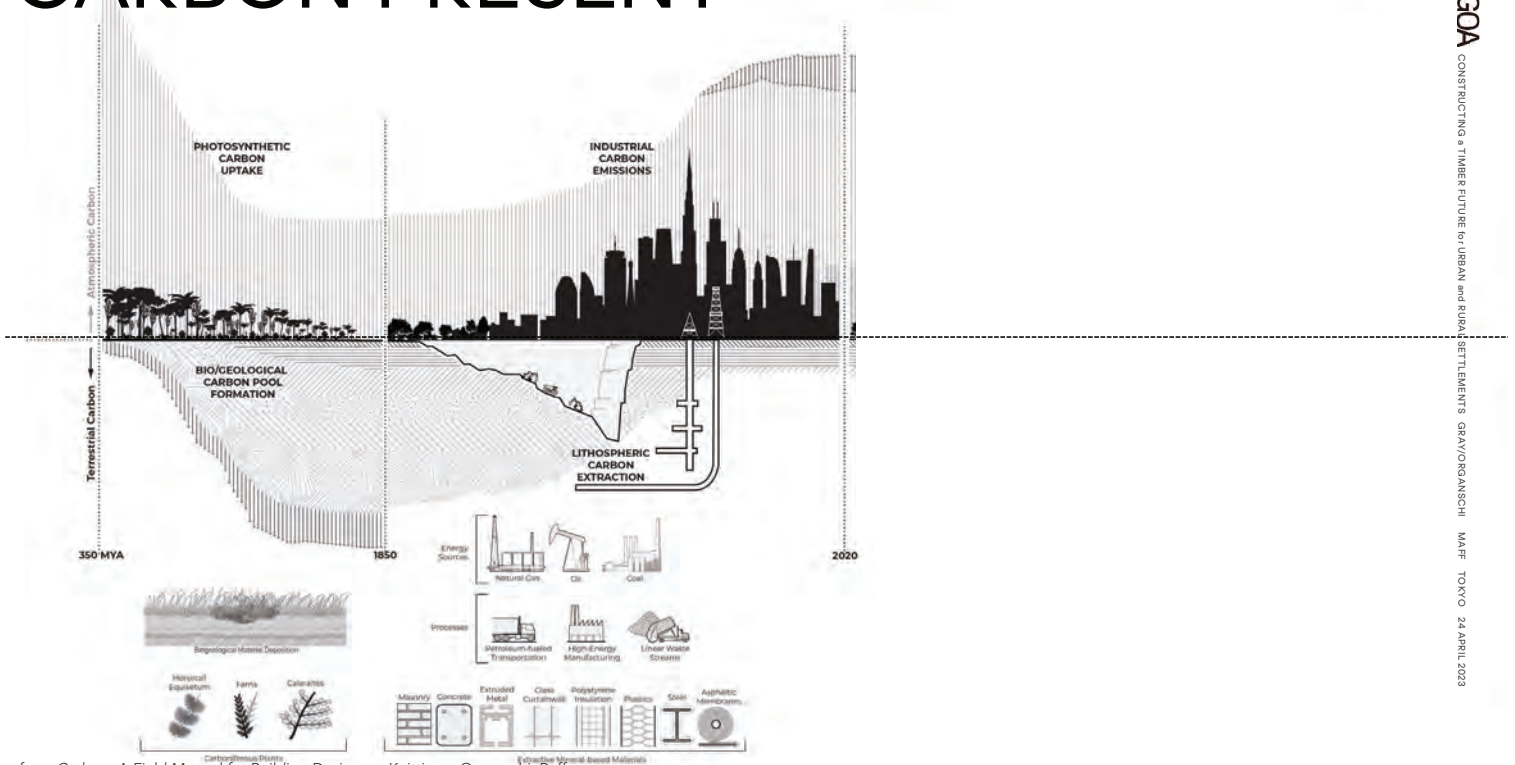
GOA CONSTRUCTING A TIMBER FUTURE FOR URBAN AND RURAL SETTLEMENTS GRAY/ORGANISCH | MAF | TOKYO | 24 APRIL 2023

# CARBON PAST



from Carbon: A Field Manual for Building Designers, Kuitinen, Organschi, Ruff

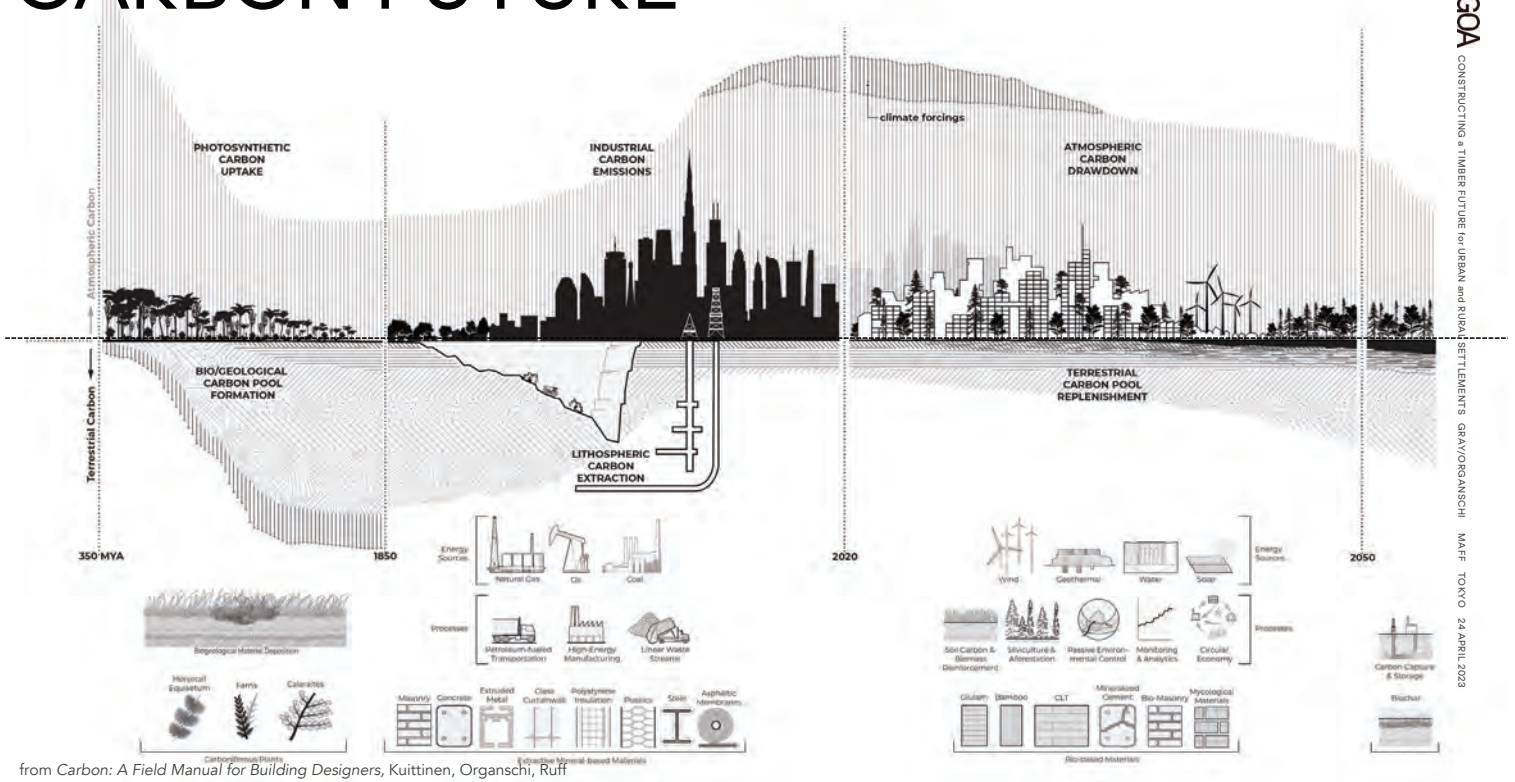
# CARBON PRESENT



from Carbon: A Field Manual for Building Designers, Kuitinen, Organschi, Ruff



# CARBON FUTURE



from Carbon: A Field Manual for Building Designers, Kuitinen, Organschi, Ruff



Mill River Carousel Pavilion  
Gray Organschi Architecture/Structure Fusion

THANK YOU