Graduation Portfolio

Haoran Wu
hw2977
MSAAD

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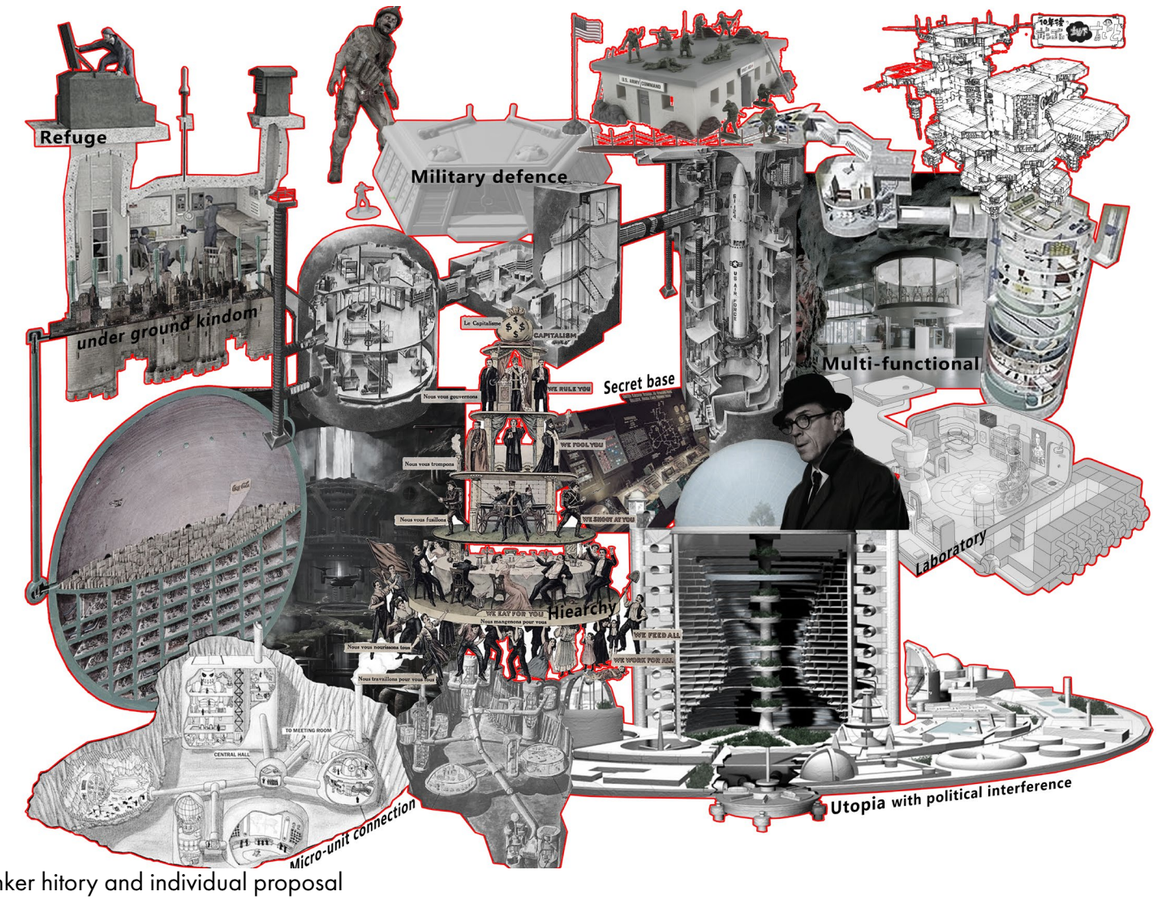
Beelding bunkers

As a result of climate change, pesticide use, biodiversity loss, and other factors, many bees are facing dangerous population declines. However, bees play a vital role in the whole ecosystem. Honeybees are responsible for about 1/3 of food eaten by Americans. Research shows that over 100,000 species of plants would become extinct if the pollinating function of bees was to cease. In this case, The End of Humans is also The End of Bees.
In New York, there are already many people using the hives to keep the bees for saving their populations and doing research. But they may just use rooftops or community gardens as their temporary place to keep the bees. So I just wonder if I could create a space for different functional uses of beekeepers to help them save the bees' population.

Bunkers normally are used for food storage, military defense. The underground bunker already has a well-established business model. And I think the bunker could be utilized in conserving endangered bee species. Integrating a bunker with bee farming or research can provide a controlled and protected environment for keeping bees, conducting research, and supporting the conservation of bee populations. It combines the advantages of controlled conditions with the natural behaviors of bees, offering valuable insights into beekeeping practices, pollination, and ecosystem preservation.

Personal work
Instructor: Uriel Fogué
Summer 2023



Bunker hitory and individual proposal

The End of Human

Beelding bunkers

Infrastructural support for bee-keepers in NYC

Architectures to address the decline of population of bees

Haoran Wu

All bees:

Estimated **1/3 of food** is pollination dependent

Pollinate **70** types of crops

Make **6,000** tonnes of honey

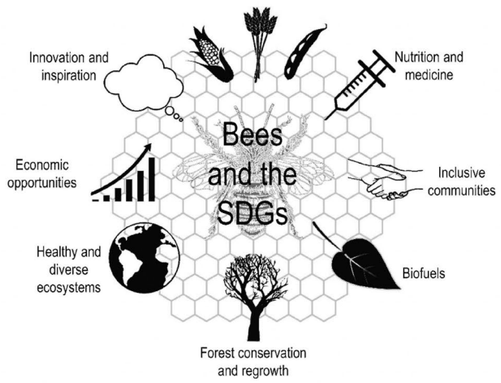
Contribute **£400 million** to the economy

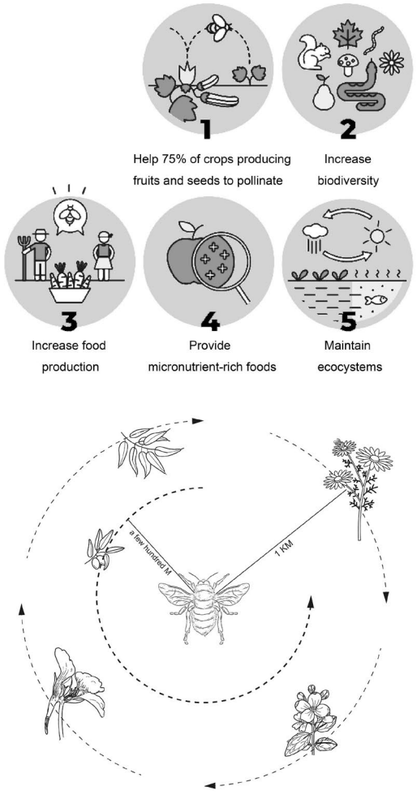
A colony:

Pollinates **4,000 m²** of fruit trees

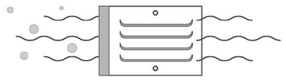
Makes avg **14kg** of honey

Contains **50,000** bees



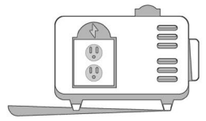


Bunkers setup



VENTILATION

Needed for providing clean air. NBC filters are considered the best for emergencies.

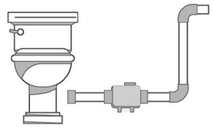


GENERATOR

Needed to provide power to the bunker. Solar generators don't need fuel to be stockpiled.

WATER FILTER

Needed to provide a reliable source of clean water. A UV filter removes contaminants using UV light.

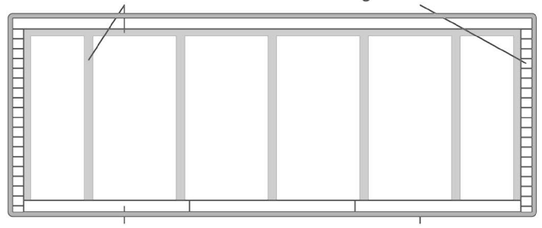


WASTE REMOVAL SYSTEM

To prevent waste build up, which can cause health issues, a pump and lift system is recommended.

METAL BEAMS to protect against cave-ins.

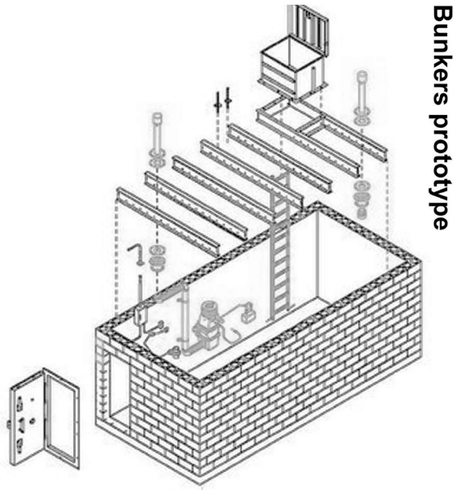
1-3 FEET THICK WALLS for protection against radiation.



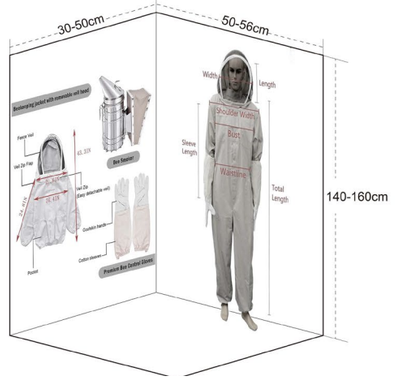
A CONCRETE FOUNDATION for support.

A WATERPROOF COATING to prevent unsanitary

Bunkers prototype

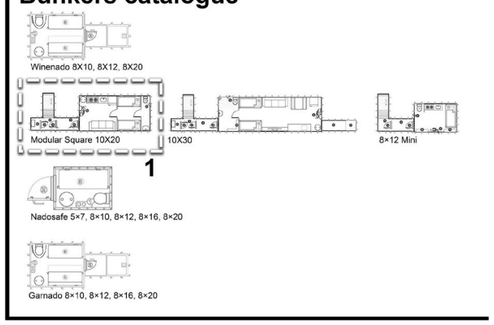


Size of tools for the beekeepsers

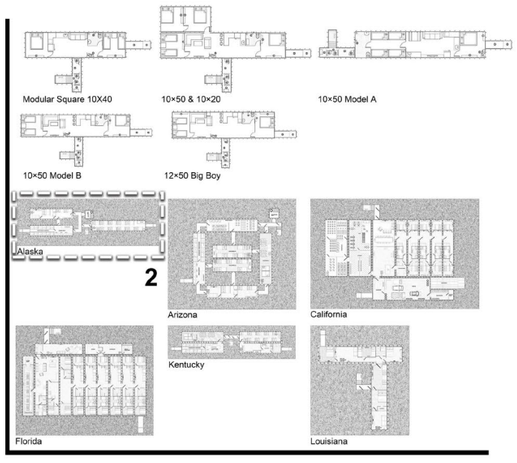


Safe Cellars

Bunkers catalogue



Platinum Series



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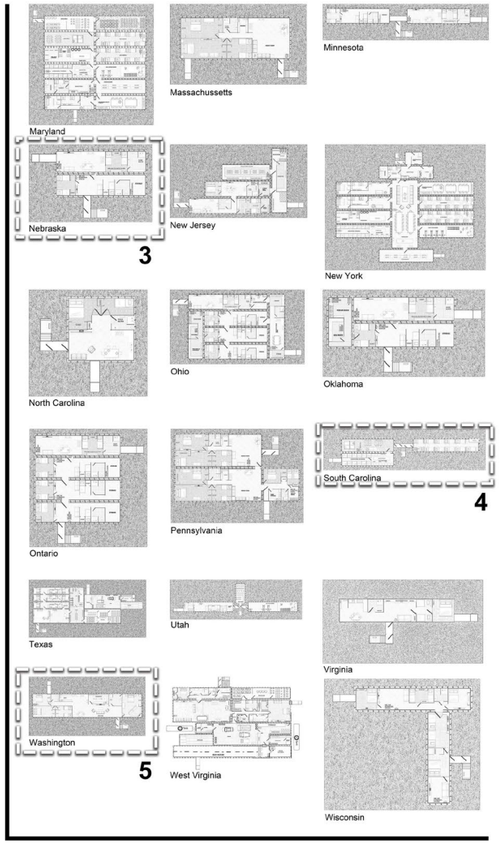
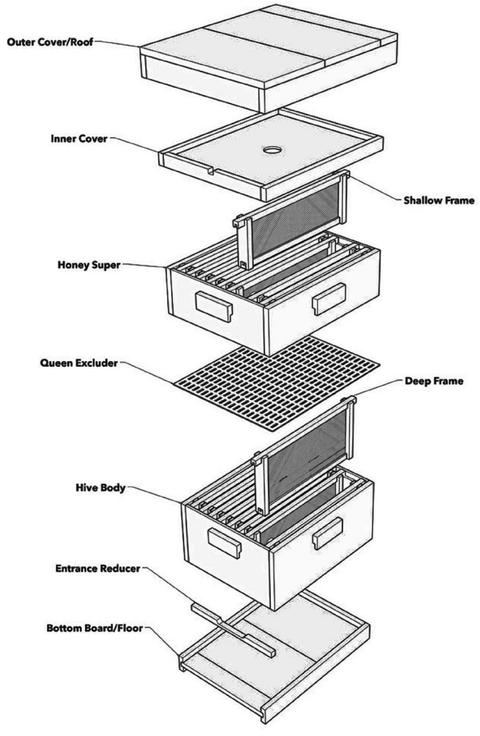
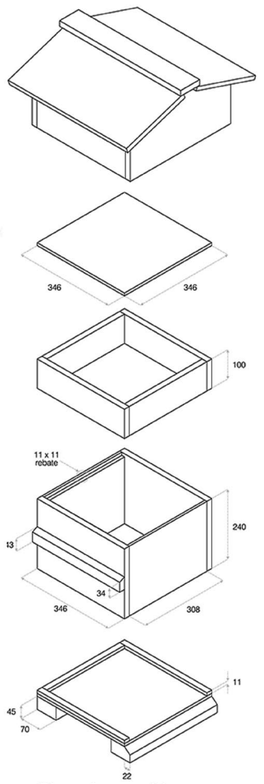
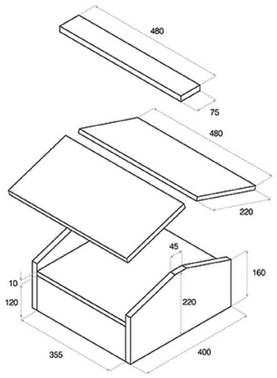


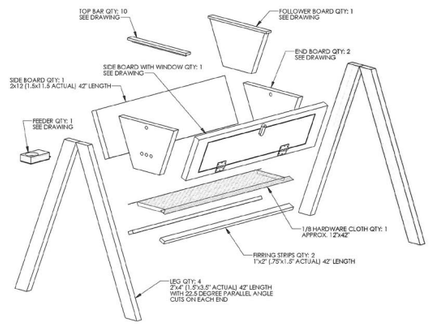
Size of bee hives





Size of warre hives





Size of top-bar hive

The End of Human

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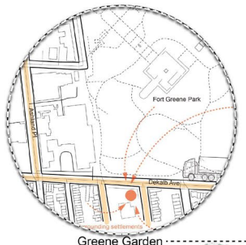
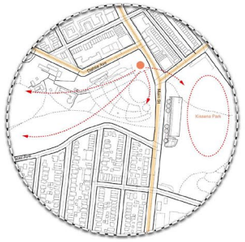
Carver Community Garden

Pleasant Village Community Garden

Queens Botanical Garden



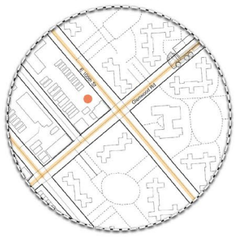


Greene Garden

CubeSmart Self Storage

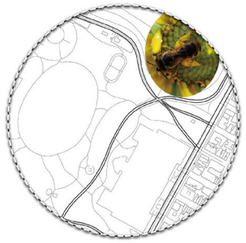
Ponderosa Garden

Transportation of bunkers

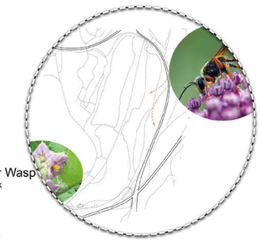


Brown Belted Bumble Bees are generalists pollinators, which means they can forage nectar and pollen from a wide variety of plants. Some species have very long tongues that enable them to sip nectar from plants that have long, tubular or spurred flowers such as native beardtongue, foxglove, Virginia bluebells and columbine.

Season: April through September



Look for Ligated Furrow Bees in Halictus ligatus, which is the most common Halictus species on plants in the Apiaceae (carrot), Allium (onion), and Asteraceae (aster) families.



Golden Digger Wasp
Van Cortlandt Park

Ligated Furrow Bee
Central Park

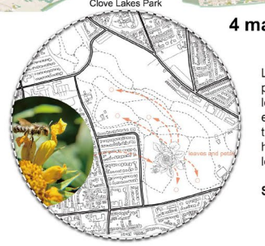
Brown Belted Bumble Bee
Prospect Park

Adult wasps subside on sap and a variety of flower nectars from flowering plants that blossom from May through October.
Season: May through October

Leaf Cutter Bee
Clove Lakes Park

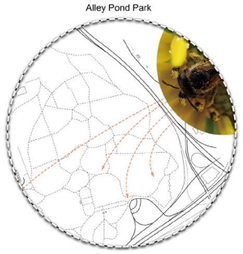
Sweat Bee
Alley Pond Park

4 main types of bees in NYC

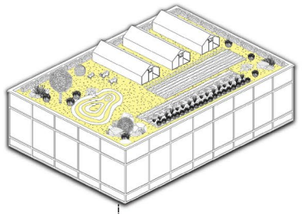


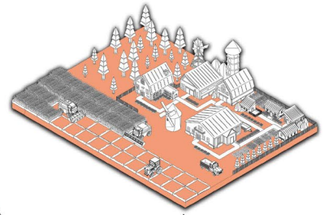
Leaf Cutter Bee seem to prefer rose, lilac, or redbud leaves, and you can often see evidence of their work in the form of small, circular holes on the edges of the leaves of these plant species.

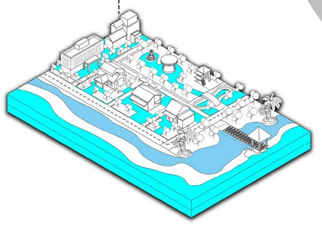
Season: April through October

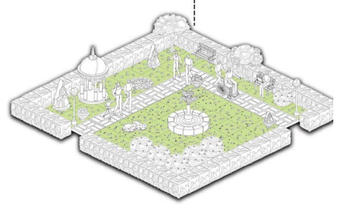


The preferred habitat of bees in NYC





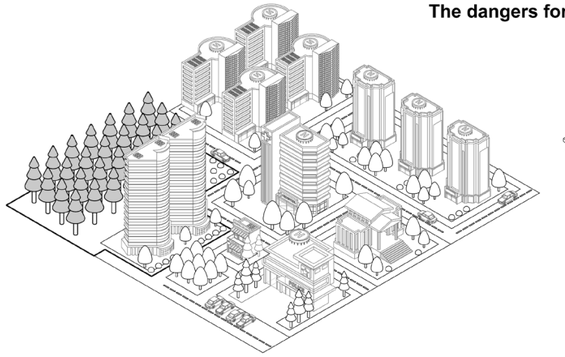




Bees living radius

- Long island
- Public park
- Urban farm
- Green roofs
- 500-800 feet
- 800 feet-1 mile
- 300-500 feet
- 100-200 feet

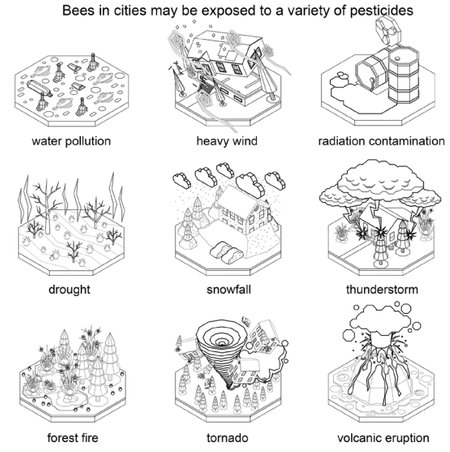
The dangers for the bees in NYC



Urbanization and development in New York City result in the loss of natural habitats for bees

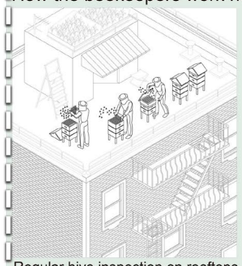
Higher levels of air pollution

Bees in cities may be exposed to a variety of pesticides

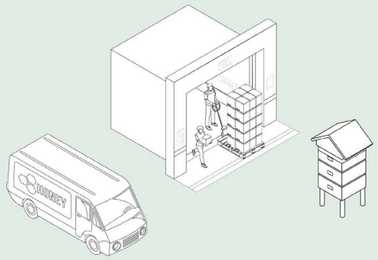


Climate change

How the beekeepers work now



Regular hive inspection on rooftops



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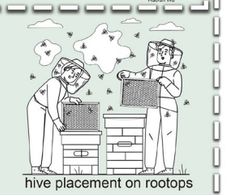
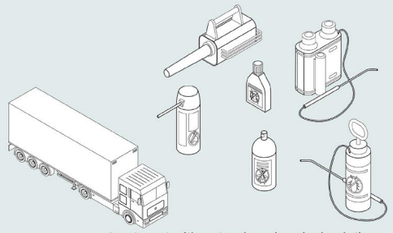


hive placement on rootops

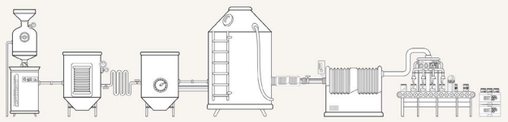
Pest and disease management/ swarm control



treatment with natural or chemical solutions

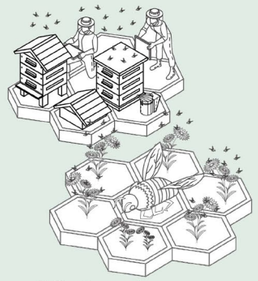
hygienic practices

Honey extraction

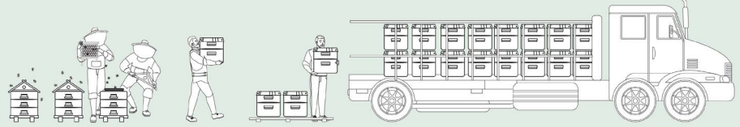


centrifugal, crshing, straining

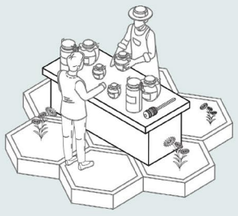
How the beekeepers work now



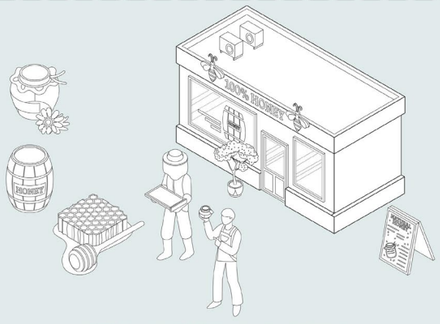
Pollination services



renting out bees to help crop pollination

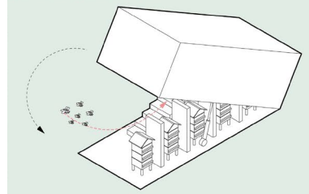


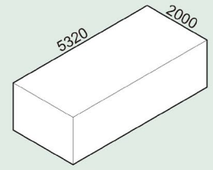
Educational outreach



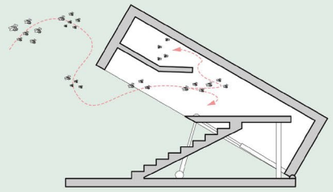
workshop, presentations, community events

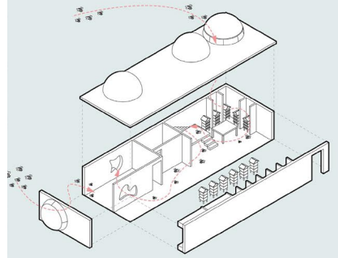
Bunkers utilization

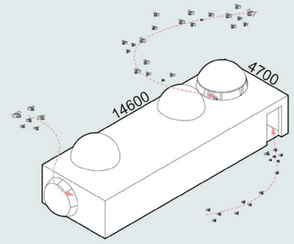




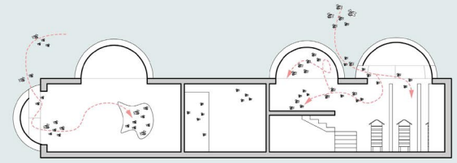
Hub

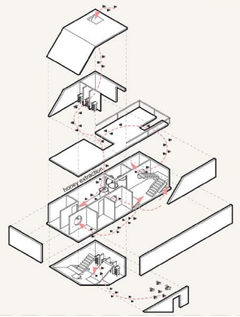


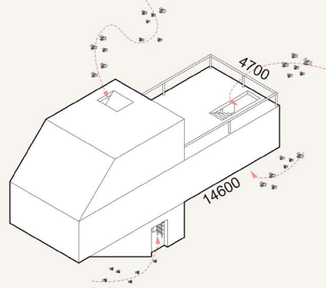




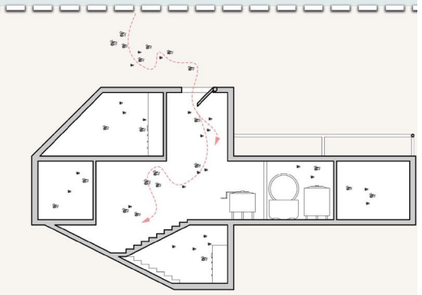
Storage/ living space



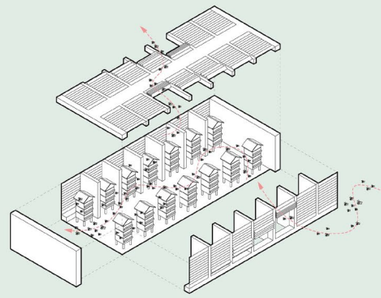




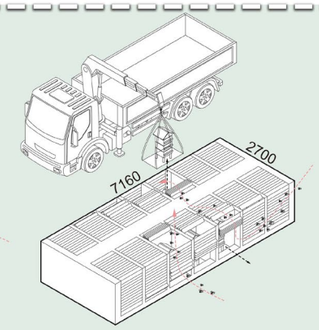
Laboratory

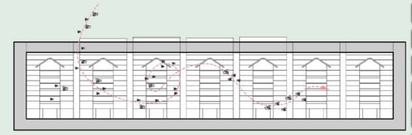


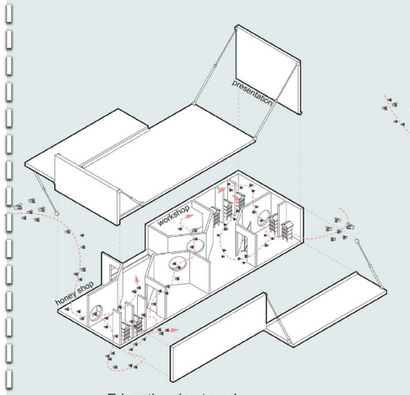
Bunkers utilization



As a container for transportation







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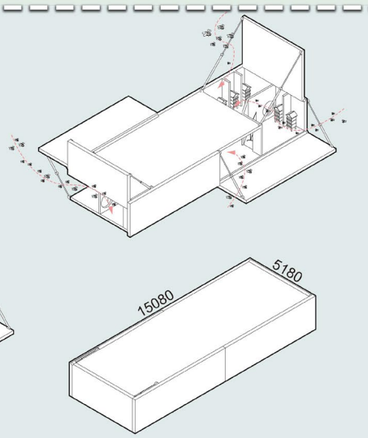

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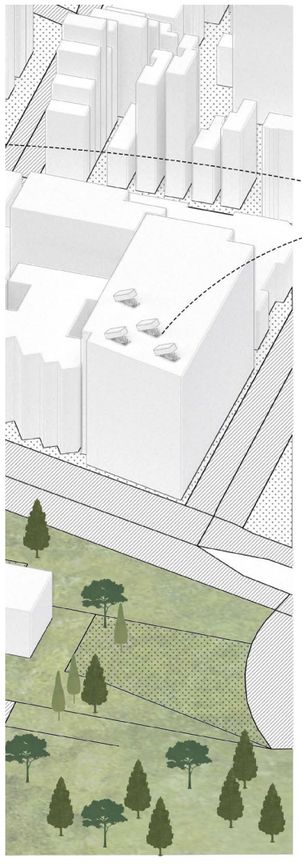
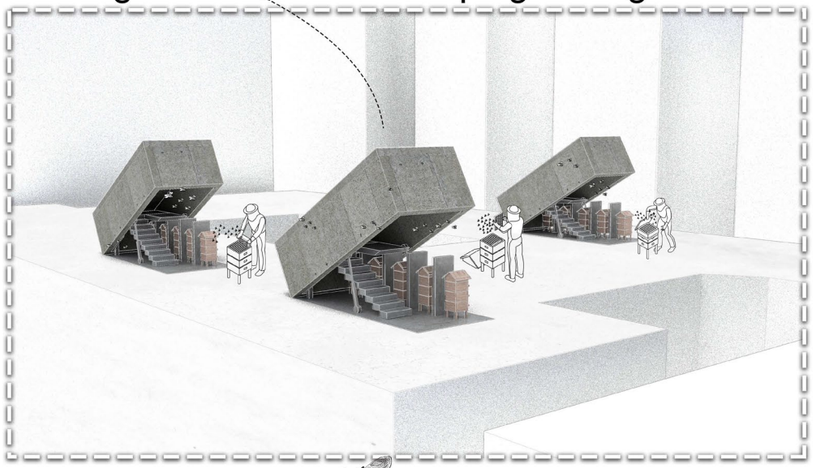
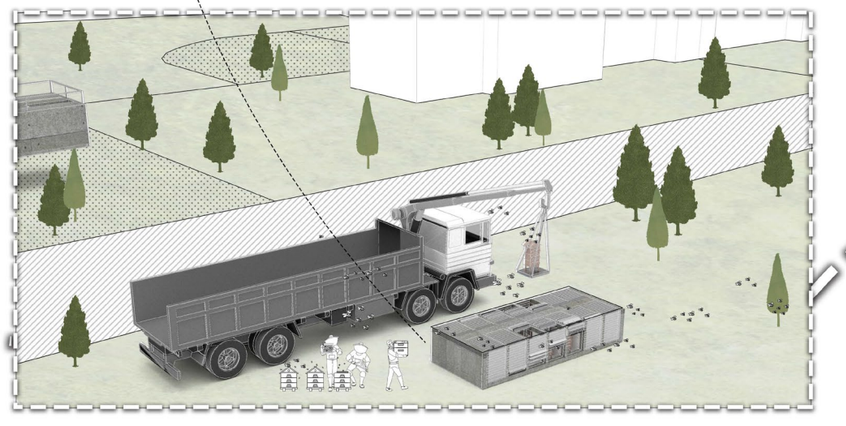
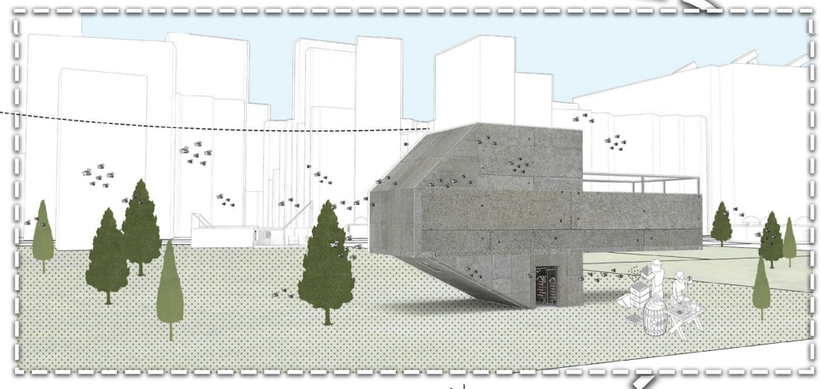
Prospect Park, Brooklyn, NY

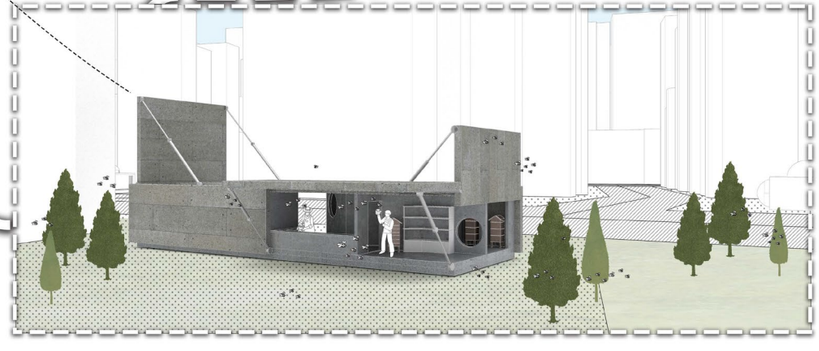


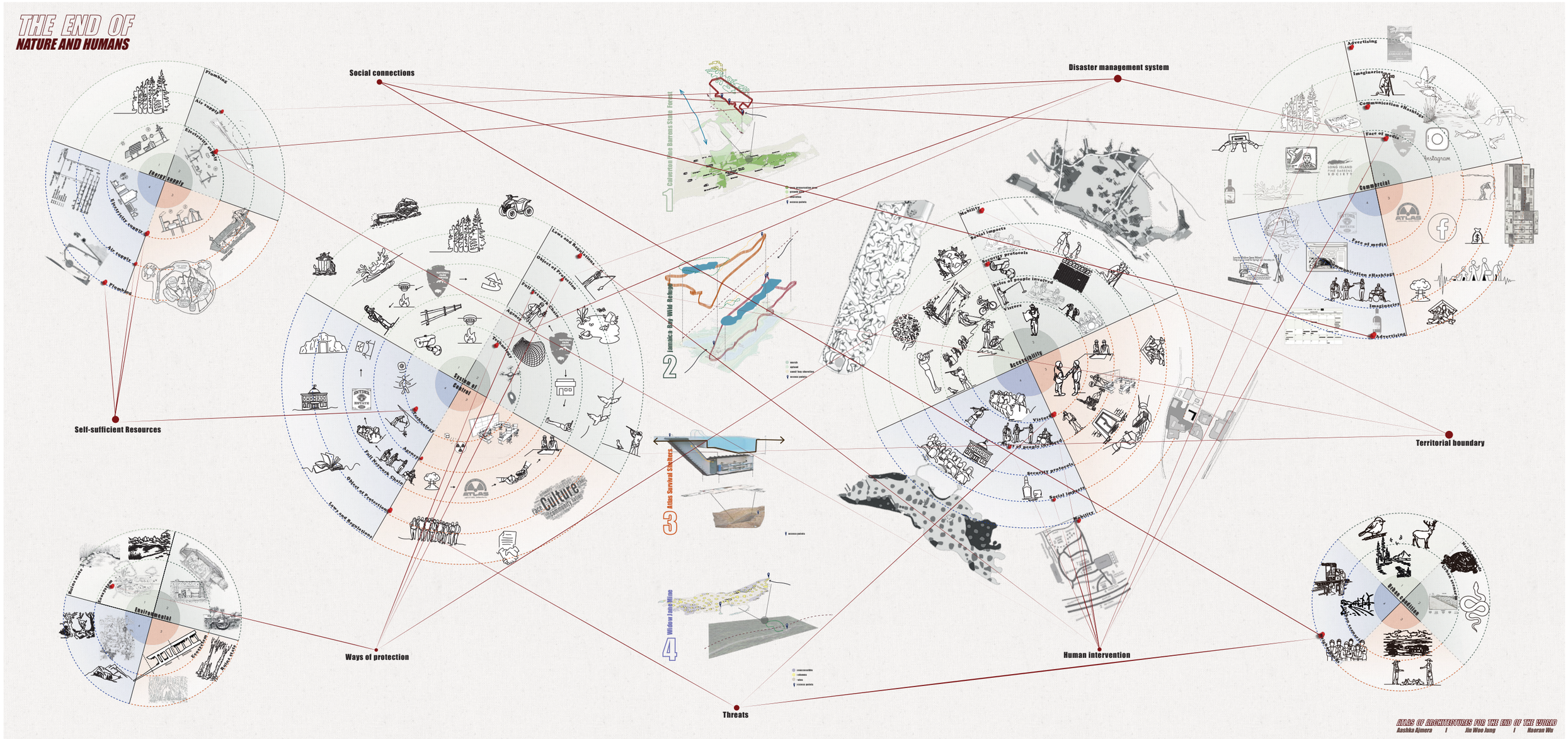
utilizing bunkers for beekeeping in neighborhood











Cosmograph
Jin woo Jung, Aashka Paras Ajmera, Haoran Wu
Summer 2023

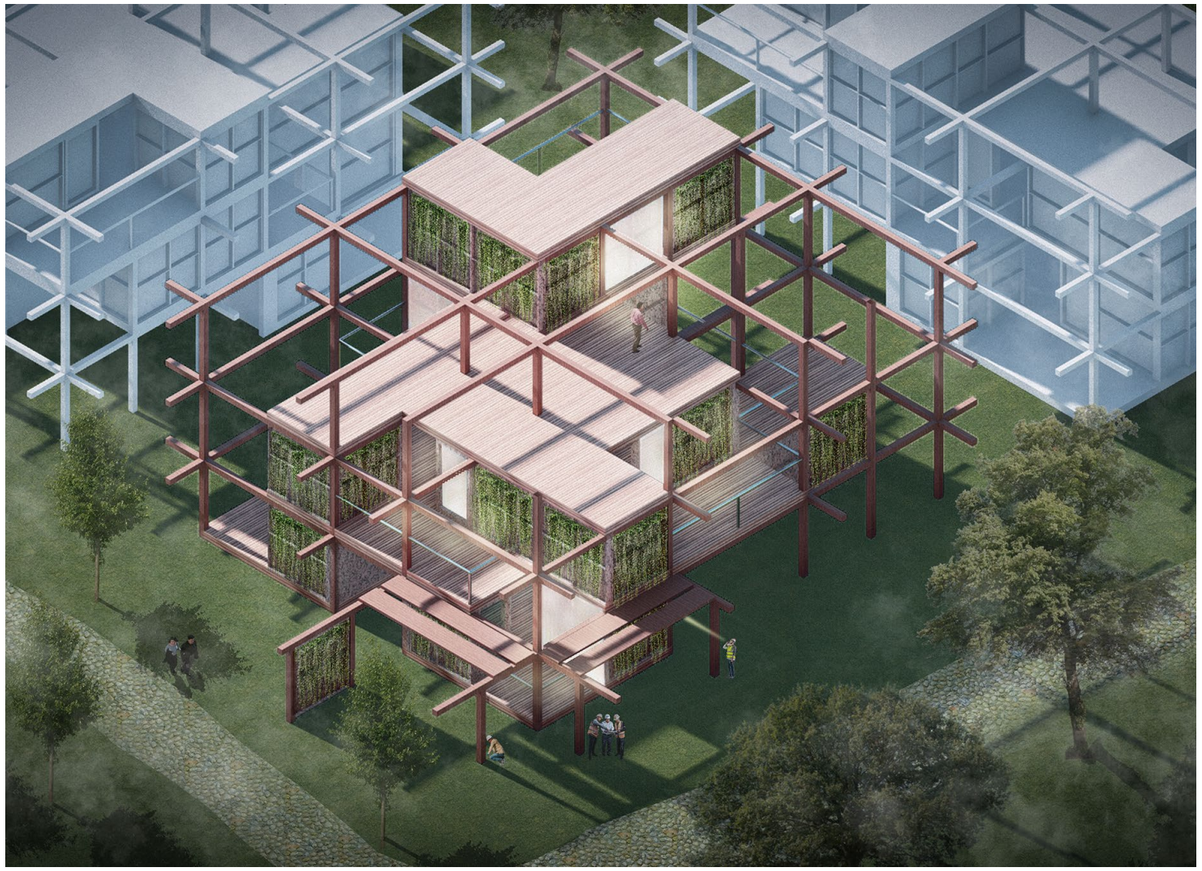
02
Earth-Based Green Wall

Our research focuses on advancing sustainable architecture through earth materials for future decarbonization. Our design employs uniform wall panels with layered construction: The innermost part is the rammed earth layer. Then there is the straw layer, which provides insulation. And next is the retaining grids which could use the gravity and form to create the pressure to hold the soil. The outermost part is the rock layer. We will use the most suitable size for the outer iron mesh to prevent the soil surface from falling apart or blown away by wind.

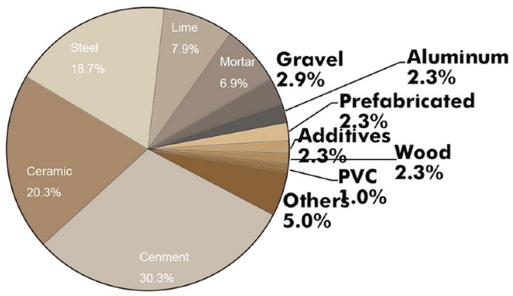
We used the CLT-processing wood slab and column for the structure system of our module. The whole structure is a beam-column structure with mortise and tenon structures at the joints.

In a fragment context, a corner of our design can be reconfigured into a stove mode, showcasing adaptability. Additionally, we implement a strategic approach in the tower module, assigning specific wall panel layers to different living spaces. The rammed earth layer finds its place in bathrooms, the rock layer with iron mesh serves between living and dining areas, and the composite wall complements bedrooms. This comprehensive strategy aims to harmonize sustainable construction with practical living scenarios.

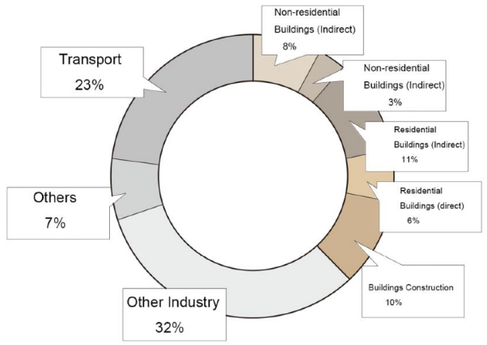
Tianyu Lyu (DK) & Haoran Wu
Instructor: Gordon Kipping
Fall 2023



INTRODUCTION Carbon Emission



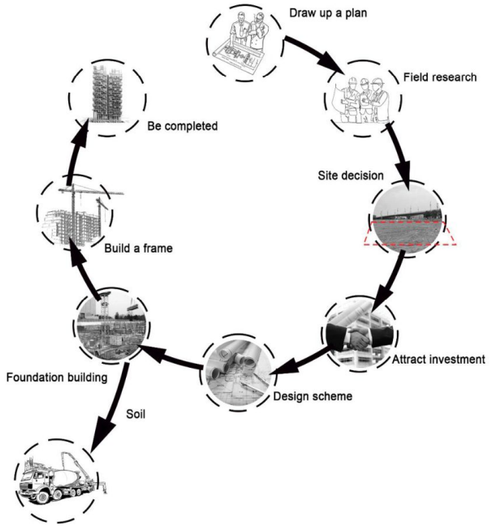
Carbon Emission- Building Materials



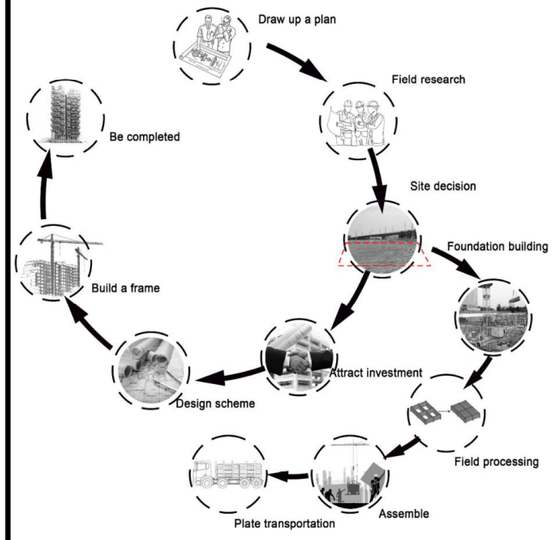
CO2 Emission

INTRODUCTION Proposal of New Process

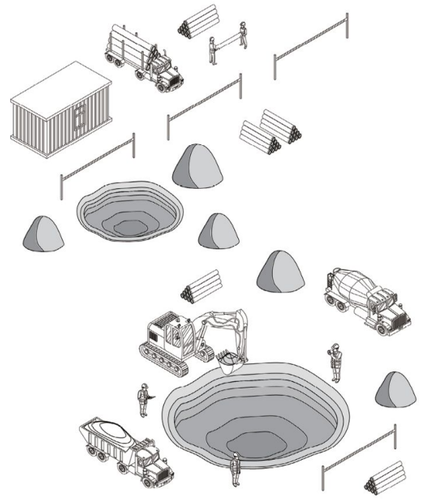
CURRENT SITUATION



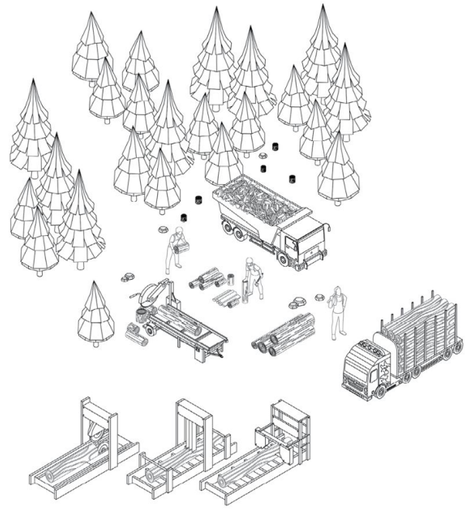
POSSIBLE SOLUTION



RESEARCH Preparation



- Excavate and gather the soil from the site, ensuring it is free of organic matter, roots, and large stones.
- Use the soil from digging the foundation



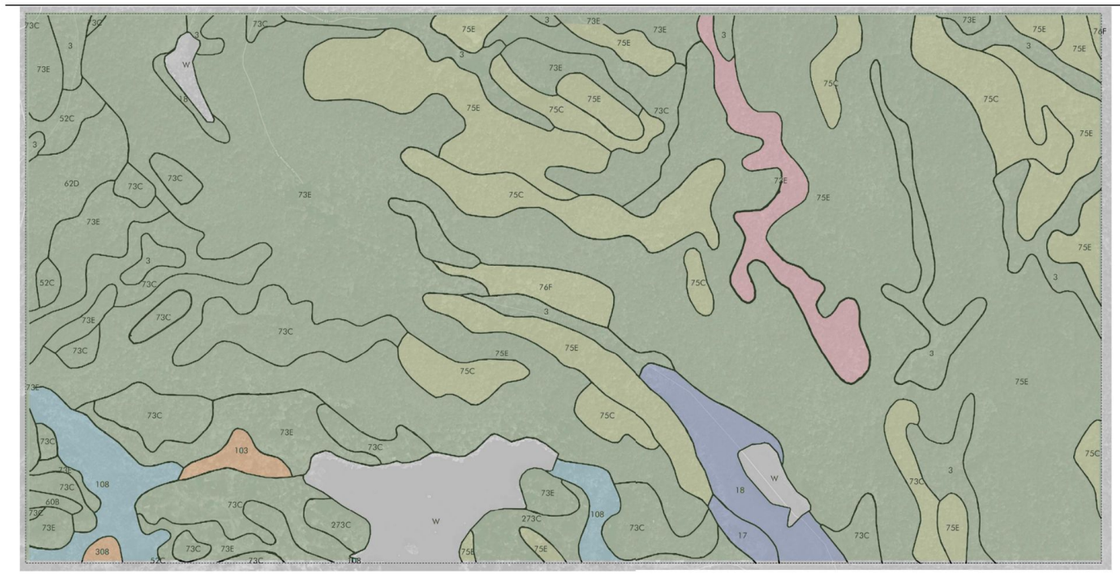
- The required wooden structures are sourced from local materials

RESEARCH Soil Sampling Site-White Plains

Google Map

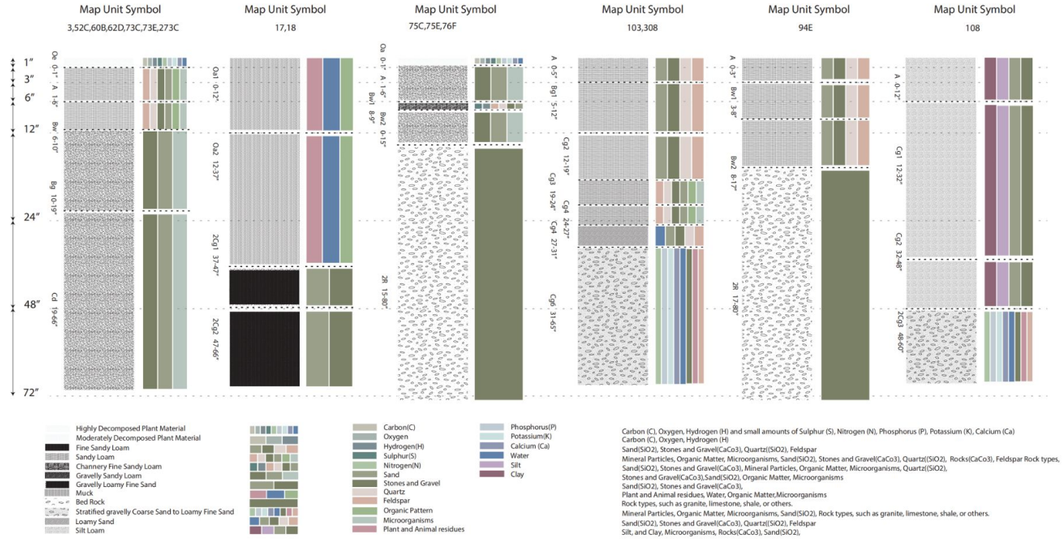
RESEARCH Site Analysis

RESEARCH Soil Districts in White Plains



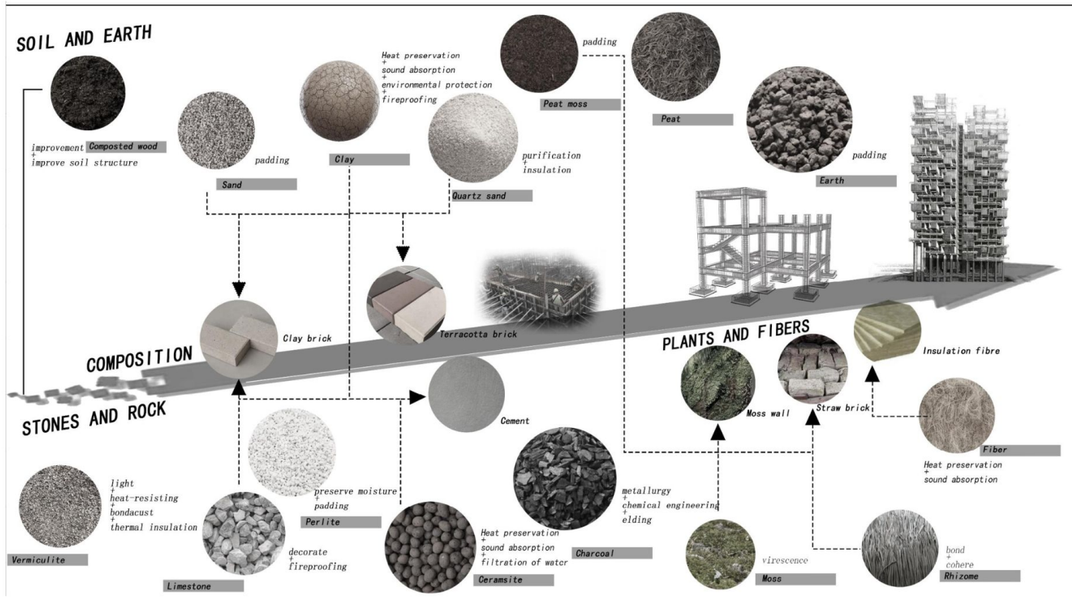
Google Map

RESEARCH Soil Contents in White Plains

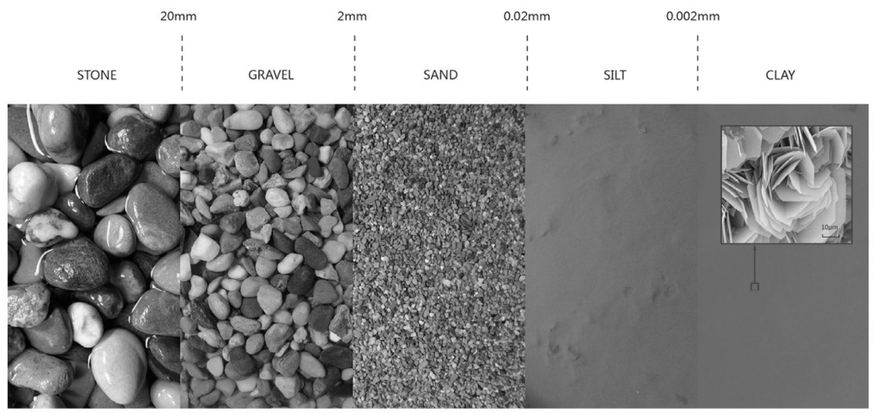


U.S. Soil Survey

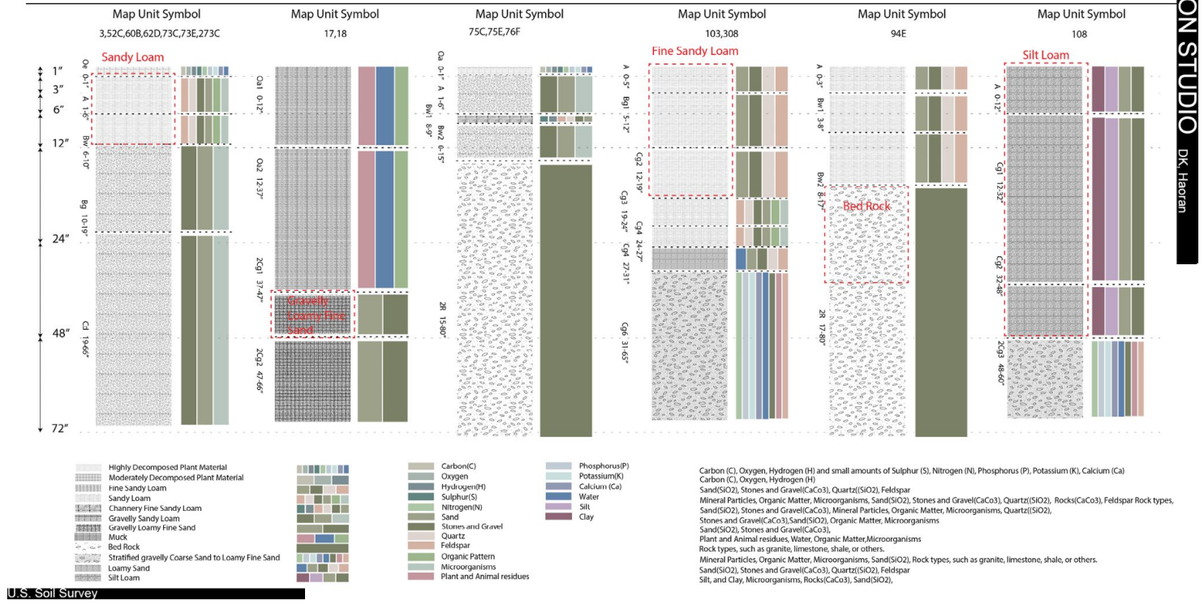
RESEARCH General Soil Components



RESEARCH Rammed Earth



RESEARCH Components Choice

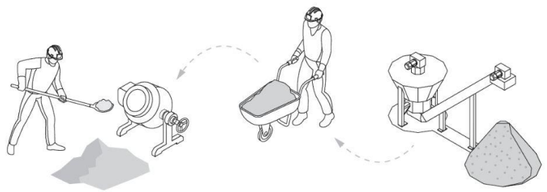


U.S. Soil Survey

RESEARCH Mixing Process

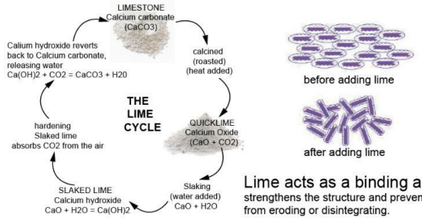
- Combine the soil with the stabilizers, if required, in the right proportions.
- Mix the materials thoroughly to achieve a consistent blend.

a. Chemical Stabilization

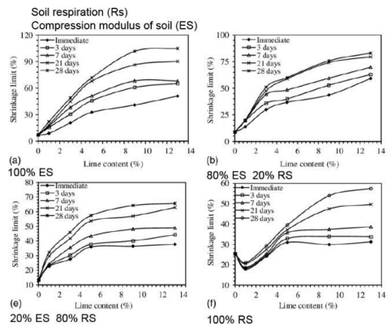


- Lime stabilization:
  Lime is mixed with the soil to improve its plasticity and strength.

- Cement stabilization:
  Cement is mixed with the soil to create a cement-soil mixture that hardens over time.

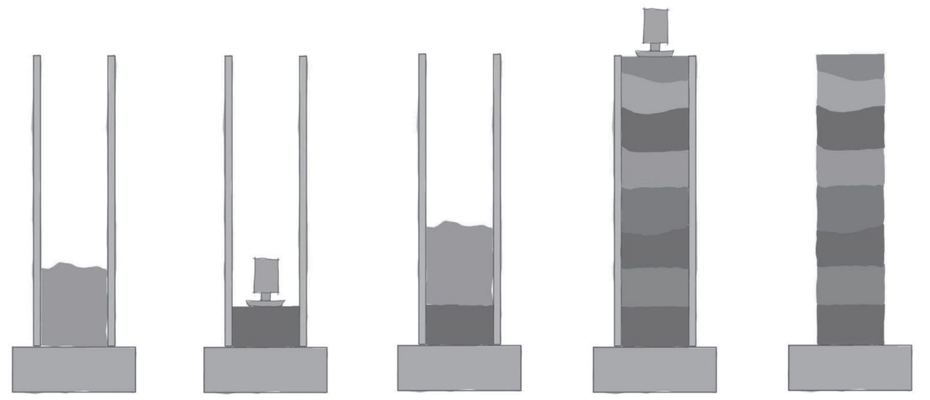


Lime acts as a binding agent
strengthens the structure and prevents it from eroding or disintegrating.



-Reduces Shrinkage and Cracking

RESEARCH Rammed Earth Layering



plywood formwork filled with layer of moist earth mix (concrete, gravel, sand, clay etc)

earth layer compacted using pneumatic backfill tamper

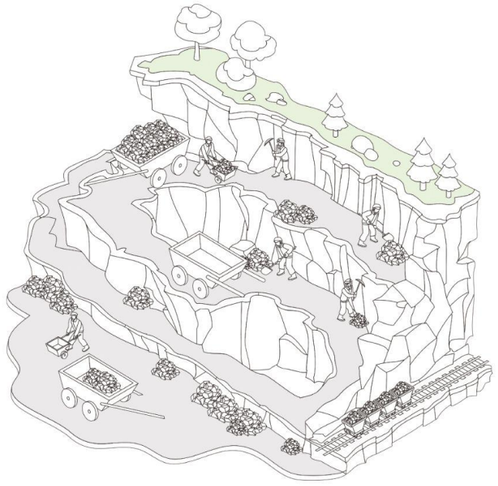
next layer added and process repeated

additional layers of moist earth are added and compressed

once dry, the formwork is removed to reveal the rammed earth wall

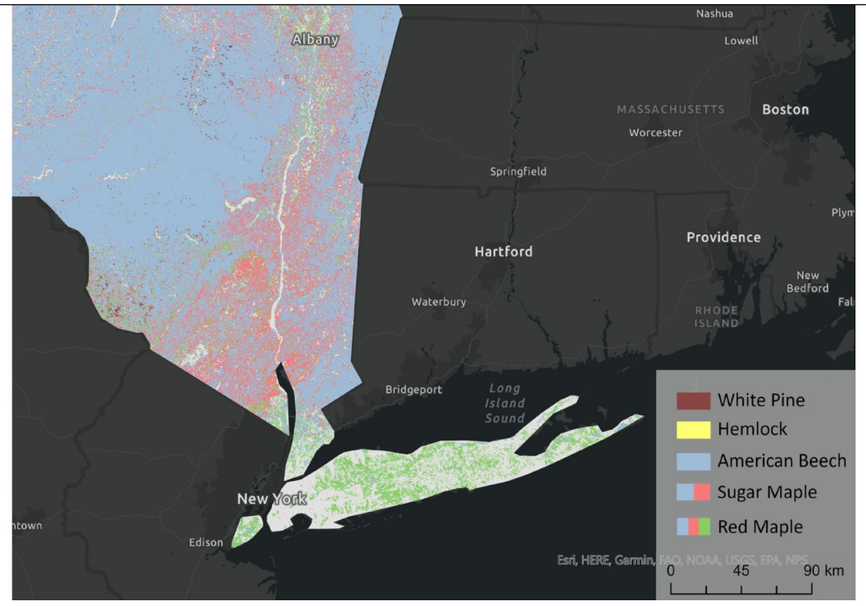
- Fill the formwork in even layers, typically 6 to 12 inches (15 to 30 cm) thick.
- Compact each layer using a pneumatic or manual ramming tool. The goal is to achieve maximum compaction to ensure the wall's strength.

RESEARCH Rock



The required rocks are sourced from local materials

RESEARCH Timber Distribution



RESEARCH Nearby Quarry

R•J•VALENTE COMPANIES

R. J. Valente Gravel, Inc. is one of the Capital District's largest Material Handlers. With over 40 dump trucks and numerous gravel pits, we can offer residential and commercial customers timely service and quality products.

Clifton Park Pit
Liebich Ln, Halfmoon, NY

Schaghticoke Pit
805 Farm to Market Rd, Schaghticoke, NY

Halfmoon Pit
118 Button Rd, Waterford, NY

Petersburg Pit

Grafton Quarry

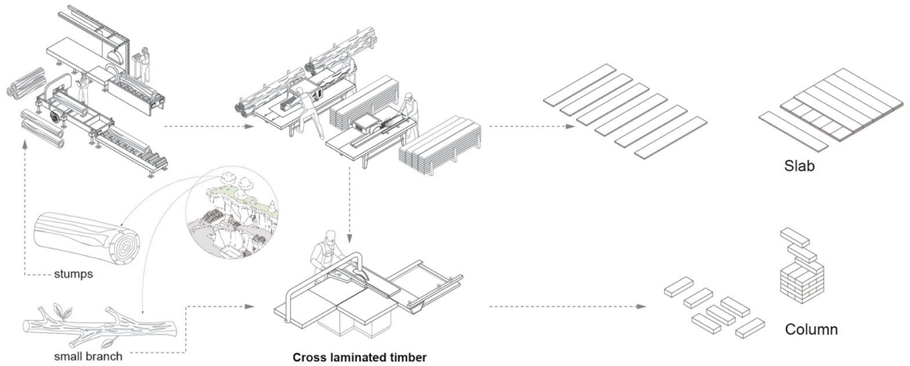
New Baltimore Pit

Schodack Pit
Schodack Landing, NY

RESEARCH Wood Species

	White Pine	Hemlock	American Beech	Sugar Maple	Red Maple
Hardness					
Durability					
Machinability					
Beauty					
Information	**Description:** straight trunk, conical crown, and slender needles. **Habitat:** well-drained soils, mixed deciduous and coniferous forests. **Uses:** construction, carpentry, and making furniture.	**Description:** small, flat needles and a pyramidal shape. **Habitat:** moist, shaded forests, moist, shaded forests. **Uses:** construction, framing and heavy structural applications, pulpwood.	**Description:** smooth, gray bark and elliptical, toothed leaves. **Habitat:** mixed hardwood forests. **Uses:** furniture, flooring, and veneers.	**Description:** distinctive five-lobed leaves and bark that takes on a rough, furrowed appearance as the tree matures. **Habitat:** eastern North America and prefer well-drained, acidic soils. **Uses:** flooring, cabinetry, and furniture.	**Description:** reddish twigs, leaves, and flowers. The leaves are typically three-lobed, and the bark is smooth and gray. **Habitat:** eastern North America. **Uses:** furniture, flooring, and pulpwood.

RESEARCH Timber Producing Process



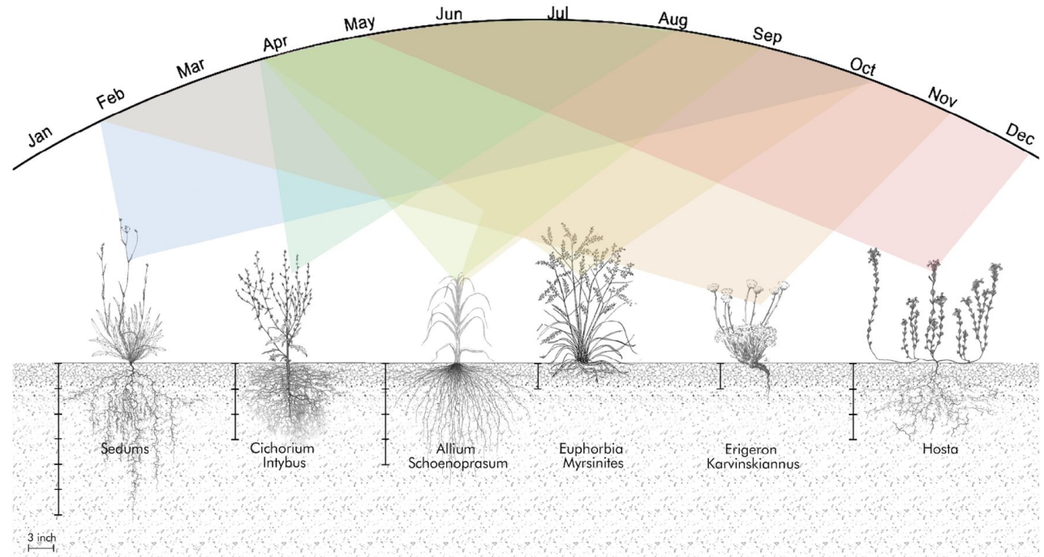
- Create wooden formwork or molds to define the shape and dimensions of your rammed earth wall. Ensure it is sturdy and level.

- And processing the subsequent required wood structure.

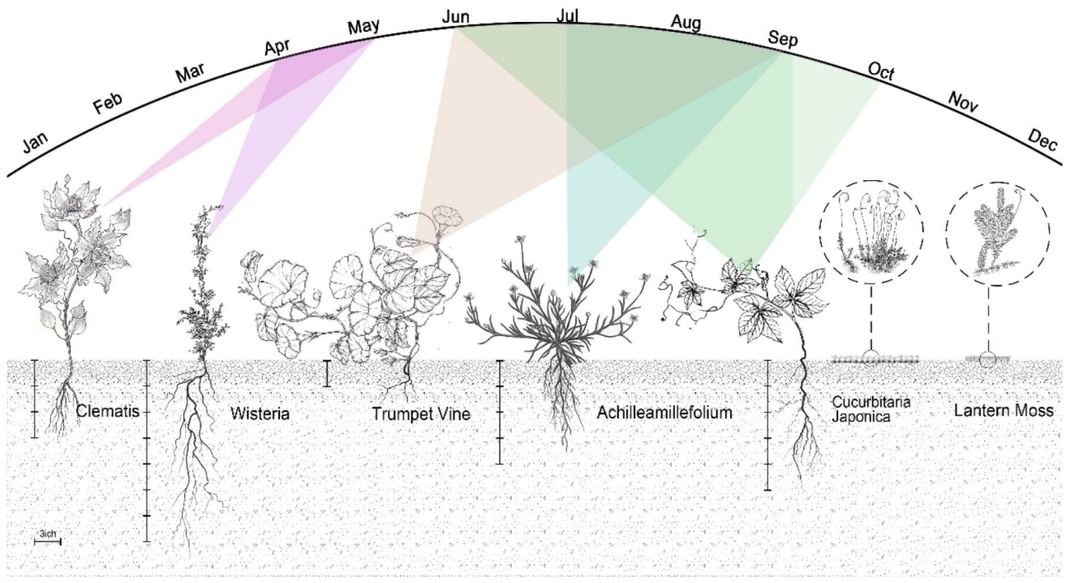
RESEARCH Function of Roots

https://www.youtube.com/watch?v=QRQsRreAncM
https://www.istockphoto.com/photos/soybean-roots

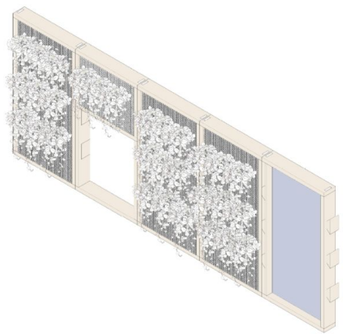
RESEARCH Plants

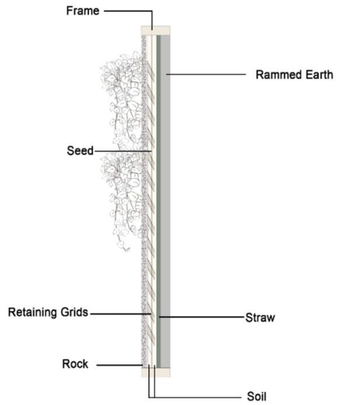


RESEARCH Plants

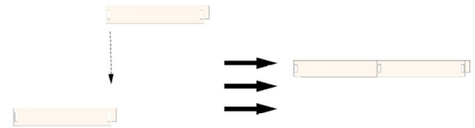


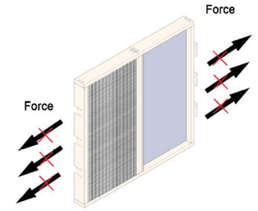
MODULE Wall-General View

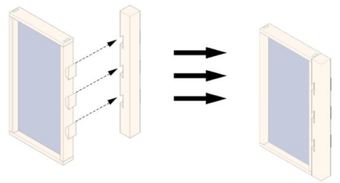


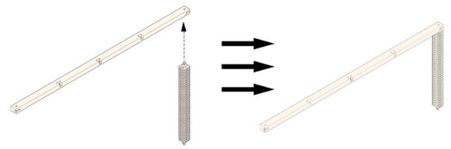


MODULE Wall-Structure Diagrams

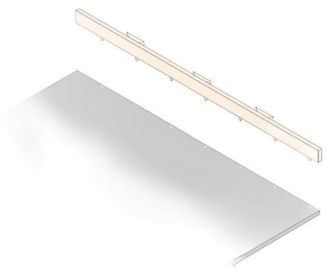


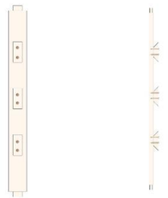


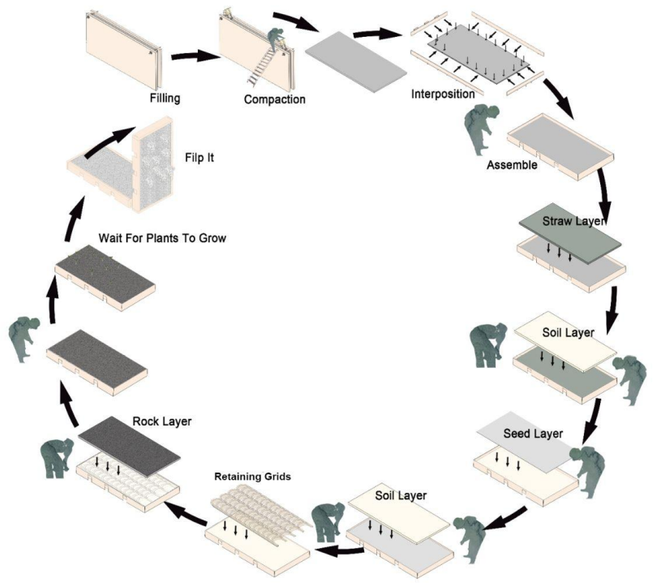




MODULE Wall-Assembling Process

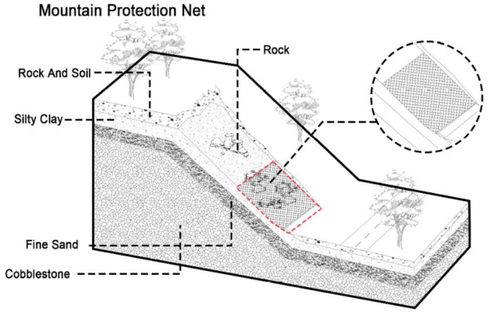




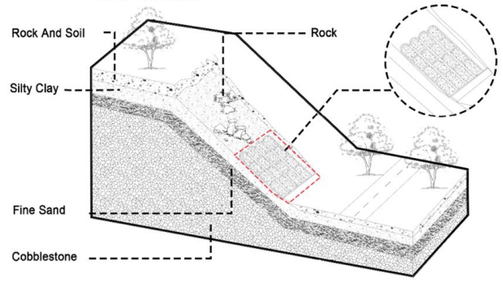


MODULE Retaining Grids- Ideas

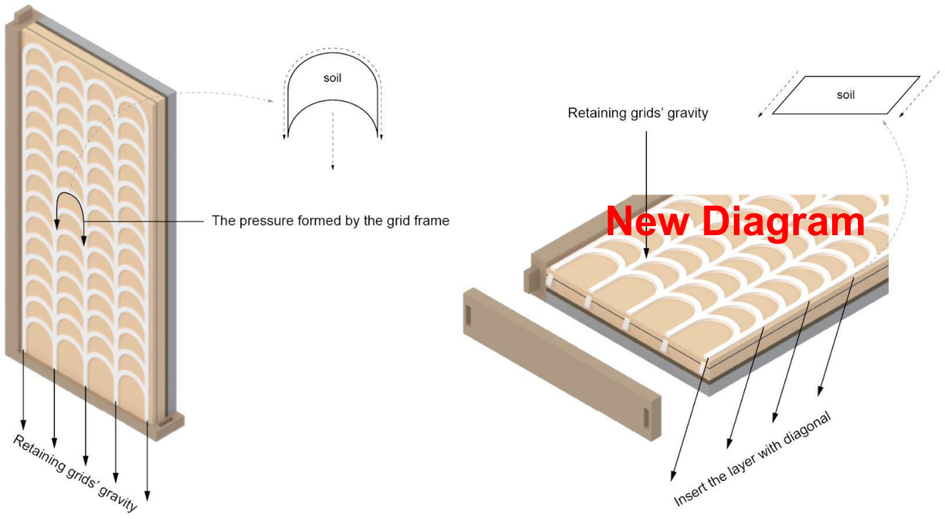
Mountain Protection Net



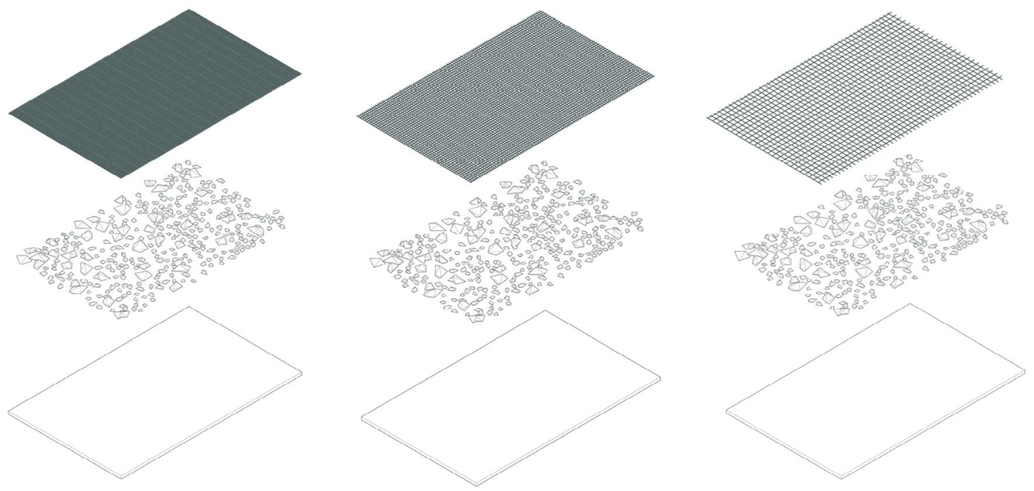
Arch Protection



MODULE Retaining Grids- Diagram



MODULE Wall-Rock Layer

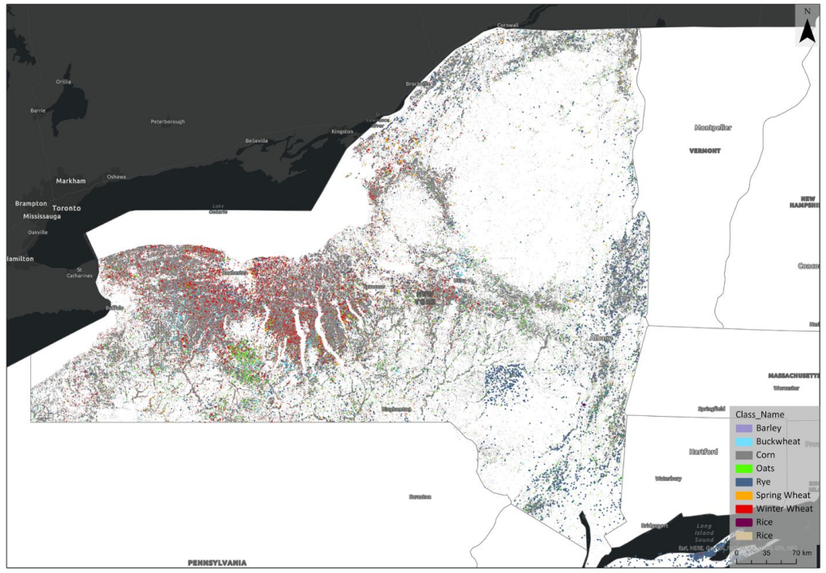


Narrow Crevices (1/4 inch to 1 inch or less)

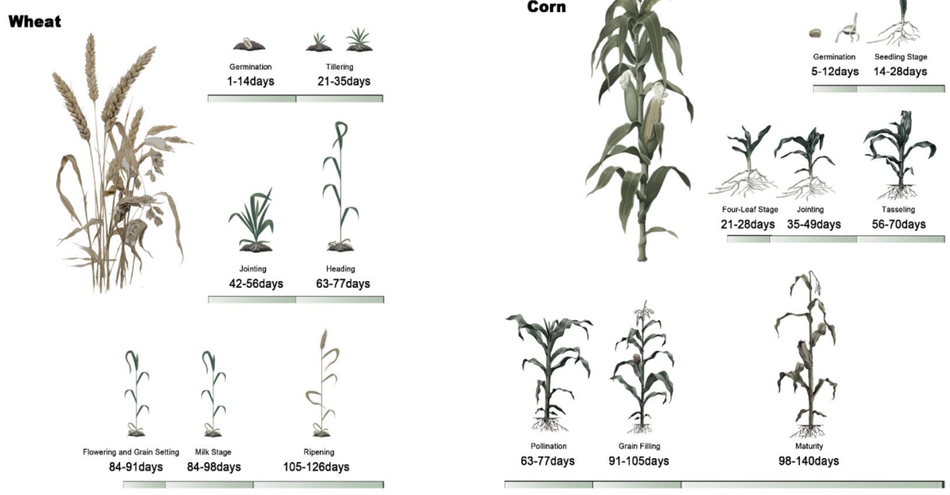
Medium-Sized Crevices (1 inch to 4 inches)

Large Crevices (Over 4 inches)

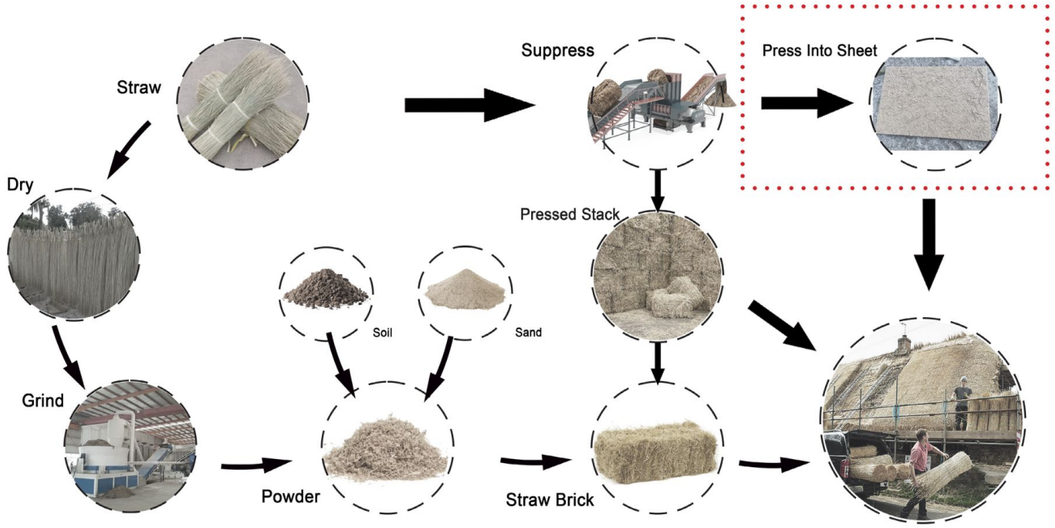
MODULE Straw Layer



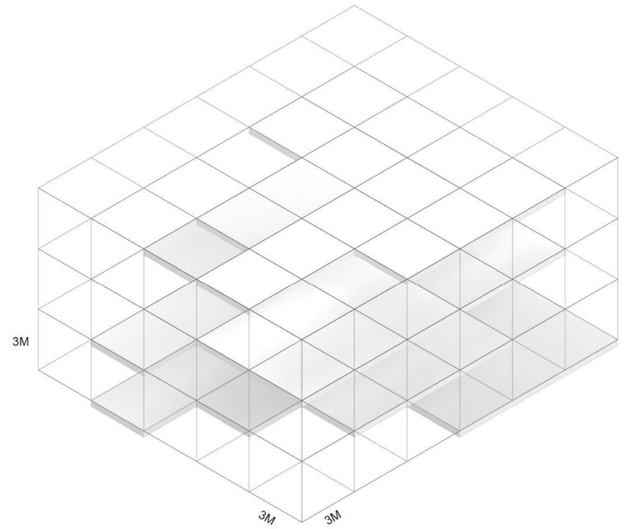
MODULE Straw Layer



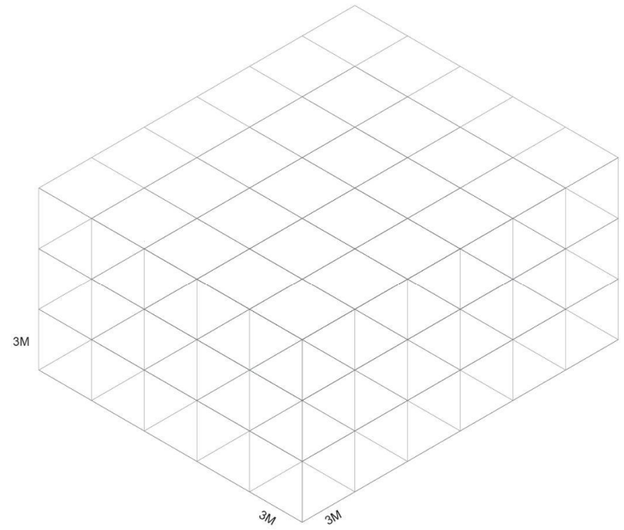
MODULE Straw Layer



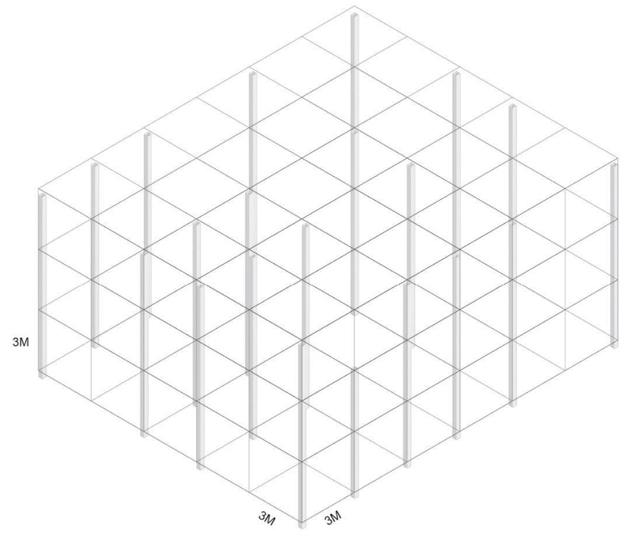
MODULE Design Process

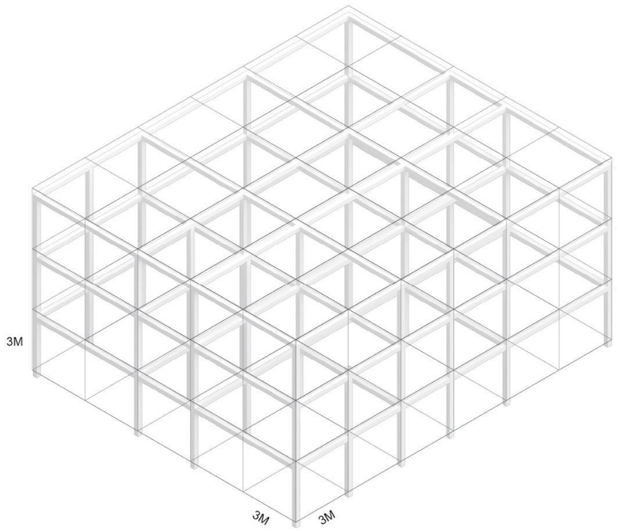


MODULE Design Process



MODULE Design Process




3M
3M
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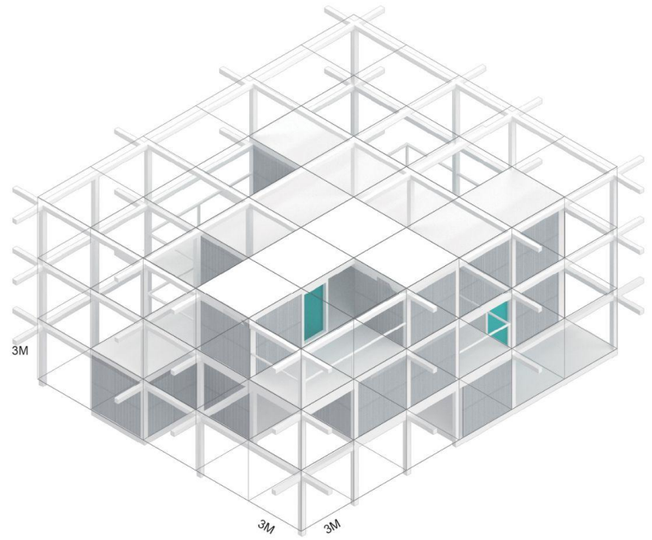
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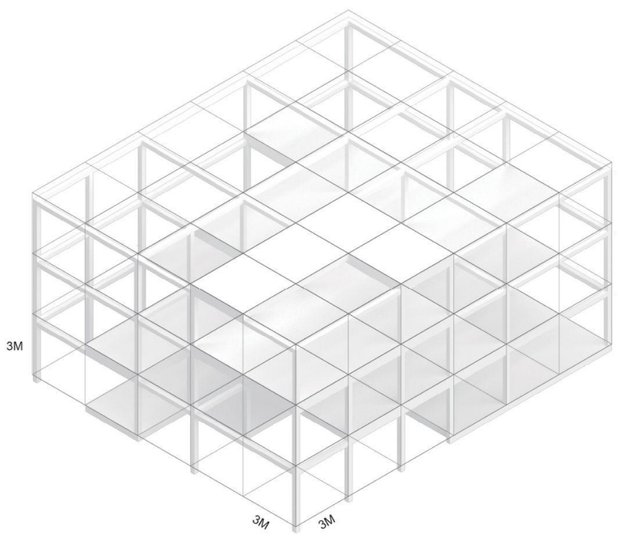
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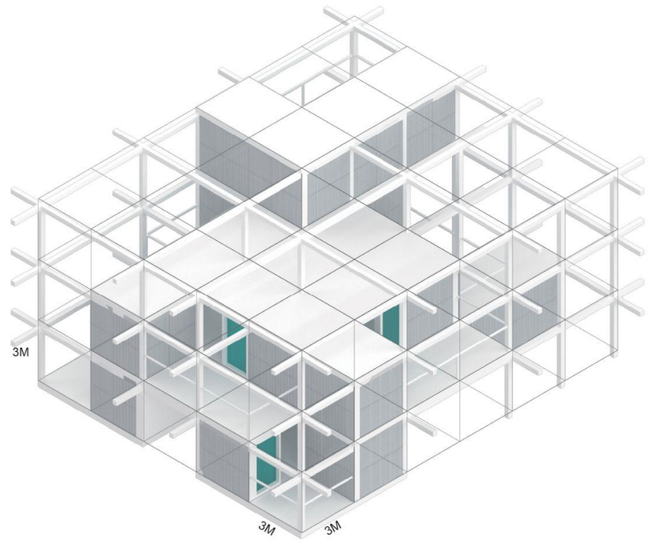
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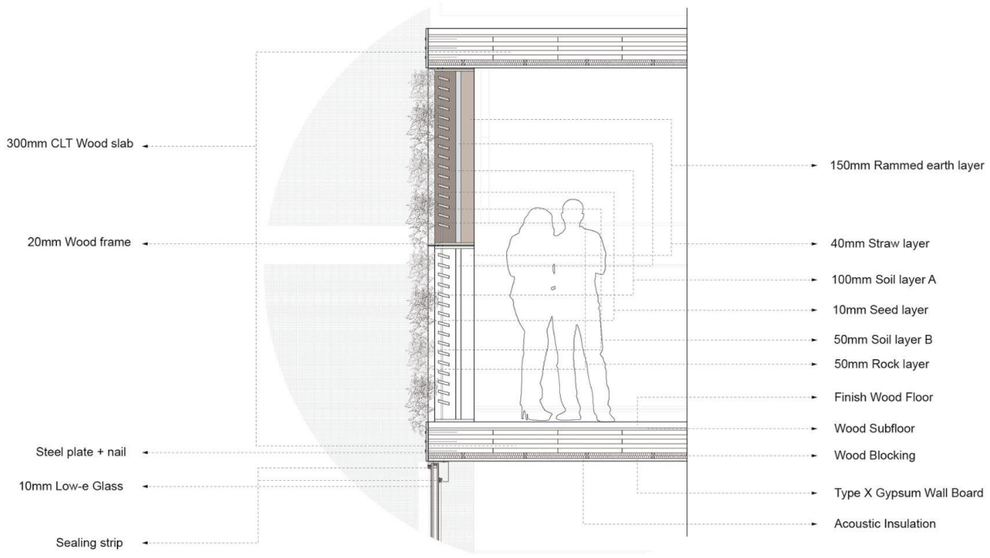
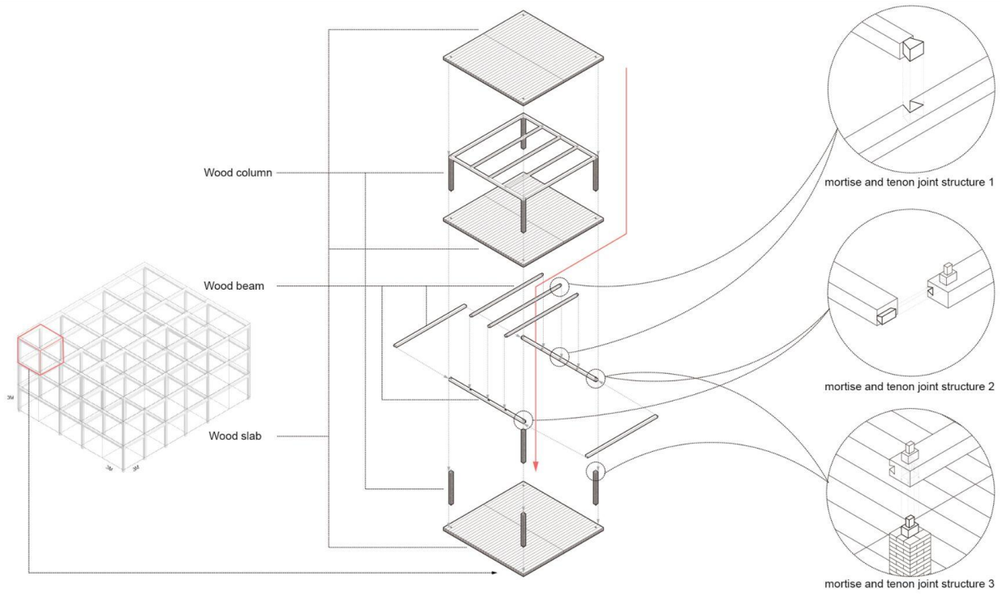
]DULE Integration-Detailed Wall Section

MAISON STUDIO DK. Haoran



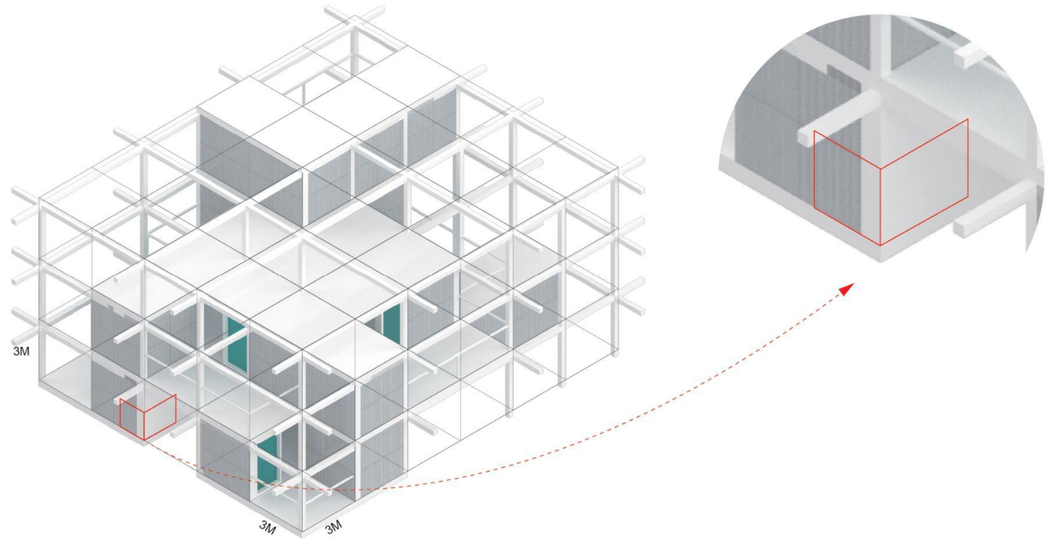
]DULE Structure

MAISON STUDIO DK. Haoran



]DULE Selected Corner

MAISON STUDIO DK. Haoran



FRAGMENT Size

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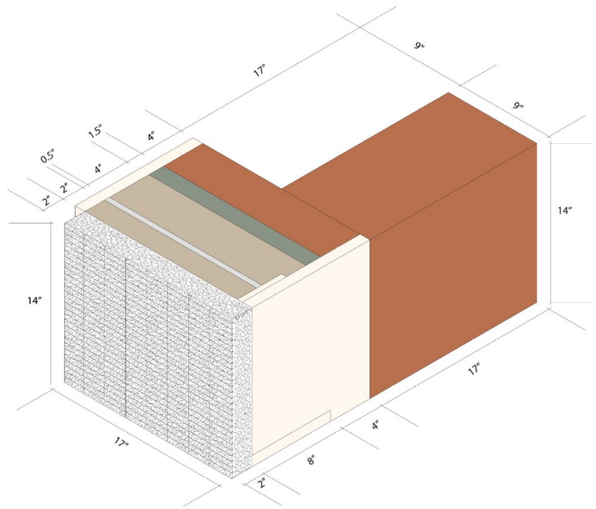
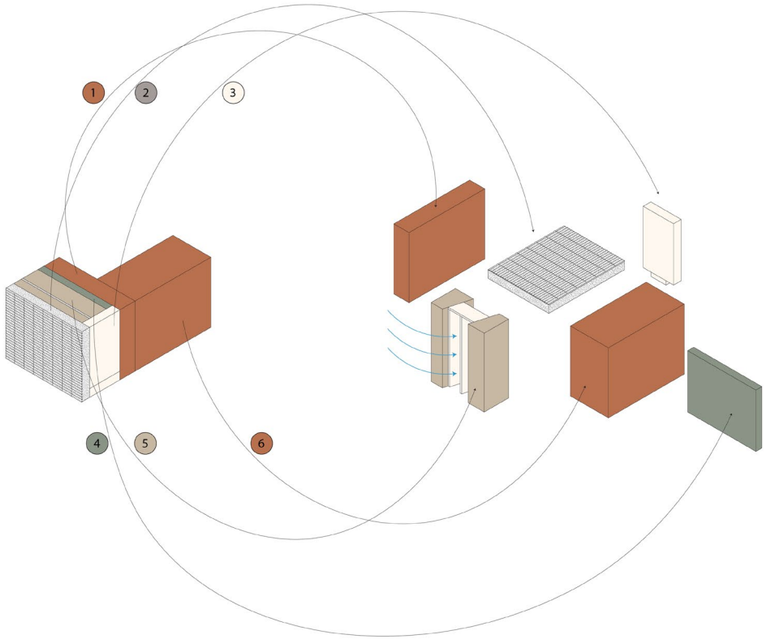
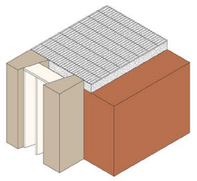
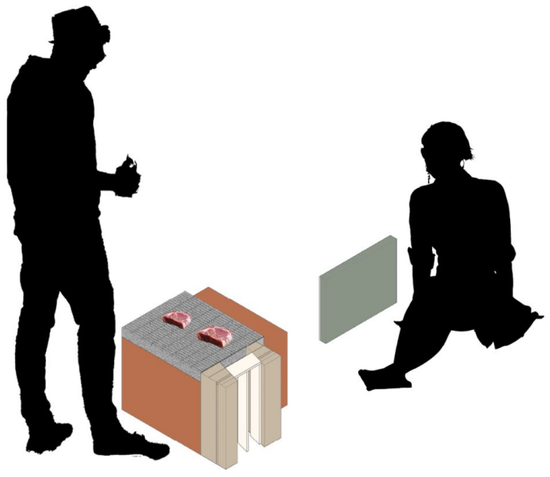






1 Rammed Earth
2 Rock Cage
3 Timber Frame
4 Straw Layer
5 Planting Earth
6 Rammed Earth

-ASSEMBLE Stove



YSICAL MODEL Experiments

PHYSICAL MODEL Experiments

		1	2	3	4	5	6
Unit: Cup	Soil	5	5	5	5	5	5
	Rock	0.5	1	3	0	1	2
	Sand	1	3	1	0	1	3
	Lime	2	0.5	0.5	0.5	1	1
	Cement	0.5	0.5	0.5	0	3	2
	Water	0.5	0.5	0.5	0	1	0

YSICAL MODEL Rammed Earth and Iron Mesh

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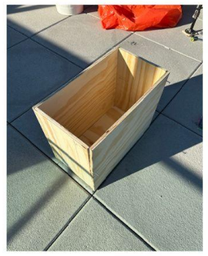


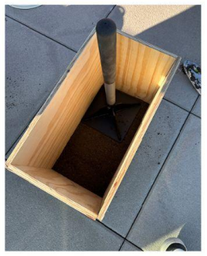

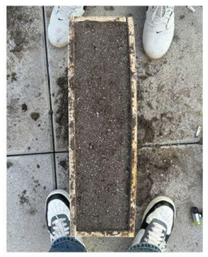


PHYSICAL MODEL Fragment Wall Mode

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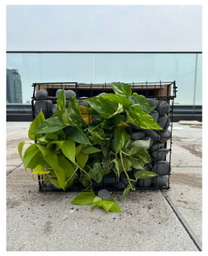
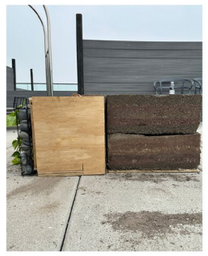
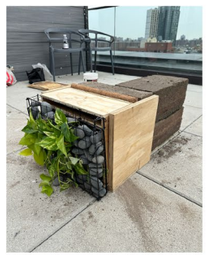
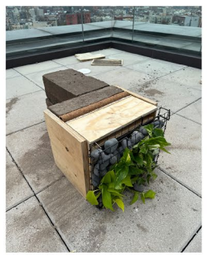
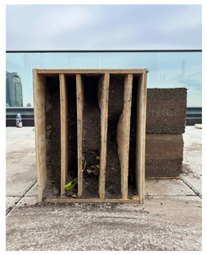



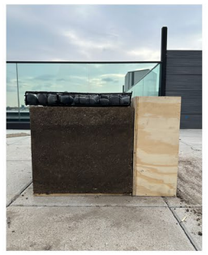
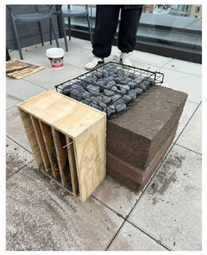


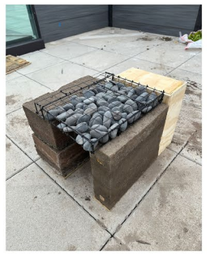
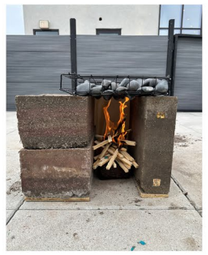




PHYSICAL MODEL Fragment Stove Mode

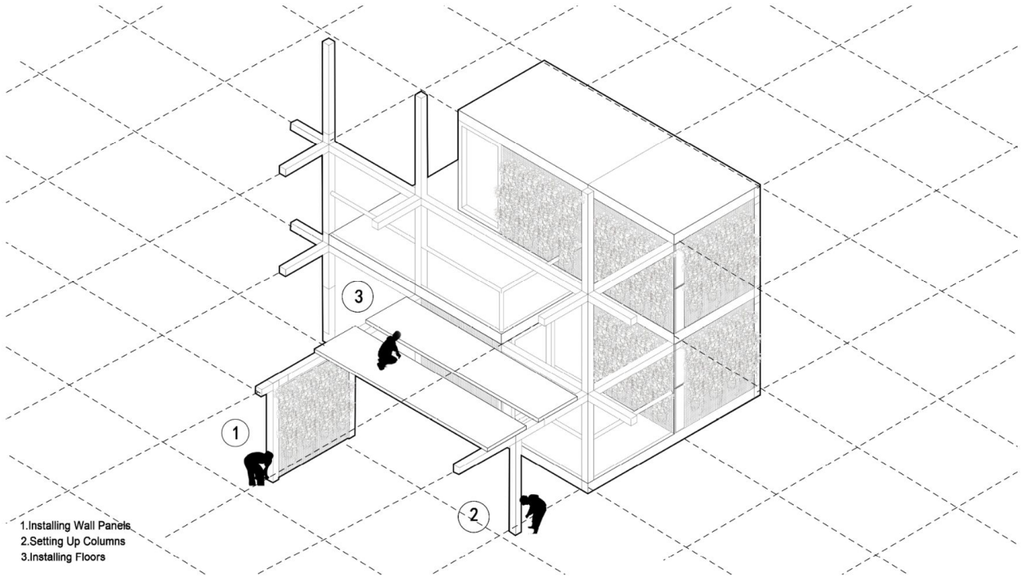
MAISON STUDIO DK. Haoran



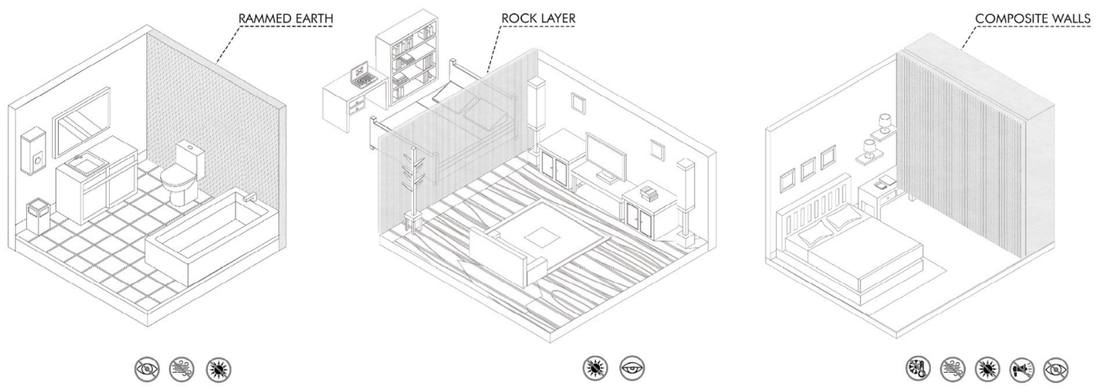



WER Principles



MAISON STUDIO DK. Haoran

WER Principles



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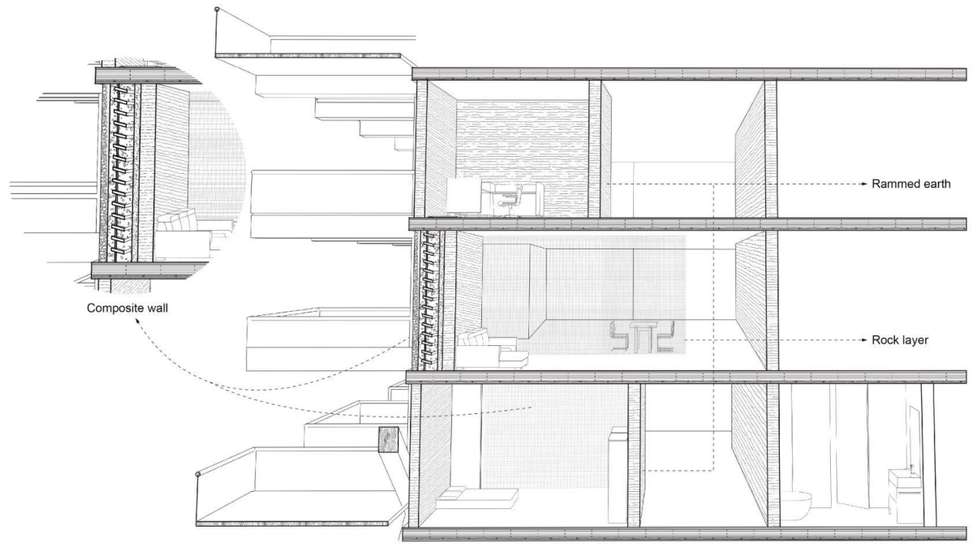
WER Section

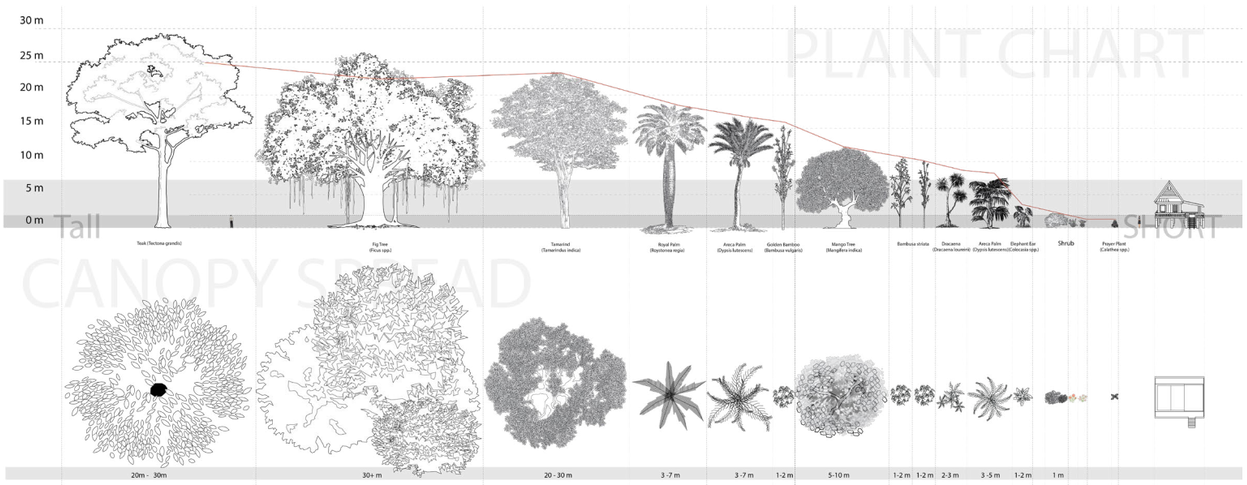


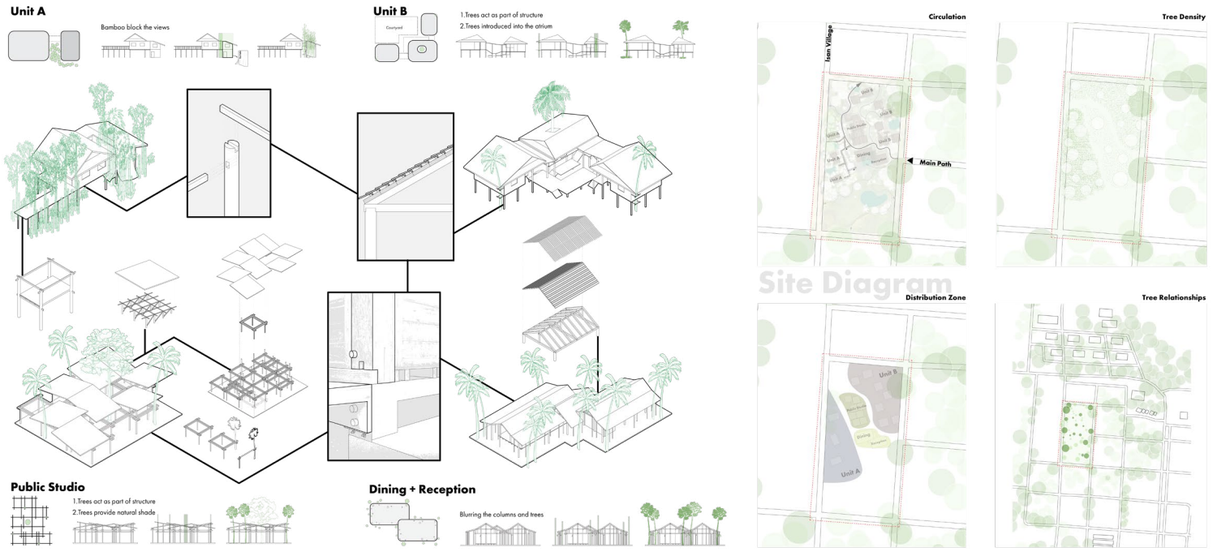
MAISON STUDIO DK. Haoran

03
Framing and Farming

During our exploratory trip, we observed a fascinating blend of structural columns in village houses and surrounding trees, highlighting a natural integration of architecture with the environment. This led to our design project at the Jim Thompson Farm, focusing on "Framing / Farming: Natural and Artificial." We explore the relationship between man-made architectural elements and their natural counterparts, inspired by the Thai concept that building a house is similar to growing one. Our project challenges the traditional separation between nature and architecture, proposing a symbiotic relationship where structures evolve organically within their landscape. The Jim Thompson House, known for its gardens that intertwine with architectural structures, illustrates this potential harmony. Our design for the artist residences at the farm extends these ideas into architectural forms that grow in sync with the local ecological and cultural context. We aim to explore materiality, tectonics, and spatial organization in ways that merge the natural with the artificial, embracing principles of growth, decay, and renewal. This approach seeks to create adaptable, resilient architecture that is deeply connected to its surroundings.

Kris(Jiachen) Liu & Haoran Wu
Instructor: Rachaporn Choochuey
Spring 2023


PLANT CHART
30 m
25 m
20 m
15 m
10 m
5 m
0 m
Tall
SHORT
Teak (Tectona grandis)
Fig Tree (Ficus spp.)
Tamarind (Tamarindus indica)
Royal Palm (Roystonea regia)
Areca Palm (Dypsis lutescens)
Golden Bamboo (Bambusa vulgaris)
Mango Tree (Mangifera indica)
Bambusa striata
Dracaena (Dracaena tourenii)
Areca Palm (Dypsis lutescens)
Elephant Ear (Colocasia spp.)
Shrub
Prayer Plant (Calathea spp.)
CANOPY SPREAD
20m - 30m
30+ m
20 - 30 m
3 -7 m
3 -7 m
1-2 m
5-10 m
1-2 m
1-2 m
2-3 m
3 -5 m
1-2 m
1 m


Unit A
Bamboo block the views
Unit B
Courtyard
1.Trees act as part of structure
2.Trees introduced into the atrium
Public Studio
1.Trees act as part of structure
2.Trees provide natural shade
Dining + Reception
Blurring the columns and trees
Circulation
Teen Village
Unit B
Unit A
Main Path
Tree Density
Site Diagram
Distribution Zone
Unit B
Unit A
Tree Relationships