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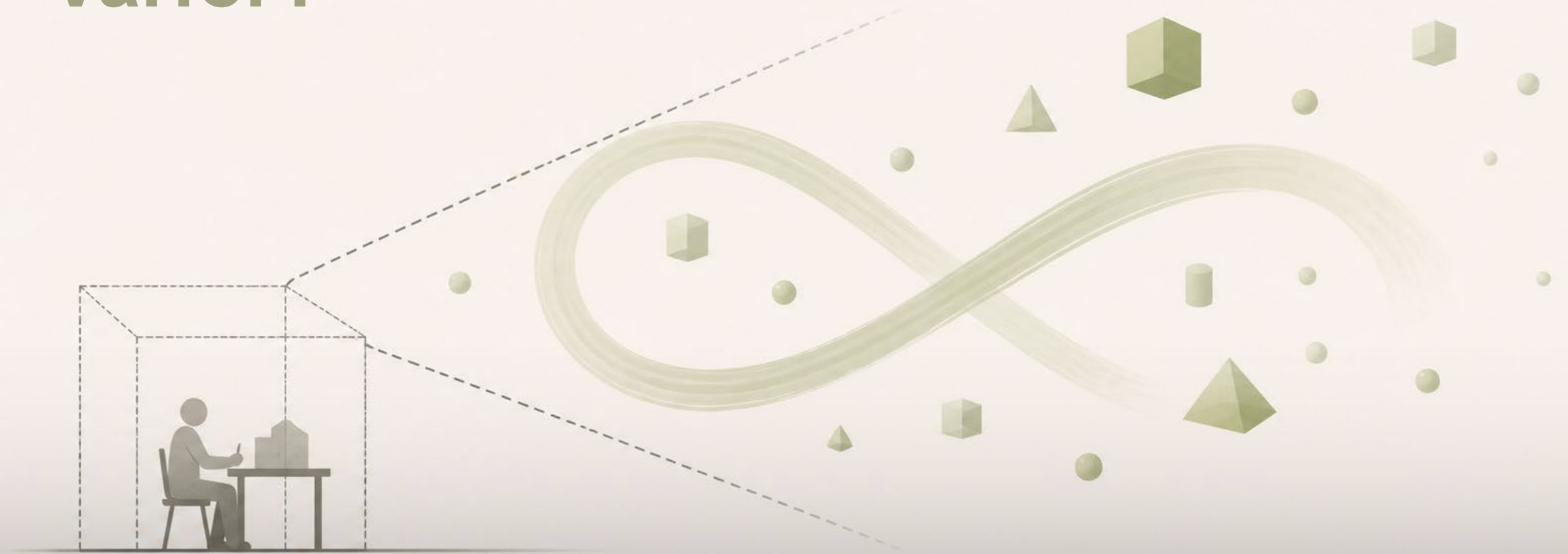
# Biobaserade byggmaterial

DESIGNING CARBON FLOWS IN A FINITE SYSTEM  
BARBARA VOGT | 5 MAJ 2026

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white

# Varför?



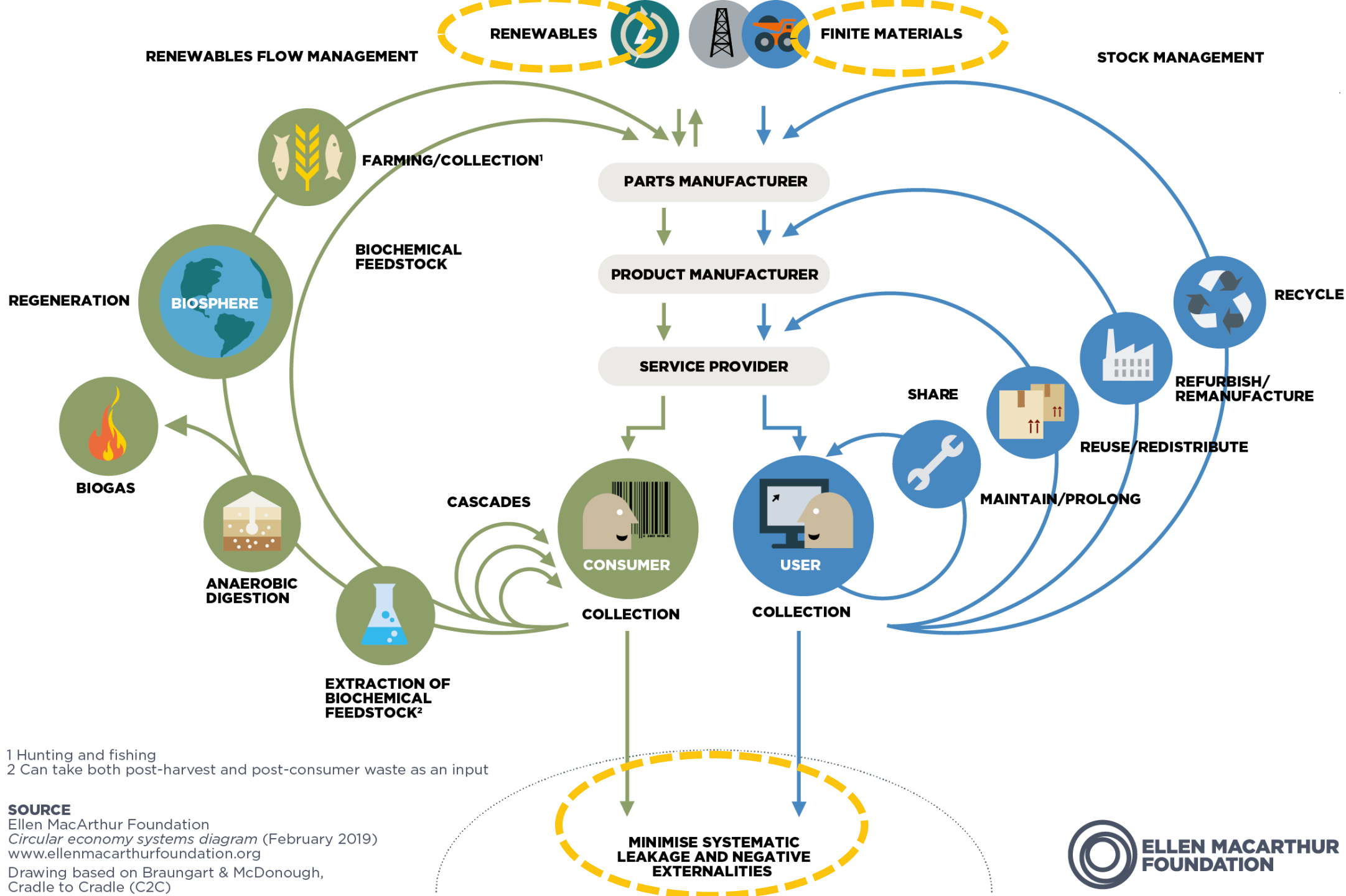
# Skalan vi inte förstår





SYSTEM BOUNDARIES

white



1 Hunting and fishing  
 2 Can take both post-harvest and post-consumer waste as an input

**SOURCE**

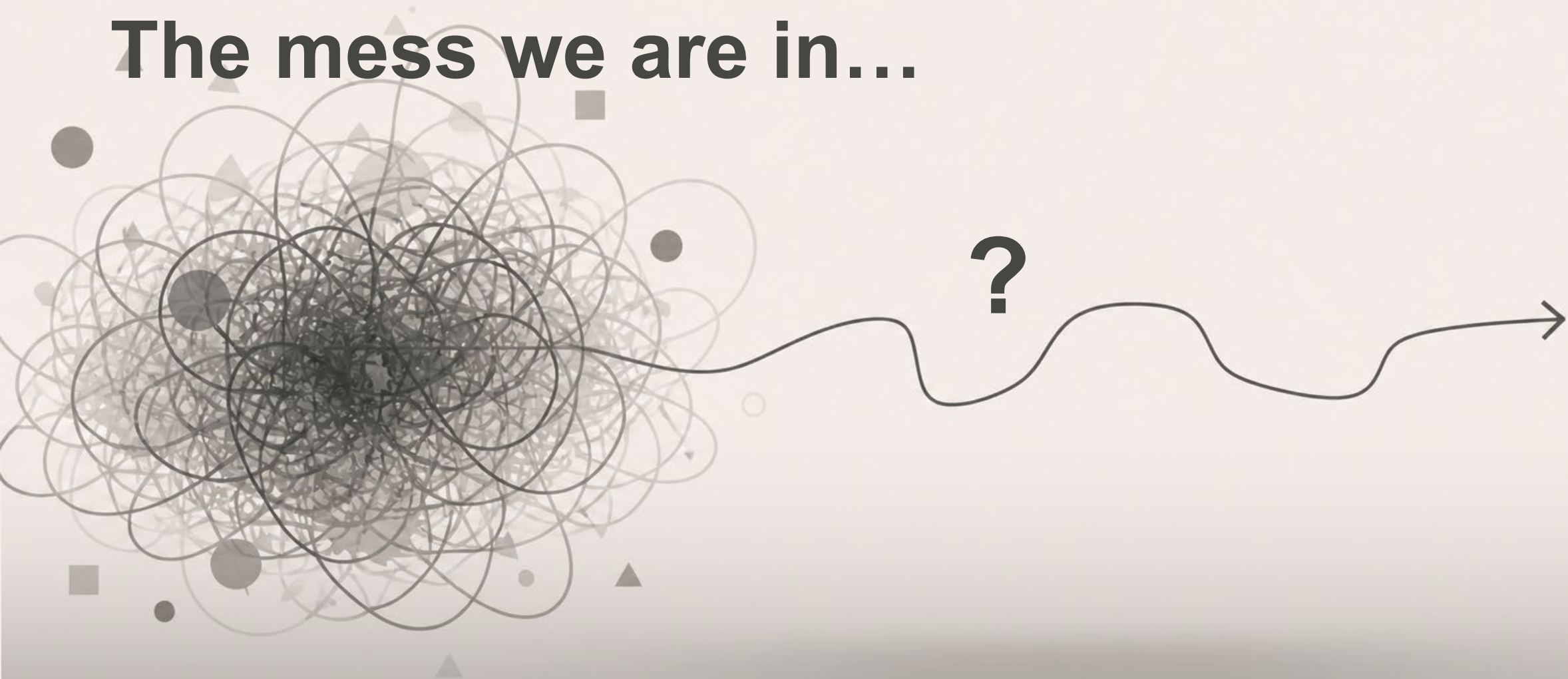
Ellen MacArthur Foundation  
*Circular economy systems diagram* (February 2019)  
[www.ellenmacarthurfoundation.org](http://www.ellenmacarthurfoundation.org)

Drawing based on Braungart & McDonough,  
 Cradle to Cradle (C2C)

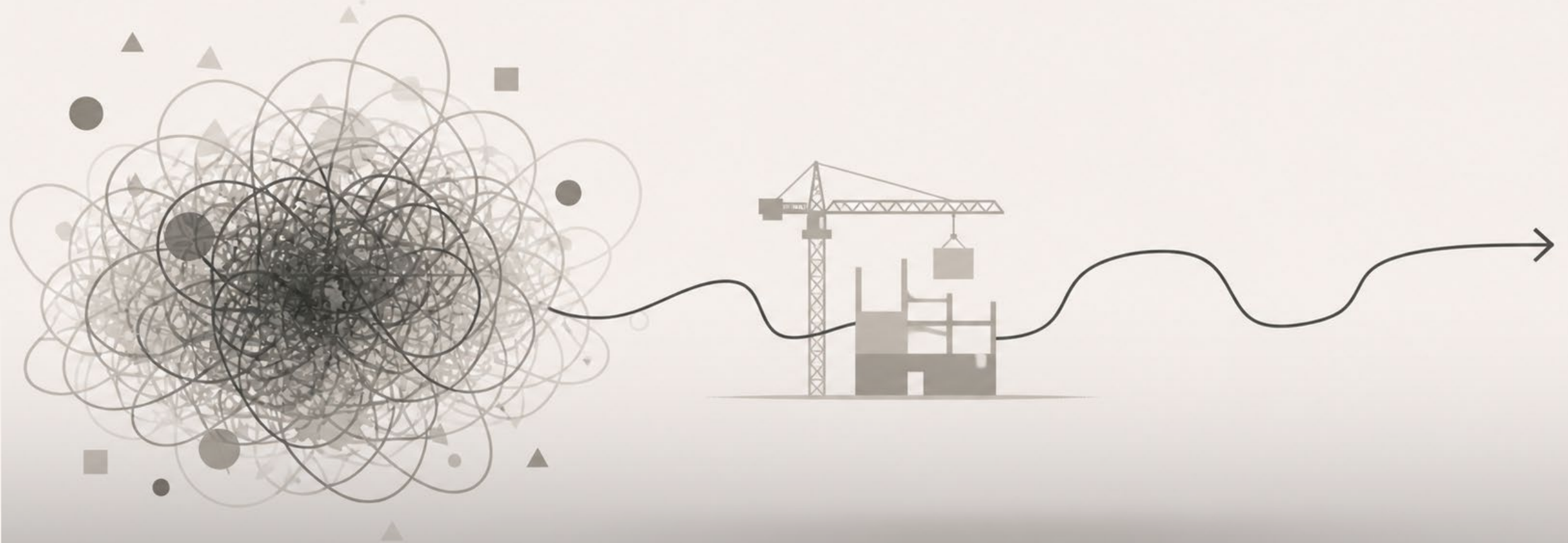
# Även marken är ändlig.



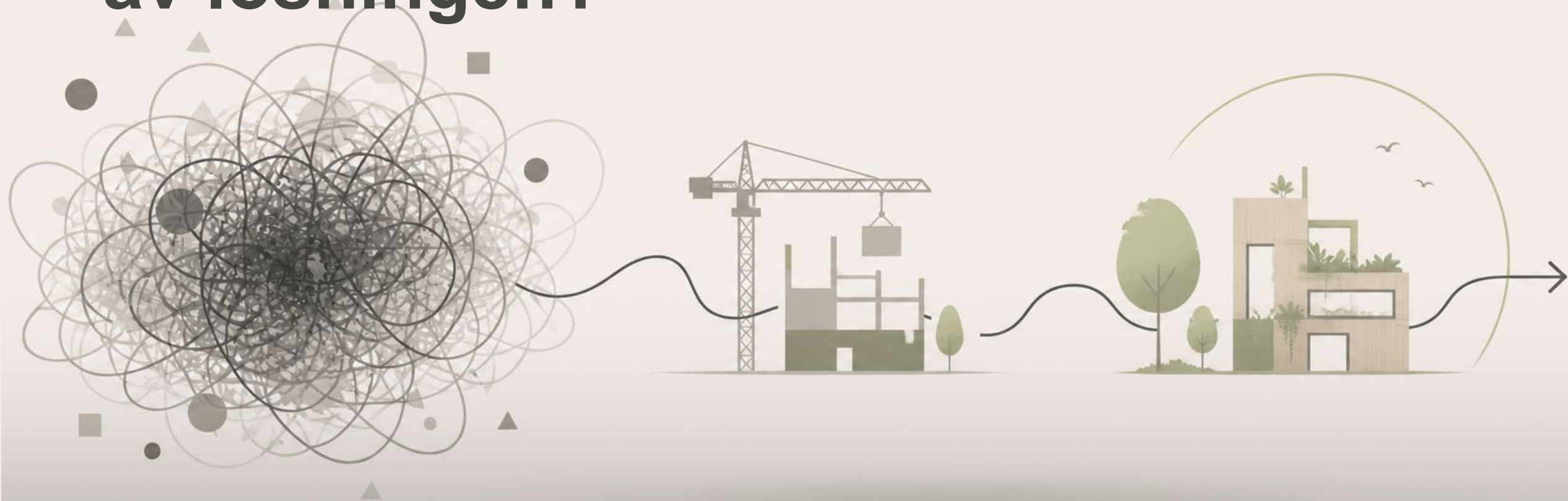
# The mess we are in...



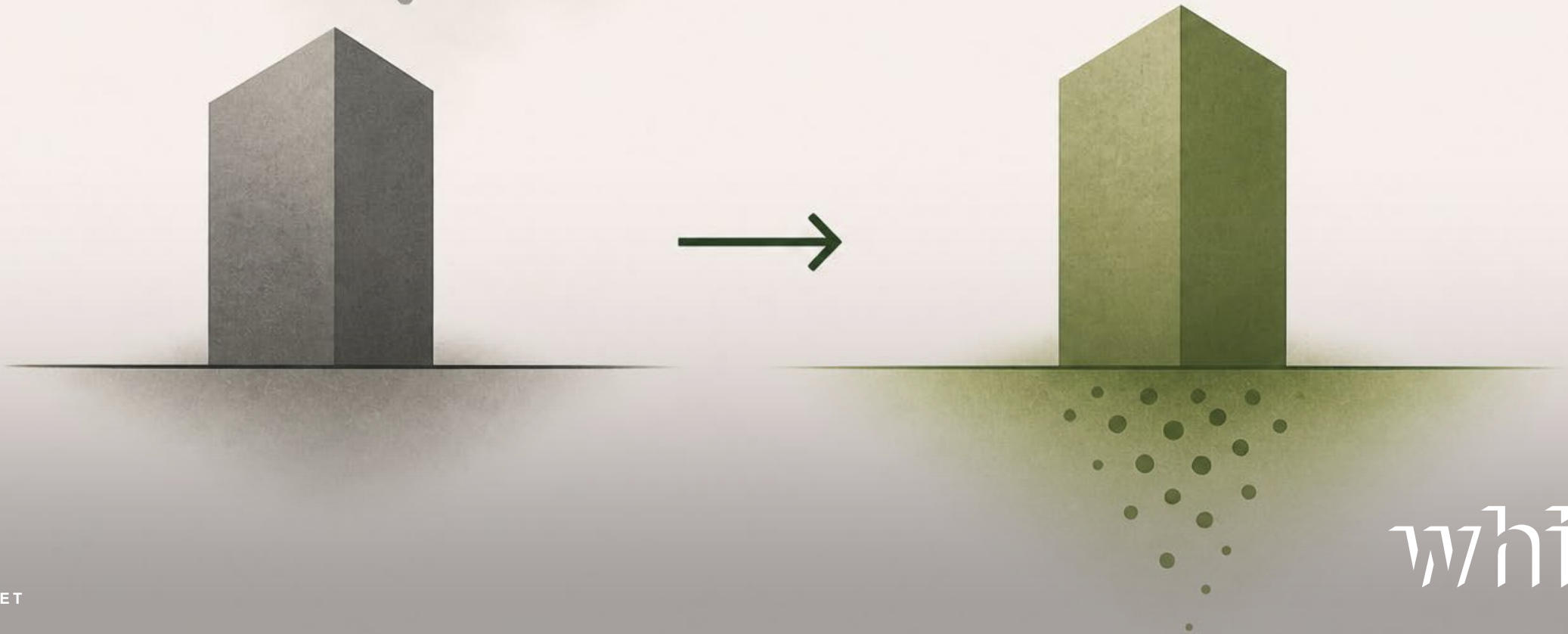
# Byggandet är en del av problemet.



# Tänk om byggandet kunde vara en del av lösningen?



# Byggnader måste byta roll

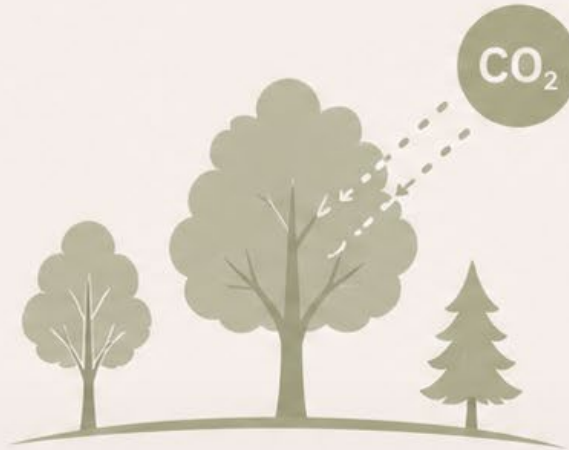


# Växter + byggnader = CCS



# Varför inte bara bygga i trä?

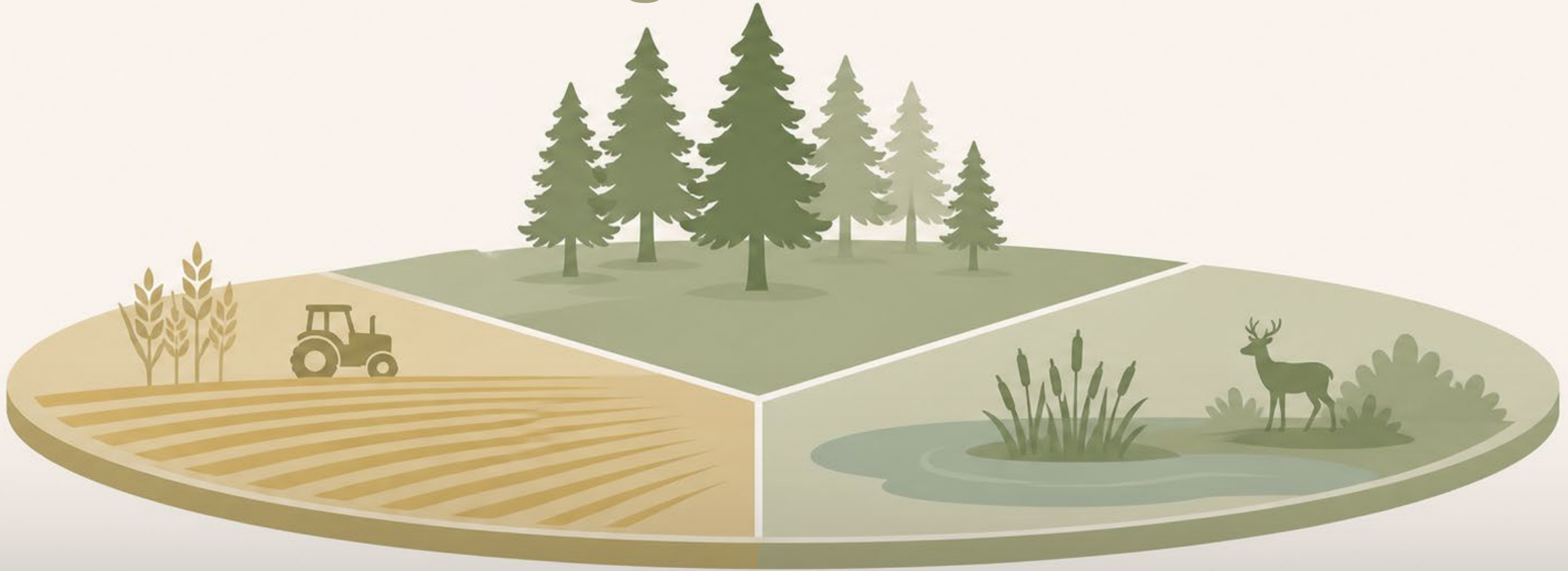
# Varför inte bara bygga i trä?



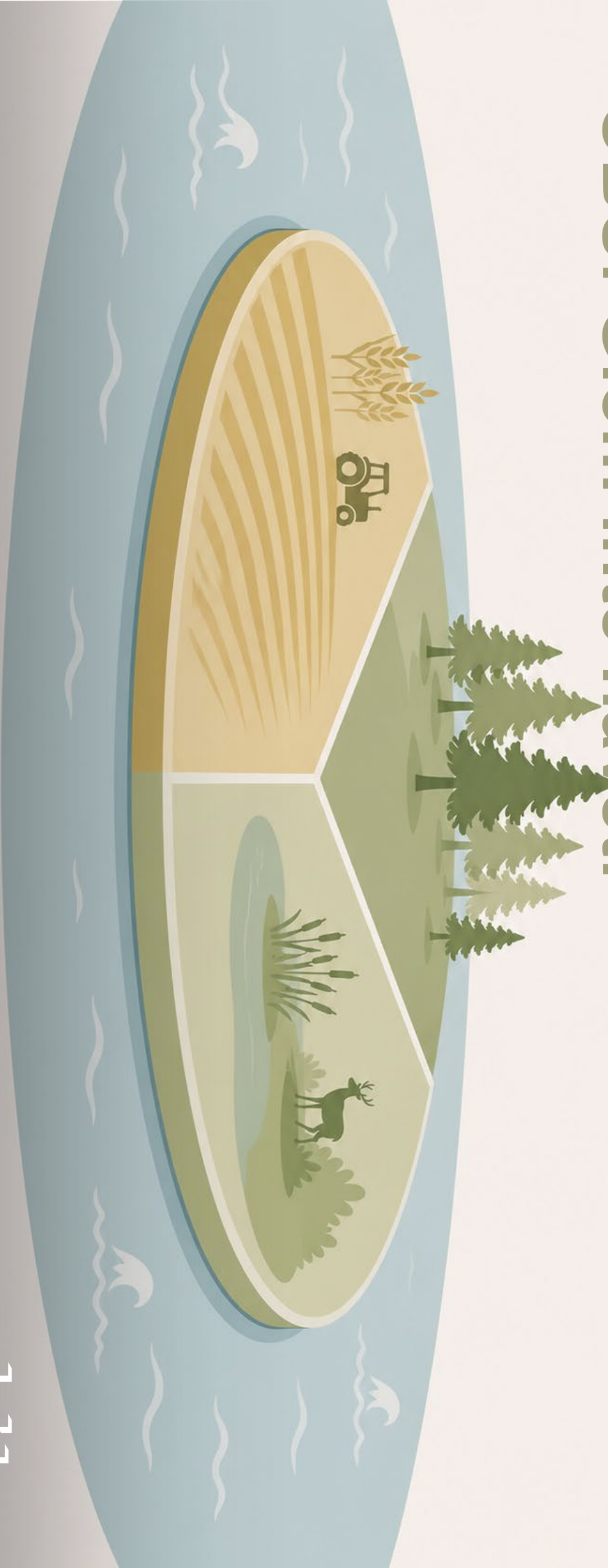
# Vi borde gestalta kolcykler.



# Marken är ändlig...



# OBS! Glöm inte havet!



# Vad menar vi med biobaserat?

- Material baserade på förnybara biologiska resurser, som alternativ till fossila och mineraliska material.
- Byggmaterial
- T.ex.: trä, halm, mm
- Ej: lera, sten, mm
- Betyder inte automatiskt “Hållbart”
- Mest fokus på europeiska leverantörer

# Metod och angreppssätt

- **Material och produkter**
- **Kommersiellt tillgängliga**
- **Pilot**
- **Research**
- **Fokus på alternativ till trä**
- **Produktreferenserna är ingen betalt reklam utan resultat av vår kartläggning där vi valde produkter som vi tyckte är intressanta**
- **Syftet är att inspirera att våga testa något nytt i kommande projekt**

# Från gården





HEMP

BIOBASERADE BYGGMATERIAL

# Hampa

- 
- **Snabbväxande**
  - **Hög koldioxidbindning**
  - **Låg klimatpåverkan**
  - **Kan odlas med små insatser**
  - **Förbättrar marken**
  - **Goda isolerande och fuktreglerande egenskaper**

# CaNaCrete | EXIE

**Raw Material** Pre-mixed wet composite of hemp shives and hydrated lime.

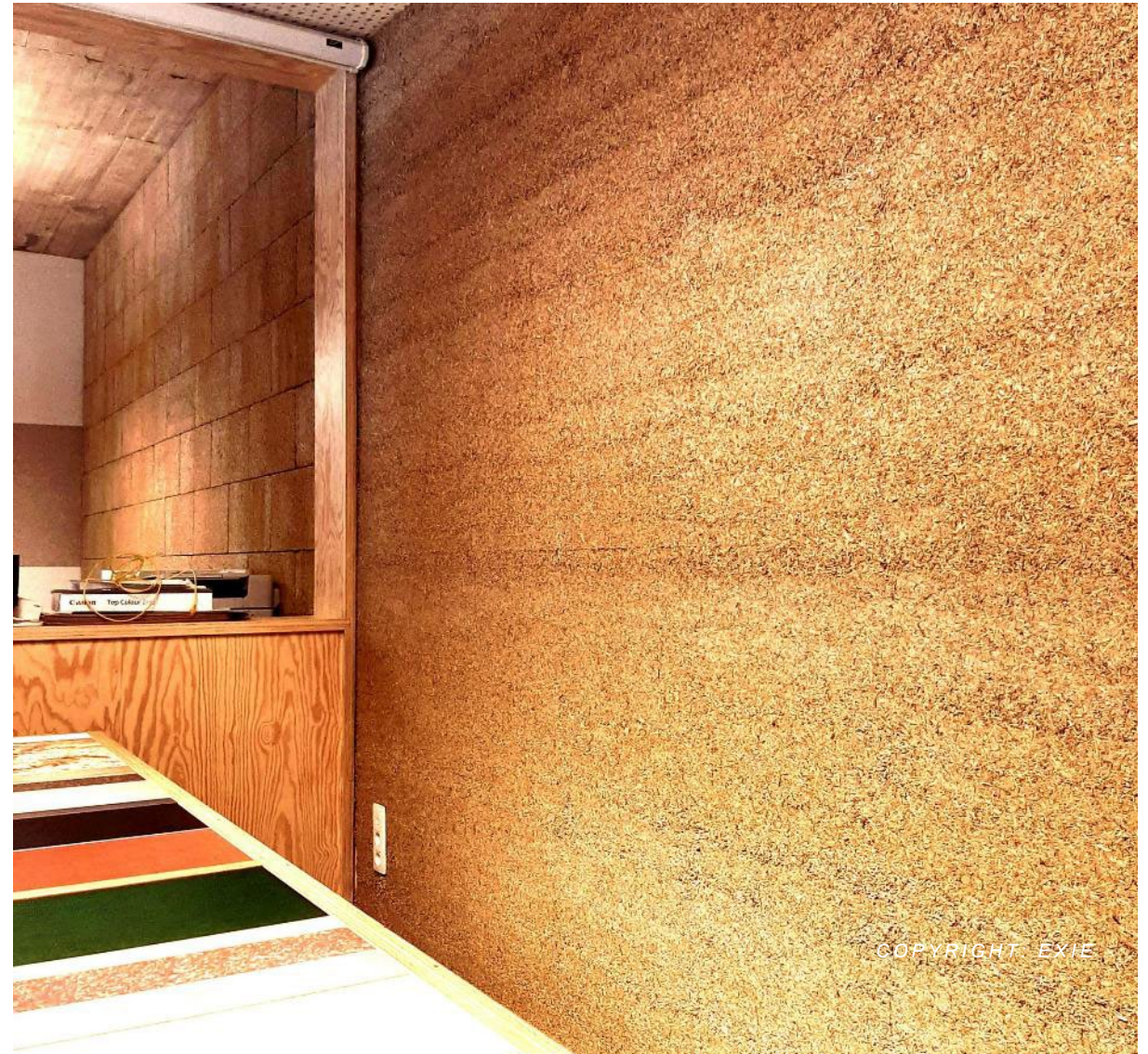
**Other Components / Additives** EXIE additive (proprietary) and water.

**Potential Applications** Non-load-bearing insulation for interior and exterior walls in new construction, restoration, and renovation. Requires protective finish when applied to exterior.

**Readiness Level** Commercially available

**Circularity Potential** 100% bio-based, recyclable, and circular. Stores more CO<sub>2</sub> than emitted through hemp growth and lime carbonation.

**Produced In** Belgium



# CaNaDry | EXIE

**Raw Material** Dry biocomposite of hemp shives and lime.

**Other Components / Additives** Natural minerals to improve adhesive strength and accelerate hardening.

**Potential Applications** Non-load-bearing insulation for:

Interior walls, Roofs (flat and pitched), Ceilings, Facades, Floors, Attic floors

**Readiness Level** Commercially available

**Circularity Potential** 100% bio-based, recyclable, and circular. Captures CO<sub>2</sub> during hemp growth and lime carbonation. Reprocessable at end-of-life.

**Produced In** Belgium



# IsoHemp Block

**Raw Material** Hemp shives and a mix of air and hydraulic lime.

**Other Components / Additives** Water; no chemical additives.

**Potential Applications** Construction of insulating wall systems in new builds and renovations, partition walls, lining walls, interior and exterior insulation of existing buildings.

**Readiness Level** Commercially available

**Circularity Potential** 100% natural material, low-energy production, local sourcing.

**Produced In** Belgium



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# HempFlax HB

**Raw Material** Milled wooden core of the industrial hemp plant (hemp shives).

**Other Components / Additives** Lime-based binder.

**Potential Applications** Non-load-bearing wall and roof constructions; cast or sprayed around wooden or steel frames.

**Readiness Level** Commercially available.

**Circularity Potential** Made from renewable resources; breathable and durable with excellent insulating properties.

**Produced In** The Netherlands.



*COPYRIGHT: HEMPFLAXX*

# ThermoHemp Combi Jute

**Raw Material** High-quality hemp fibers and recycled jute fibers sourced from upcycled cocoa and coffee bags.

**Other Components / Additives** Stabilizing support fibers made from recycled PET.

**Potential Applications** Insulation

**Readiness Level** Commercially available.

**Circularity Potential** Made from annually renewable raw materials and recycled fibers; promotes sustainability and environmental responsibility.

**Produced In** Germany.



# Biostone

**Raw Material** Hemp shives and lime mortar.

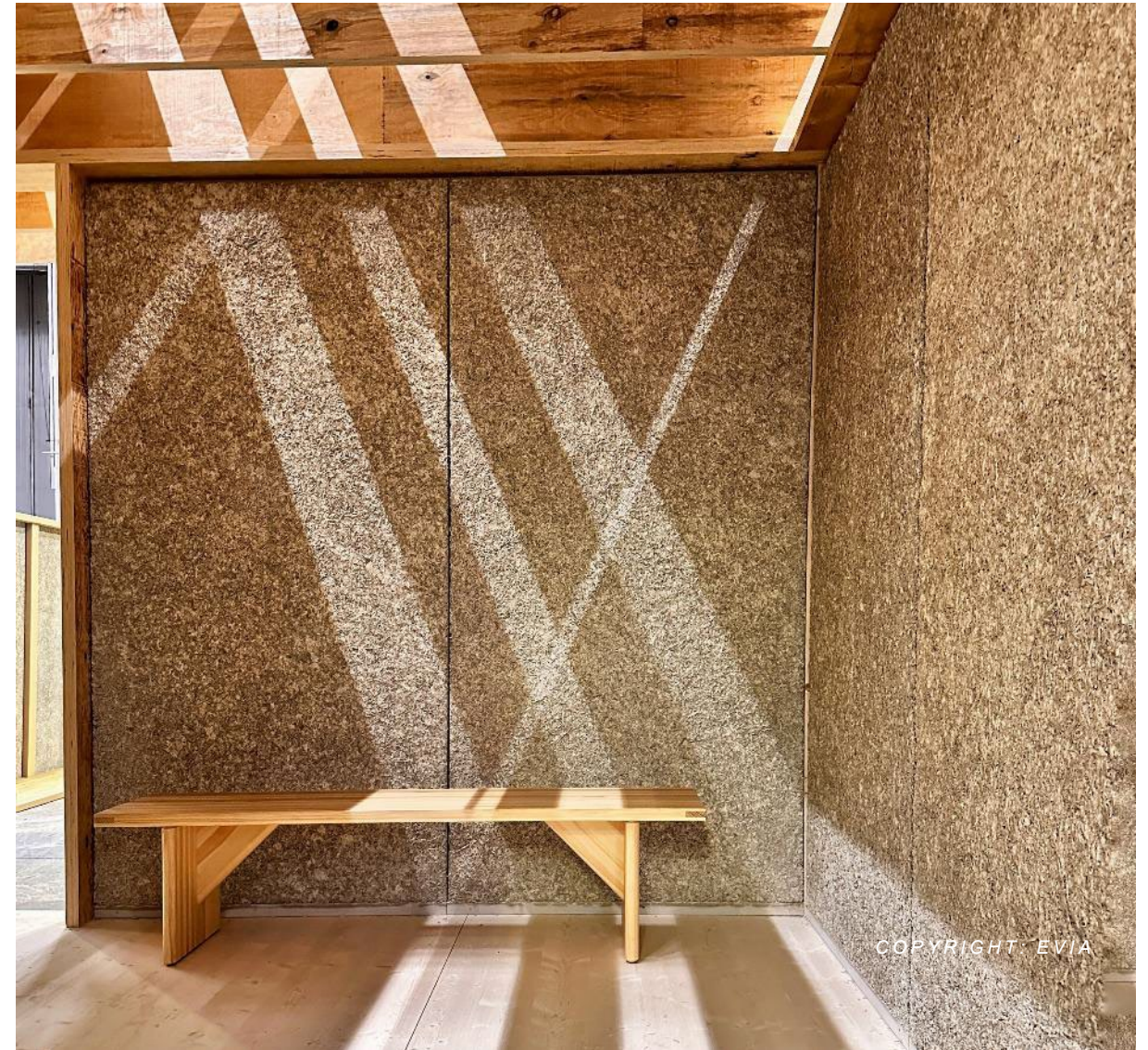
**Other Components / Additives** Natural minerals.

**Potential Applications** Prefabricated wall systems for residential and commercial buildings, providing insulation and structural support.

**Readiness Level** Commercially available.

**Circularity Potential** Constructed from natural, renewable materials; offers breathability, durability, and resistance to fire, rot, and pests.

**Produced In** Sweden.



# ThermaFleece NatraHemp

**Raw Material** 85% hemp fibre

**Other Components / Additives** 15% polyester binder; treated with a natural insect repellent

**Potential Applications** Thermal and acoustic insulation for roofs, walls, and floors, suitable for timber frame constructions and internal partitioning

**Readiness Level** Commercially available

**Circularity Potential** Made from rapidly renewable hemp, contains no sheep wool; suitable for wool-free specifications, partially biodegradable and includes recycled content

**Produced In** United Kingdom





BIOBASERADE BYGGMATERIAL

# Halm

- 
- **Restprodukt från jordbruket**
  - **Låg klimatpåverkan**
  - **God tillgång**
  - **God isolerförmåga och fuktreglering**
  - **Känslig för fukt och brand**

# EcoCocon Prefabricated Straw Panels

**Raw Material** Compressed straw bales (approximately 89%) and FSC-certified wood (approximately 10%).

**Other Components / Additives** None; the panels are constructed using natural materials without synthetic additives.

**Potential Applications** Suitable for both load-bearing and non-load-bearing walls.

**Readiness Level** Commercially available.

**Circularity Potential** Utilizes renewable resources with a short growth cycle, acts as a carbon sink, sequestering CO<sub>2</sub> during the growth of straw, panels are biodegradable and have low embodied energy.

**Produced In** Manufactured in Europe, with production facilities in multiple countries.

## Relevant Case Studies

Feldballe School | Henning Larsen





BIOBASERADE BYGGMATERIAL

# Lin

- 
- **Låg klimatpåverkan**
  - **God koldioxidbindning**
  - **Kräver små insatser**
  - **Passar i jordbrukets växtföljd**
  - **Lätt, stark och fuktreglerande**
  - **Goda isolerande egenskaper**

# Isolina linisolering

**Raw Material** Linfiber (flax fiber)

**Other Components / Additives** Textile binding fibers and environmentally friendly flame retardants

**Potential Applications** Thermal and acoustic insulation for roofs, walls, floors, and ceilings

**Readiness Level** Commercially available

**Circularity Potential** Linfiber is a renewable natural resource. The insulation is biodegradable and produced without emitting formaldehydes, isocyanates, or (H)CFC gases, ensuring minimal environmental impact

**Produced In** Finland



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# Linex flaxboard

**Raw Material** Flax shives (the woody core of the flax plant)

**Other Components / Additives** Synthetic resin adhesive; formaldehyde-free options available (E0 to E1 standards)

## Potential Applications

- Core material for doors and wall panels, especially fire-resistant doors
- Furniture manufacturing
- Interior design elements

**Readiness Level** Commercially available

**Circularity Potential** Flax is a rapidly renewable resource; the entire plant is utilized, minimizing waste.

Flaxboard is biodegradable and can be recycled into new boards. Formaldehyde-free production options enhance environmental friendliness

**Produced In** The Netherlands



# Left overs.





SHEEP'S WOOL

BIOBASERADE BYGGMATERIAL

# Fårull

- 
- Ofta utnyttjad resurs i Europa
  - Låg påverkan som biprodukt
  - Mycket god isolerförmåga
  - Regulerar fukt
  - Brandsäkert

# Isolena Wool insulation

**Raw Material** 100% pure new sheep wool

**Other Components / Additives** No chemical additives; treated with IONIC PROTECT® technology for moth and pest resistance

**Potential Applications** Thermal and acoustic insulation for roofs, walls, and floors, interior partition walls and timber construction

**Readiness Level** Commercially available

**Circularity Potential** Made from renewable raw material, fully biodegradable

**Produced In** Austria



# Therma Fleece

**Raw Material** 75% British sheep wool

**Other Components / Additives** 25% recycled polyester binder; treated with a natural insect repellent (usually borax-based)

**Potential Applications** Thermal and acoustic insulation for roofs, walls, and floors, ideal for timber frame construction and renovation projects

**Readiness Level** Commercially available

**Circularity Potential** Wool is renewable, breathable, and biodegradable, contains recycled content

**Produced In** United Kingdom



therma  
fleece®  
COSYWOOL SLAB



SEASHELLS

BIOBASERADE BYGGMATERIAL

# Musselskal

- 
- Restprodukt från livsmedelsindustrin
  - Potential att ersätta kalkbaserade material
  - Underutnyttjad potential

# Thames glass

**Product Name** Thames Glass

**Raw Material** Crushed Thames mussel shells (from quagga and zebra mussels)

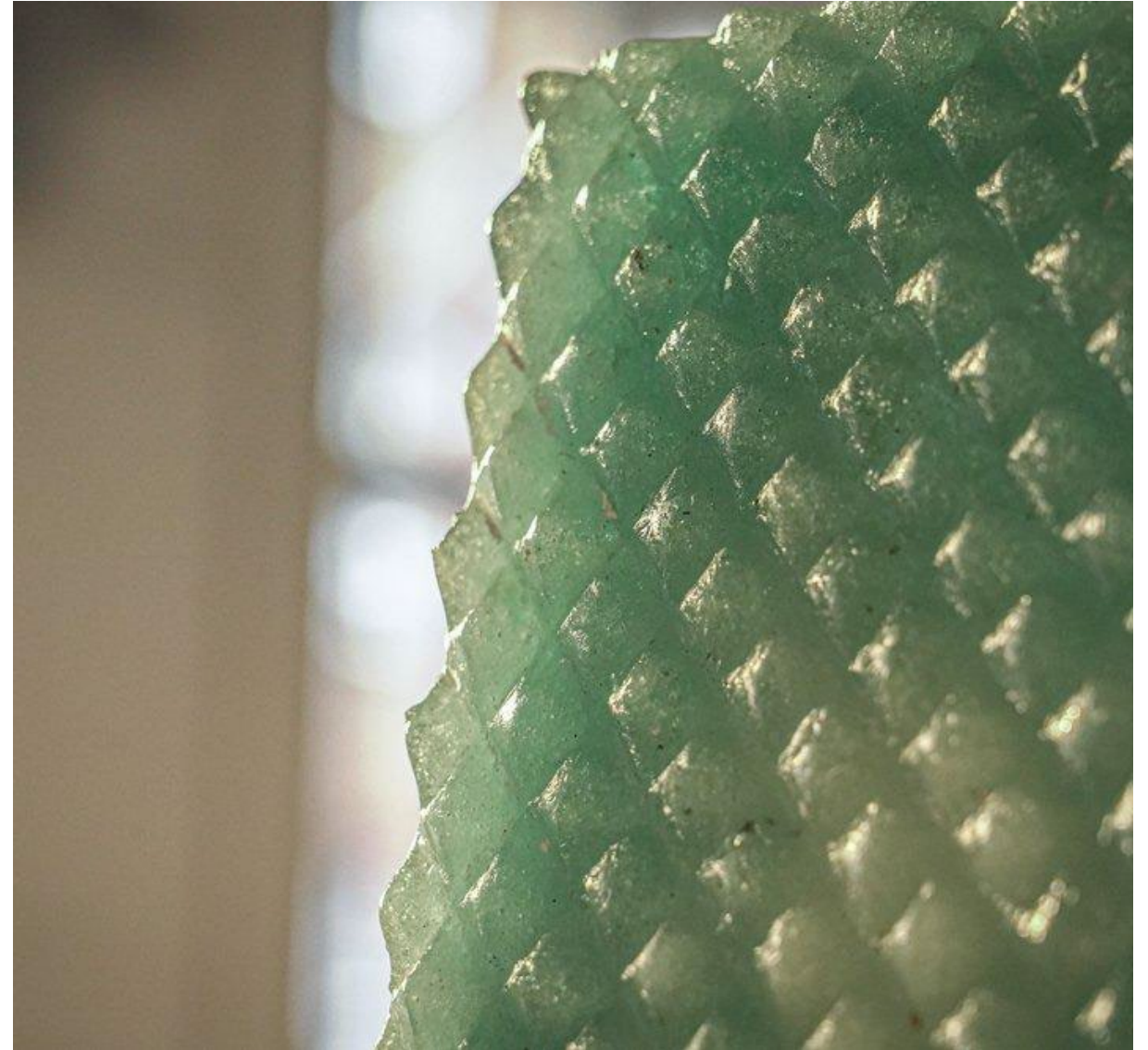
**Other Components / Additives** Locally sourced sand and a bio-based binder developed from waste materials

**Potential Applications** Interior and exterior surface elements, tiles, inlays, decorative panels

**Readiness Level** Pilot stage

**Circularity Potential** Made from invasive species and urban waste materials, bio-based and recyclable depending on application

**Produced In** United Kingdom



# Building with Shells

## Local Works Studio

**Raw Material** Waste seashells (primarily oyster and mussel shells)

**Other Components / Additives** Combined with natural binders such as lime to form shellcrete or used as aggregate in plasters and mortars

**Potential Applications** Shellcrete blocks and panels, lime-shell plasters for walls and finishes

**Readiness Level** Pilot stage

**Circularity Potential** Utilizes marine waste streams, reduces extraction of virgin aggregate materials

**Produced In** United Kingdom



# DanShells Shell Gravel

**Raw Material** Crushed seashells (by-products from Danish mussel and clam industries)

**Other Components / Additives** None

**Potential Applications** Garden and landscape surfaces (paths, driveways, patios), soil improvement and pH regulation, decorative ground cover

**Readiness Level** Commercially available

**Circularity Potential** Made from marine industry waste, fully natural and biodegradable, replaces conventional gravel or mineral aggregate with a renewable alternative

**Produced In** Denmark



# Från skogen





BIOBASERADE BYGGMATERIAL

# Kork

- 
- **Koldioxidnegativt**
  - **Förnybart**
  - **Skördas utan att skada trädet**
  - **Bidrar till biologisk mångfald**
  - **Låg energianvändning i produktion**
  - **God isolerförmåga**
  - **Motståndskraftigt mot fukt och skadedjur**

# Wikanders Cork Flooring

**Raw Material** Natural cork harvested from the bark of cork oak trees.

**Other Components / Additives** Some product ranges may incorporate additional materials for enhanced durability and design, such as high-density fiberboard (HDF) or protective surface finishes.

**Potential Applications** Suitable for residential and commercial flooring

**Readiness Level** Commercially available

**Circularity Potential** Cork is a renewable resource, and Wikanders emphasizes sustainability by offering products with negative carbon balances and utilizing PVC-free materials.

**Produced In** Portugal.



# ThermaCork

**Raw Material** 100% natural cork granules from cork oak bark

**Other Components / Additives** None; cork is expanded using heat only, activating its natural resin (suberin) as a binder

**Potential Applications** Thermal and acoustic insulation, façade cladding and acoustic panels

**Readiness Level** Commercially available

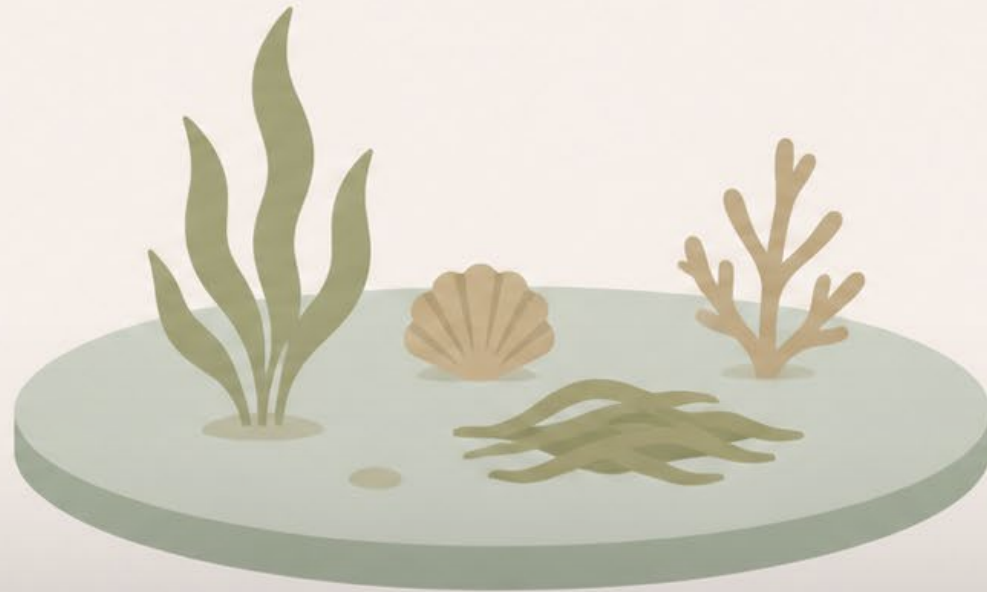
## Circularity Potential

- Renewable and recyclable material
- Produced with no additives or synthetic binders
- Biodegradable and carbon-negative over its life cycle

**Produced In** Portugal



# Från hav + strand





BIOBASERADE BYGGMATERIAL

# Vass

- 
- **Naturligt förekommande**
  - **Mycket låg klimatpåverkan**
  - **Skörd kan gynna biologisk mångfald och ekosystem**
  - **Lätt**
  - **Välisolerande**
  - **Kräver brandskydd i modern byggnation**

# Reed for thatched roofs (method, not product)

**Raw Material** Water reed (*Phragmites australis*), a durable, natural material harvested from wetlands.

**Other Components / Additives** N/A

**Potential Applications** Roofing material

**Readiness Level** Widely utilized in traditional and modern construction across various regions.

**Circularity Potential** Renewable resource with sustainable harvesting practices, biodegradable

**Produced In** Various countries with suitable wetland environments, including Germany.



# Reed for facades (method, not product)

**Raw Material** Water reed (*Phragmites australis*), a durable, natural material harvested from wetlands

**Other Components / Additives** N/A

**Potential Applications** Exterior cladding

**Readiness Level** Increasingly utilized in contemporary architecture across Northern and Western Europe

**Circularity Potential** Renewable and biodegradable material, harvested using sustainable methods, low embodied energy and natural insulation properties

**Produced In** Various countries with suitable wetland environments.

## Relevant Case Studies

- Sundby School in Nykøbing Falster, Denmark – Henning Larsen
- Naturum Tåkern, Sweden – Wingårdh Arkitektkontor



# Hiss Reed Panel

**Raw Material** Natural reed stalks.

**Other Components / Additives** None; the panels are bound using galvanized wire without chemical binders.

**Potential Applications** Interior and exterior wall insulation, roof insulation, ceiling insulation, view protection and windbreaks in gardens.

**Readiness Level** Commercially available.

**Circularity Potential** Produced from renewable resources without chemical additives; energy-efficient production and environmentally friendly disposal.

**Produced In** Germany



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BIOBASERADE BYGGMATERIAL

# Macroalger/ Sjögräs

- 
- **Climate impact**
  - **Resource availability**
  - **Land use and biodiversity**
  - **Water and chemical input**
  - **Harvesting and processing effort**
  - **Material properties**

# Tangtage

## (Seaweed roofs)

**Raw Material** Dried eelgrass (*Zostera marina*) harvested from Danish coastal areas

**Other Components / Additives** None; thatching technique uses only dried seaweed and wooden structural supports

**Potential Applications** Traditional and modern roof thatching, used for residential and heritage buildings in coastal regions

**Readiness Level** Commercially available (niche craft sector)

**Circularity Potential** Seaweed is a renewable marine material with natural fire resistance and durability, eelgrass roofs have a lifespan of 50+ years, biodegradable and compostable at end-of-life

**Produced In** Denmark



# Sould Acoustic Panels

**Raw Material** Seaweed (harvested from Danish beaches)

**Other Components / Additives** Natural wool and textile backings; no synthetic binders

**Potential Applications** Acoustic wall and ceiling panels, interior finishes

**Readiness Level** Commercially available

**Circularity Potential** Made from renewable, natural materials, seaweed used without chemical processing, panels are fully compostable and biodegradable

**Produced In** Denmark



*COPYRIGHT: SOULD*



CATTAIL

BIOBASERADE BYGGMATERIAL

# Kaveldun

- 
- **Snabbväxande**
  - **Binder kol**
  - **Kan odlas utan konkurrens om åkermark**
  - **Kräver inga tillsatser**
  - **Kan bidra till restaurering av ekosystem**
  - **God isolerförmåga**
  - **Lätt**

# Typhaboard

**Raw Material** Typha (cattail) fibres harvested from wetlands

**Other Components / Additives** Natural binding agents; no synthetic resins or chemical additives

**Potential Applications** Wall and ceiling panels, acoustic insulation

**Readiness Level** Pilot stage

**Circularity Potential** Renewable and locally sourced raw material, fully biodegradable and compostable, low energy production process

**Produced In** Germany



# Typha Kappendecke

## (Vault Ceiling Elements)

**Raw Material** Typha (cattail) stems

**Other Components / Additives** Clay and lime plasters; wooden structural elements

**Potential Applications** Prefabricated, curved ceiling panels for ecological buildings, suitable for interior applications requiring thermal and acoustic insulation

**Readiness Level** Pilot stage

**Circularity Potential** Made from fast-growing wetland plants, combined with natural, mineral-based materials, biodegradable and low embodied energy

**Produced In** Germany



# Typha Sandwich Panels

**Raw Material** Typha (cattail) stems

**Other Components / Additives** Clay or lime plasters; wood-based structural framing

**Potential Applications** Wall and roof elements in ecological and energy-efficient buildings, prefabricated panel systems for timber construction, thermal and acoustic insulation

**Readiness Level** Pilot stage

**Circularity Potential** Constructed from rapidly renewable wetland plants, uses only natural, compostable materials, supports healthy indoor climate and low embodied energy

**Produced In** Germany



# Typha Structural Timber Substitute

**Raw Material** Typha (cattail) stems

**Other Components / Additives** Natural binders (clay or lime-based); no synthetic resins

**Potential Applications** Substitute for structural timber elements in ecological construction, used in wall framing, partition structures, and prefabricated building systems

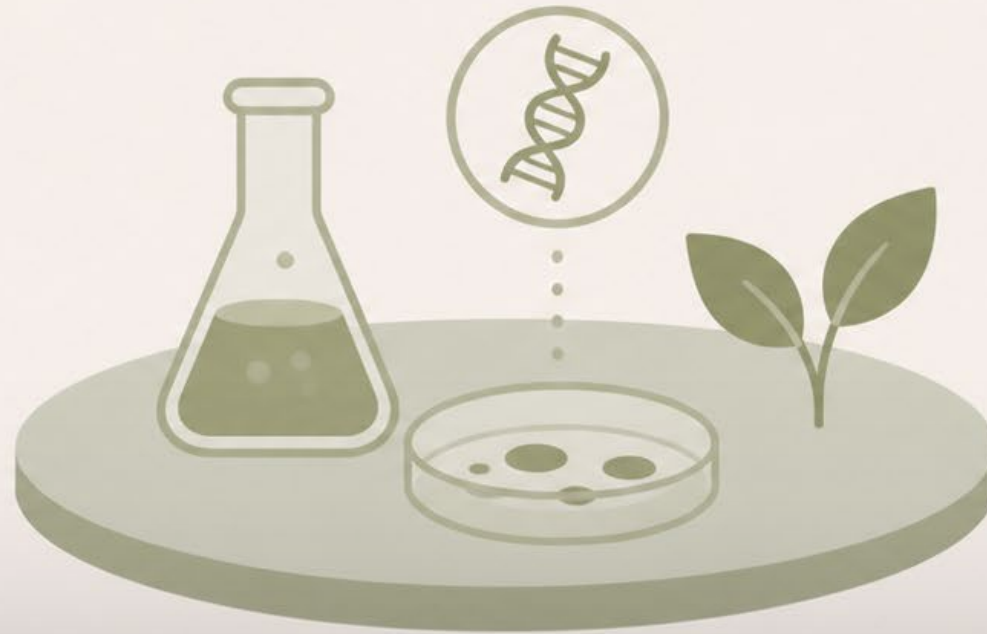
**Readiness Level** Pilot stage

**Circularity Potential** Made from fast-growing wetland plants, fully biodegradable and recyclable, low embodied energy and supports circular construction models

**Produced In** Germany



# Från biotech





BIOBASERADE BYGGMATERIAL

# Mycelium

- 
- **Odlas på organiskt avfall**
  - **Mycket låg klimatpåverkan**
  - **Liten resursanvändning**
  - **Kräver ingen mark eller kemikalier**
  - **Nedbrytbart**
  - **Ljudabsorberande**

# Mogu

## Acoustic + decorative panels

**Raw Material** Mycelium (fungal root system) and upcycled textile residues

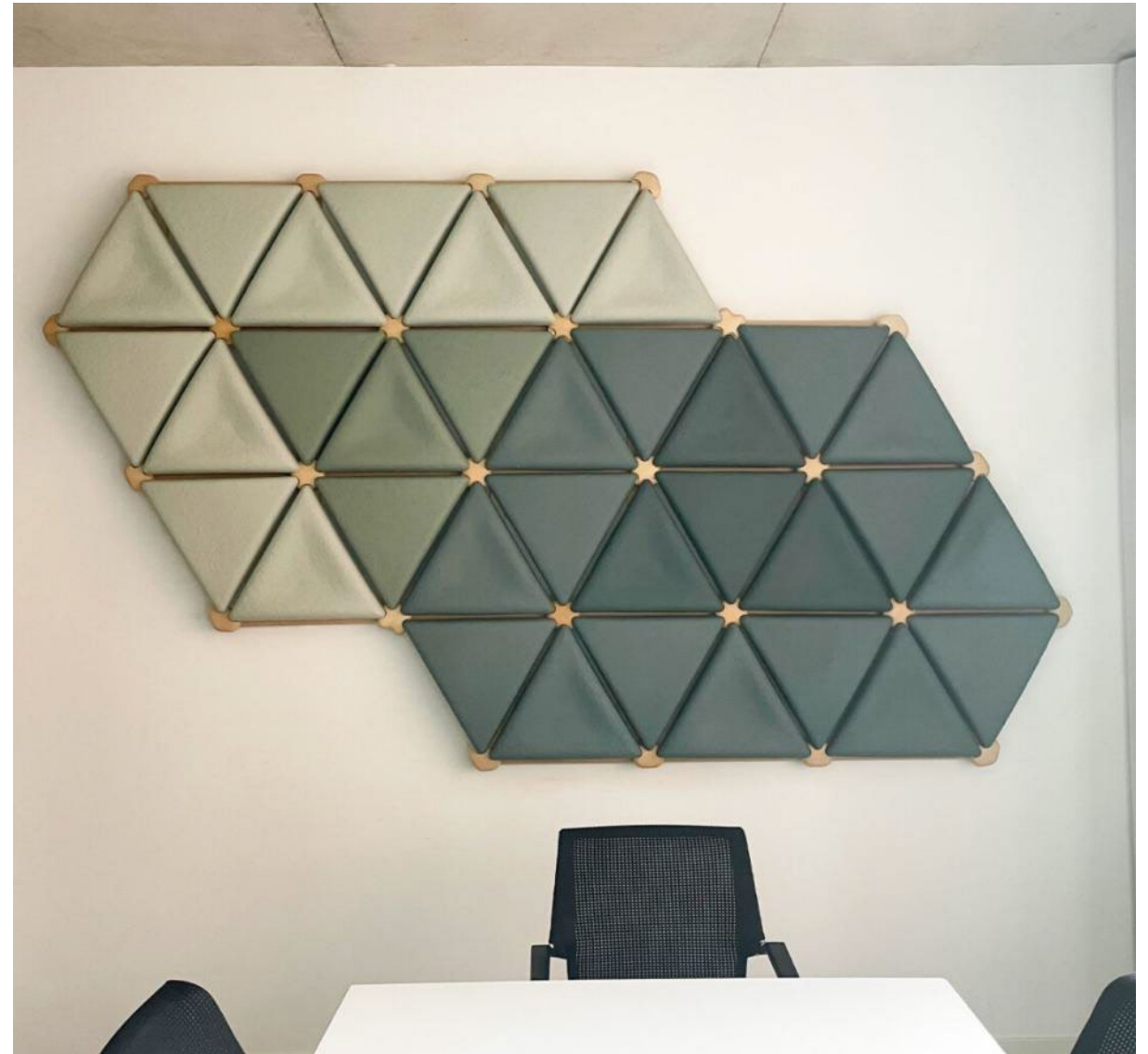
**Other Components / Additives** No synthetic additives; natural growth and pressing processes

**Potential Applications** Acoustic wall and ceiling panels for interior spaces, decorative surface elements

**Readiness Level** Commercially available

**Circularity Potential** Made from renewable and biodegradable materials, designed for full biodegradability at end-of-life, low-energy manufacturing using natural growth processes

**Produced In** Italy



# Myceen Acoustic Panel

**Raw Material** Mycelium (fungal root structure) grown on agricultural waste (e.g. sawdust, hemp, or other organic residues)

**Other Components / Additives** No synthetic additives; grown and formed through controlled biological processes

**Potential Applications** Acoustic wall and ceiling panels

Interior design elements for offices, public buildings, and residential spaces

**Readiness Level** Commercially available

**Circularity Potential** Fully biodegradable and compostable

Produced from renewable and waste-based feedstock

Low-energy manufacturing through biological growth processes

**Produced In** Estonia



# The Growing Pavilion

**Raw Material** Mycelium (fungal root system) and agricultural residues

**Other Components / Additives** No synthetic binders; formed through natural mycelial growth

**Potential Applications** Wall cladding, interior panels, pavilion and exhibition structures

**Readiness Level** Pilot stage

**Circularity Potential** Fully biodegradable and compostable, low embodied energy, produced from renewable and waste-based raw materials

**Produced In** The Netherlands

**Relevant Case Studies**

- The Growing Pavilion (Dutch Design Week 2019)





MICROALGAES

BIOBASERADE BYGGMATERIAL

# Microalger

- 
- **Climate impact**
  - **Resource availability**
  - **Land use and biodiversity**
  - **Water and chemical input**
  - **Harvesting and processing effort**
  - **Material properties**

# Prometheus Materials

## Acoustic Panels

**Raw Material** Microalgae-based bio-cement combined with natural aggregates

**Other Components / Additives** Plant-based reinforcement fibers; no synthetic resins

**Potential Applications** Acoustic wall and ceiling panels for interior environments

**Readiness Level** Pilot stage

**Circularity Potential** produced using photosynthetic microorganisms that absorb CO<sub>2</sub>, low-carbon alternative to traditional cement-based materials, designed to be recyclable and made from renewable ingredients

**Produced In** United States



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# Prometheus Materials

## Bio Block

**Raw Material** Microalgae-based bio-cement combined with natural aggregates

**Other Components / Additives** Plant-based reinforcement fibers; no synthetic resins or Portland cement

**Potential Applications** Non-load-bearing masonry units for walls, suitable for commercial, institutional, and residential construction

**Readiness Level** Pilot stage

**Circularity Potential** Made from renewable, carbon sequestering materials, low embodied carbon compared to conventional concrete blocks, designed to be recyclable and biodegradable at end of life.

**Produced In** United States



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BIOBASERADE BYGGMATERIAL

# Kitosan

- 
- Tillverkas av skaldjursavfall
  - Relativ låg klimatpåverkan
  - Kräver kemisk bearbetning
  - Antibakteriellt
  - Nedbrytbart

# Kitosan

**Raw Material** Chitin extracted from crustacean shells (typically shrimp and crab), processed into chitosan through deacetylation

**Other Components / Additives** Varies depending on application; often combined with natural fibers, clays, or bio-polymers when used in composites

**Potential Applications** Biopolymer matrices and coatings, flame-retardant fillers in biocomposites, packaging, biomedical materials, and building insulation research

**Readiness Level** Research stage

**Circularity Potential** Derived from seafood industry waste streams, biodegradable and non-toxic, potential to replace synthetic polymers in multiple applications

**Produced In** Various research labs and pilot-scale facilities internationally



# Från soffan.





POP CORN

BIOBASERADE BYGGMATERIAL

# Popcorn

- 
- **Resurskrävande odling**
  - **Låg klimatpåverkan i tillverkningskedet**
  - **Enkel bearbetning**
  - **Lätt**
  - **Nedbrytbart**
  - **God isolerförmåga**
  - **Kräver skydd mot fukt, skadedjur och brand**

# Popcorn Panel

**Raw Material** Expanded corn (popcorn)

**Other Components / Additives** Natural adhesive; no synthetic binders used

**Potential Applications** Interior wall and ceiling panels, thermal and acoustic insulation, sustainable furniture elements, conceptual applications in ecological design and construction

**Readiness Level** Pilot stage

**Circularity Potential** Made from agricultural by-products (renewable raw material), fully compostable and biodegradable, low embodied energy, non-toxic, and safe for indoor environments, can serve as a direct replacement for conventional plastic-based insulation boards

**Produced In** Germany



# Vad hindrar oss?

- **Regler och standarder**
- **Riskaversion i branschen**
- **Brist på kunskap och referensprojekt**
- **Produktionskapacitet**

# Sammanfattning

- Vi lever i ett ändligt system
- Byggnader måste lagra kol
- Biosbaserade material möjliggör detta
- Trä räcker inte
- Lösningar finns redan
- Våga testa i den lilla skalan

# Fördjupning

- **Marine Biobased Building Materials: Technical Playbook"** by Nordic Innovation and Arup (May 2024)
- **Veje til Biobaseret Byggeri – Et blik på tværs**, Realdania, JAJA Architects, January 2025

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# Tack!

BIOBASERADE BYGGMATERIAL  
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