BUILDINGENERGY BOSTON

The Materials Revolution

James Kitchin, Bio-Based Materials Collective & MASS
Chris Magwood, RMI
Ace McArleton, Bio-Based Materials Collective & New Frameworks
Jonsara Ruth, Healthy Materials Lab at Parsons School of Design

Curated by Megan Nedzinski

Northeast Sustainable Energy Association (NESEA) | March 20, 2025


The Materials Revolution

Learning Objectives

Utilize tools to specify bio-based materials in AEC practices

Make key connections to scale practical climate solutions for buildings

Identify and compare bio-based solutions

Implement strategies for movement building within the AEC industry to scale solutions

Agenda

Ace McArleton (7 mins) - BBMC SC, systems view

(8 minutes) bio based manuf, workforce dev & training, building phase

Chris Magwood (10 mins) - RMI & Builders & Carbon Incentives/Training networks, codes & policy

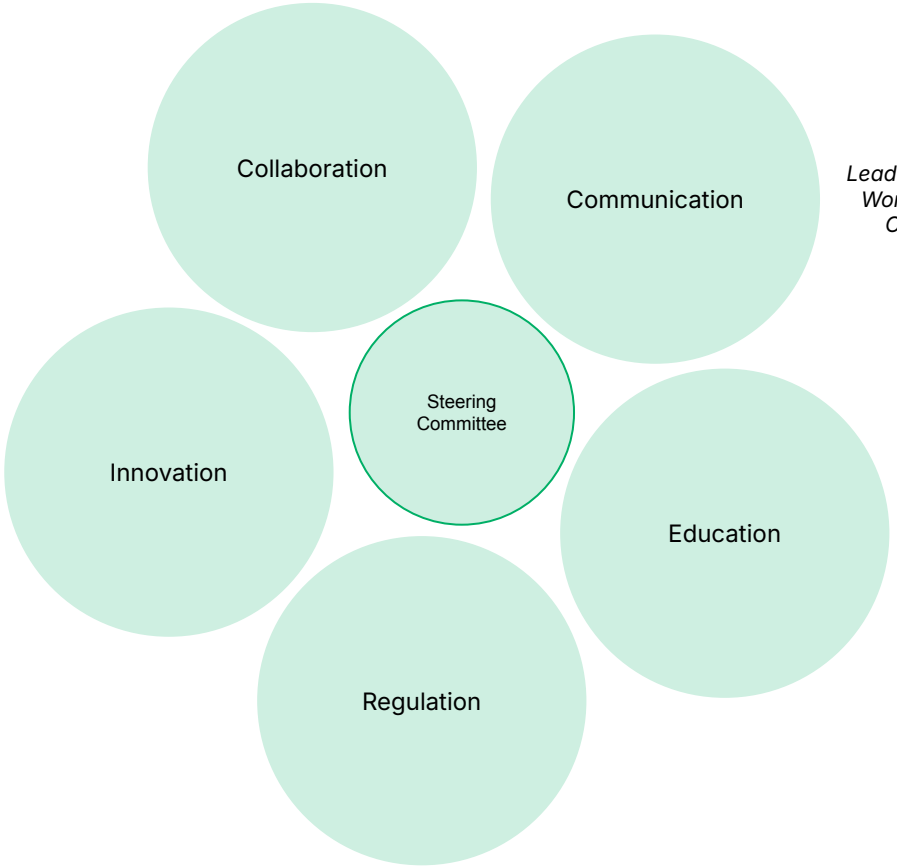
Jonsara Ruth (10 mins) - BBMC EWG, systems view, healthy materials & healthy people and planet throughout the system

James Kitchin(10 mins) - BBMC SC, systems view, Arch specification/sustainability

The Material Revolution

Bio-Based Materials Collective: values & vision

Bio Based Materials Collective Founding Summit September 2023



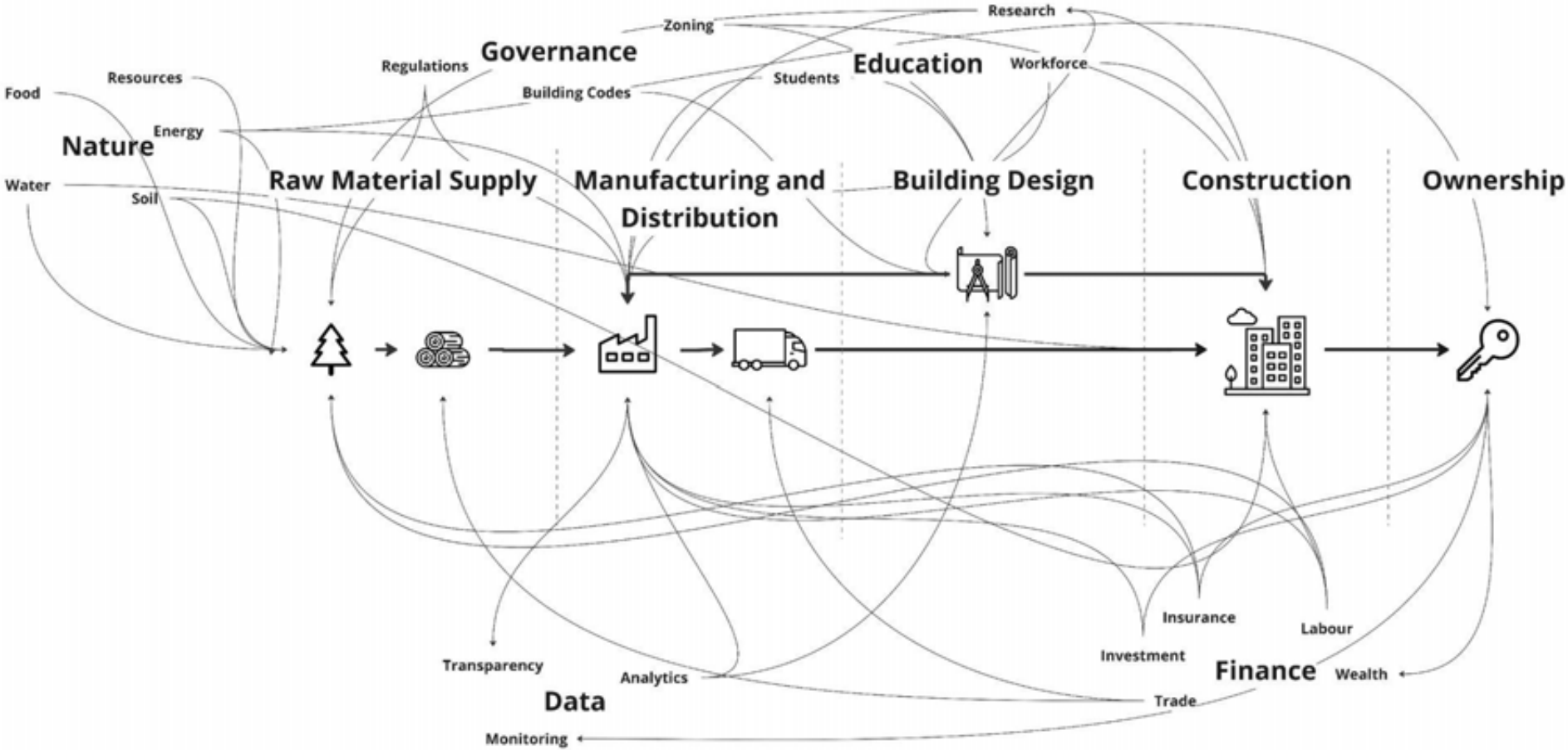
Leadership Team: Working Group Co-Chairs

- **All built environment work in the region is:**
  - **Good for Land = Regenerative**
    - Bio-based materials have demonstrated biogenic carbon storage.
    - Bio-based materials are demonstrated to be healthy for all humans, species, and ecologies.
    - Agricultural and forestry practices have enhanced productivity for generations to come through improved soil, water and ecosystem health.

- **All built environment work in the region is:**
  - **Good for People = Abundant**
    - Economic, social and environmental welfare prospers due to a thriving bio-based materials industry using a cooperative economic model that benefits all.
    - Regional material suppliers and supply chains are resilient to economic, social, climatic, and technological hazards.
    - Everyone within the life cycle is educated in, and empowered to use bio-based materials.

- **All built environment work in the region is:**
  - **Good for All = Connected**
    - Cultures and communities are protected, respected, and better connected through regional supply chain collaboration.
    - Strong relationships exist across the life cycle from farmer to user, from rural to urban.
    - The relationships between harvesters, the land and all interconnected communities are mutually beneficial.

Ecosystem Diagram

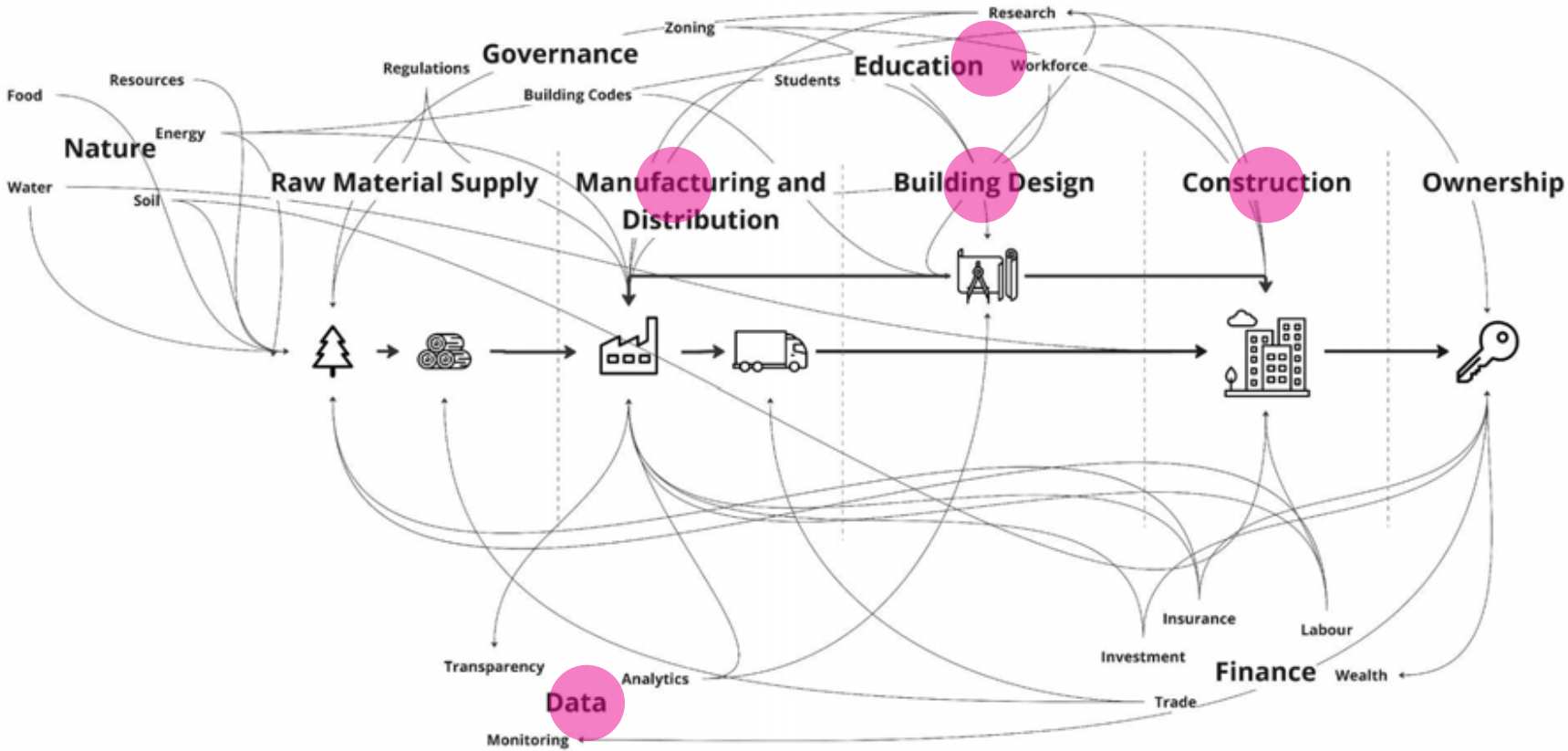

Research
Zoning
Governance
Regulations
Education
Workforce
Students
Building Codes
Resources
Food
Energy
Nature
Water
Soil
Raw Material Supply
Manufacturing and Distribution
Building Design
Construction
Ownership
Insurance
Labour
Investment
Finance
Wealth
Transparency
Analytics
Data
Trade
Monitoring

Mentimeter

Ace

Who am I in this ecosystem and what do I do?

- Manufacturing
- Builder
- Design
- Education & Workforce Development
- Advocacy/ Organizing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Monitoring

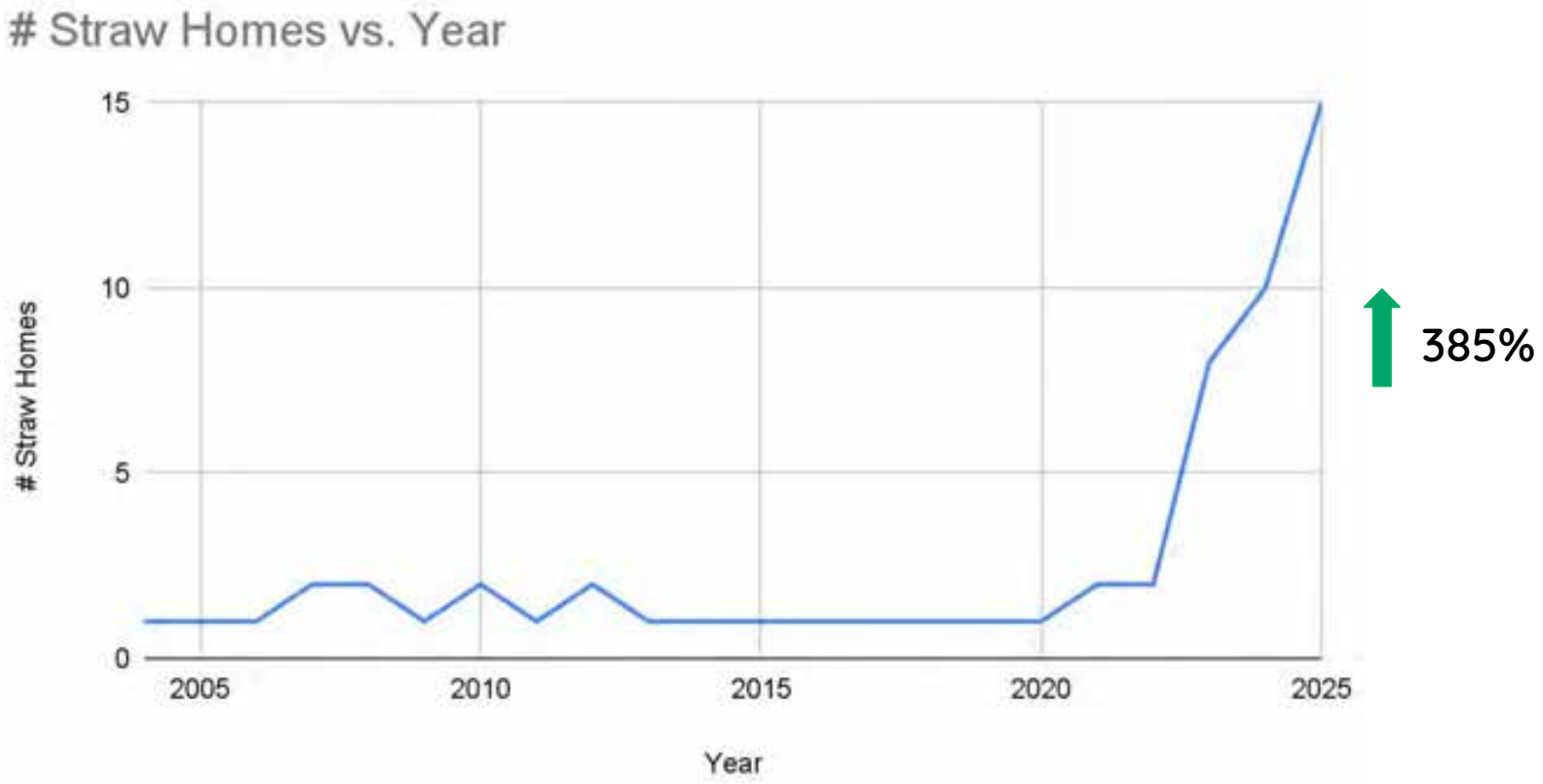
From Bespoke Straw —> Prefab & Pre-design Straw Panels → Seed Program → Seed Collaborative
2004 —> 2025

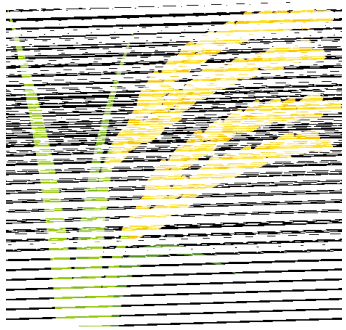
Straw bale timber frame home in Barnet, VT - 2007

Built avg of 1-2 homes & buildings /year in the Northeast from 2004-2019 = 20 straw homes total over 1st 15 years

Structural Straw Bale Panel Predesigned Kit Home (Casita Terra) - 2024

Built avg of 6 straw panel homes & buildings per year across the U.S. from 2019-2025 (6 years) = 36 homes total with straw panels


Straw Homes vs. Year
15
10
5
0
Straw Homes
2005
2010
2015
2020
2025
Year
385%



MATERIAL CARBON
PROJECT RESULTS

CLIMATE ACTION BUSINESS FOR | BEAM

PROJECT INFORMATION

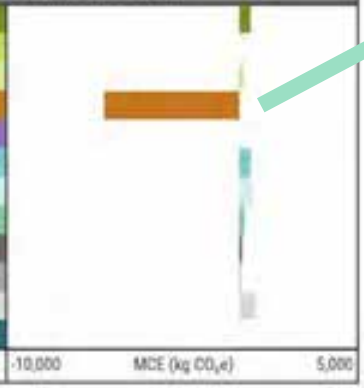
Project Name	Terra	Construction Year	
Design Firm(s)		Number of Bedrooms	
Engineering Firm(s)		Stories Above Grade	2
Builder / Developer			
Development Project		CONDITIONED AREA	
Street Address		Above Grade	770 ft²
City		Below Grade	0 ft²
Province / State		Total	770 ft²
Country	United States		
		GROSS AREA	
Building Type	Single Detached House	Excluding Garage	770 ft²
Construction Type	New Construction	Garage	0 ft²
Project Stage	Construction Documents	Total	770 ft²

Net total: -3,057 kg CO2e

Ext. walls: -5,922 kg CO2e

MATERIAL CARBON EMISSIONS BY SECTION

Footings & Slabs	489 kg CO_2e
Foundation Walls	0 kg CO_2e
Structural Elements	176 kg CO_2e
Exterior Walls	-5,922 kg CO_2e
Party Walls	0 kg CO_2e
Exterior Wall Cladding	493 kg CO_2e
Windows	592 kg CO_2e
Interior Walls	225 kg CO_2e
Floors	119 kg CO_2e
Ceilings	50 kg CO_2e
Roof	711 kg CO_2e
Garage	0 kg CO_2e
NET TOTAL	-3,057 kg CO_2e



What connections do I have and how is that helpful?

Nature & Materials Harvesting: Sawmills, Foresters, Farmers, Food, quarries & minerals,

Helpful because: many folks are disconnected, bring embodiment, reconnection to nature into construction/workforce development.

Local, organic straw: residue of food production


Hay: polycultural mix of grasses and legumes for animal fodder
Straw: monocultural cellulosic tubular stems of cereal grains
Photo credit: Alex English

GRAIN CO.
NITTY GRITTY
OF VERMONT

Wheat Straw

Local Vermont lumber from Eastern Hemlock, White Pine, and Spruce trees

TimberHP

Local lime & clay plasters

The Fabrication

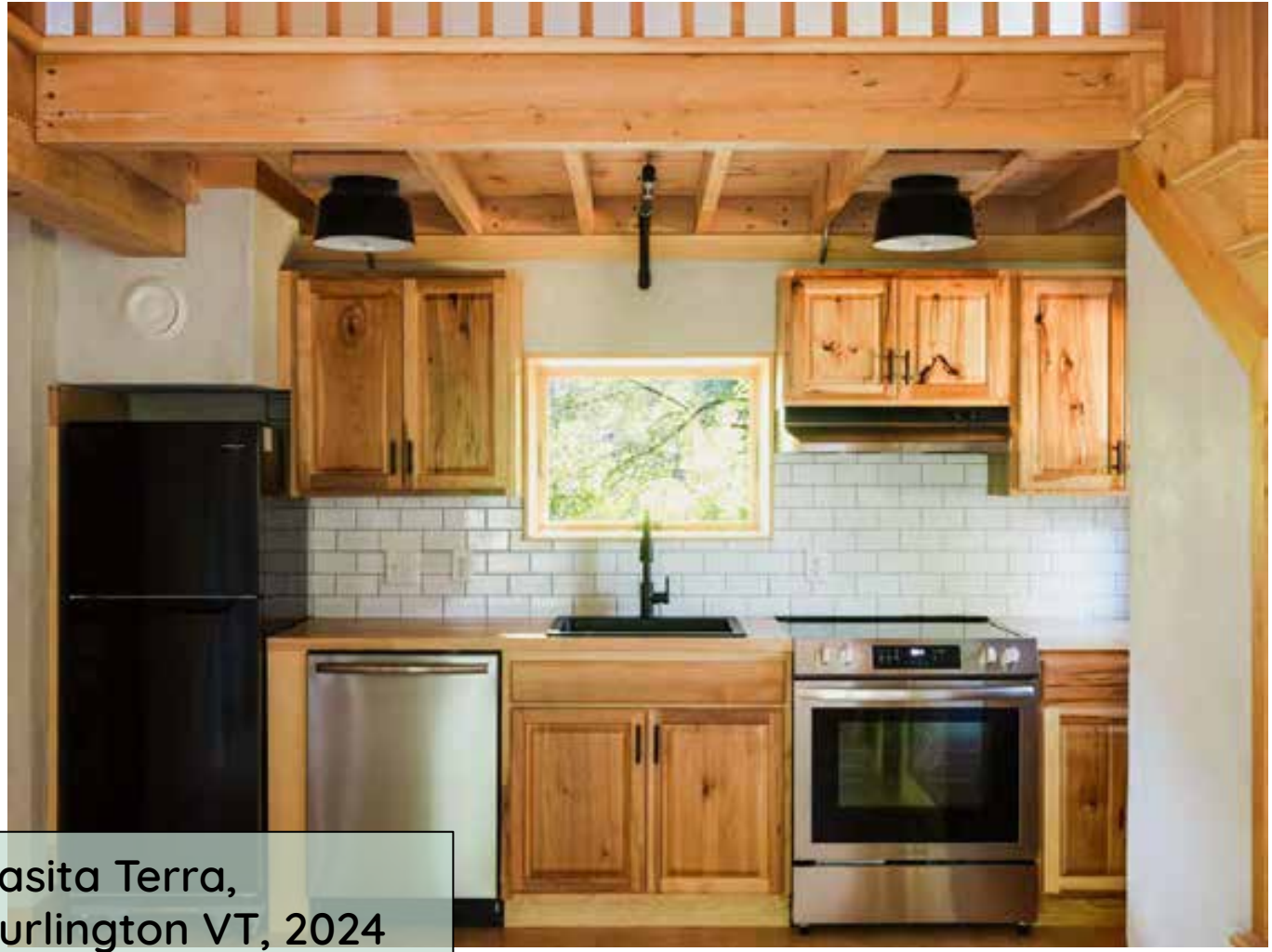

CLADDING PANELS
DOOR CABINETS

The Installation


ESSEX EQUIPMENT
Genie

Custom Panel Project,
Shelburne VT - 2024

Cabañita, Burlington VT, 2023



Casita Terra,
Burlington VT, 2024

Casita Terra,
Burlington VT, 2023

Education & Workforce Development

Scaling our movement

Cooperative business gives paths to ownership for all.

Equitable hiring, inclusive culture, and language justice build our workforce.

How We Scale: The Seed Collaborative

The Seed Program & Seed Network → Seed Collaborative:

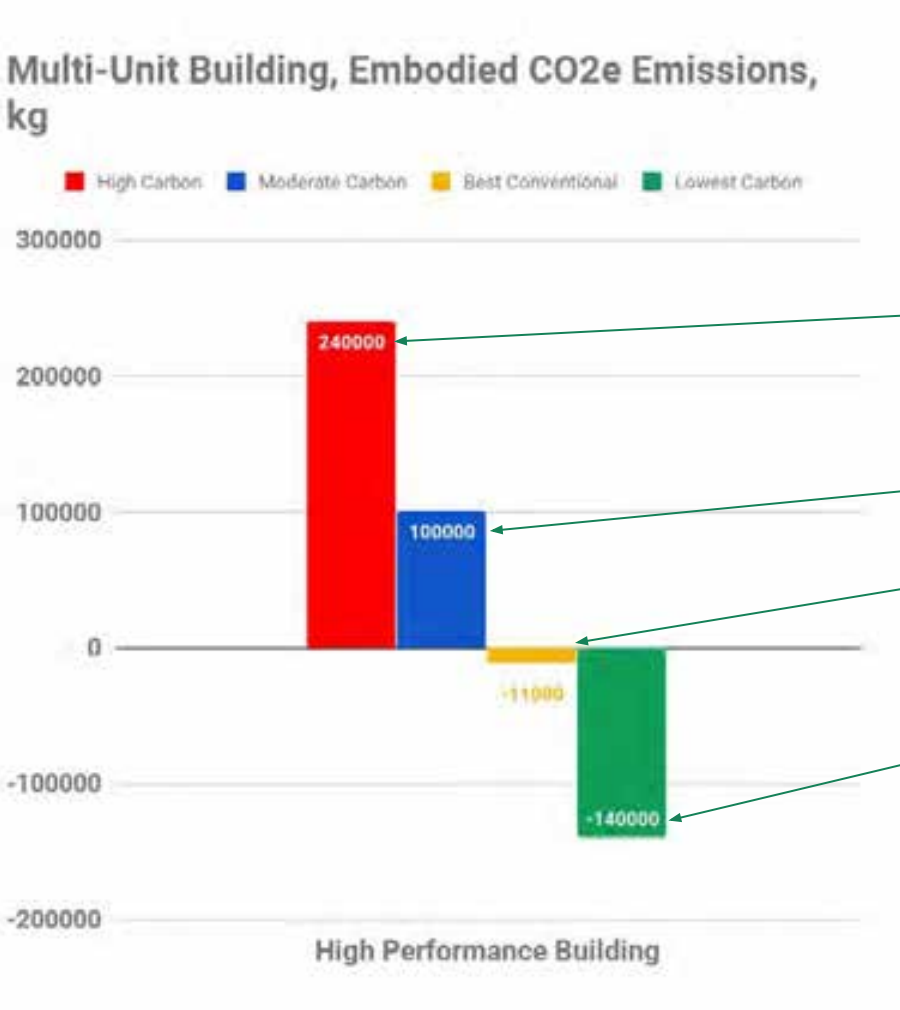
Vermont, Massachusetts, Maryland, Missouri, Colorado, Washington State

Advocacy & Organizing

In 2019, 6 years ago, I gave the keynote address for NESEA BE Boston with Chris Magwood and Jacob Racusin, entitled:

“Carbon Drawdown Now! Turning Buildings into Carbon Sinks”

How we doing?



Call to action in 2019, to do by 2024:

1. Stop doing this immediately
2. Do this right now
3. Do this within the next 2-3 years
4. Do this within the next 5 years

Trans and non-binary folks and women

Black & Indigenous & people of color & lifeways

The “Normal” Construction Industry

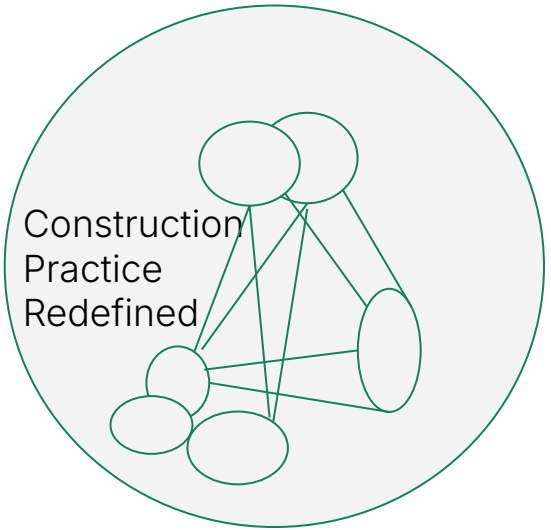
Earth & Ecology

Natural materials

Immigration & migration

Climate change & healing

Redraw, now:



Building bespoke straw homes (1-2/year)

Pre-designed, panelized kit homes “the Casitas”

Straw Structural Insulated Panels Manufacturing & Installation

Seed Collaborative: scale and grow national cooperative of regional and local producers

New Frameworks’ Seed Program (training for S-SIPS startups)

Connect BBMC to other global, continental organizations representing bio based materials (European Straw Bale Building Alliance for example)

Bio Based Materials Collective (BBMC) - connect across industry siloes to rapidly scale bio based materials - US, México, Canada

What connections do you wish you had to empower the change?

Developers, Finance, even more regenerative soil and forestry and agriculture folks, more interested in building regenerative economic systems, more Indigenous communities

Who are you going to talk to over the next 2 days?

Those people in those areas who I can identify

What will I do next to advance the use of bio based materials in the built environment?

- Keep building straw panels and predesigned straw panel kit homes
- Keep building the Seed Program and Seed Collaborative
- Keep organizing with the Bio Based Materials Collective
- Connect with those in Indigenous spaces, finance, cooperative & regenerative economics ecosystems, and development to scale the change

Chris

Who am I and what do I do?

a. Owner/builder 
b. Designer builder 
c. Manufacturing 
d. Education & Workforce Development 
e. Advocacy 

Who am I and what do I do?

a. Owner/builder 
b. Designer builder 
c. Manufacturing 
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e. Advocacy 

Who am I and what do I do?

a. Owner/builder ✅
b. Designer builder ✅
c. Manufacturing ✅
d. Education & Workforce Development ✅
e. Advocacy ✅

Who am I and what do I do?

a. Owner/builder ✅
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Who am I and what do I do?

a. Owner/builder ✅
b. Designer builder ✅
c. Manufacturing ✅
d. Education & Workforce Development ✅
e. Advocacy ✅

Who am I and what do I do?

a. Owner/builder

Pinball moment:

“This is cool stuff, but it could be done so much better…”

Who am I and what do I do?

b. Designer builder

Pinball moment:

“We need to be able to get permits more reliably…”

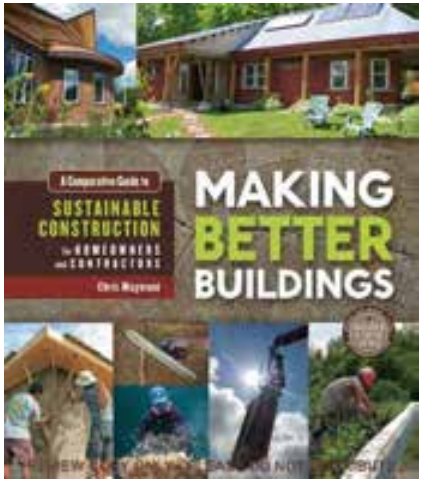
Who am I and what do I do?

c. Manufacturing

Pinball moment:

“We need a better way to build these…”

Who am I and what do I do?

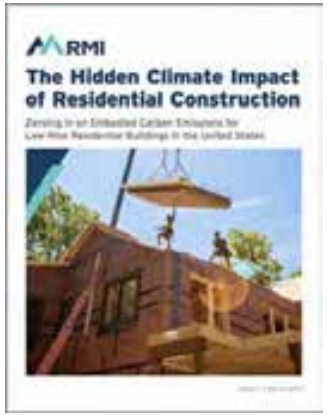


d. Education & Workforce Development

Pinball moment:

“We need more people to build these…”

Who am I and what do I do?



Pinball moment:

“We need everyone to know about this…”

e. Advocacy

Who am I and what do I do?

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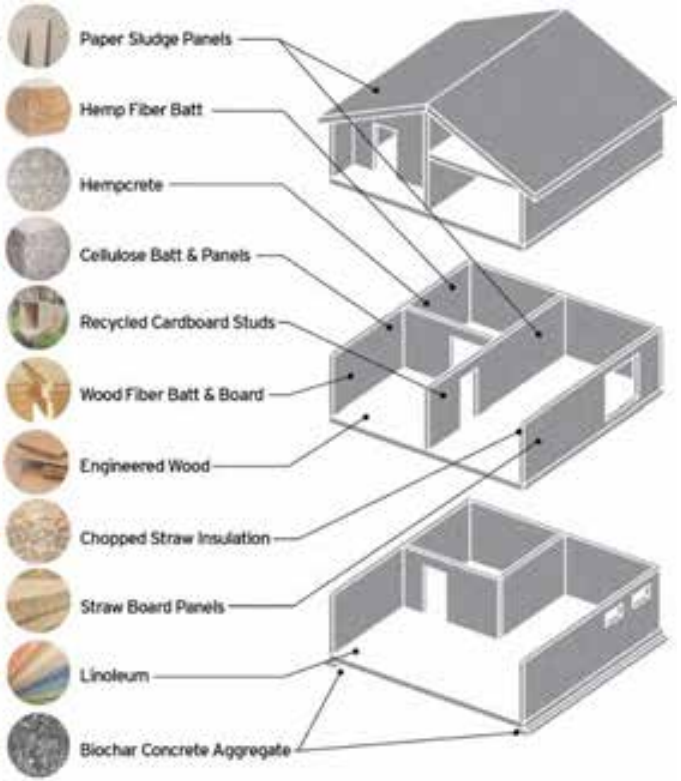
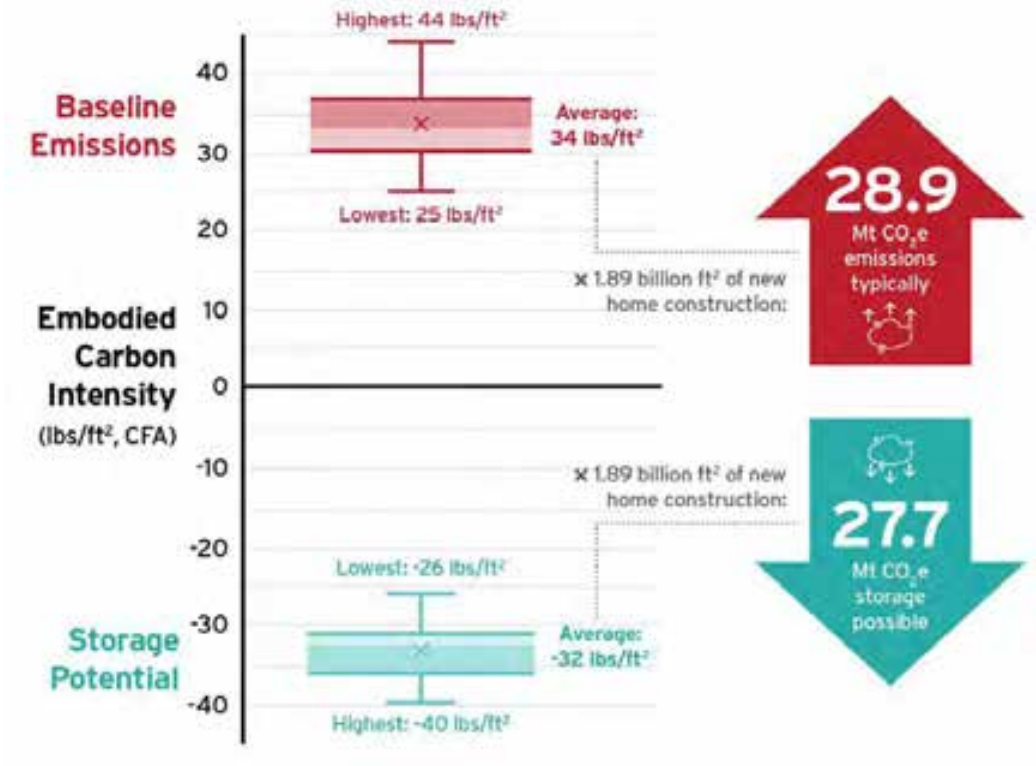




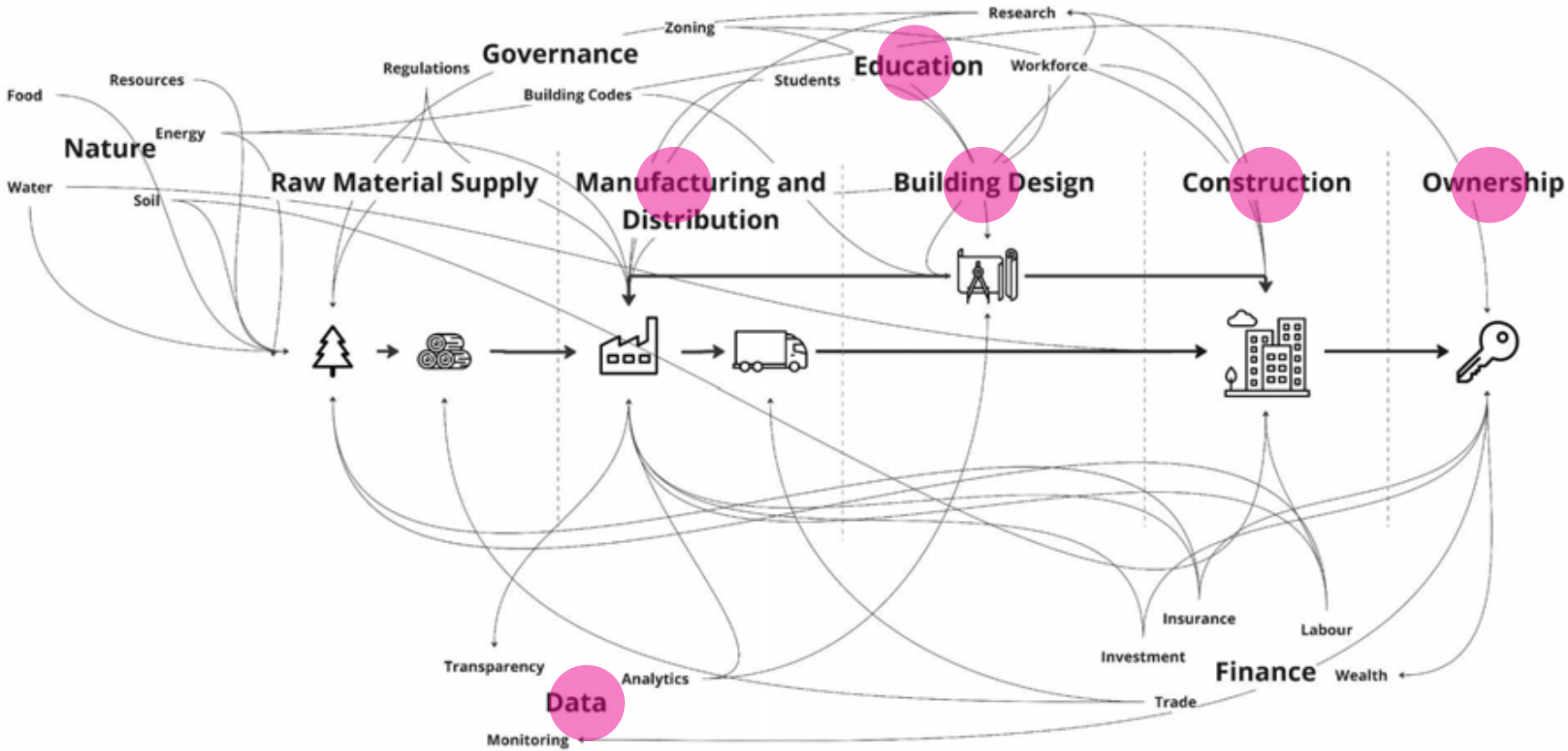
Who am I and what do I do?

By upcycling unused biomass into building products, by 2050:

100M metric tons of CO_2e could be stored profitably in new residential buildings over the next 25 years in a low-adoption scenario.

$79B of new domestic manufacturing opportunities could be created, generating 42,000 new jobs in domestic manufacturing industries.

400M tons of underused biomass from our farms, forests, and landfills will be converted into healthy, affordable products to supply growing housing demand.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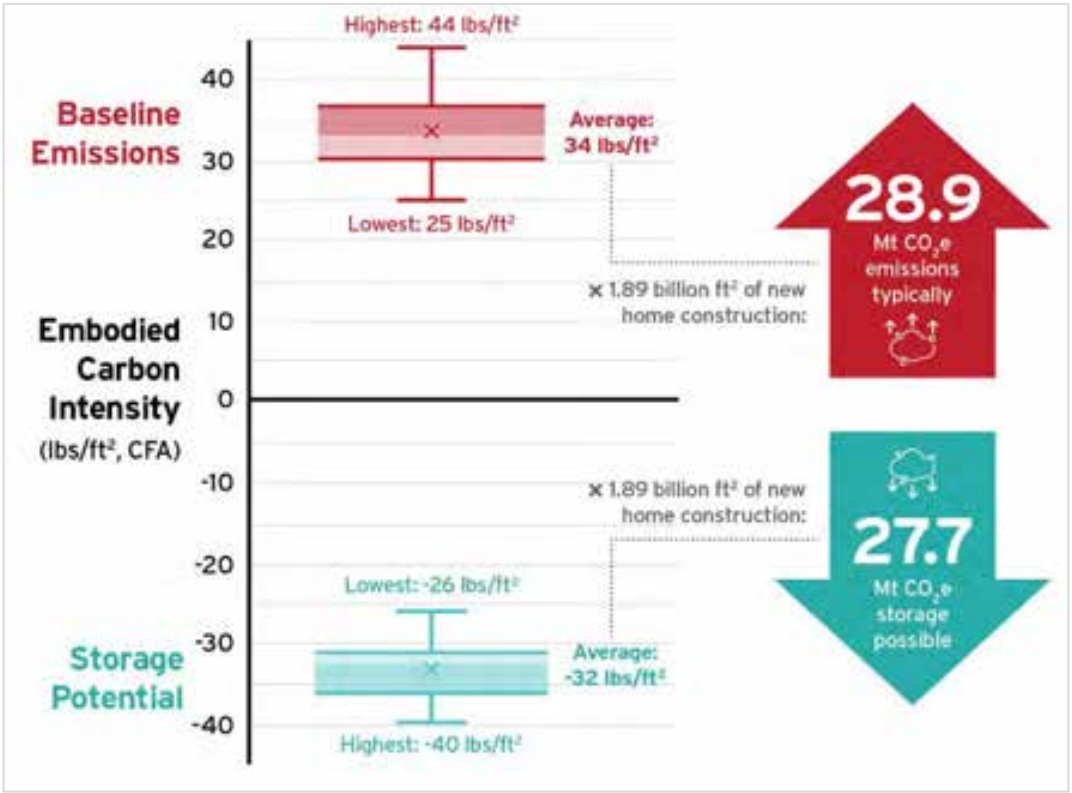
Who am I and what do I do?

I work for healthy, affordable, climate-responsible buildings

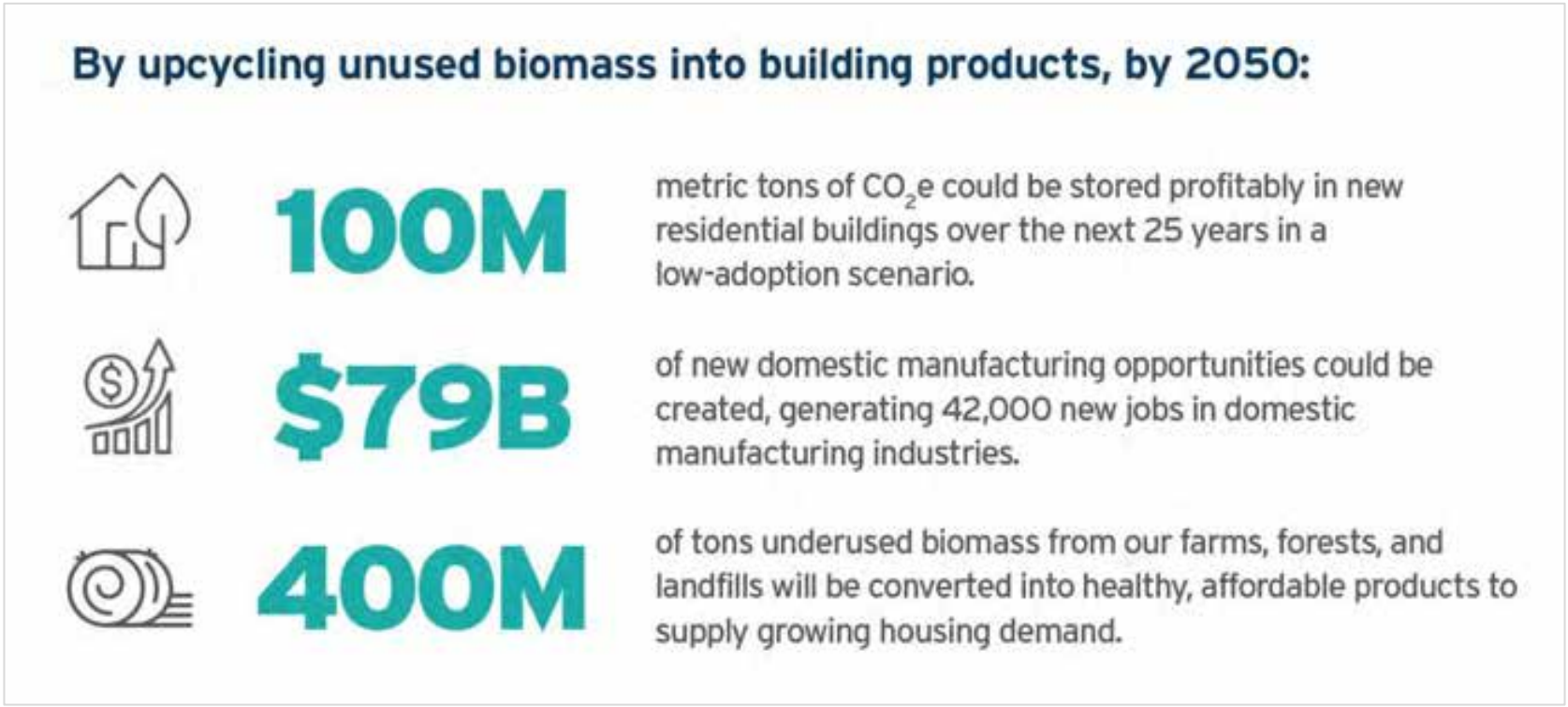
Who am I and what do I do?

I work for healthy, affordable, climate-responsible buildings



Who am I and what do I do?

I work for healthy, affordable, climate-responsible buildings



Jonsara

Who am I and what do I do?

I am a Designer

World's First GREENGUARD Certified Cribs

Who am I and what do I do?

I am an Educator

Who am I and what do I do?

I am a Researcher

Kyushu, JAPAN

Rajasthan, INDIA

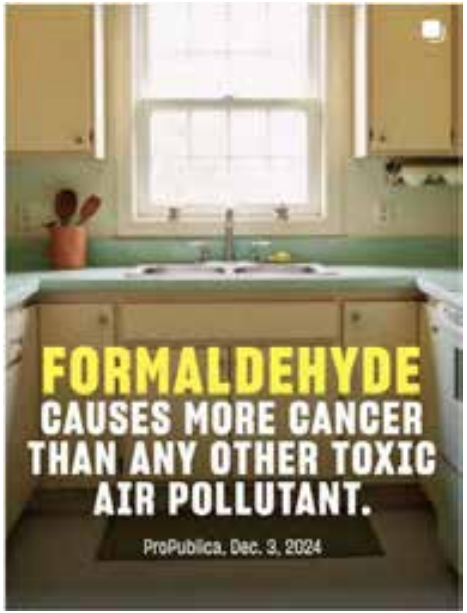
Puglia, ITALY

Kalk, Heddinge, DENMARK

Following Lime Around the World 2018-19

Who am I and what do I do?

I am an Advocate and a Futurist



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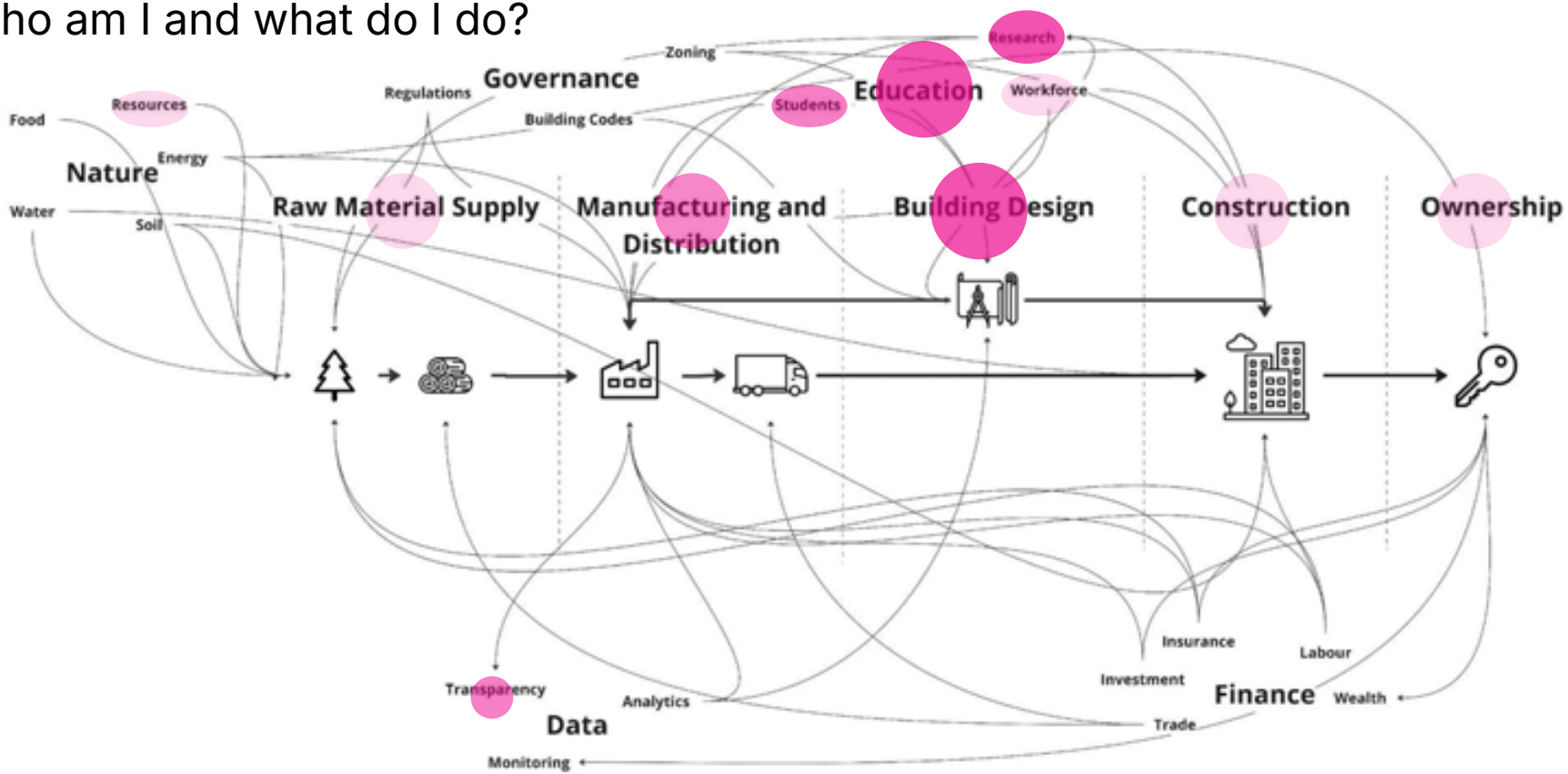


Climate Change, Toxic Burden, Loss of Biodiversity
Interconnected Triple Planetary Crisis

"Health Effects of Fossil Fuel Derived Endocrine Disrupters" March 2024

"The plastics crisis is now a global human health crisis, experts say" Nov 2024

"The building sector is key to the fight against climate change" *June 2024*

"These issues are inseparable.... to solve one, all of them must be addressed." Nov 2022

https://www.nejm.org/doi/full/10.1056/NEJMra2300476
https://news.mongabay.com/2024/11/the-plastics-crisis-is-now-a-global-human-health-crisis-experts-say/
https://chemsec.org/chemicals-are-part-of-the-triple-planetary-crisis-here-are-3-things-that-must-be-done/
https://www.weforum.org/stories/2024/06/building-sector-climate-change-construction-materials/

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

Parsons Healthy Materials Lab

The path to healthier people and planet begins with healthy affordable homes.

Centering human health in design and construction will change the future for everyone.

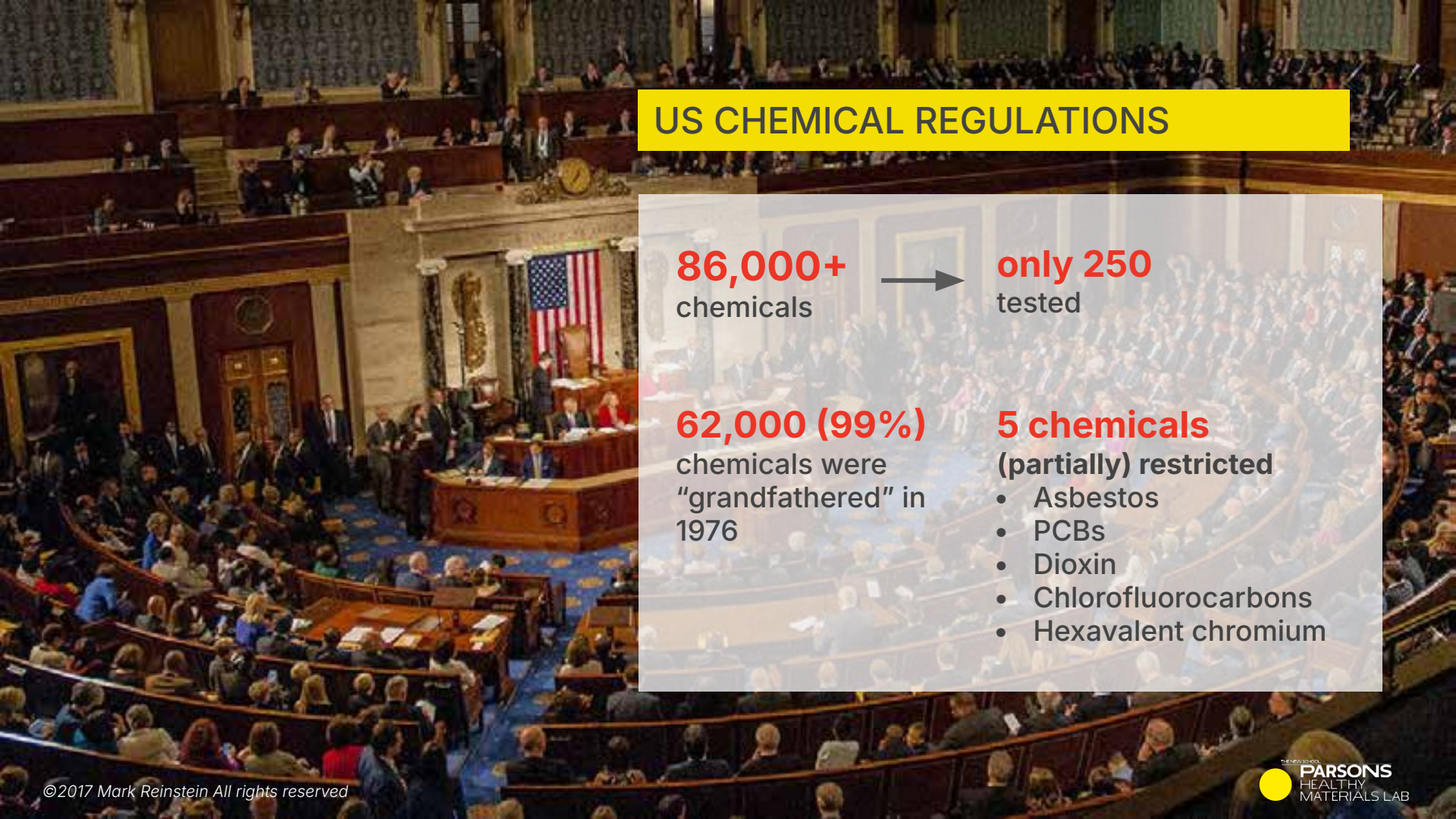
Established May 2015
Parsons School of Design | The New School | New York City

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

PARSONS HEALTHY MATERIALS LAB TEAM

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB


If we are what we eat,
we are where we live.



US CHEMICAL REGULATIONS

86,000+
chemicals

→

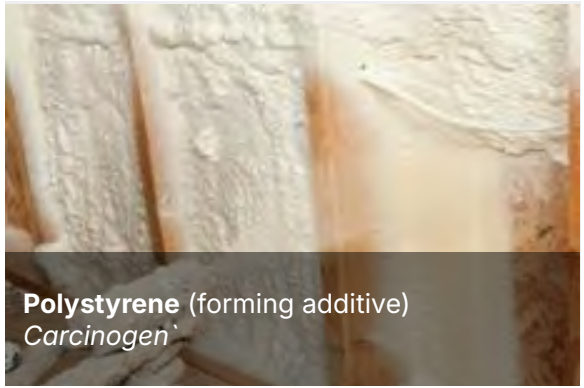
only 250
tested

62,000 (99%)
chemicals were "grandfathered" in 1976

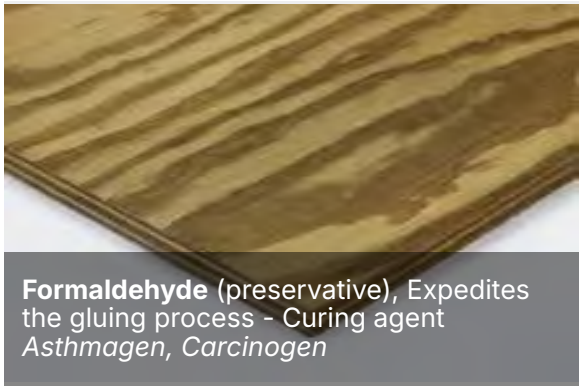
5 chemicals
(partially) restricted

- Asbestos
- PCBs
- Dioxin
- Chlorofluorocarbons
- Hexavalent chromium

HARMFUL CHEMICALS IN BUILDING MATERIALS



Polystyrene (forming additive)
Carcinogen`



Formaldehyde (preservative), Expedites the gluing process - Curing agent
Asthmagen, Carcinogen

Arsenic (biocide), Wood Treatment - Pesticide
Reproductive Toxicant

Phthalates (plasticizer)
Endocrine Disruptor

Bisphenol A (BPA) (plasticizer)
Endocrine Disruptor

Polybrominated diphenyl ethers (PBDE) (flame retardants)
Endocrine Disruptor, Reproductive

PARSONS
THE NEW SCHOOL
PARSONS HEALTHY MATERIALS LAB

PETROCHEMICAL BASED PLASTICS IN CONTEMPORARY CONSTRUCTION

Interiors:
Wall/ Window Coverings
Flooring
Shower Curtains
Furniture
etc.

Windows
Shutters
Blinds

Roofing Membrane
Fascia
Gutters
Downspouts

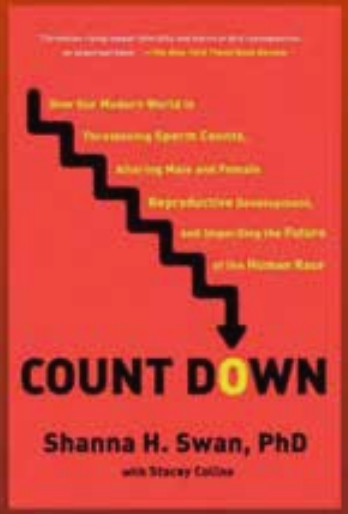
Siding
Wall Cladding / Boards
Column Wraps

Cables and Wiring
Conduit

Irrigation
Sewer Pipes

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

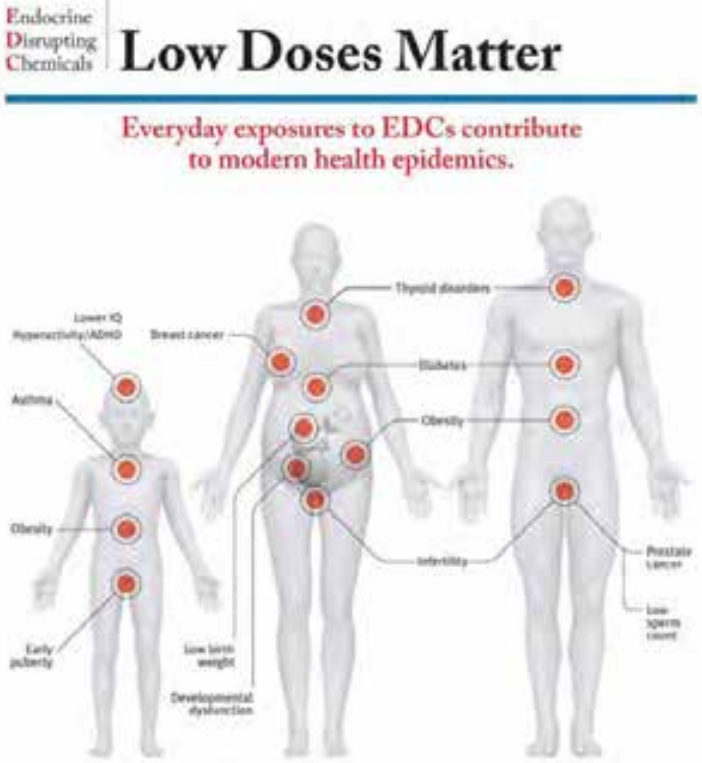
“In some ways, the sperm-count decline is akin to where global warming was forty years ago - reported upon but denied or ignored.”



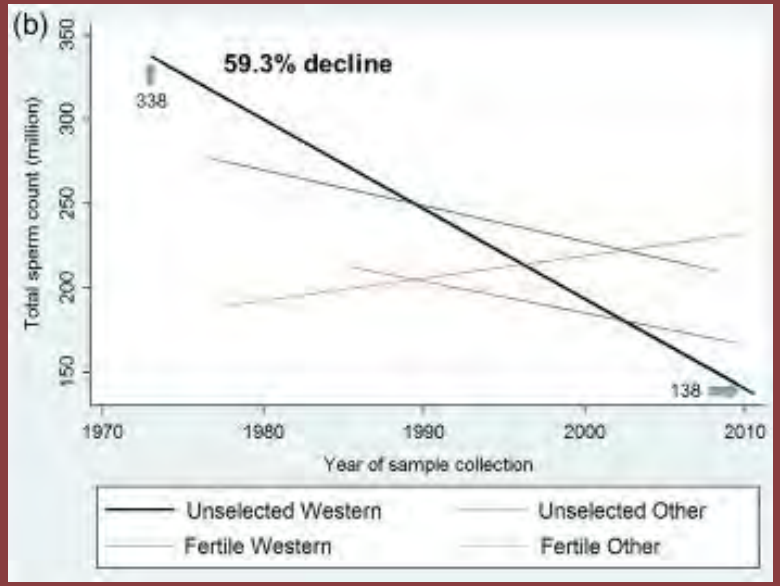
Environmental Threats
To Reproduction

Shanna Swan, PhD
Professor, Environmental Medicine and Public Health
Icahn School of Medicine at Mount Sinai

THE NEW SCHOOL
PARSONS
HEALTHY
MATERIALS LAB



59.3% decline in Sperm Count 1973 - 2011



(**b**) Meta-regression model for mean total sperm count by fertility and geographic groups, adjusted for potential confounders.

Levine, Hagai et al. "Temporal trends in sperm count: a systematic review and meta-regression analysis." Human reproduction update vol. 23,6 (2017): 646-659. doi:10.1093/humupd/dmx022

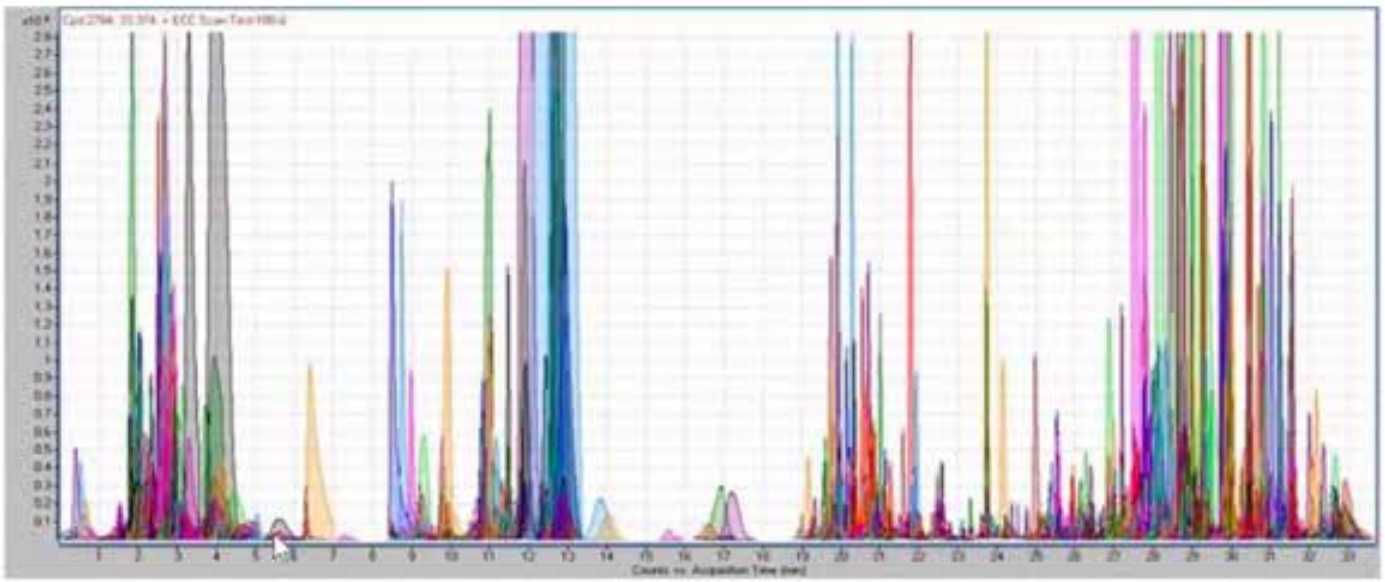
PARSONS HEALTHY MATERIALS LAB

"Genetics accounts for only about 10% of diseases, and the remaining 90% appear to be from environmental causes."

Center for Disease Control

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

THOUSANDS OF INDUSTRIAL CHEMICALS IN OUR BODIES

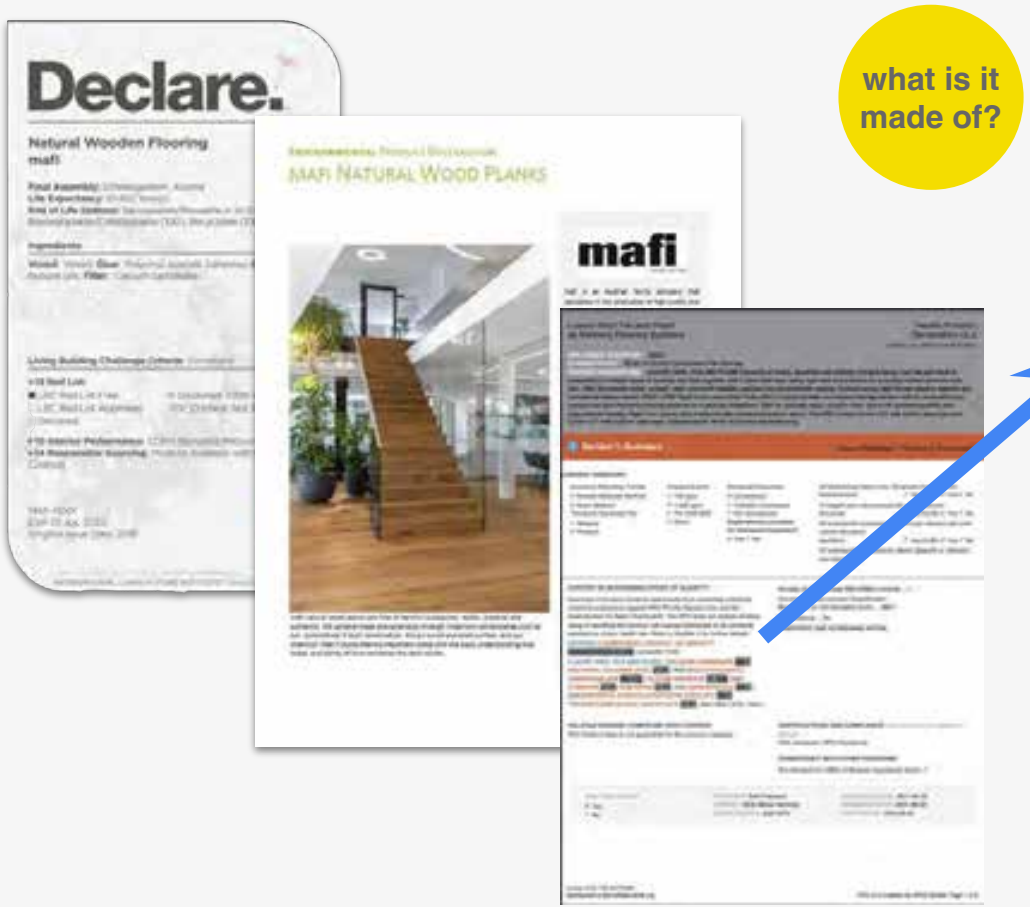


A Chromatogram measures thousands (eventually millions) of chemicals in our body: nutrients, consumer products, air, water, etc.

Internal Exposome: Measure of Blood + Urine

Will Aid In Diagnostics:
- Early diagnosis or identify disease
- Predict speed of disease progression

Ask for Transparency Documents & Ingredient Disclosures



what is it made of?

CONTENT IN DESCENDING ORDER OF QUANTITY

Summary of product contents and results from screening individual chemical substances against HPD Priority Hazard Lists and the GreenScreen for Safer Chemicals®. The HPD does not assess whether using or handling this product will expose individuals to its chemical substances or any health risk. Refer to Section 2 for further details.

MATERIAL | SUBSTANCE | *RESIDUAL OR IMPURITY*
GREENSCREEN SCORE | HAZARD TYPE

LUXURY VINYL TILE AND PLANK [CALCIUM CARBONATE BM-3 POLYVINYL CHLORIDE (PVC) LT-P1 | RES BIS(2-ETHYLHEXYL) TEREPHTHALATE BM-3dg CALCIUM STEARATE LT-UNK ZINC STEARATE LT-P1 GUM ROSIN LT-P1 | SKI CARBON BLACK BM-1 | TAN BISPHENOL A-EPICHLOROHYDRIN ACRYLATE BM-1 TRIPROPYLENE GLYCOL DIACRYLATE LT-P1 | SKI | MUL | EYE | AQU]

VOLATILE ORGANIC COMPOUND (VOC) CONTENT

VOC Content data is not applicable for this product category.

Third Party Verified?
(•) Yes
( ) No

PREPARER: Self-Prepared
VERIFIER: SCS Global Service
VERIFICATION #: qGE-6276

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

Material Health Thinking

HempLime Block

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

Material Health Thinking

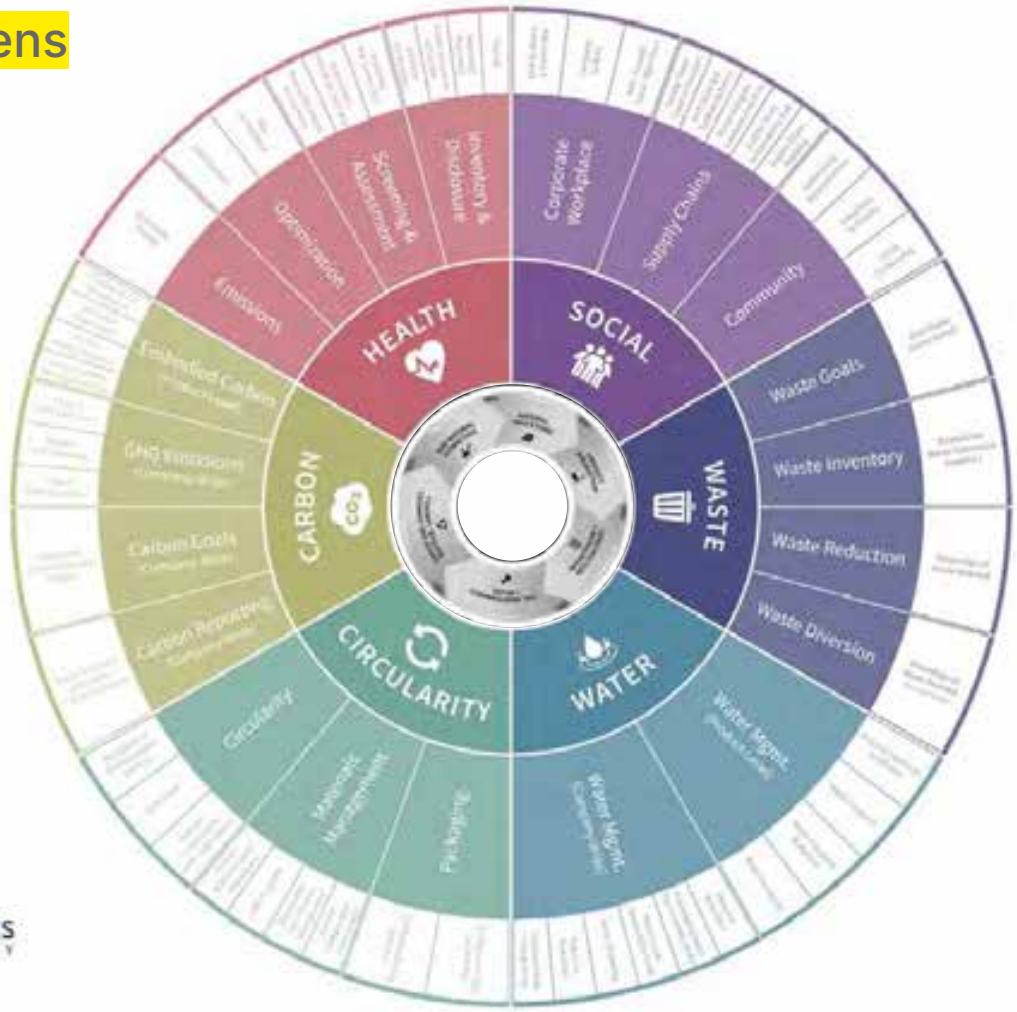
What is it made of?
How is it made?
Where is it made?
Does it require harmful finishes?
How will it be installed?
Where does it go at the end of its useful life?

Who is impacted throughout its lifecycle?

HempLime Block

Life Cycle of a Building Material

Material Health Lens



PARSONS DONGHIA healthier MATERIALS LIBRARY

BRIGHTWORKS SUSTAINABILITY

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

TOXIC COMPONENTS OF ACRYLIC PAINT

ACRYLIC RESIN

EPOXY RESIN

VOCs

PHTHALATES

HEAVY METALS

ANTIMICROBIALS

PFAS

APEs

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB


PLASTIC PAINT
LARGEST SOURCE OF
MICROPLASTICS IN THE OCEAN
https://www.e-a.earth/plasticpaintstheenvironment
PARSONS
HEALTHY
MATERIALS LAB

PLASTICS ARE NOW FOUND IN HUMAN BLOOD

https://www.sciencedirect.com/science/article/pii/S0160412022001258

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

Comparison: **Modern Acrylic Paint vs. Historic Limewash**

Low VOC Flat Acrylic Paint*

INGREDIENTS:

Water (solvent)
Limestone; Calcium Carbonate (extender)
Vinyl Acetate, Polymer w/ N-Butyl Acrylate (binder) ***carcinogen***
Titanium Dioxide (pigment) ***carcinogen***
Kaolin Clay (extender)
Propylene Glycol (freeze/thaw stabilizer) ***endocrine disruptor***
1,3-Pentanediol, 2,2,4-Trimethyl-Monoisobutyrate (coalescent) ***carcinogen***
Hydroxyethyl Cellulose (thickener) ***endocrine disruptor***
Polyethylene Glycol Nonylphenyl Ether (surfactant) *persistent bioaccumulative toxicant (PBT)*
Polysiloxanes (defoamer)
Methylchloroisothiazolinone (preservative) ***mammalian toxicant***
Polycarboxylic Acid, Sodium Salt (dispersant)
Polyurethane Based Associative Thickener (rheology modifier) ***carcinogen***
2-(2-Butoxyethoxy)Ethanol (rheology modifier) ***developmental toxicant***
Ammonium Hydroxide (pH buffer) ***respiratory toxicant***

Italian Limewash, circa 600 AD*

INGREDIENTS:

Water (solvent)
Limestone; Calcium Carbonate (binder)
Polycarboxylic Acid, Sodium Salt (dispersant)
Iron Oxide (pigments, optional)

carcinogen
endocrine disruptor
persistent bioaccumulative toxicant
mammalian toxicant
developmental toxicant
respiratory toxicant

Content based on Pharos Common Product Profile

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PLASTICS EMISSIONS
WILL OUTPACE COAL BY 2030
https://www.beyondplastics.org/plastics-and-climate
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HEALTHY
MATERIALS LAB

THE REDUCED CARBON IMPLICATIONS

44%
Reduction in CO2

Climate impact of indoor paint according to binder type (A1-A3 phases)

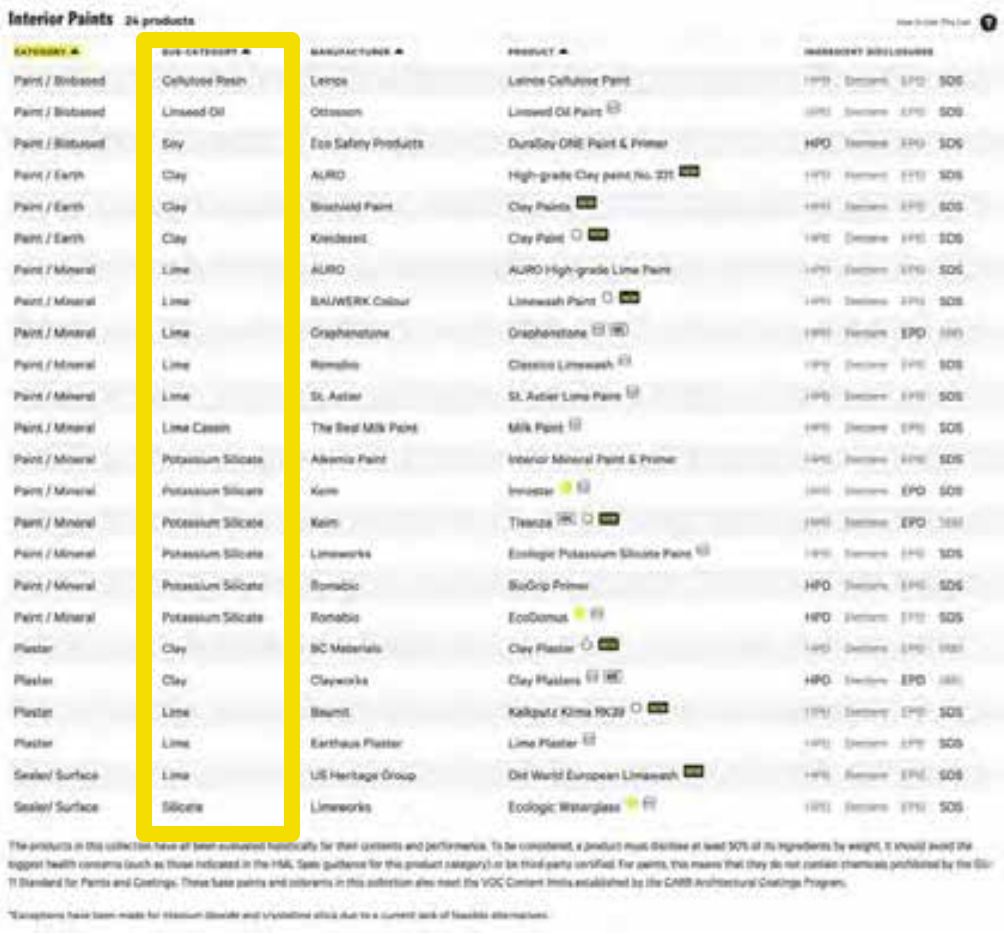
Using products' average coverage & two layers

Visual and data adapted from Henning Larsen, 2024

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

Spec Guidance

- ✔ **Minimize specifying Acrylic Paint.** New research shows that **Acrylic (Plastic) Paint appears the largest source of microplastics** in oceans and waterways. And, acrylic paint is now **found in human blood**.
- ✔ **Prefer Mineral-based paints.** They tend to avoid VOCs and hazardous additives. Certain mineral-based paints also absorb impurities from the air, actively improving indoor air quality.
- ✔ **Look for paints that meet the Green Seal-11 (GS-11) standard from 2010 or later**. This certification limits the content of VOCs and prohibits other potential hazards such as heavy metals, carcinogens, mutagens, and reproductive toxins.
- ✔ **Prefer paints that meet the strict VOC emission standards** of the CDPH Standard Method.
- ✔ **Specify paints with a VOC content of 10g/L or less.** Look out for VOCs in colorants.

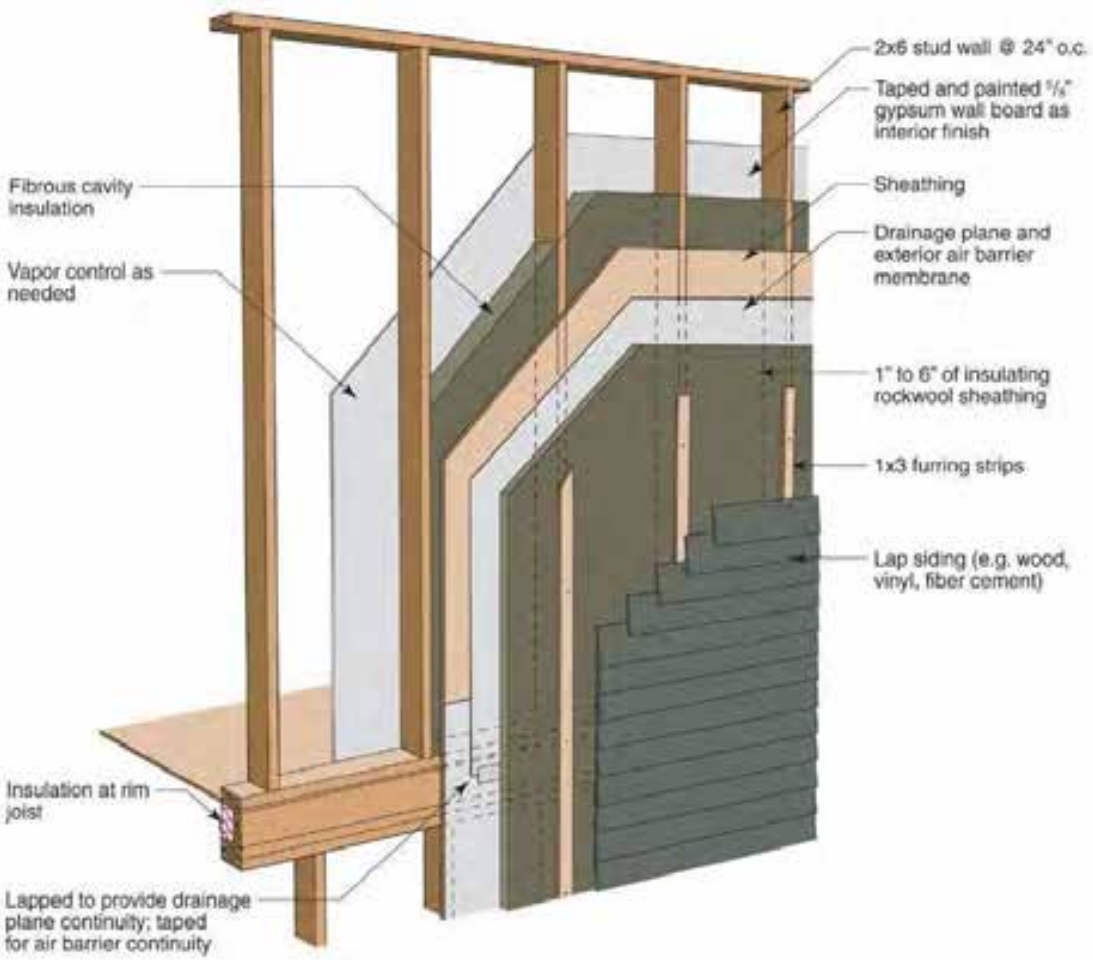


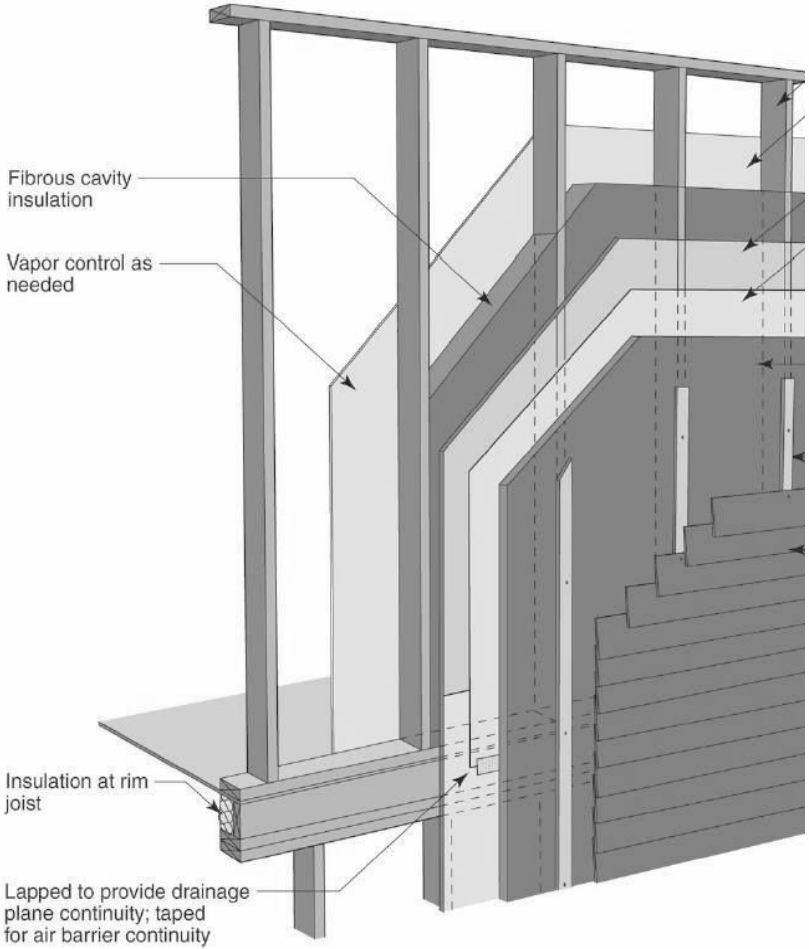
Interior Paints 24 products

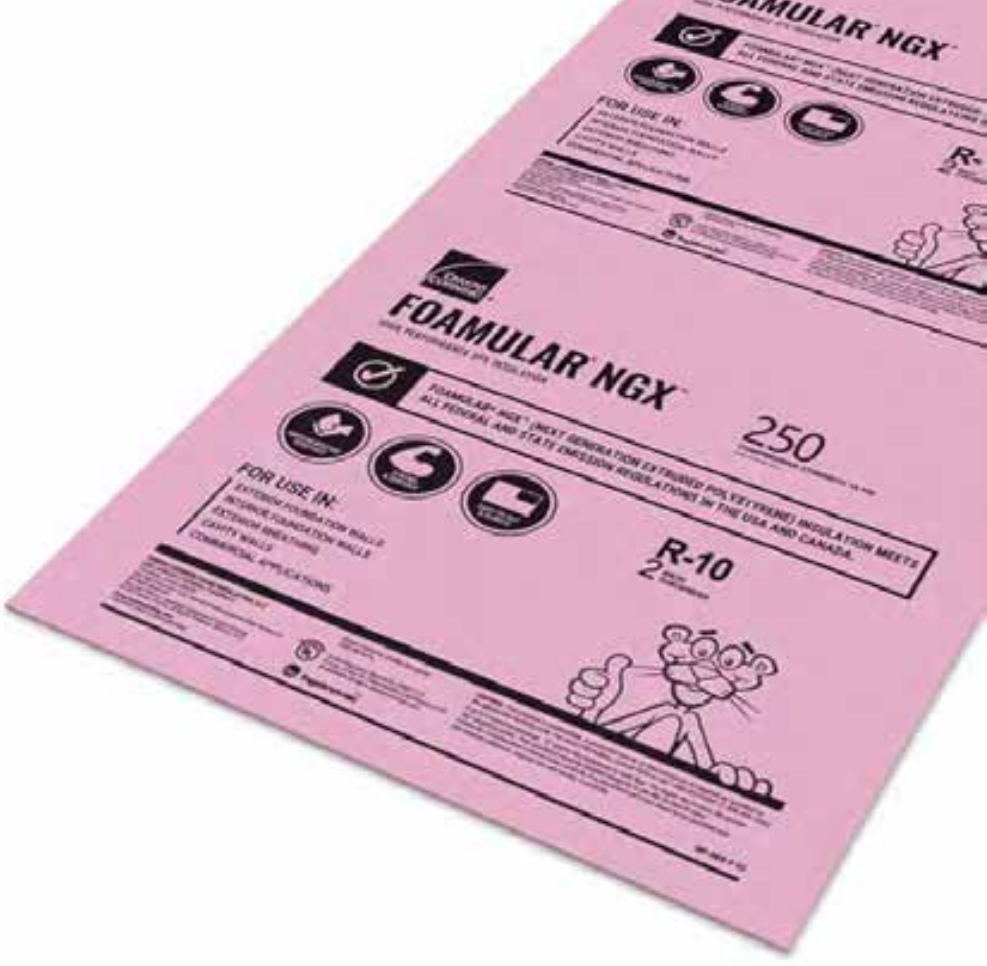
CATEGORY	SUB-CATEGORY	MANUFACTURER	PRODUCT	INGREDIENT DISCLOSURE
Paint / Biobased	Cellulose Resin	Lanros	Lanros Cellulose Paint	SDS
Paint / Biobased	Linseed Oil	Ottosson	Linseed Oil Paint	SDS
Paint / Biobased	Soy	Eco Safety Products	DuraSoy ONE Paint & Primer	HPD SDS
Paint / Earth	Clay	AURO	High-grade Clay paint No. 331 NEW	SDS
Paint / Earth	Clay	Bioshield Paint	Clay Paints NEW	SDS
Paint / Earth	Clay	Kreidezeit	Clay Paint NEW	SDS
Paint / Mineral	Lime	AURO	AURO High-grade Lime Paint	SDS
Paint / Mineral	Lime	BAUWERK Colour	Limewash Paint NEW	SDS
Paint / Mineral	Lime	Graphenstone	Graphenstone EPD	EPD
Paint / Mineral	Lime	Romabio	Classico Limewash	SDS
Paint / Mineral	Lime	St. Astier	St. Astier Lime Paint	SDS
Paint / Mineral	Lime Casein	The Real Milk Paint	Milk Paint	SDS
Paint / Mineral	Potassium Silicate	Alkemix Paint	Interior Mineral Paint & Primer	SDS
Paint / Mineral	Potassium Silicate	Keim	Innostar	EPD SDS
Paint / Mineral	Potassium Silicate	Keim	Tiranza NEW	EPD
Paint / Mineral	Potassium Silicate	Limeworks	Ecologic Potassium Silicate Paint	SDS
Paint / Mineral	Potassium Silicate	Romabio	BioGrip Primer	HPD SDS
Paint / Mineral	Potassium Silicate	Romabio	EcoDomus	HPD SDS
Plaster	Clay	BC Materials	Clay Plaster NEW	SDS
Plaster	Clay	Claywerks	Clay Plasters NEW	HPD EPD
Plaster	Lime	Baumit	Kalkputz Klima 19C2F NEW	SDS
Plaster	Lime	Earthaus Plaster	Lime Plaster	SDS
Sealer/ Surface	Lime	US Heritage Group	Old World European Limewash NEW	SDS
Sealer/ Surface	Silicate	Limeworks	Ecologic Waterglass	SDS

The products in this collection have all been evaluated holistically for their contents and performance. To be considered, a product must disclose at least 50% of its ingredients by weight, it should avoid the biggest health concerns (such as those indicated in the HML Spec guidance for this product category) or be third-party certified. For paints, this means that they do not contain chemicals prohibited by the Gr-11 Standard for Paints and Coatings. These base paints and colorants in this collection also meet the VOC Content limits established by the CARB Architectural Coatings Program.

*Exceptions have been made for titanium dioxide and crystalline silica due to a current lack of feasible alternatives.


2x6 stud wall @ 24" o.c.
Taped and painted ⅛" gypsum wall board as interior finish
Sheathing
Drainage plane and exterior air barrier membrane
1" to 6" of insulating rockwool sheathing
1x3 furring strips
Lap siding (e.g. wood, vinyl, fiber cement)
Fibrous cavity insulation
Vapor control as needed
Insulation at rim joist
Lapped to provide drainage plane continuity; taped for air barrier continuity


Fibrous cavity insulation
Vapor control as needed
Insulation at rim joist
Lapped to provide drainage plane continuity; taped for air barrier continuity


FOAMULAR NGX
FOR USE IN:
250
R-10

HempLime


HEMP + LIME
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PARSONS
HEALTHY
MATERIALS LAB


HEMP ABSORBS BETWEN 8-15 METRIC
TONS OF CARBON PER HECTARE
more than captured by tree forests
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MATERIALS LAB

HEMP+LIME

100% Recyclable + Biodegradable

Regulates Indoor Humidity + Climate

Carbon Sink-Net Carbon Sequestering

Energy Efficient Insulation

Naturally Fire Resistant

Mold and Pest Resistant

100 years certified

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HempLime Insulation
PA Hemp Home
New Castle, PA

THE NEW SCHOOL
PARSONS
HEALTHY
MATERIALS LAB

Hemp Fiber Test Acres Program

DON Services, New Castle, PA
2019 Harvest

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

PA HEMP HOME

HempLime Insulation
PA Hemp Home
New Castle, PA

PARSONS HEALTHY MATERIALS LAB

Cameron McIntosh of Americhanvre filling small cavities by hand

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MATERIAL PALETTE

Formaldehyde Free Plywood
Columbia Forest Products

Engineered Wood Floors
HempWood

Unglazed Colorbody Porcelain Tile
Daltile

Lime Plaster with Lime Wash
Limeworks.us

Linseed Oil Paint
Ottosson - Earth + Flax

Wool Carpet
Aronson's Floor Coverings

Solid Granite
Precision Countertops

PARSONS HEALTHY MATERIALS LAB

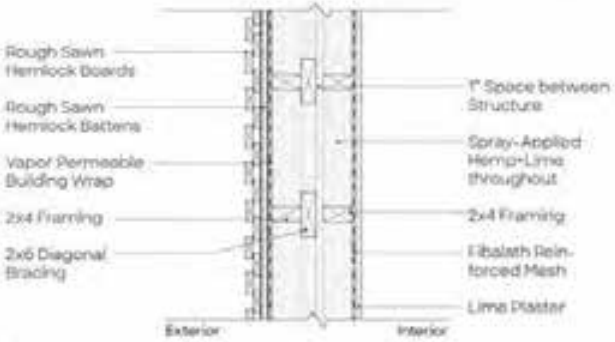
TESTING HEMP + HEALTHIER MATERIALS' IMPACT

Testing the Indoor Air Quality for VOCs, Formaldehyde, PFAS and other toxics

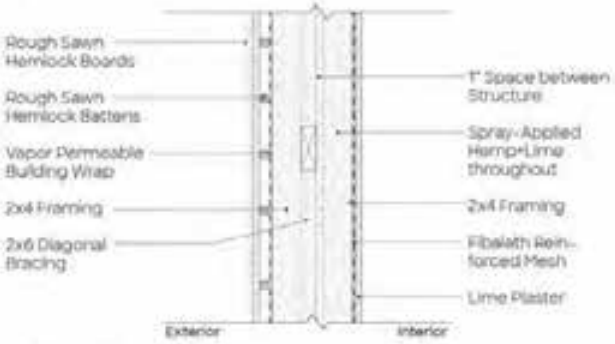
Sensors were installed to test the energy efficiency of the HempLime wall system

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

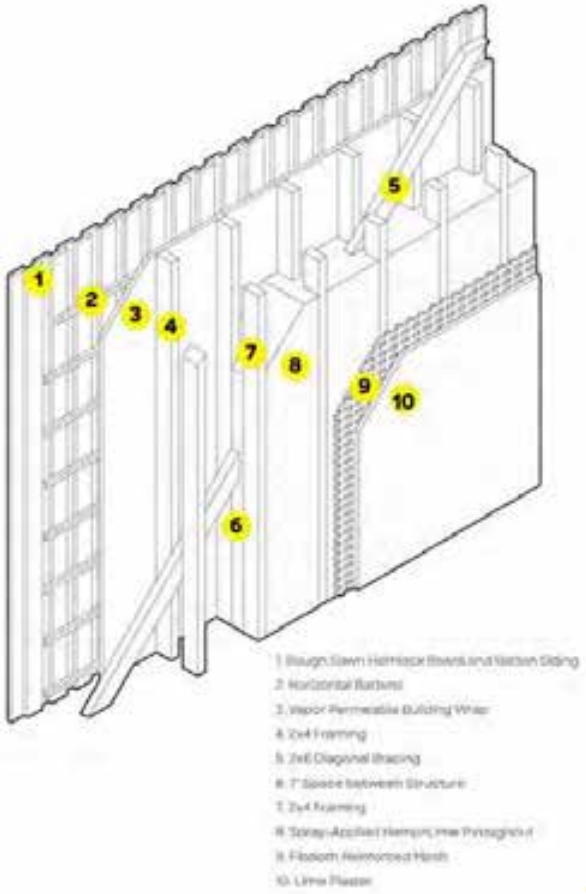
WALL SECTION DETAILS



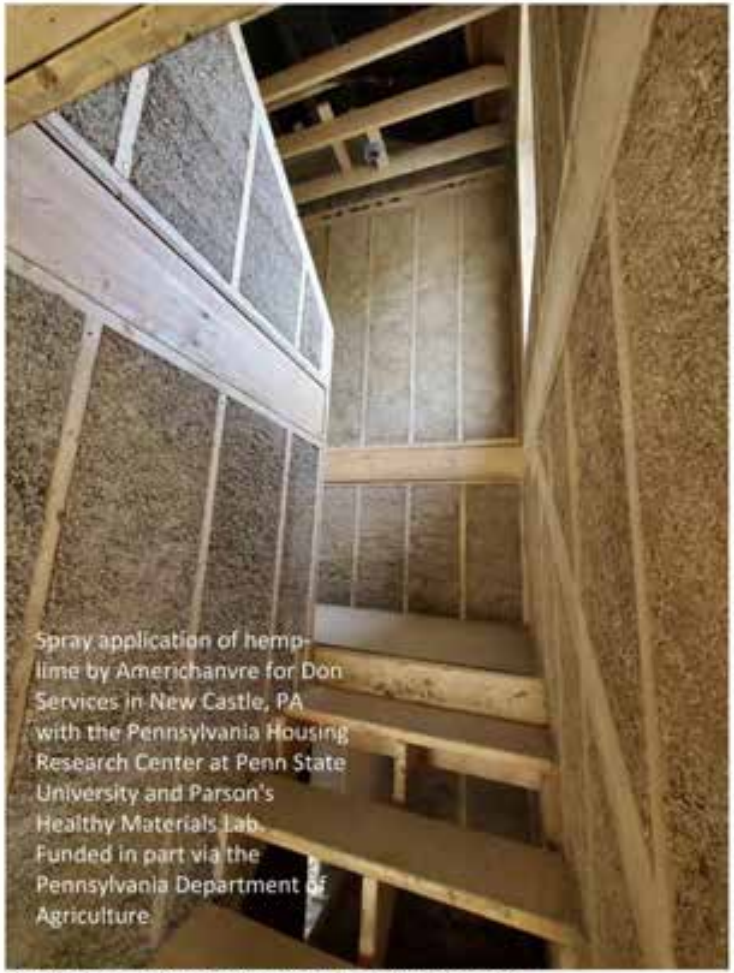
PLAN



SECTION



THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB



New Castle stairs photo courtesy of Cameron McIntosh

RATIONALE FOR SPECIFIC SECTIONS OF PROPOSED APPENDIX Y – HEMP-LIME (HEMPCRETE) CONSTRUCTION

SECTION AY101 - GENERAL: Hemp-lime is limited to use as a nonbearing, wall infill material. It primarily functions as insulation and a substrate for finish. Until further seismic testing is done, hemp-lime construction is restricted to use in Seismic Design Categories (SDCs) A, B, and C, except with an approved engineered design. Engineering analysis based on structural and materials tests and accepted engineering practice have determined hemp-lime's safe prescriptive use in SDCs A, B, and C, within the limits of the IRC's structural provisions and this appendix. Testing reports, structural analysis, and other supporting documents are available at: https://ushba.org/icc-supporting-documents/

SECTION AY102 - DEFINITIONS: Hemp-lime specific terms not found in the IRC are defined. Some definitions are consistent with identical or related terms defined in IRC appendices AR – Light Straw-Clay Construction, AS - Strawbale Construction, and AU - Cob Construction.

SECTION AY103 - HEMP-LIME CONSTRUCTION: Hemp-lime as a non-structural infill must comply with the Figures in Section AY103 or an approved alternative. The four Figures show different locations of the structural stud wall framing; interior, center, exterior, or double (interior and exterior). These Figures indicate the IRC sections that the foundation, wall framing, floor, and roof/ceiling assembly must comply with, unless otherwise stated in the appendix. They also identify code sections for other elements of a hemp-lime wall. Hemp-lime infill is limited to densities within a range of 12.5 to 25 pcf. This range encompasses the practical and commonly used hemp-lime densities.

SECTION AY104 - FINISHES: Hemp-lime infill requires vapor permeable finishes on the interior and exterior of the wall. The finish is necessary to create an air barrier and the high vapor permeability is required to allow vapor to move through the wall. As with many other building materials, hemp-lime infill must be sufficiently dry before finishes are applied. Hemp-lime is most commonly finished with plaster. Plaster is best applied directly to the hemp-lime infill.

SECTION AY105 - FIRE RESISTANCE: Hemp-lime is known for its fire-resistive properties through tests in Europe. When structural members are surrounded by hemp-lime infill, it can protect them from fire. However because ASTM E119 or UL263 tests have not yet been performed, a fire-resistance rating is not included in this proposal.

SECTION AY106 - THERMAL PERFORMANCE: Hemp-lime walls provide we[illegible] performance, with a combination of low thermal conductivity, thermal mass, and hygrothermal effects.

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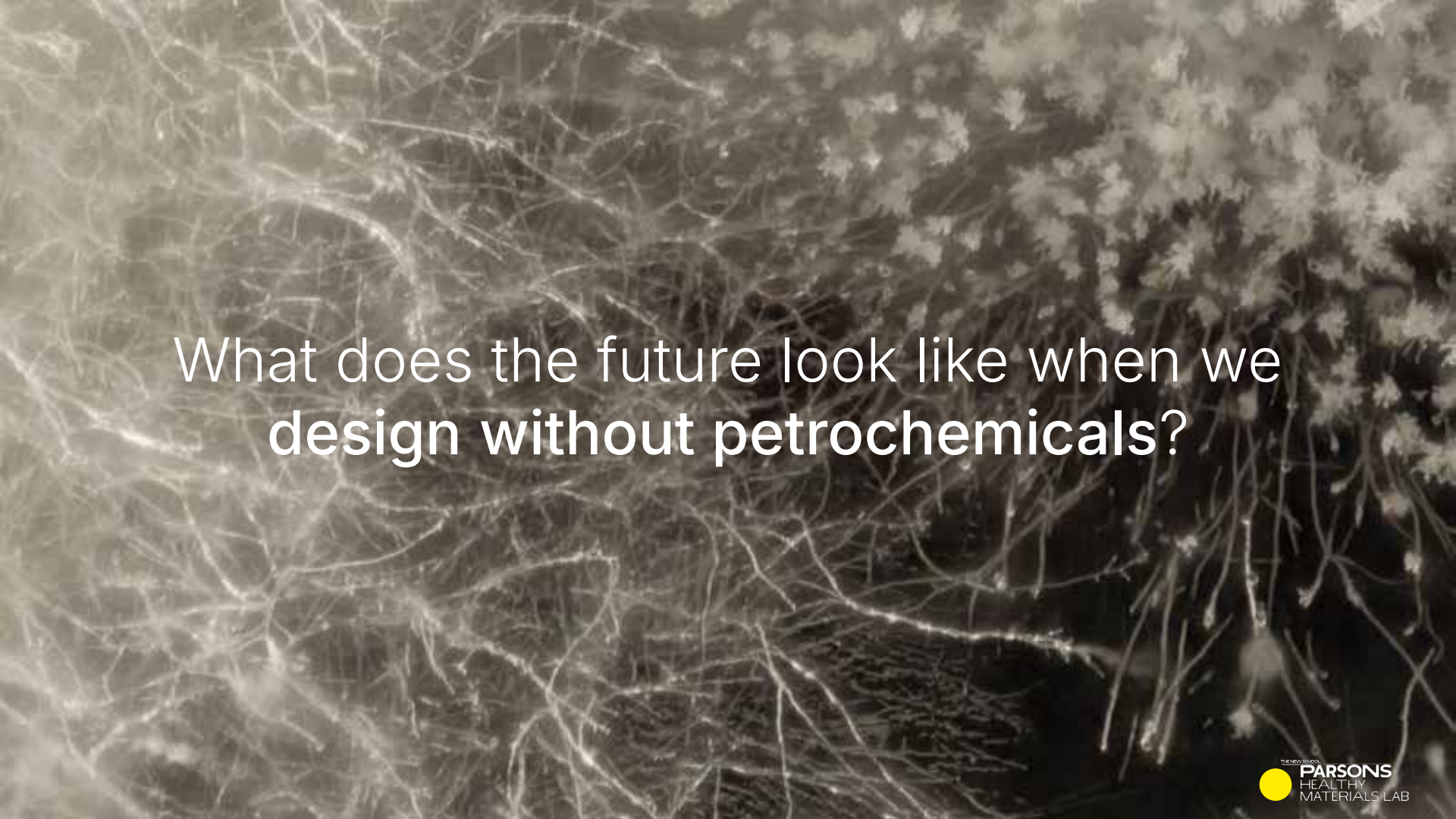
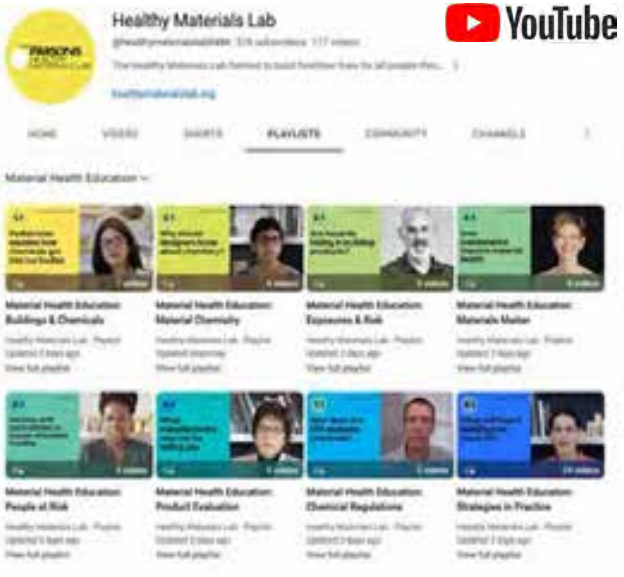
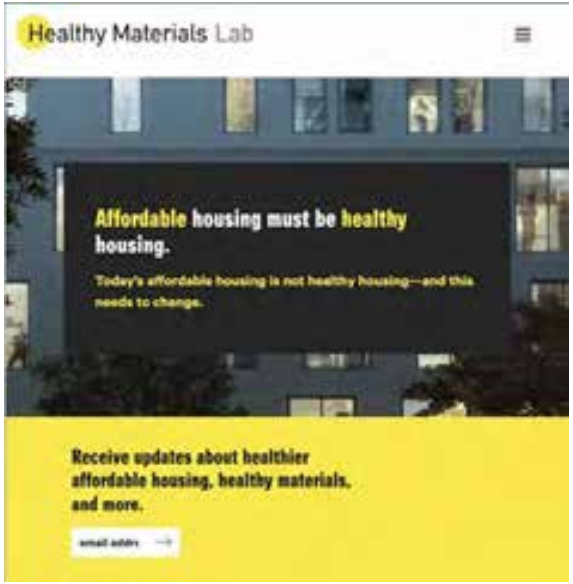
What does the future look like when we **design without petrochemicals**?


What does the future look like when we
design without petrochemicals?
THE NEW SCHOOL
PARSONS
HEALTHY
MATERIALS LAB

What Does HML Do?

Free Resources, Education + Awareness Campaigns





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Sustainable Building: A Materials Guide
at Parsons School of Design

1. Health in Practice

This course provides tools and methods to make healthier building product choices while being mindful of cost and larger issues of sustainability.

2. Designing + Building A Healthy, Circular Future

In this course we discuss design strategies, methods and priorities that can help you identify useful design principles and achieve your healthier materials goals.

Visit our Learning Hub for Online Material Health Education.

Short Courses on Material Health

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

Healthier Building Product Collections

Specify healthier, sustainable, low-carbon choices

Wall Coverings

Healthier Finishes

Exterior & Structural

Textiles

Flooring

Interior Paints

Composite Wood Products

Insulation

Wallboard

Adhesives, Mortars, Grouts, and Sealants

Countertops

Carpet

Tile

Visit our Material Collections for healthier, low-carbon products.

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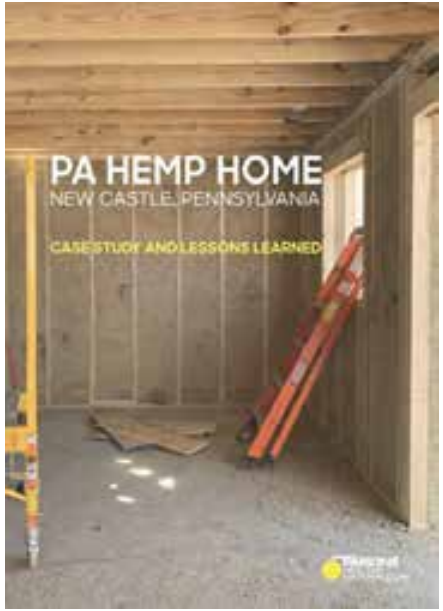
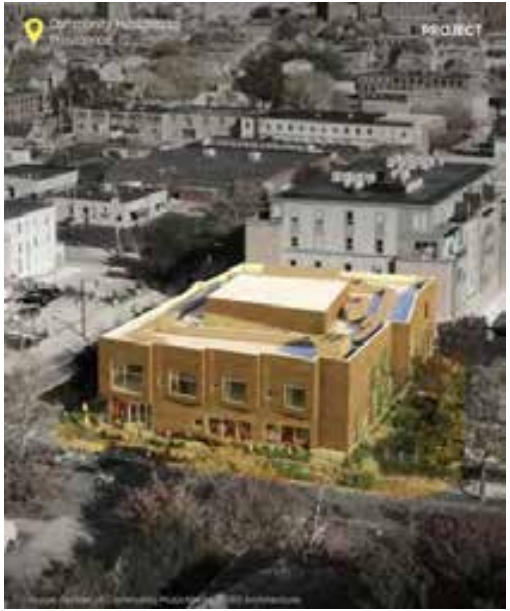
Consultations + Demonstration Projects

Create replicable, healthy, sustainable construction projects

NYCHA = 170,000 Homes
Eliminate High VOC Paint



PA Hemp Home used as Supportive documentation for the proposed Hemplime Construction appendix for IRC



Community MusicWorks in Providence, Rhode Island; a pioneering, healthy, low-embodied carbon center for music performance, education and community.

Visit our Demonstrations for healthier projects.

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Free Events
Online and In-Person

Restoration and Resilience: Rebuilding Ukraine

March 3, 2025
6:30pm – 8:00pm
Wollman Hall

Join architects Victoria Caubet and Alison Mears for a powerful talk on rebuilding Ukraine with sustainable design and circular materials. This will be a hybrid (in person and online) event.

Marine Materials: Designing the Future

March 25, 2025
12:00pm – 1:30pm

Discover how aquatic plants like seaweed, eelgrass, and algae are shaping a healthier, petroleum-free future in design with experts in biobased materials and marine biology.

From Field to Form: Cork with The Architectural League of New York

April 28, 2025
6:30pm – 8:00pm
Wollman Hall

A group of experts discuss the use of cork as a building material.

Subscribe to be the first to know of upcoming events.

Events on Demand
30+ Events Available

Sustainable and Equitable Manufacturing with IKEA
Healthy Materials Lab

Mineral Paint: Rock Beats Plastic. A Presentation by Keim
Healthy Materials Lab

An Integrated Approach to Material Health in Affordable Housing with Mithun
Healthy Materials Lab

Kia Weatherspoon on Interior Design for Affordable Housing
Healthy Materials Lab

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

"Materials are the crux of the problem. They are also the key to the solution."

Martha Lewis
Senior Architect and Head of Materials,
Henning Larsen Architects, Denmark

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MATERIALS LAB

healthymaterialslab.org

@healthymaterialslab

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HEALTHY
MATERIALS LAB

James

MASS.

Performance

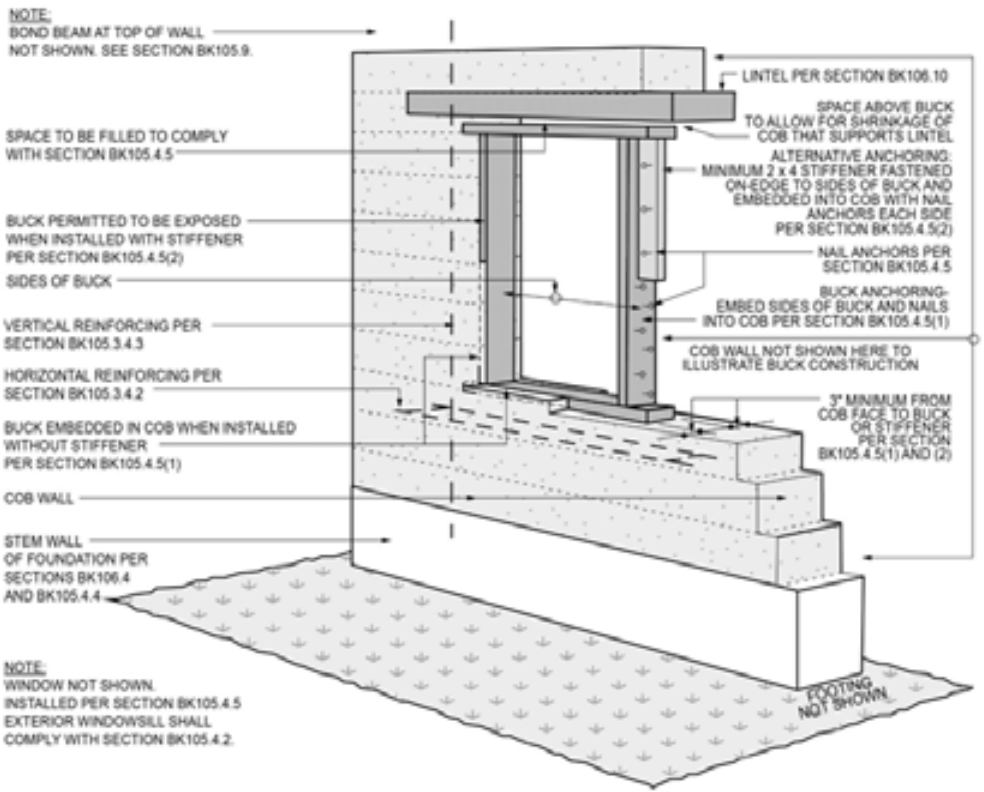
Fire

Code

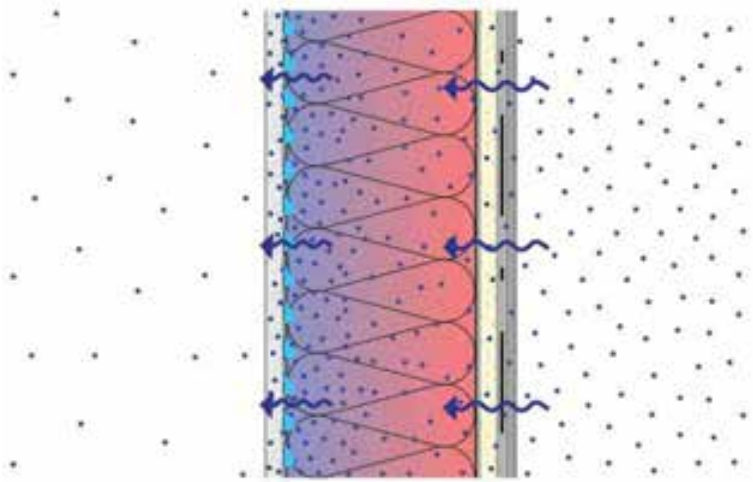
Petrochemical products have exceptions in the building code, but ...

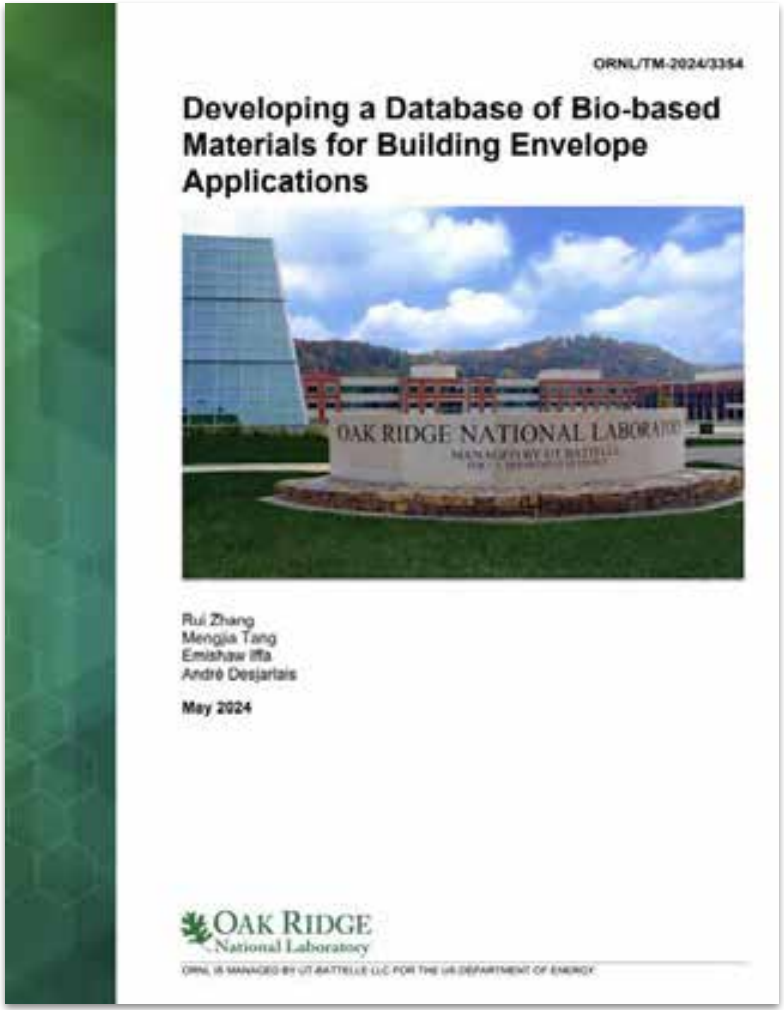
IRC 2024

- Appendix BI Light Straw-Clay Construction
- Appendix BJ Strawbale Construction
- Appendix BK Cob Construction
- Appendix BL Hemp-Lime (Hempcrete) Construction



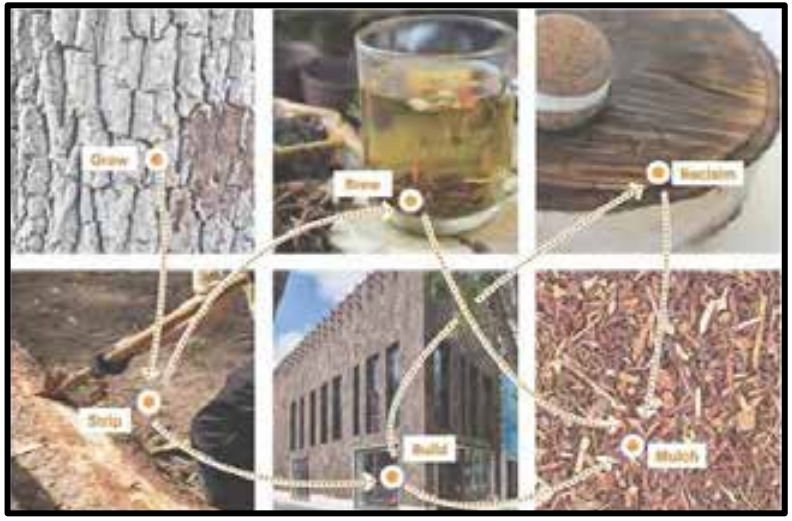
Material Data






Forage
Cook
Build
Grow
Form
Compost


Grow
Bake
Build
Process
Eat
Mulch


Grow
Brew
Reclaim
Strip
Build
Mulch


Grow
Build
Nest
Bale
Plow
Mulch

Who am I and what do I do?

Structural Engineer

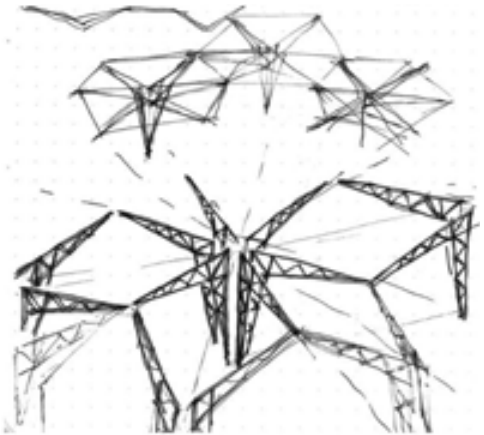
Who am I and what do I do?

Structural Engineer

Who am I and what do I do?

Structural Engineer

Designer

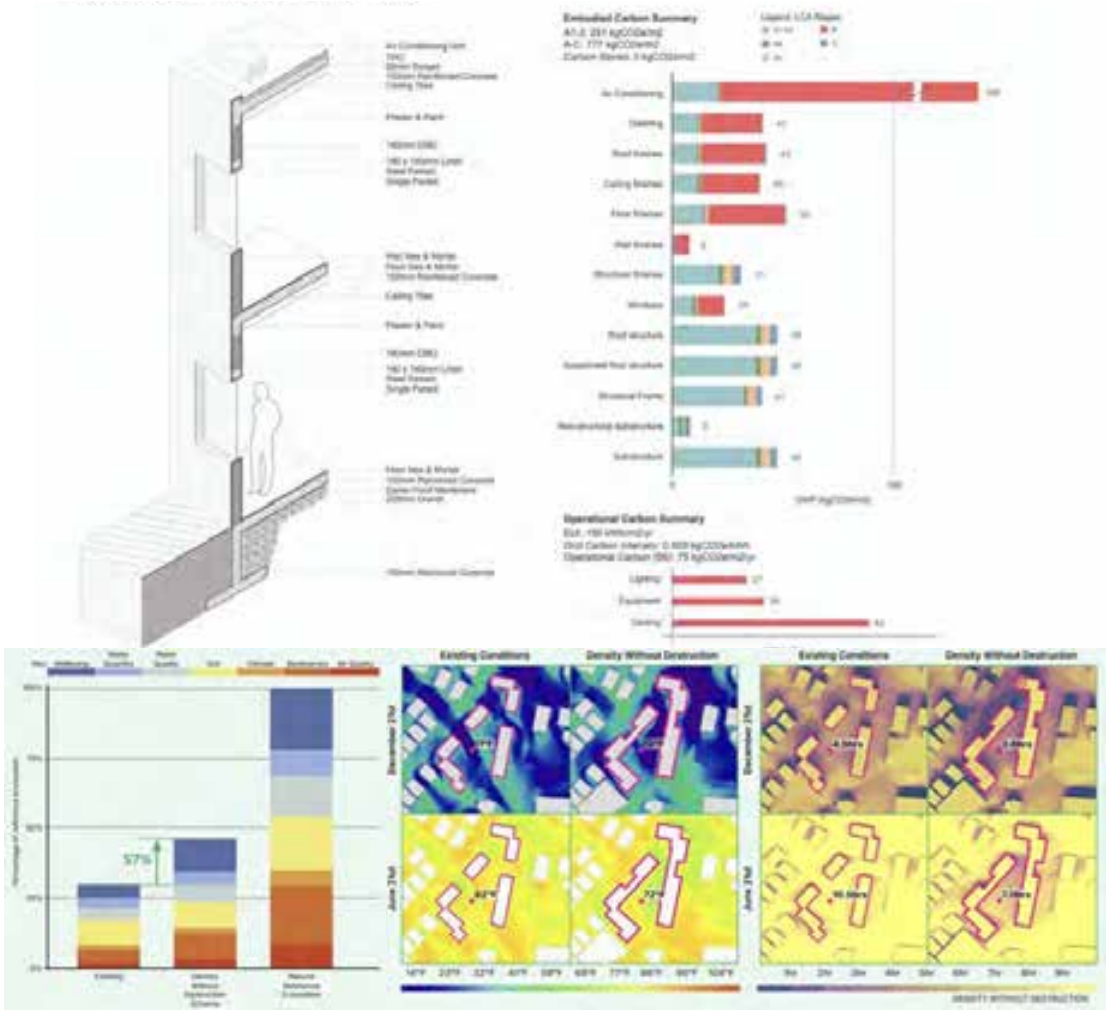


Who am I and what do I do?

Structural Engineer

Designer

Sustainability Consultant



Who am I and what do I do?

Structural Engineer

Designer

Sustainability Consultant

Researcher

Who am I and what do I do?

Structural Engineer

Designer

Sustainability Consultant

Researcher

Advocate

PRACTICE

Imagining Abundant Futures.

What if the planetary crisis made us better?

By

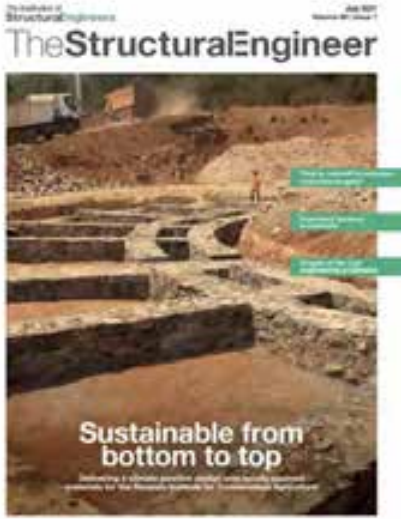
Photo credit: Chester Savage

The Fall Kill is mostly ignored and sometimes a liability, but it is, and can be, an ecological asset.

As designers, we are in the business of creating the future, but how many of us actually stop to truly imagine it? What does it look like, sound like, taste like, smell like, and feel like?

I recently attended the Sustainable Design Leaders Summit on Bainbridge Island, where I posed a question to my peers: imagine the ferry to Seattle is a time machine. Picture that when we arrive back in Seattle, it's the year 2050. In this future, every political, financial, technological, social, and environmental decision has been made with the goal of creating a world of abundance. The climate is showing signs of cooling, pollution and waste are non-existent, biodiversity has rebounded, inequality is at an all-time low, and happiness is at an all-time high.

Do you think the essence of the places we would all imagine, despite our diversity, would be so different? I don't think they would be. So, how do we get there?



Who am I and what do I do?

Structural Engineer

Designer

Sustainability Consultant

Researcher

Advocate

Organiser

Who am I and what do I do?

Structural Engineer

Designer

Sustainability Consultant

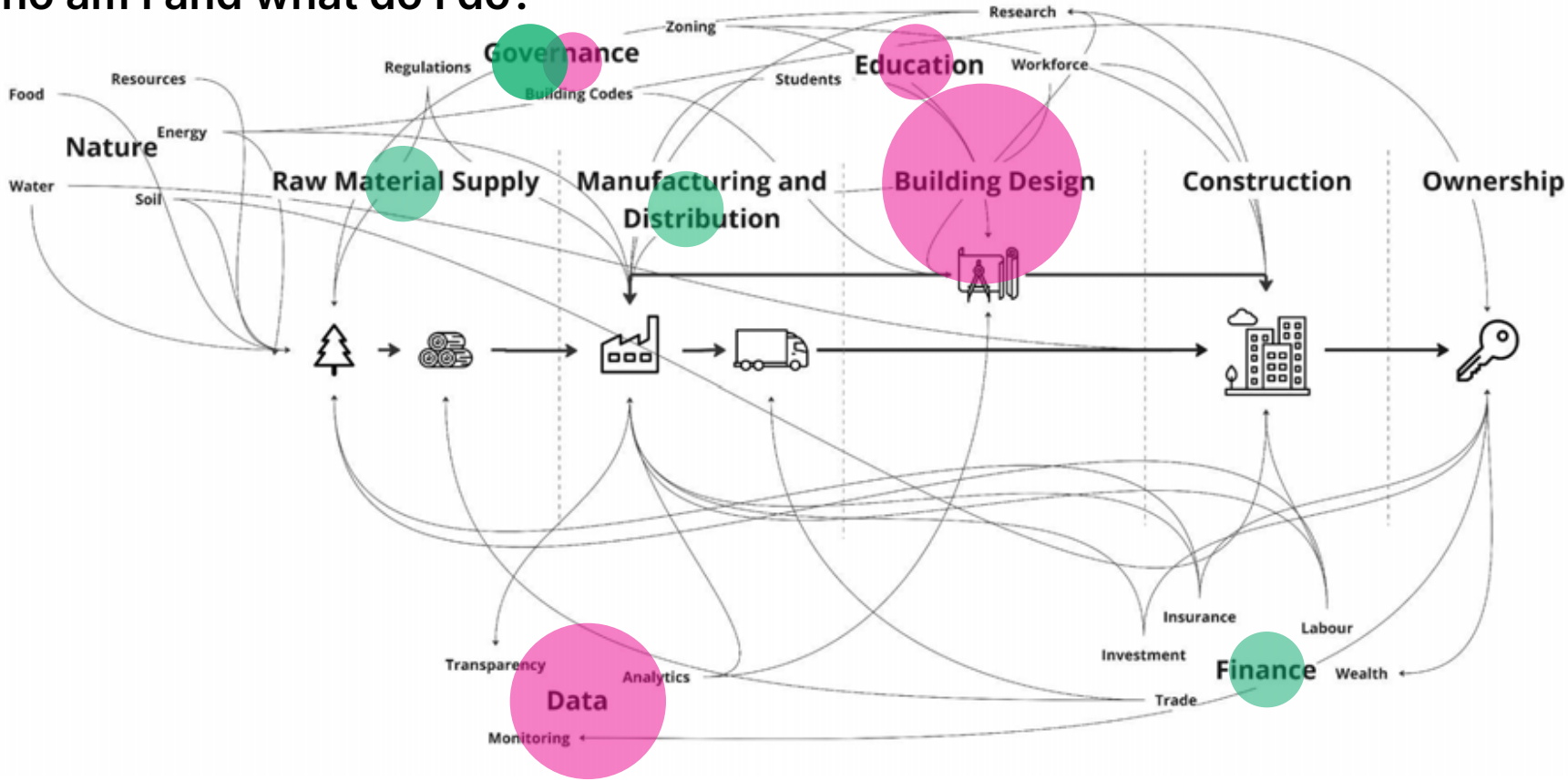
Researcher

Advocate

Organiser

Educator

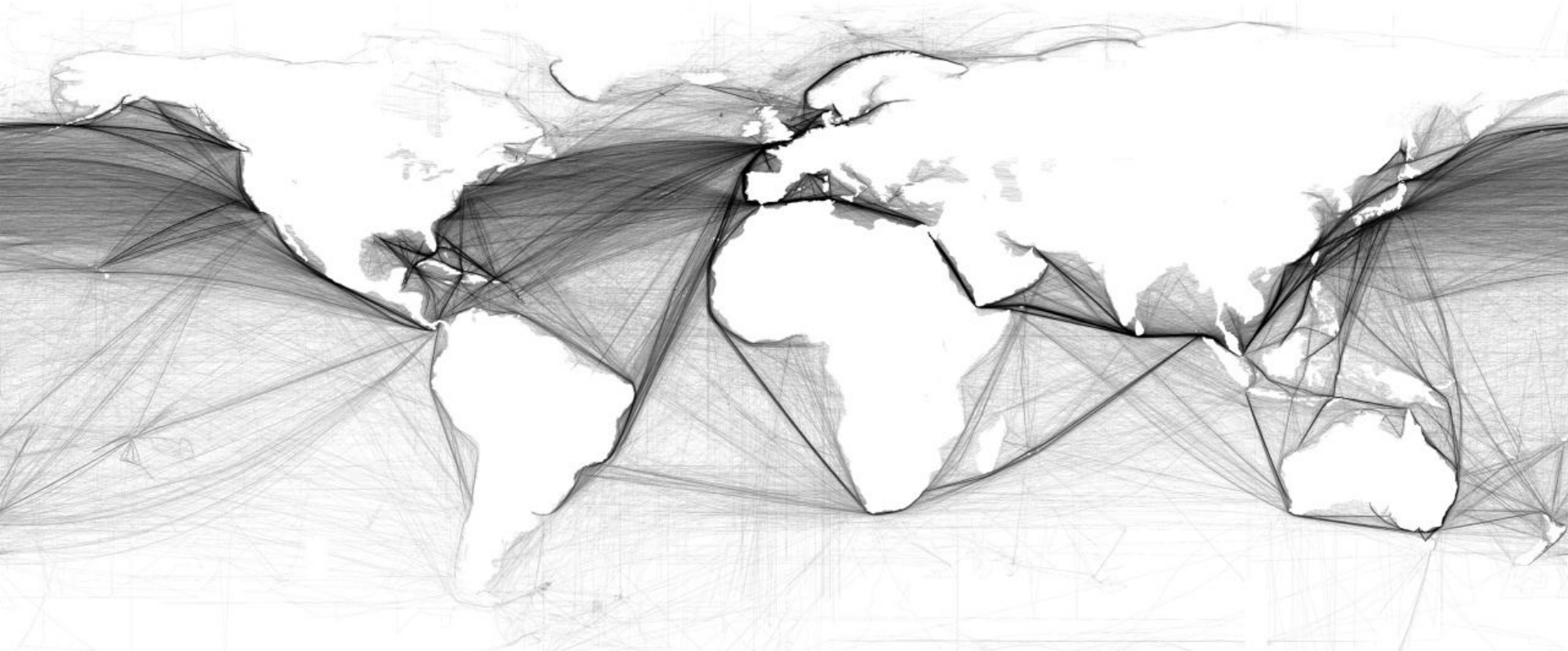
Who am I and what do I do?



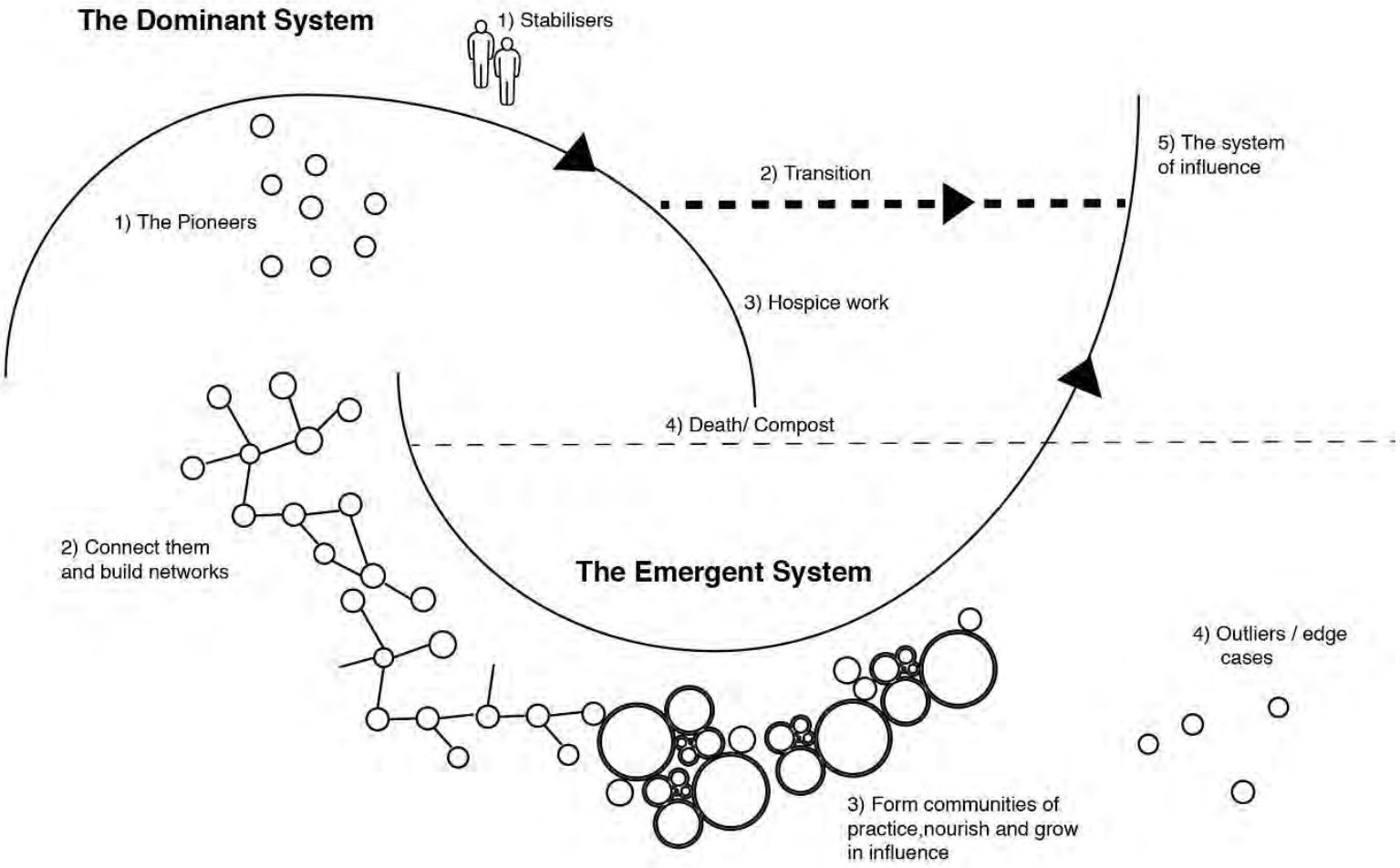
Who am I and what do I do?

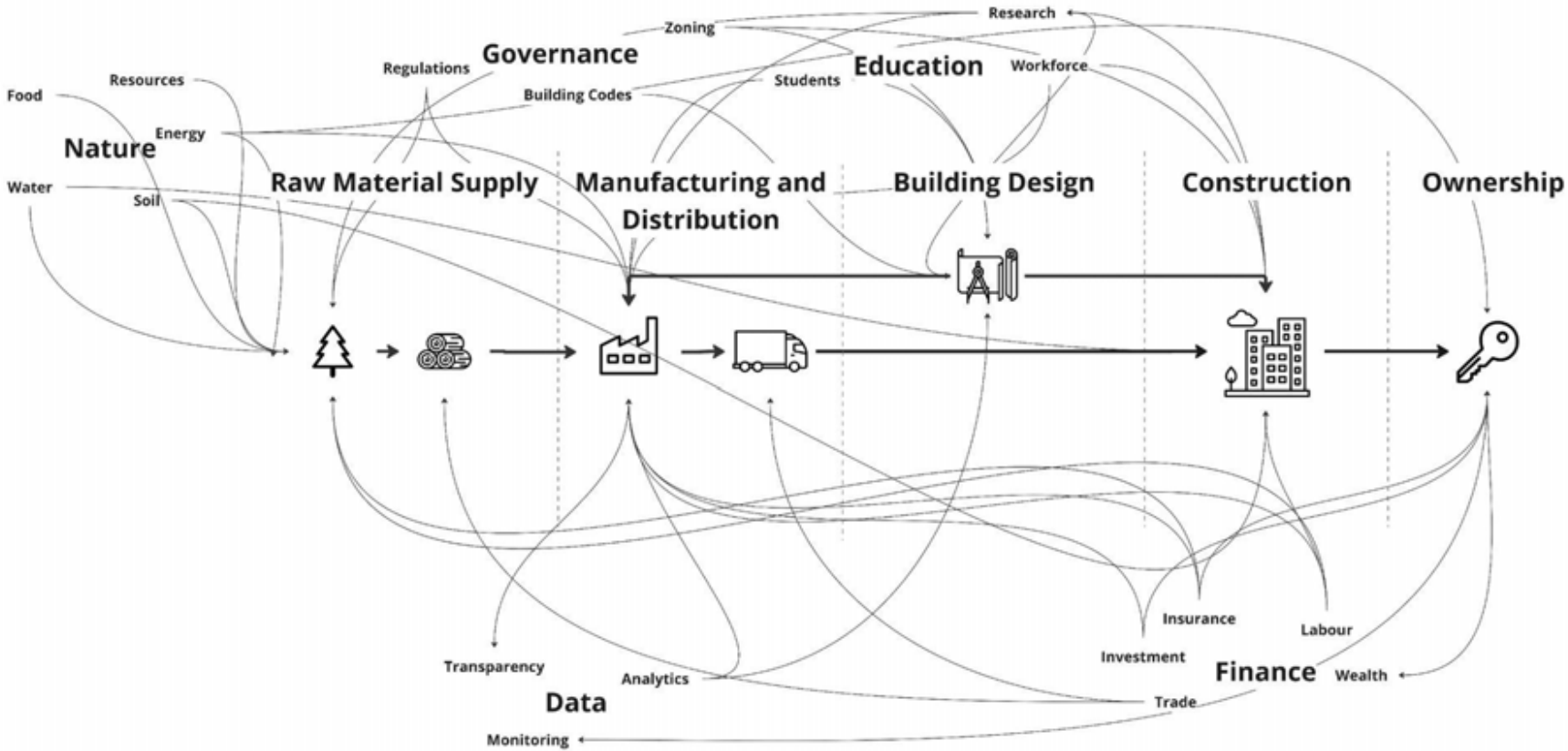
I work to create a world where we're more connected with each other, the rest of nature and our impacts.


UHD TV
49
SAMSUNG
UHD TV
49
SAMSUNG
UHD TV
49
SAMSUNG
Philco
Philco




Defend Me !!
STRAND


The Dominant System
1) Stabilisers
1) The Pioneers
2) Transition
5) The system of influence
3) Hospice work
4) Death/ Compost
2) Connect them and build networks
The Emergent System
4) Outliers / edge cases
3) Form communities of practice,nourish and grow in influence


Research
Zoning
Governance
Regulations
Education
Students
Workforce
Resources
Food
Building Codes
Energy
Nature
Water
Soil
Raw Material Supply
Manufacturing and Distribution
Building Design
Construction
Ownership
Insurance
Labour
Investment
Transparency
Analytics
Finance
Wealth
Data
Trade
Monitoring

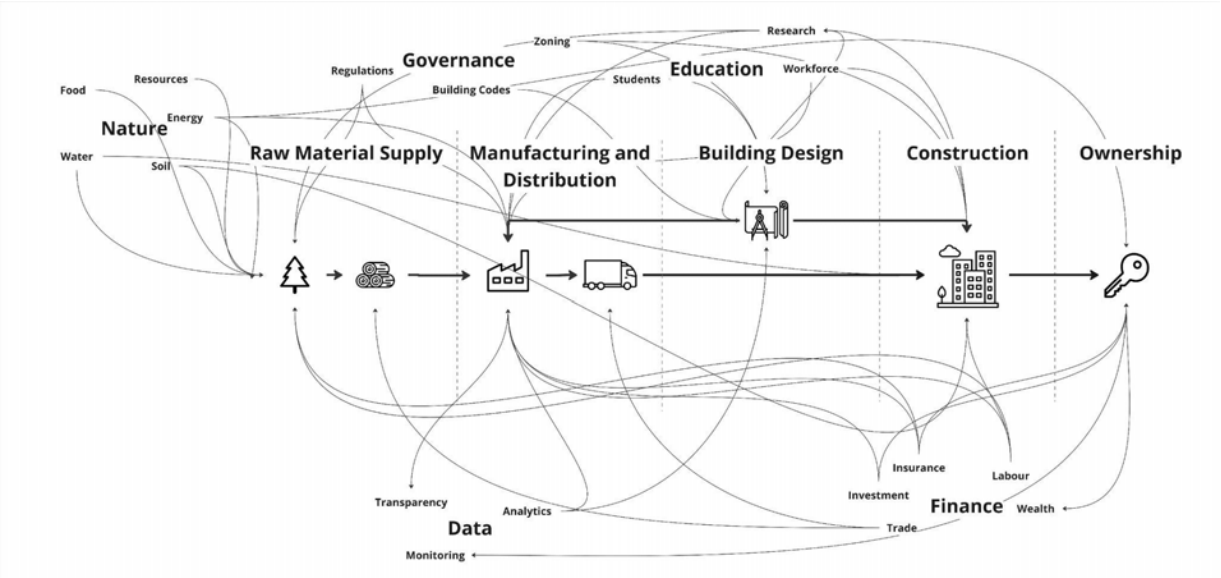
Bio-Based Materials Collective (BBMC)

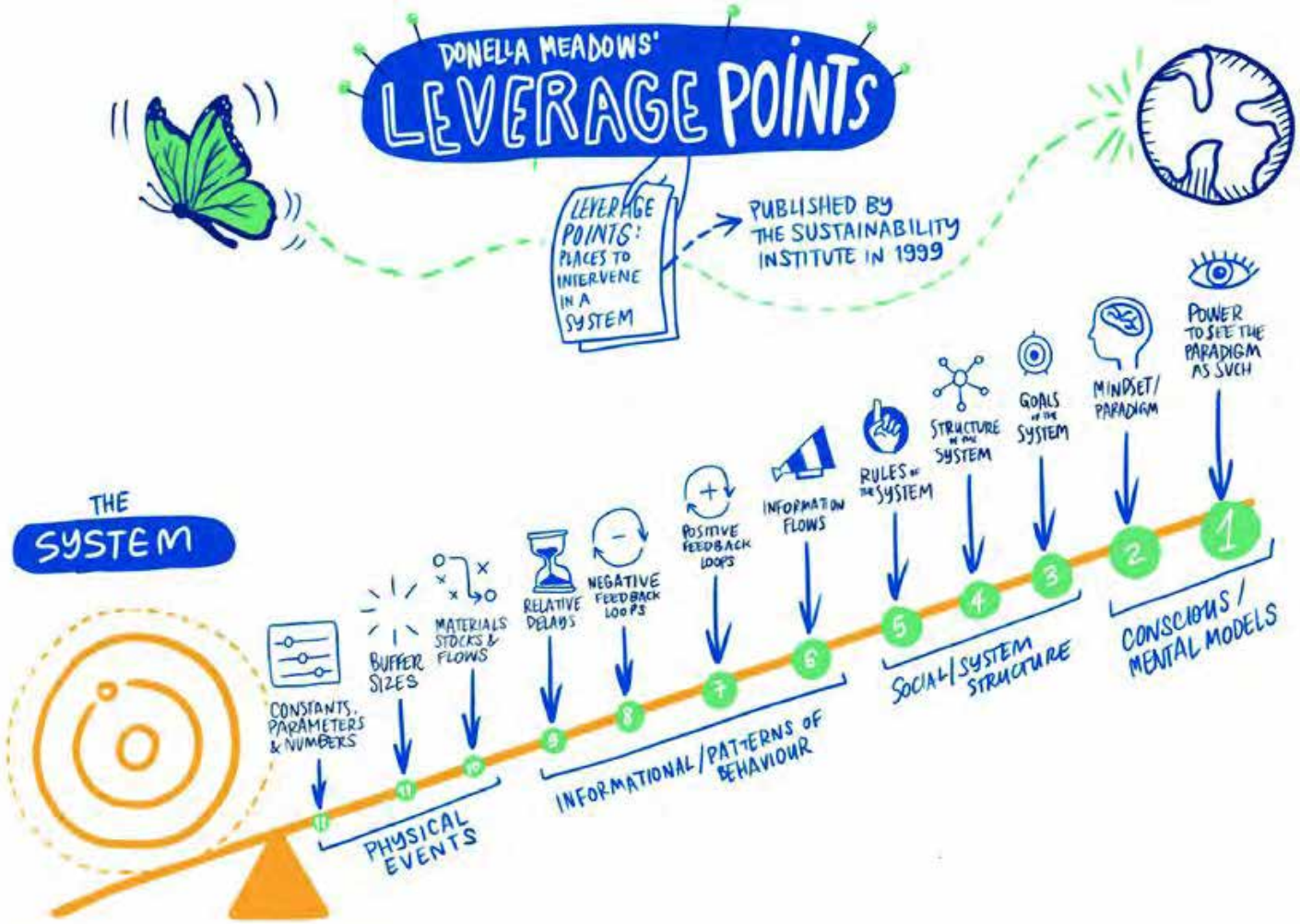
How do we rapidly scale regional **plant-based materials** in North America?

> Register for our 2025 Summit in Vermont

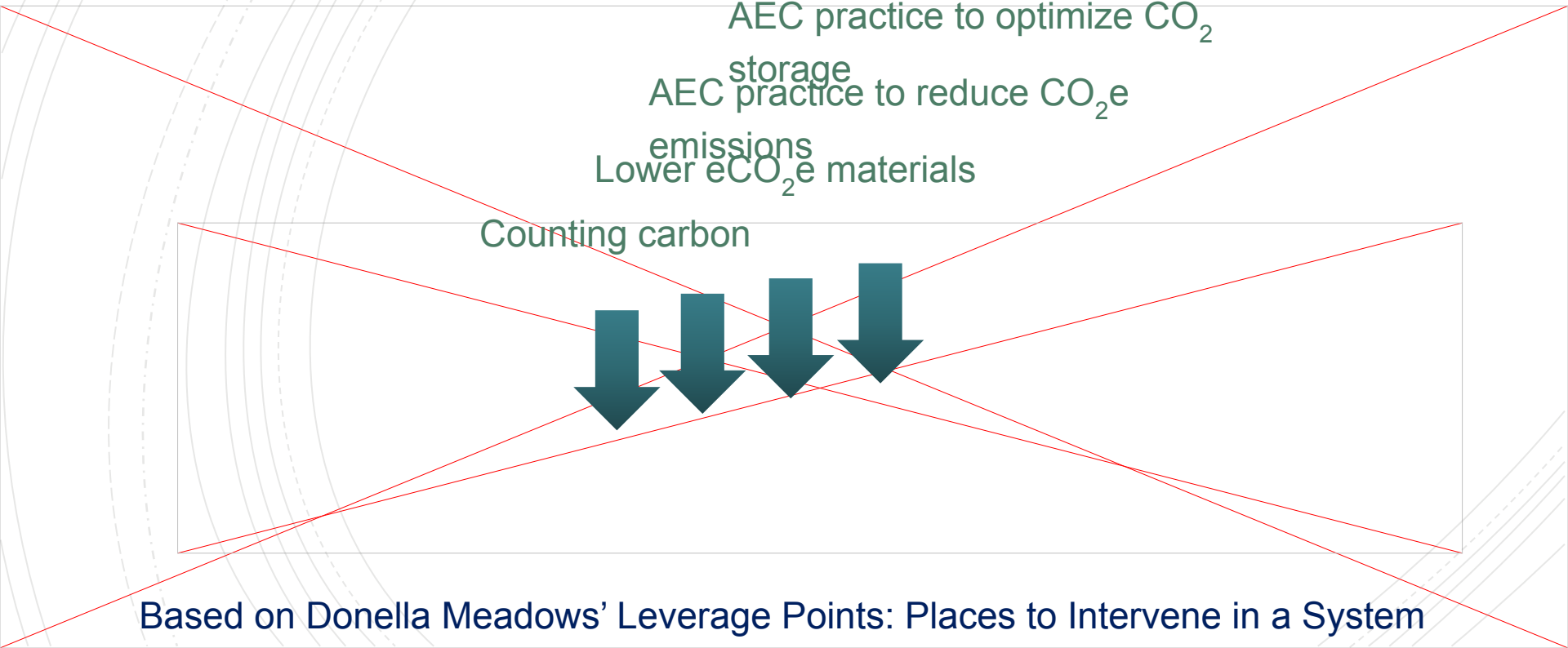
Audience questions ...

1. Where are you in this ecosystem?
2. What connections do you have and how is that helpful?
3. What connections do you wish you had to empower the change?
4. Who are you going to talk to over the next 2 days?
5. How will you contribute to the Material Revolution next week, next month and next year?




DONELLA MEADOWS'
LEVERAGE POINTS
LEVERAGE POINTS: PLACES TO INTERVENE IN A SYSTEM
PUBLISHED BY THE SUSTAINABILITY INSTITUTE IN 1999
THE SYSTEM
CONSTANTS, PARAMETERS & NUMBERS
BUFFER SIZES
MATERIALS STOCKS & FLOWS
RELATIVE DELAYS
NEGATIVE FEEDBACK LOOPS
POSITIVE FEEDBACK LOOPS
INFORMATION FLOWS
RULES OF THE SYSTEM
STRUCTURE OF THE SYSTEM
GOALS OF THE SYSTEM
MINDSET/ PARADIGM
POWER TO SEE THE PARADIGM AS SUCH
12
11
10
9
8
7
6
5
4
3
2
1
PHYSICAL EVENTS
INFORMATIONAL/PATTERNS OF BEHAVIOUR
SOCIAL/SYSTEM STRUCTURE
CONSCIOUS/ MENTAL MODELS

Simple Substitution



Based on Donella Meadows' Leverage Points: Places to Intervene in a System

Whole systems approach

Global Climate Movement

Cross-industry alliances

Change industry culture

Zero carbon in code, programs, policy

“Handprinting” carbon-storing projects

Based on Donella Meadows’ Leverage Points: Places to Intervene in a System