Graduation report

Dwelling Graduation Studio: Global Housing
Repair & Consolidate / São Paulo
Winnie Goldsteen

Content

Problem statement

What is the relation between the way we value food and the housing crisis in Brazil?

Brazil is a country of abundance, containing around 12% of all fresh water on the planet. It has enormous water potential, capable of providing a volume of water per person 19 times greater than the minimum established by the United Nations (UN). It's an inherently agricultural country and one of the worlds biggerst exports in this area.

Brazil's economic development over the last decade has resulted in rapid population growth, and therefore urban growth. Unequipped governance structures have failed to keep up with this transition and in some cases, building the expansions of cities is done by autoconstruction; the process of building one's own house. In São Paulo, this has resulted in the emergence of favelas and cortiços, which are the only affordable space for the poorest level of the population. These neighbourhoods are placed far from the city centre, most of the time without sufficient infrastructure to connect them (Caldeira, 2012).

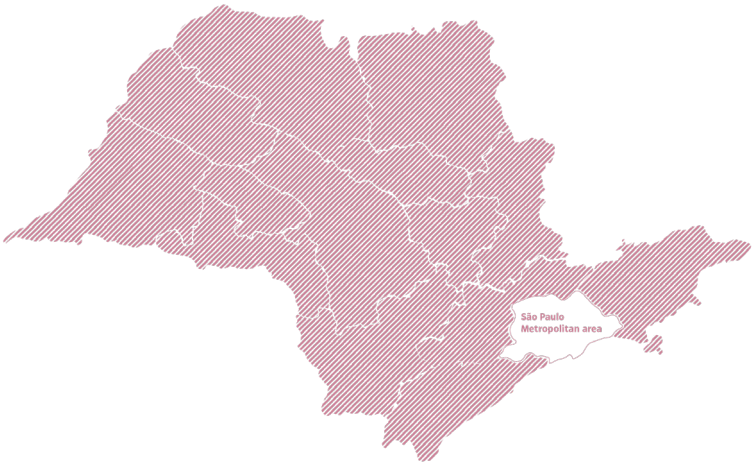
Despite their abundance, Brazilian water resources are not inexhaustible. Moreover, access to water is not the same for everyone. The lack of regular and permanent access to water – or water insecurity – is a reality for 12% of the general Brazilian population.
In Brazil, access to adequate food is a fundamental human right guaranteed under the country's Constitution since 2010. According to Olhe para a fome, a Brazilian institution, more than half of the Brazilian population, 125 million people, present some level of food insecurity, and approximately 33 million people suffer severe food insecurity (hunger). The population living in the rural areas suffer the most from this.

Brazil, like many countries, exhibits a complex and multifaceted dichotomy between abundance and scarcity in various aspects of its economy, society, and environment. This duality is shaped by a combination of historical, geographical, political, and socioeconomic factors.

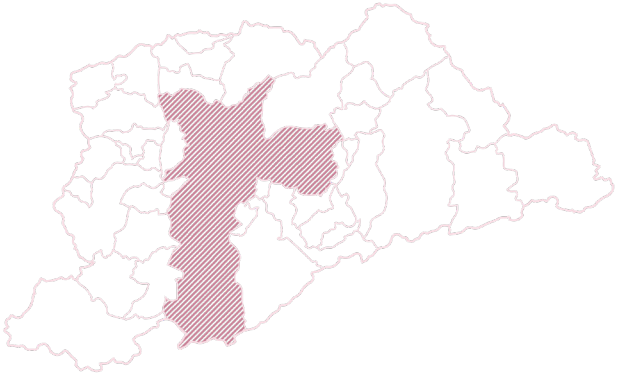
Our population is growing, so the amount of mouth's to feed is. The way we farm in this day and age is not sustainable, that we know. We're depriving our soil of nutrients with mono-cultures; we contaminate our finite water sources with pesticides, and we're running out of oil and gas to keep everything running.

We need to find a more sustainable way to eat, drink, trade and build, but where do we start?

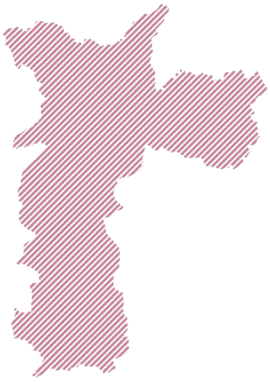
São Paulo, Brazil
Geography



São Paulo state

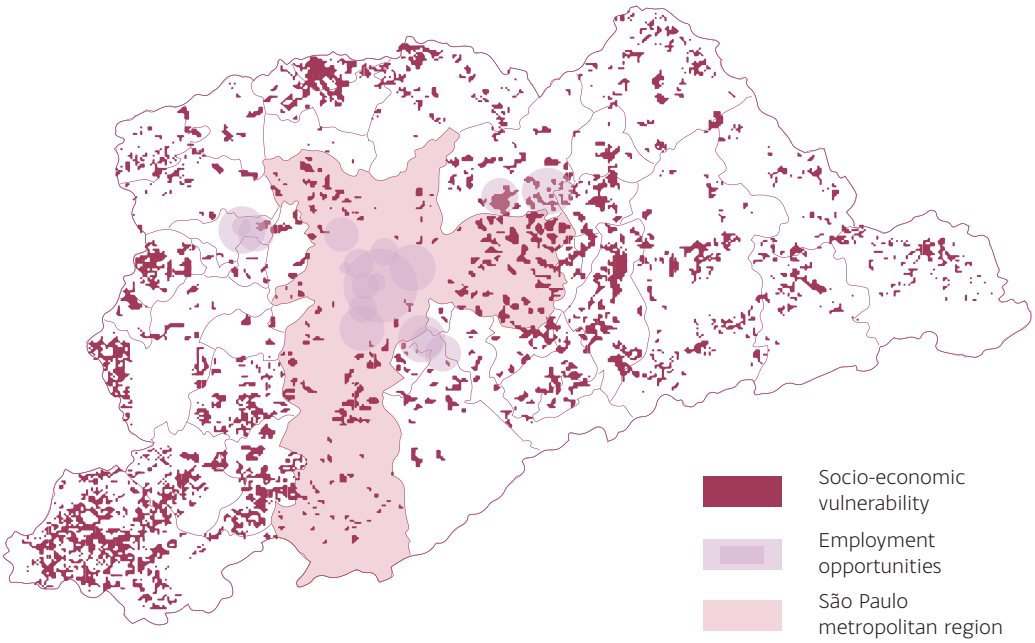


São Paulo metropolitan region



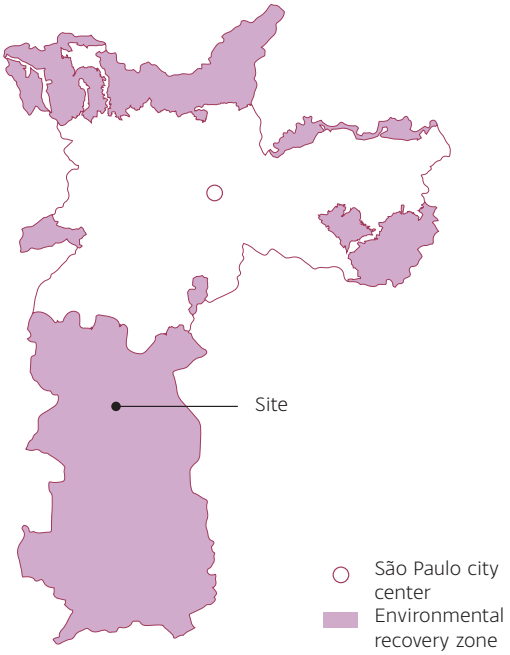
São Paulo city

Socio-economic vulnerability



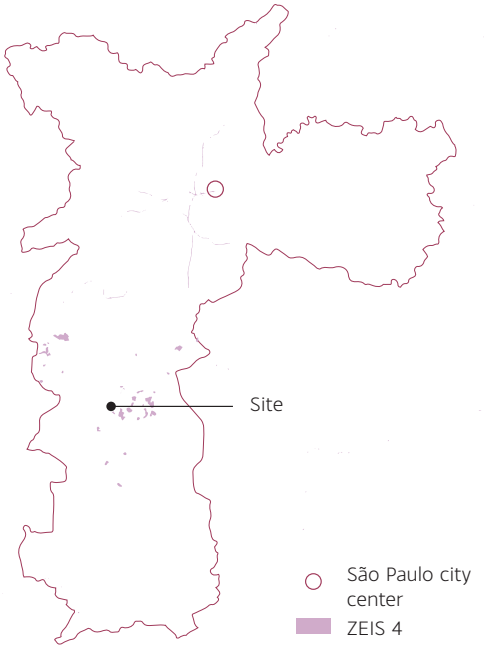
São Paulo Masterplan

Environmental recovery zone



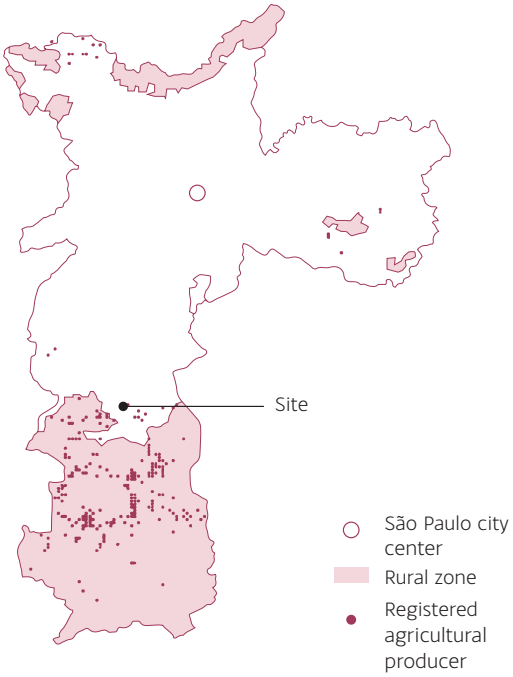
Reduction Area of Urban Vulnerability and Environmental Recovery

Zeis 4



Areas characterized by vacant land, suitable for urbanization and construction, located in watershed protection areas.

Rural zone & Agriculture



Allocated SP rural zone with registered agricultural producers

A sitopian way of thinking

Our civilization has been shaped by food for as long as we know it. It has always been an influence of our bodies, economy, climate, ect. From hunters and gatherers to the first built settlements, food and its trade have been a key element in the development of our being. It's been the rise and downfall of empires and the subject of culture and connections. The topic of food and our world has been thoroughly examined by Carolyn Steel, researcher and architect. She calls the world a 'sitopia', referencing the Greek sitos, "food", + topos, "place".

A shared meal is a culturally significant activity and has been for centuries. We connect to each other through food.

If the world is a food place, Brazil is at the center of it. It's among the highest grossing food producing countries in the world and it's food production accounts for nearly 11 percent of it's GDP (Topic: Food Industry in Brazil, 2023). It has an abundance of recourses used to fuel this enormous food economy. Not just produce for people, but food for livestock (like soy) and livestock itself.

Brazil's abundance of recourses and agriculture means nobody would have any trouble finding a meal or clean water, right? The opposite is true, paradoxically, Brazil has one of the highest inequality rates in the world. To understand how we got to this place, we have to understand how we started. When the hunters and gatherers occupied the earth, our home was equivalent to our food. You lived where you could find food, and when food would run out, one simply moved their home. Our diets were also very different, as there was no supermarket to get your ready-to-eat meal which you can simply pop in the microwave. The food you ate was whatever was available in your 'home'.

The next step was agriculture; which meant that you could stay in one place, as farmers mastered the art of cultivating their own food. This invention resulted in the first settlements, with a much clearer separation of what is home and were we get our food. With these small settlements, food and home were still close, but not equal.

Urban growth relative to food production is a topic which keeps society busy, then and now. The industrialization agriculture was both the solution and the final nail in the coffin. By mastering trade, global infrastructure and the art of farming, we were able to maximize our production of food, an ship it to anywhere in the world. Our home and the food we eat now have nothing in common with each other anymore.

Research question

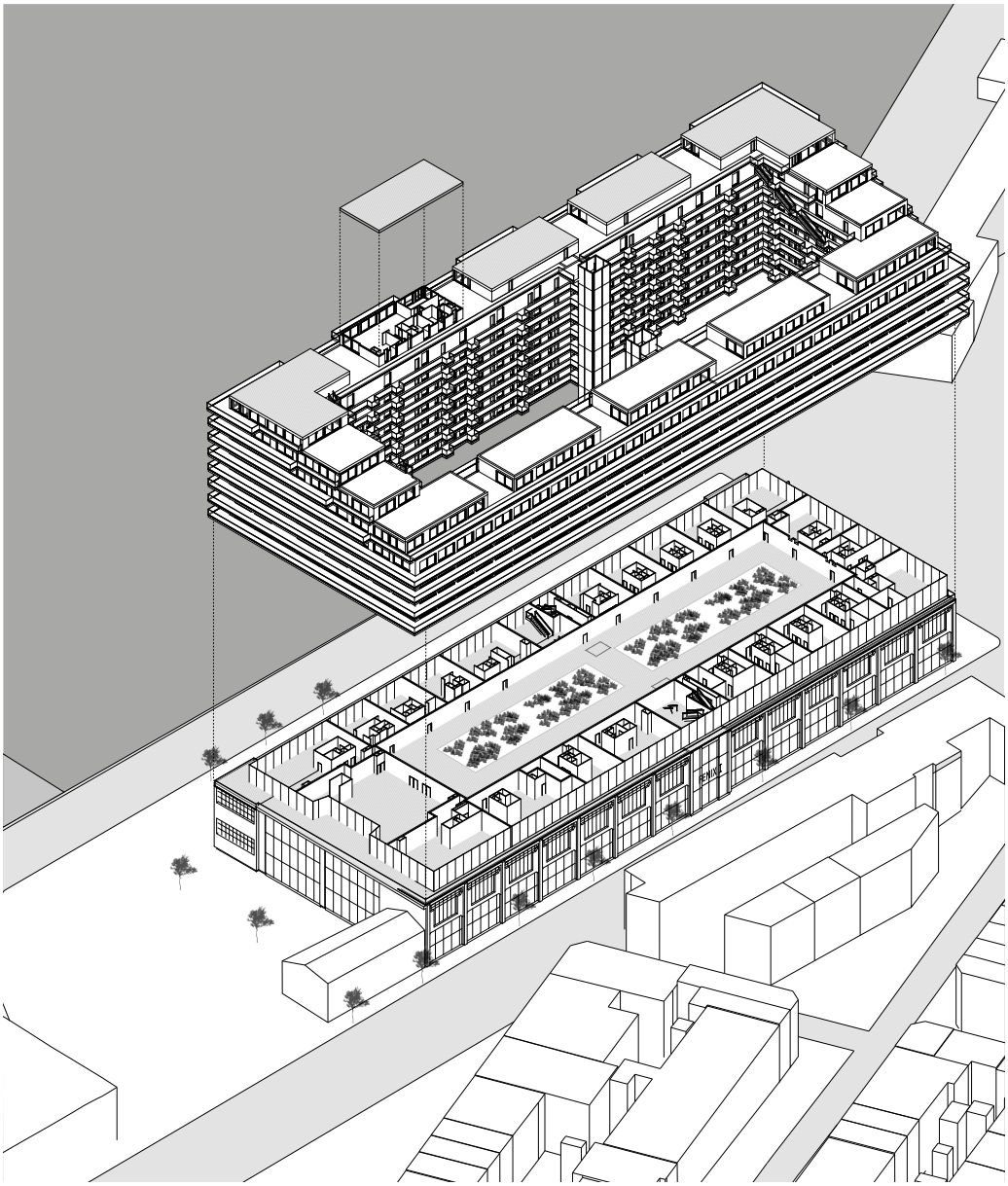
How can **urban farming** and **mass housing** be combined to support **environmental recovery** and create opportunities for **income generation** in the peripheries of São Paulo?

Precedent analysis

Fenix 1

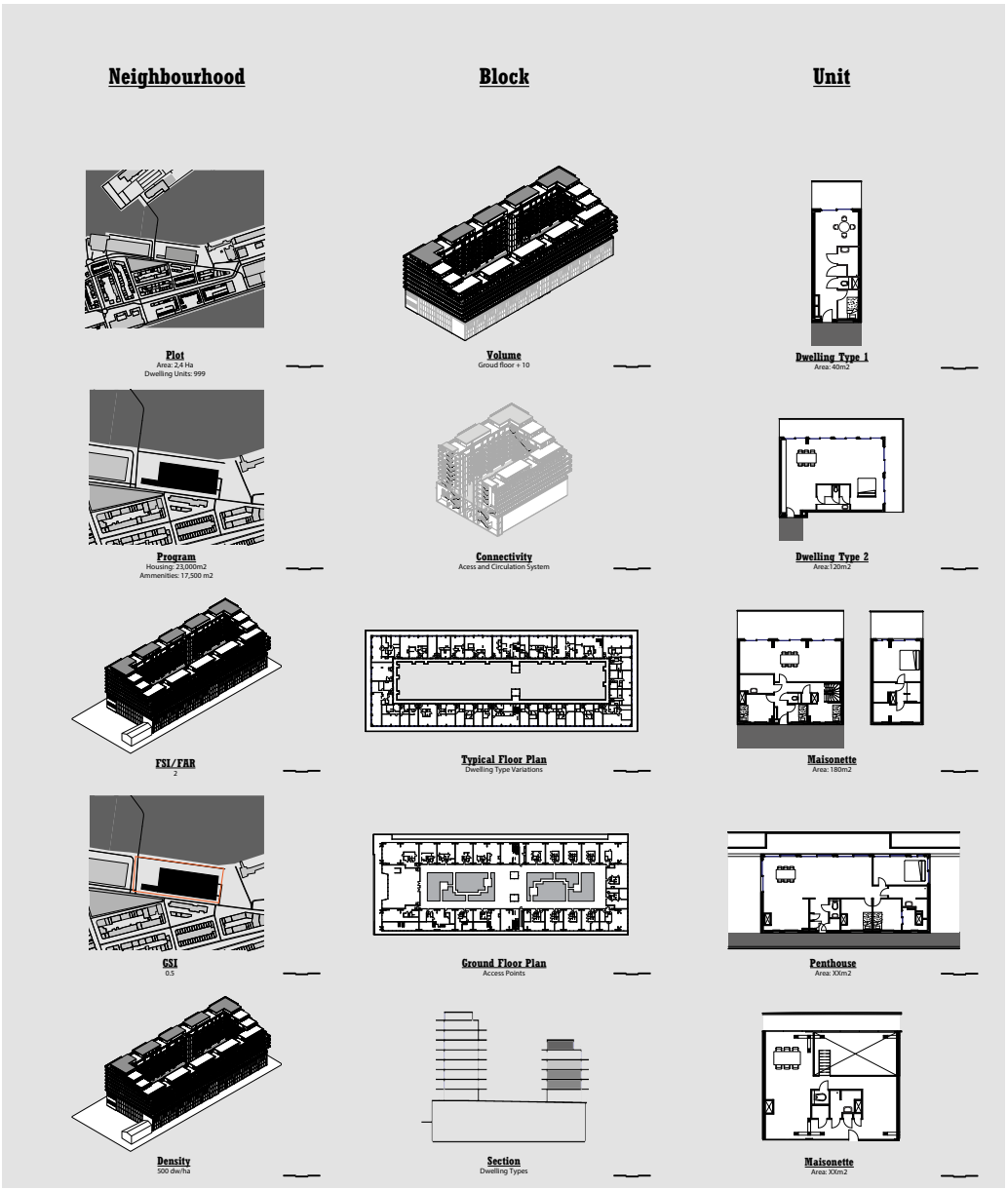
Architect: Mei Architects
Design: 1988-1990
Construction: 2013-2019
Location: Rotterdam, The Netherlands (NL)

Fenix is a complex with in the old building many food and culture hotspots. The city of Rotterdam used the former image of Katendrecht as a leading factor with, in a way, similar types of usage. The area is a 'pleasurescape' again, but for a different



group of people. What used to be a poor area for the workers of the port is now a modern high end area with apartments of a much higher price range. Even though it's not affordable for everyone, the public space is for the larger public to use.

The lofts vary substantially in size and shape. This is becasue they have been designed seperately in collaboration with the buyer of the space.



Jintai Village

Bazhong, China
by Rural Urban Framework

The Jintai Village has a mix of traditional architecture with new technologies. You can see the stepped agricultural landscape mirrored in the shapes of the roof. The community center also has an active rooftop with agriculture. The center itself is a shelterd space with a roof and no walls. Each individual rooftop has farming possibilities and on the ground there is space for family-owned workshops.

roof follows agricultural stepped landscape

Space for family-owned workshop and gardens

Sheltered communal space with rooftop agriculture

Commerce: family-owned workshops/agriculture

Community center: rooftop agriculture

Community center: sheltered meeting and dining space

Cidades Sem Fome (Cities Without Hunger)

São Paulo/SP, Brasil
NGO

The NGO Cidades Sem Fome is dedicated to the mission of reclaiming unviable urban land for sustainable agriculture. Their work serves a dual purpose – to provide participants with the means for self-consumption and to enable commercial activities. By doing so, they empower and support the creation of sustainable local and small businesses. Furthermore, this initiative plays a crucial role in contributing to the reduction of environmental impacts, making urban areas more ecologically friendly and resilient.

Source: https://www.cidadessemfome.org/en/hortas-acoes
Source image: https://www.facebook.com/cidadessemfome/photos

Commerce: facilitates small & local business

Employment opportunity & meeting space: green spaces for work and social activity

Social sustainability: community-based knowledge exchange

Soil-les farms
Hydroponic & airoponic farming

Hydroponic farm

Hydroponic vertical farm

Low tech

Low investment
Little agricultural knowledge
4x greater productivity

Image source 1: https://www.inclusivebusiness.net/ib-voices/providing-small-scale-farmers-affordable-nutritious-crops-using-hydroponics
Image source 2: https://www.timeout.com/news/the-worlds-largest-vertical-farm-is-being-built-in-the-uk-060922
Image source 3: https://psci.princeton.edu/tips/2020/11/9/the-future-of-farming-hydroponics
Image source 4: https://pinkfarms.com.br/

Airoponic vertical farm

Hydroponic farm, LED controlled

High tech

High investment
Extensive agricultural knowledge
170x greater productivity

Site exploration

Site
Urban growth over time

Dated 2004 (Google Earth)

Dated 2022 (Google Earth)

Fieldwork documentation

Biodiversity on site, next to agriculture

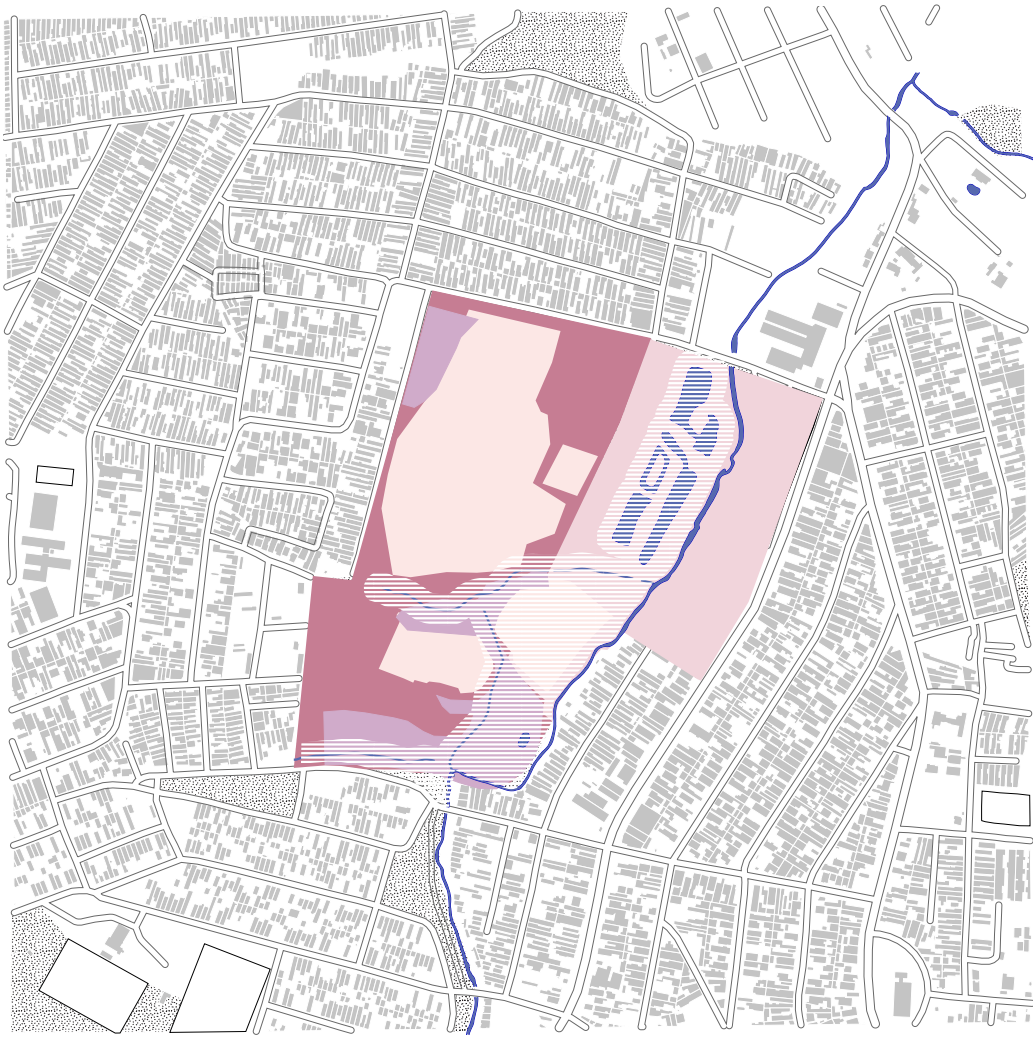
Waterbody at the end of the site parameters with informal dwelling dangerously close

Agriculture of crops, hilled topography, gutters to deal with heavy rainfall

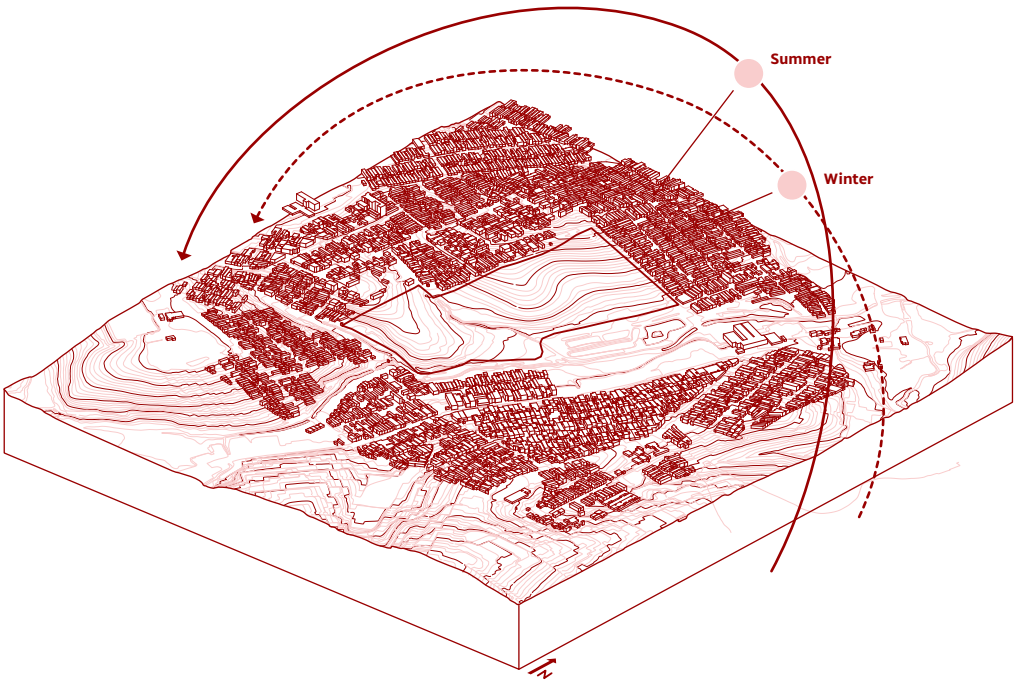
Agriculture of crops, hilled topography, gutters to deal with heavy rainfall

Agriculture of crops, hilled topography, gutters to deal with heavy rainfall, irriation system

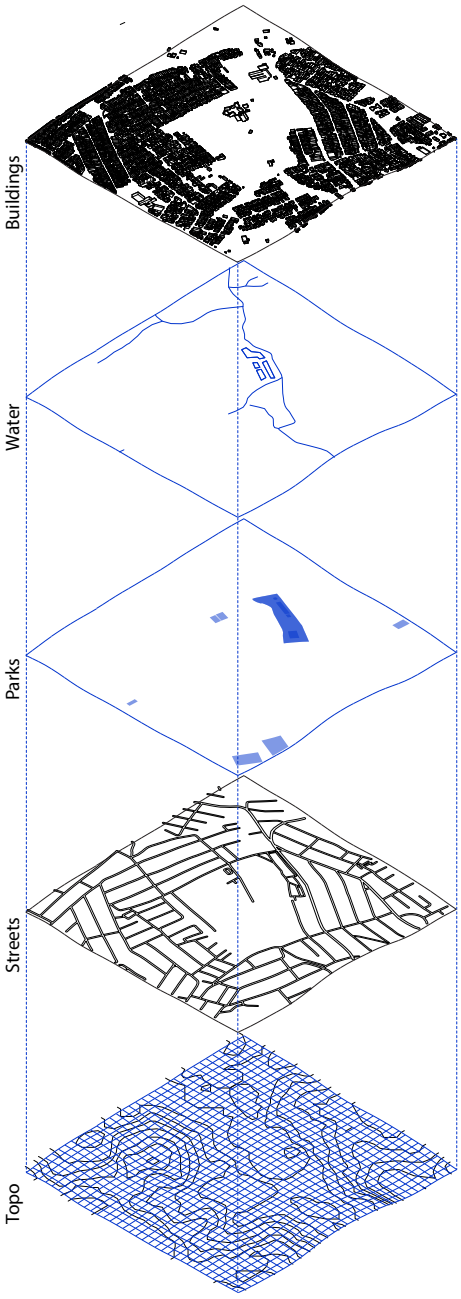
Structure for soiless agricultre with protection from excessive sun and rain



Topography

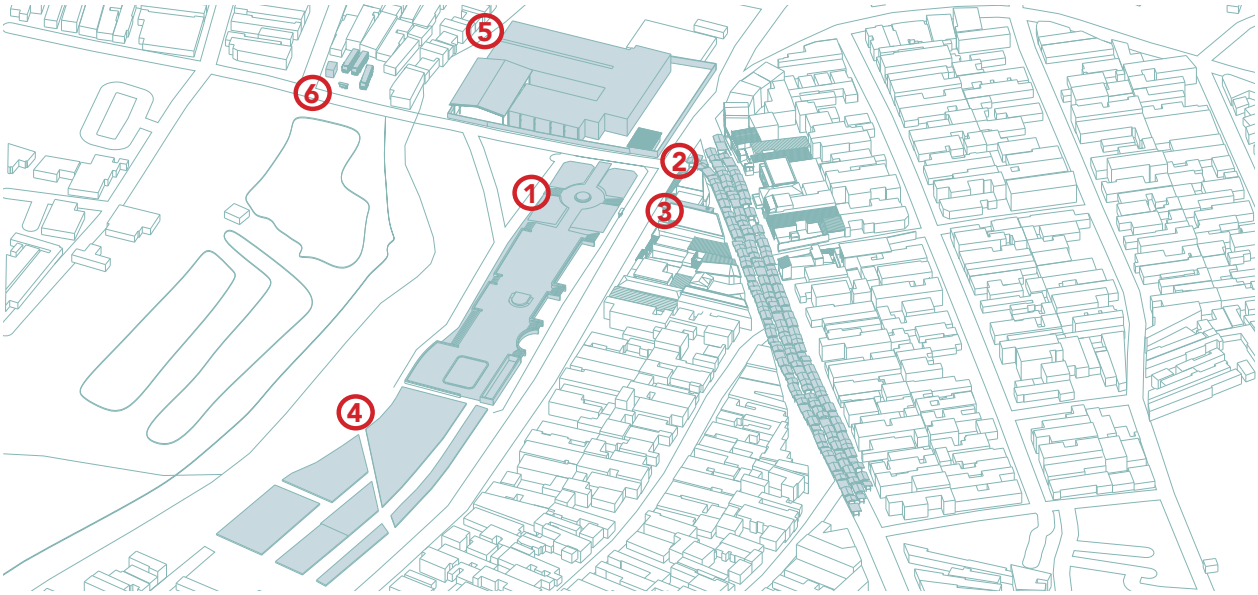


Site elements



Contextual Analysis

Cognitive map



1 PARK

A large public park along a main boulevard with shops, restaurants, food stands. The park acts as a main social space for the neighborhood and is a high traffic location.

2 MARKET

The outdoor market is often found along this street, selling fruits, small items and fabrics year long. Otherwise, the street is mainly residential and consists of mostly two-storey houses, with garages on the ground floor.

3 SOBRADO/STORE

The sobrado/store mix is commonly found along main boulevards, where owners reside above their store. They provide traffic and activity to the neighborhood, contributing to its liveliness.

4 SKATEPARK

This public space is used for recreational purposes, such as skating, biking, soccer and other sports. Together with the park, it's a social catalyst for neighbourhood.

5 SCHOOL

The school, conveniently placed next to the bus stop makes this neighbourhood more desirable, as it is an important amenity for the surrounding households.

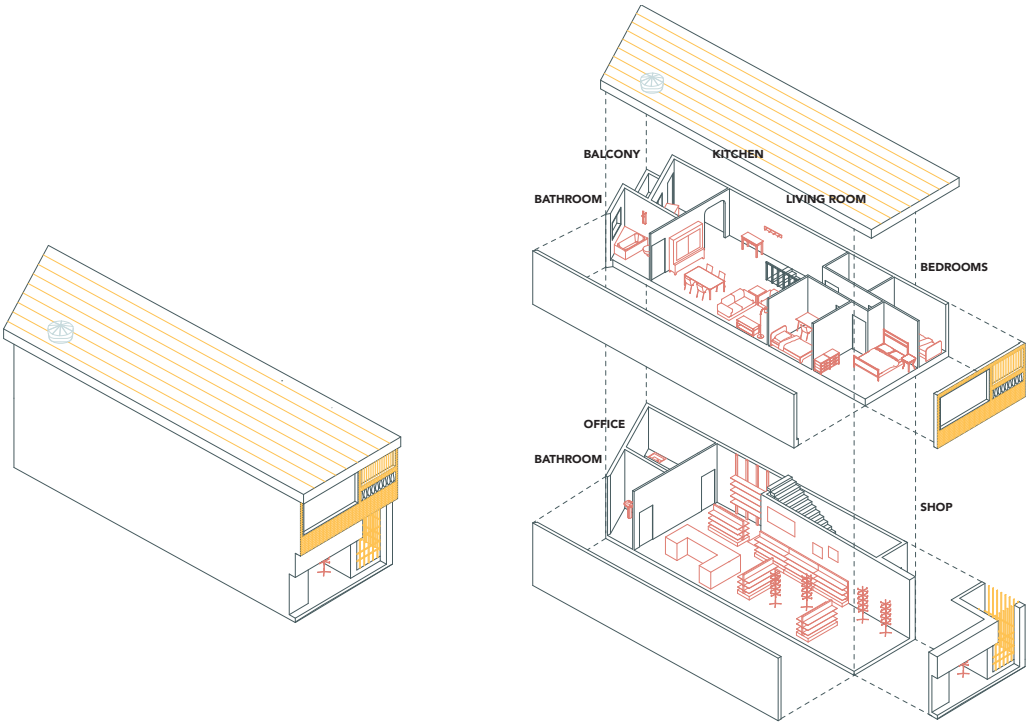
6 BUS STOP

The bus stop is part of a bigger network of transportation around the neighbourhood connecting Grajaú to the train station. As transportation is something São Paulo struggles with, this is an extremely valuable asset to this area.

Cognitive map of a large street next to the Hamada farm. Image by Genevieve Shymanski & Winnie Goldsteen

Typological mapping
Sobrado/store

This typical main street sobrado/store mix features a store on the ground floor, with the shop owners residing on the second level. Their home entrance is connected to the street, behind secure borders. The narrow house only has openings on the front and back, since it is placed between the other buildings along the street.
The ground floor shop includes a small office/storage space for the store. The house typically includes 1-4 bedrooms, with a kitchen and bathroom that are connected when possible, open to the exterior. At the back, a balcony is used for laundry and kitchen ventilation. It is typical for bedrooms and the main living space to not include a window.

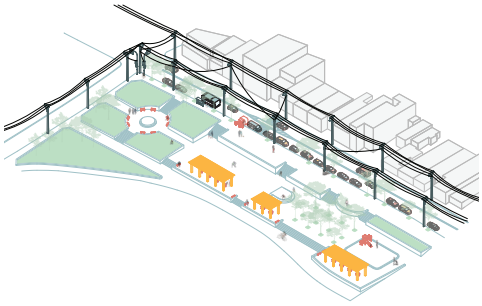


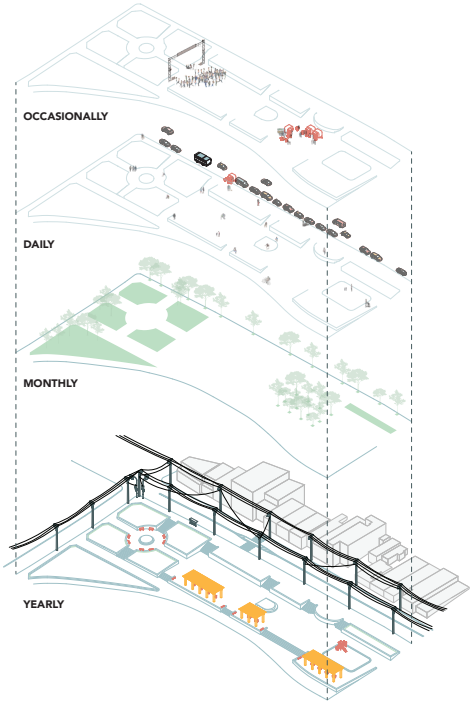
Axonometric drawing of a sobrado. Image by Genevieve Shymanski & Winnie Goldsteen

Typological mapping

Sobrado/store

The public park is a diverse space with a strong temporal quality. Built in the 2010s, it is used as a multifunctional public space adapting to daily life, changing on 4 major scales. Yearly, as the permanent structures degrade or change slowly. Monthly, as the natural environment grows. Daily, the people come and go, using the park as they please, whether for play, exercise, meeting, or waiting for a bus. The park also transforms occasionally to become a concert venue, a church, a food truck hot spot. The public park is thus appropriated and heavily used by the neighborhood.



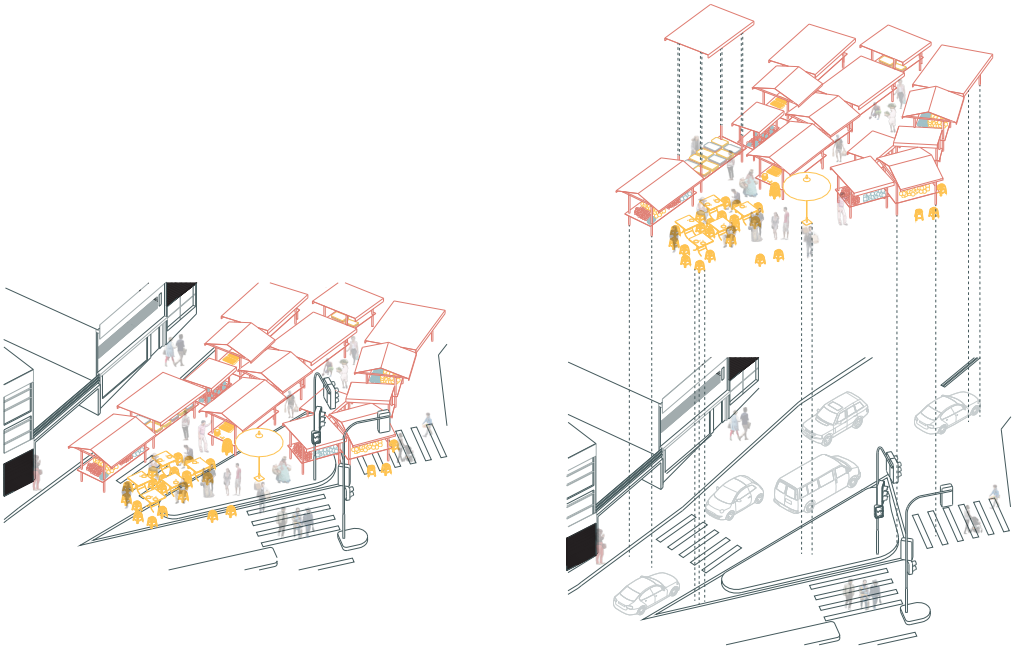


Axonometric drawing of the park. Image by Genevieve Shymanski & Winnie Goldsteen

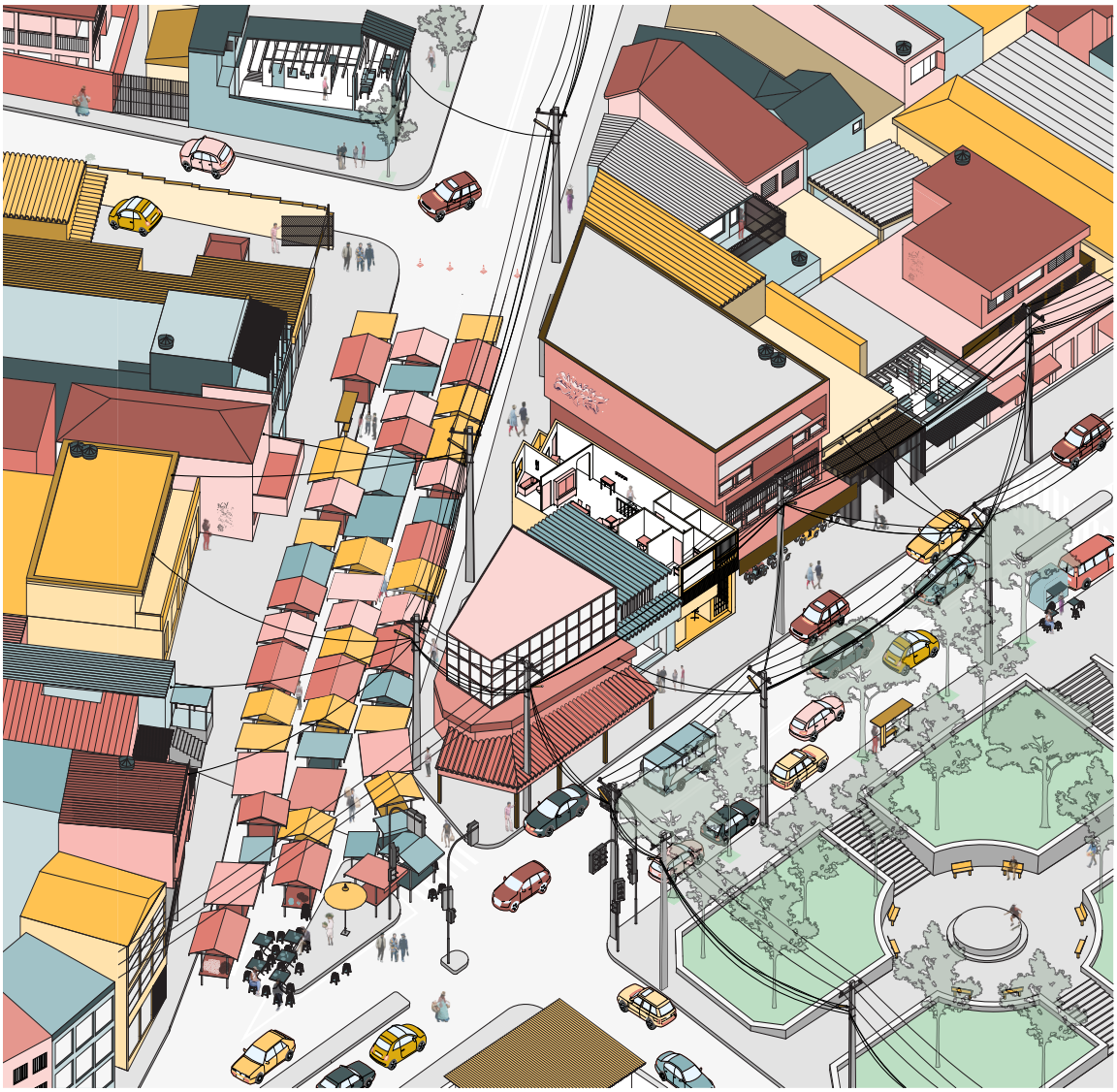
Typological mapping

Market

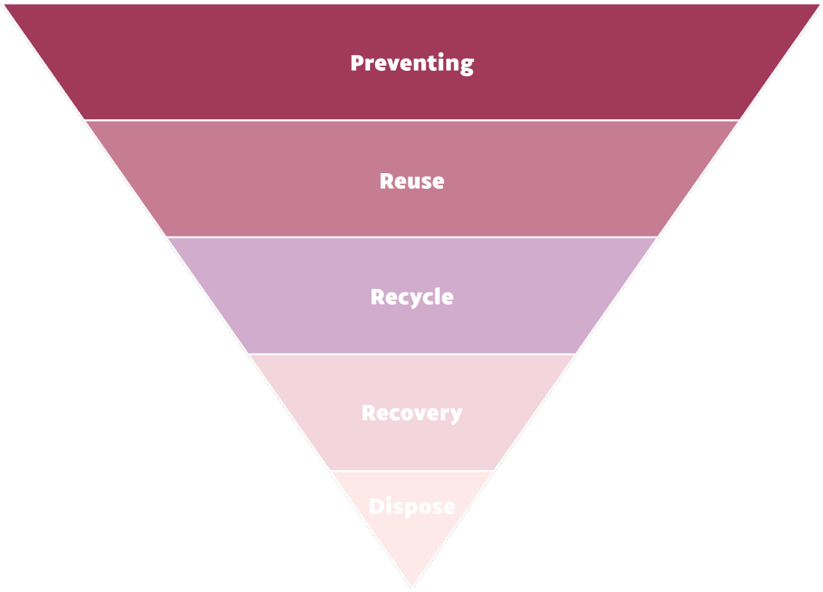
The market is a self-initiated, temporal public space, which shifts and changes every time it is assembled. It has been occurring for years in this location, several times a week. The market serves as an income generating opportunity for the residents, boosting the local economic network of the neighborhood. When the market is not present, the street is an ordinary residential area along a transit line.



Axonometric drawing of the market. Image by Genevieve Shymanski & Winnie Goldsteen



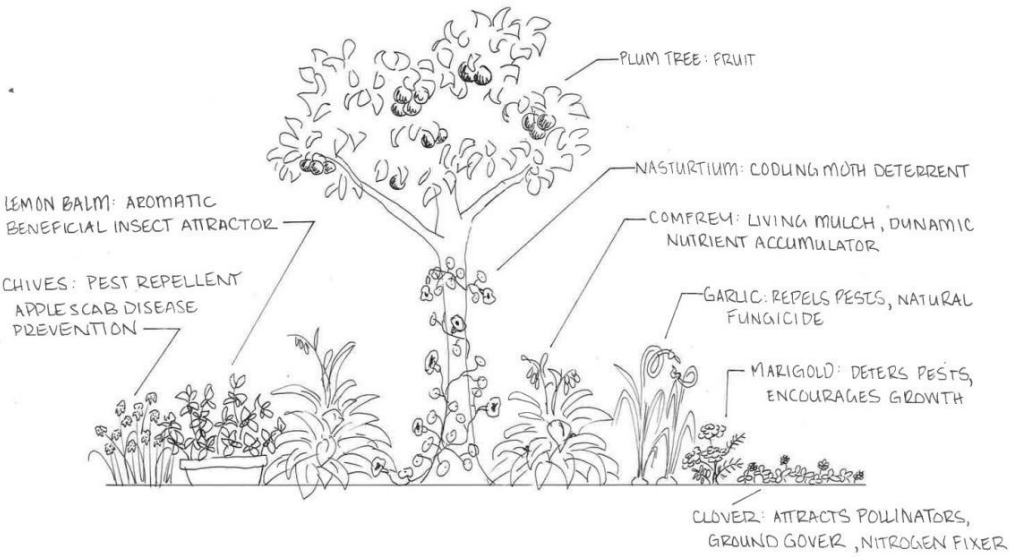
Waste management



Food waste[1]	Construction[2]
Avoiding food waste, food banks, consumer awareness	Using less material in desing and manufacturing. Keeping products for longer. Using less hazardous material
Processing and reprocessing for human food, use for animal food, raw materials for industry	Checking, cleaning, repairing, refurbishing
Composting for fertilizer or generating fertilizer and sustainable energy with cofermentation	Turning waste into a new substanceor product
Burning as waste (objective is destruction, energy production possible)	Anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy
Dumping in landfill (unacceptable)	Dumping in landfill (unacceptable)

1: Moermans Ladder for Food Waste.
2: Defra 2011 publication, Guidance on applying the waste hierarchy

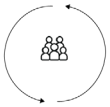
Agroforestry



1. Fruit Trees as Canopy Layer	Dwarf Citrus Tree (*Citrus sinensis or Citrus reticulata*)	Dwarf Guava Tree (*Psidium guajava*)
2. Shrubs and Bushes as the Sub-Canopy Layer	Blueberry Bush (*Vaccinium corymbosum*)	Blackberry Bush (*Rubus fruticosus*)
3. Herbaceous Layer	Basil (*Ocimum basilicum*)	Cilantro (*Coriandrum sativum*)
4. Round Cover Plants	Creeping Thyme (*Thymus serpyllum*)	Creeping Jenny (*Lysimachia nummularia*)
5. Nitrogen-Fixing Plants	Bush Beans (*Phaseolus vulgaris*)	Lupin (*Lupinus spp.*)
6. Companion Planting	Peppermint (*Mentha × piperita*)	French Marigold (*Tagetes patula*)
7. Rainwater Harvesting and Mulching	Purslane (*Portulaca oleracea*)	Sweet Potato Vine (*Ipomoea batatas*)
8. Beneficial Habitat Creation	Lavender (*Lavandula spp.*)	Butterfly Bush (*Buddleja davidii*)
9. Permaculture Design Principles	Brazilian Cherry (*Eugenia uniflora*)	Brazilian Pepper Tree (*Schinus terebinthifolius*)
10. Community Involvement	Cherry Tomatoes (*Solanum lycopersicum var. cerasiforme*)	Chives (*Allium schoenoprasum*)

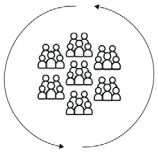
Urban farming

Personal



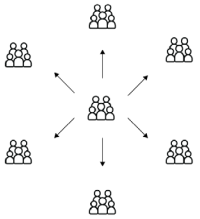
Added nutritional value
Saving money on fresh produce
Basic agricultural knowledge

Communal



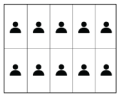
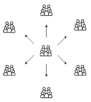
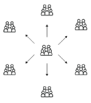
Added nutritional value
Saving money on fresh produce
Basic/moderate agricultural knowledge

Commercial



Employment opportunities
Advanced agricultural knowledge

Urban farming types

	Allotment garden	Community garden	Horizontal farm	Vertical farm
Area division	individual plots	by plant type/none	by plant type	by plant type
Recreational area	occurs	occurs	absent	absent
Production technology	soil	soil	soil/soilless	soil/soilless
Production intensity	low	low	medium	medium/high
				
				

Source: Nowysz,A. & Trocka-Leszczyńska,E.(2021).Typology of Urban Agriculture Architecture. Acta Scientiarum Polonorum Architectura,20(3) 63-71. https://doi.org/10.22630/aspa.2021.20.3.27

Program of requirements

Housing
70% HIS 1&2 housing
30% HIS 3 housing

Low to mid rise, high density
Neighborhood scale
FSI of 1 - 1,5
Density min 100 dw/ha

Environmental recovery
Flooding protection
Heavy rainfall drainage
Discouraging individual car use
Agroecological education

Income generation
(micro) Businesses connected to farming
Organic market
Workshops for agri-blocks

Urban farming
Community farm
Allotment farm
Commercial farm

Food security
Restaurante Popular
School garden
Food education

Public amenities
Sports facilities
Cultural amenities
Kindergarten
Primary school
Middle school

Urban infrastructure
Public transportation
Bike lanes
Sidewalks

Waste cycles
Reduce waste cycles within
- Communities
- Local agriculture

Design

Masterplan


RUA SÃO PLUTARCO
RUA JUSTO LEGEL
RUA SÃO SIGISMUNDO
RUA DOS MERCEDÁRIOS
RUA DO DIAMANTE
RUA SANTA FÉ
RUA APOLINÁRIO
RUA SANT'A FÉ
RUA RODRIGUES DE SOUZA
RUA NATAL
RUA BEIJA-FLOR
AVENIDA


SANTA
CECÍLIA
NATAL
RUA BEIJA-FLOR
CANÁRIO
SÃO
PLUTARCO
PÉROLA
DA
CANTO
URGEL
SIGISMUNDO
ANDORINHA
MERCEDÁRIOS
SANTA
FÉ
DE
SOUZA
RAFAEL
BRANCO
SAMUEL
KHURI
FERREIRA
CARLOS
ANTÔNIO
AVENIDA
SANTOS
DOS
RAJA
GABAGLIA
PROFESSOR
46°41'52.50"W
23°45'56.25"S
23°45'56.25"S
46°41'52.50"W


SANTA
CECÍLIA
NATAL
RUA BEIJA-FLOR
CANÁRIO
SÃO
PLUTARCO
PÉROLA
URGEL
SIGISMUNDO
ANDORINHA
MERCEDES
SANTA
FÉ
SOUZA
RAFAEL
SÃO
BRANCO
SAMUEL
KHURI
CARLOS
ANTÔNIO
SANTOS
AVENIDA
GABAGLIA
PROFESSOR
RAJA
FERREIRA


NATAL
RUA BEIJA-FLOR
SANTA CECÍLIA
CAMINHO
RUA
SÃO PLUTARCO
PÉRGOLA
DA
URGEL
SIGISMUNDO
MERCEDÁRIOS
ANTONINA
SANTA FÉ
CARLOS
ANTÔNIO
AVENIDA
SAMUEL
KHURI
SOUZA
RAFAEL
BRANCO
DIE
DOS SANTOS
EMBAIXADA
PROFESSORES
46°41'52.50"W
23°40'56.25"S

Masterplan
Facts & figures

Gross site area
9,5 Ha

Farm roof area*
2,46 Ha

Buildable area
6,65 Ha

Built area
2,46 Ha

Dwellings
1102

Apartments
32 m^2 - 82 m^2

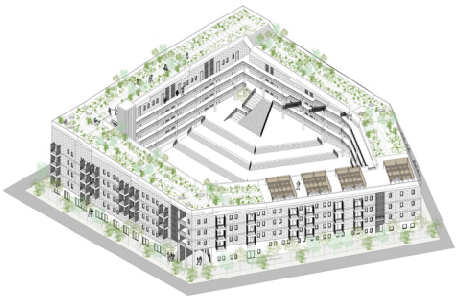
Typologies

Row house

FSI: 0,96
dw/ha: 98

Courtyard block

FSI: 1,15
dw/ha: 182



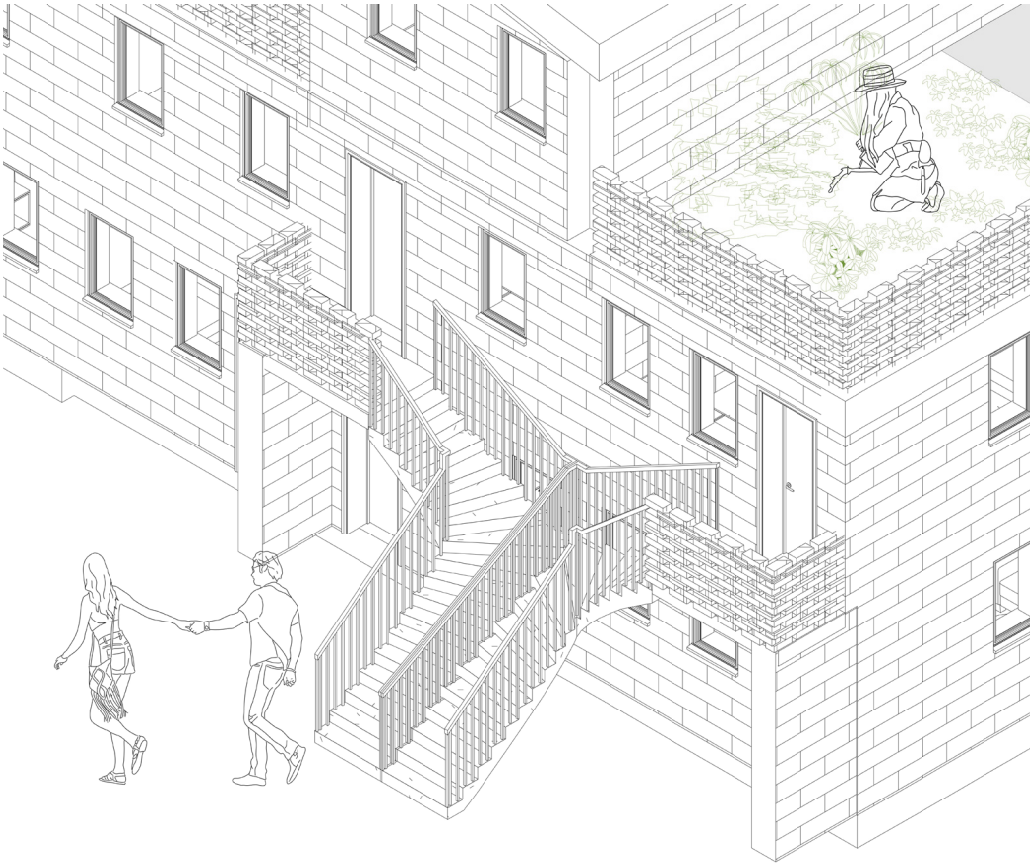
Section

Row house

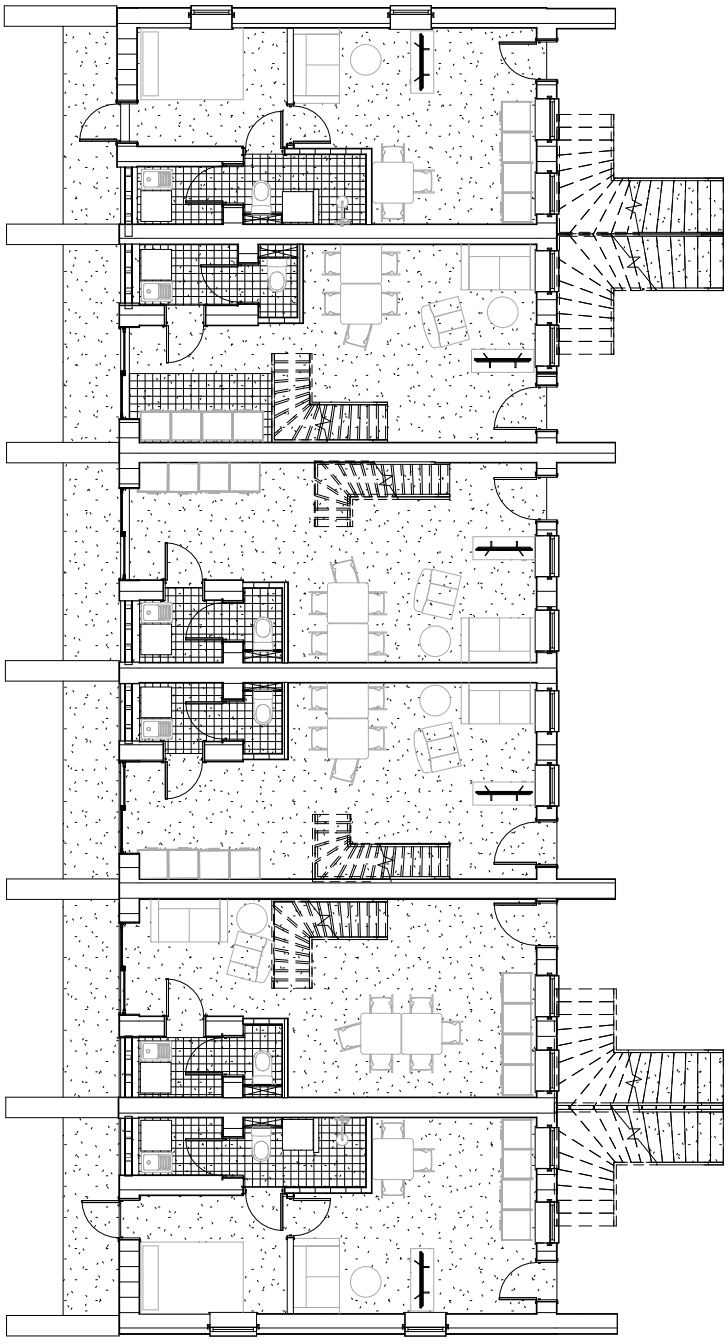
FSI: 0,96
dw/ha: 98
10 apartments
180 m2 possible farmground

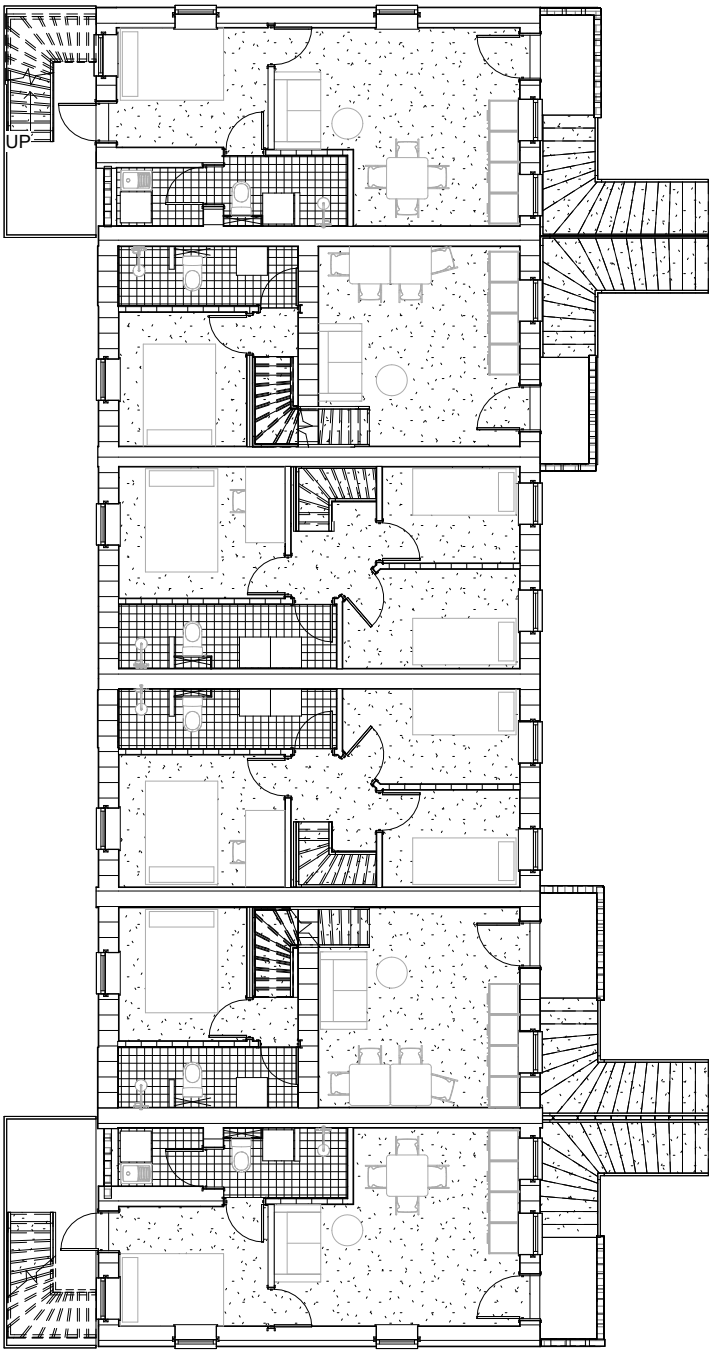
Elevation

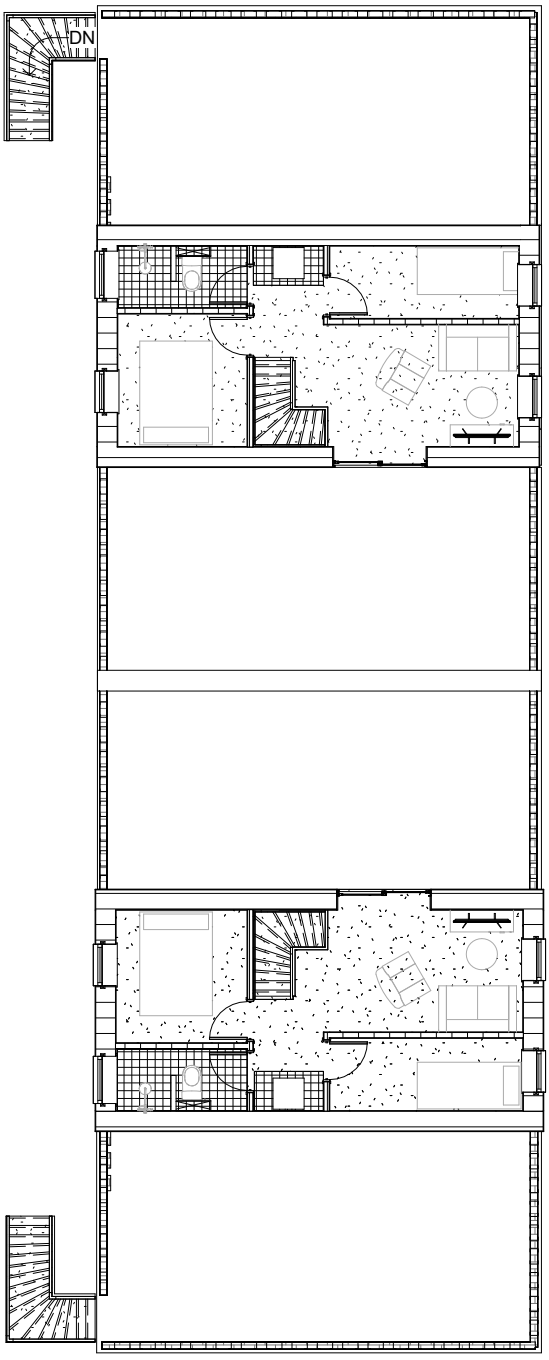
Entrance & gardens



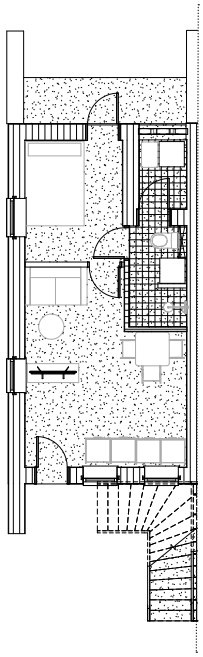
Section




UP

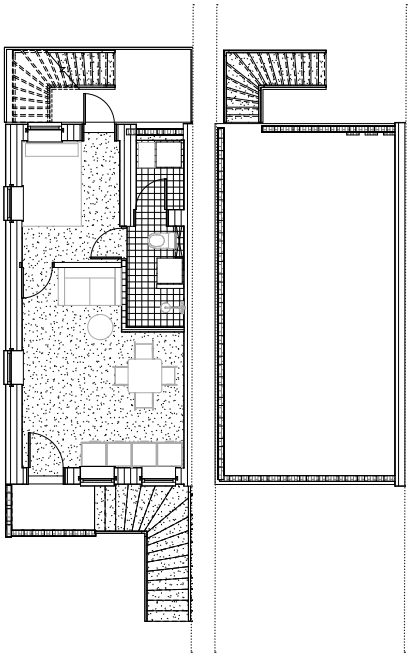

DN

Row house
Apartment types



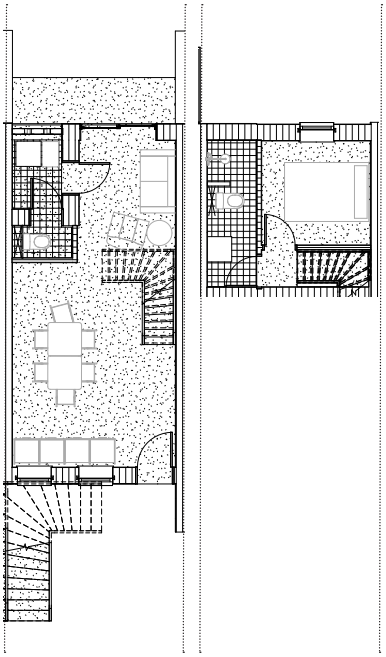
Studio + garden

One bedroom
35 m²
HIS 1



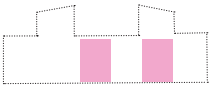
Studio + rooftop garden

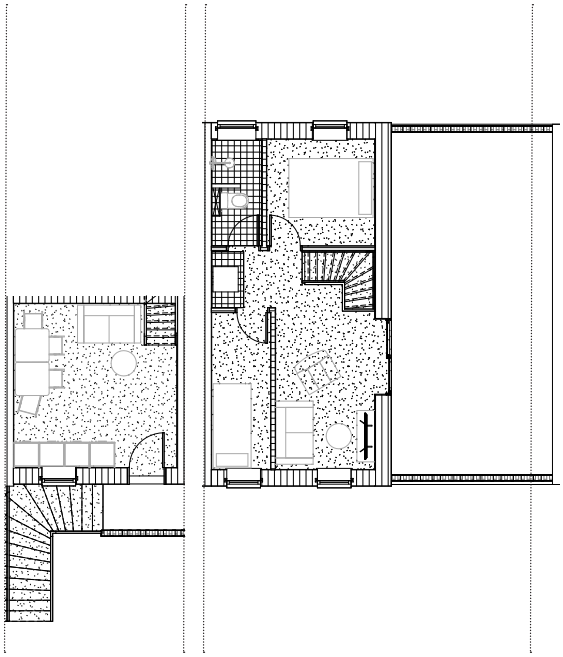
One bedroom
35 m²
HIS 1



Maisonette + garden

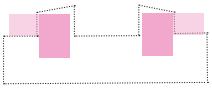
One bedroom
50 m²
HIS 1&2

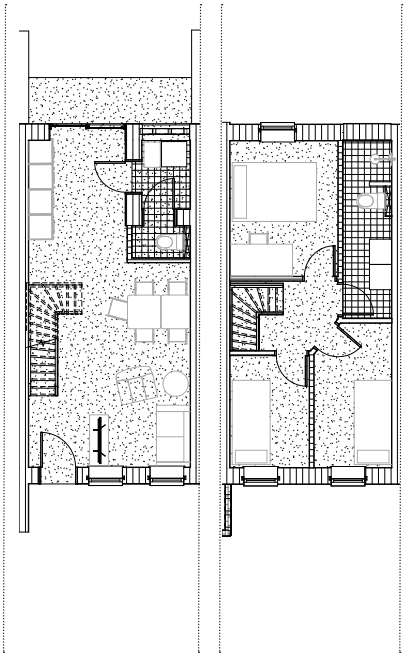




Maisonette + rooftop garden

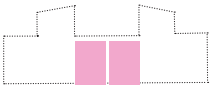
Two bedroom
52 m²
HIS 1&2

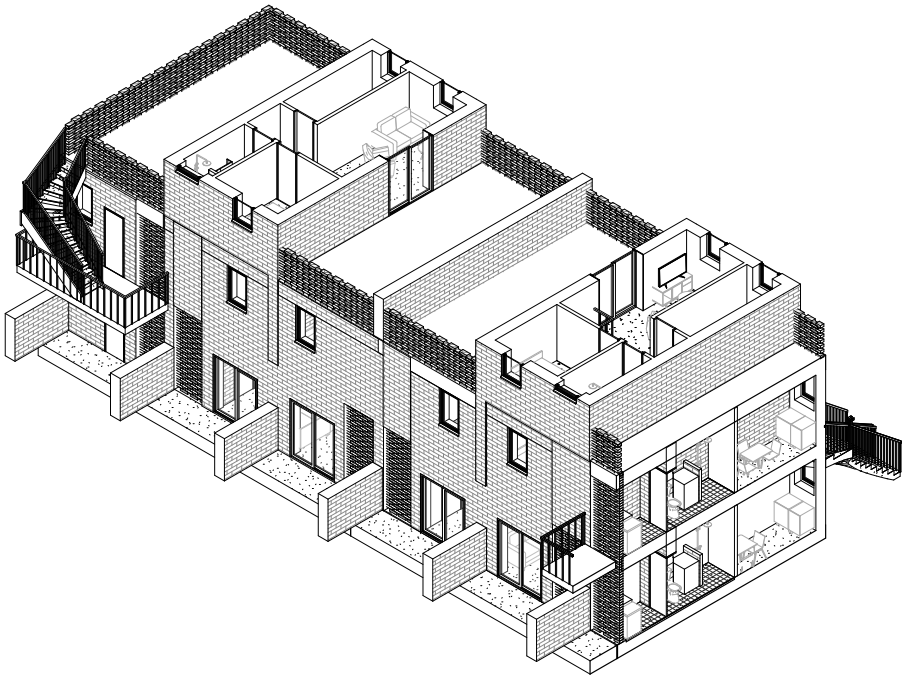




Two story + garden

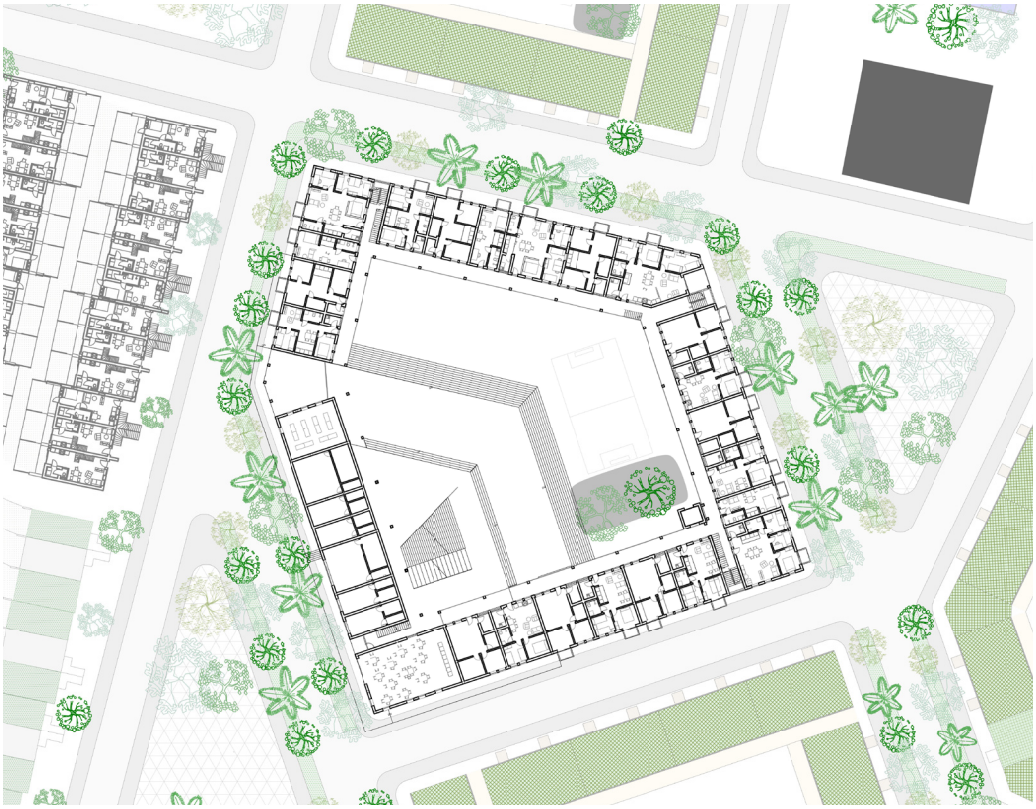
Three bedroom
64 m²
HIS 2&3

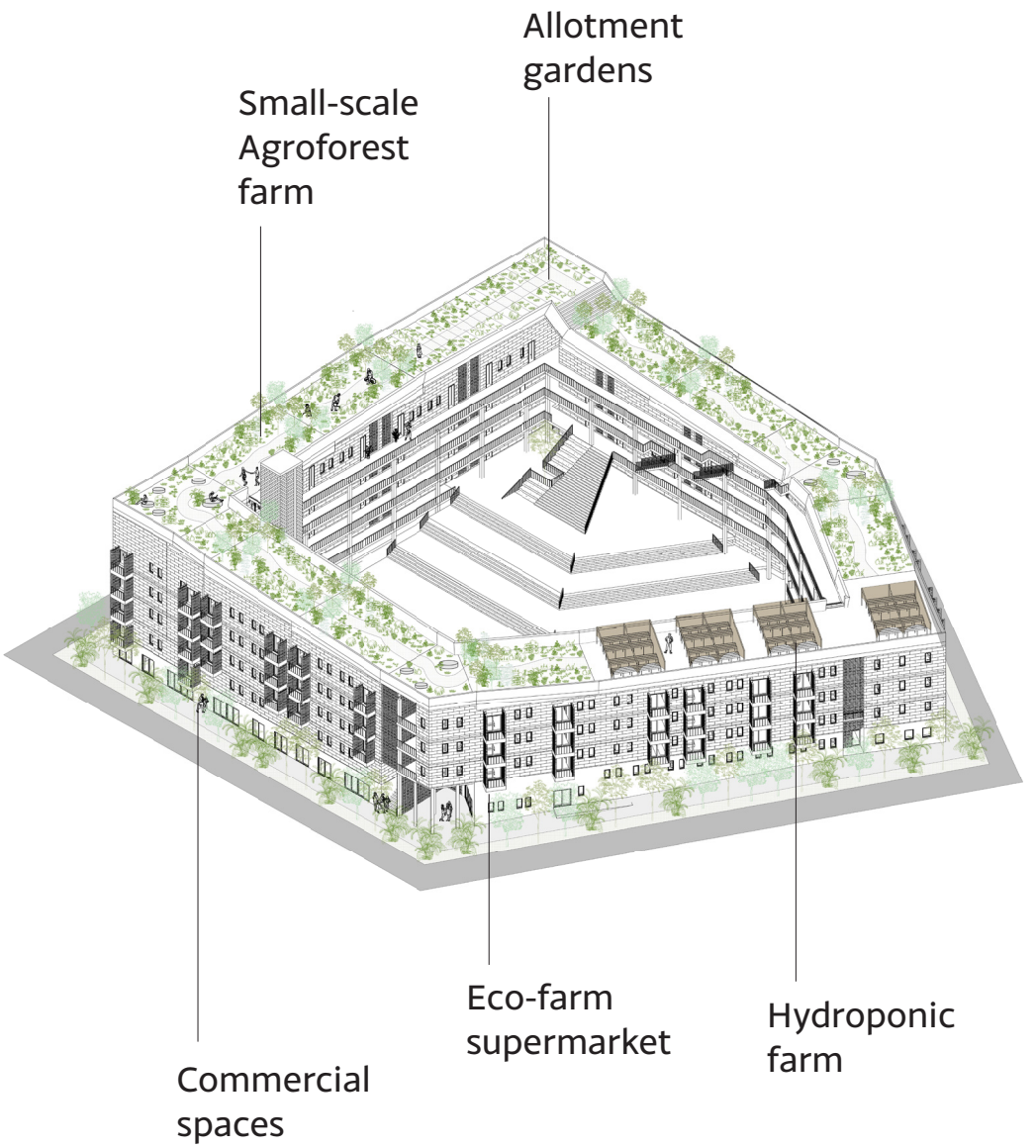




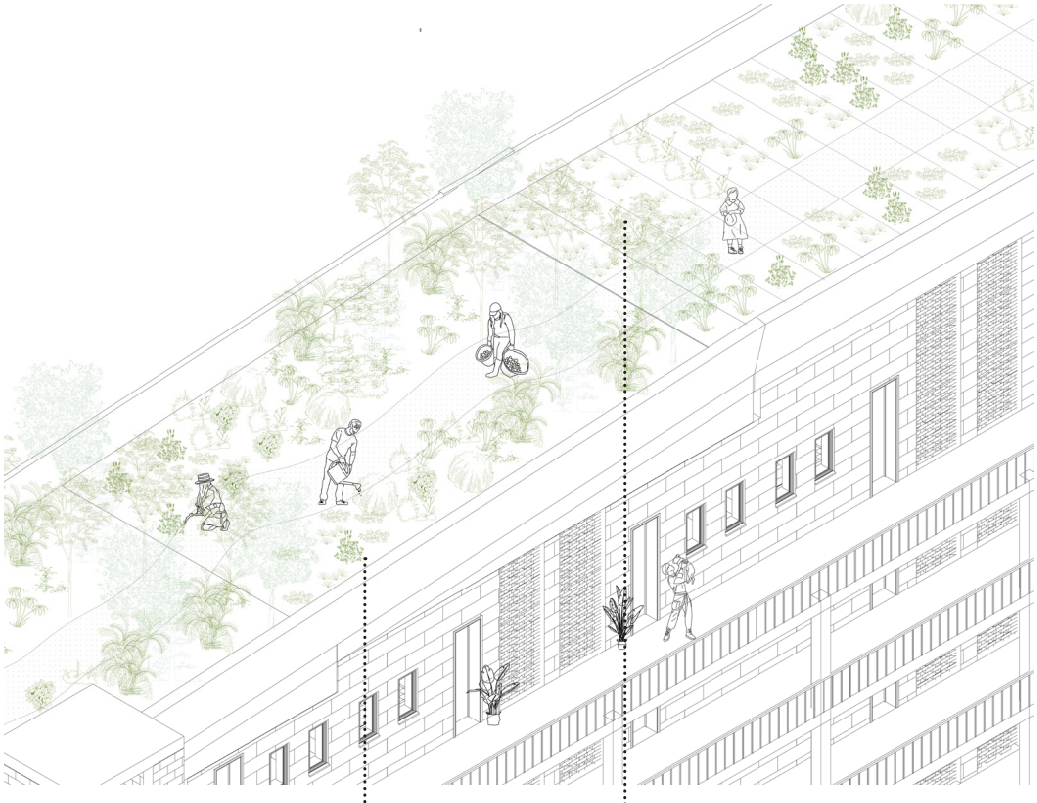
Courtyard block

FSI: 1,15
dw/ha: 182
94 apartments
376 m2 possible farmground




Allotment gardens
Small-scale Agroforest farm
Commercial spaces
Eco-farm supermarket
Hydroponic farm

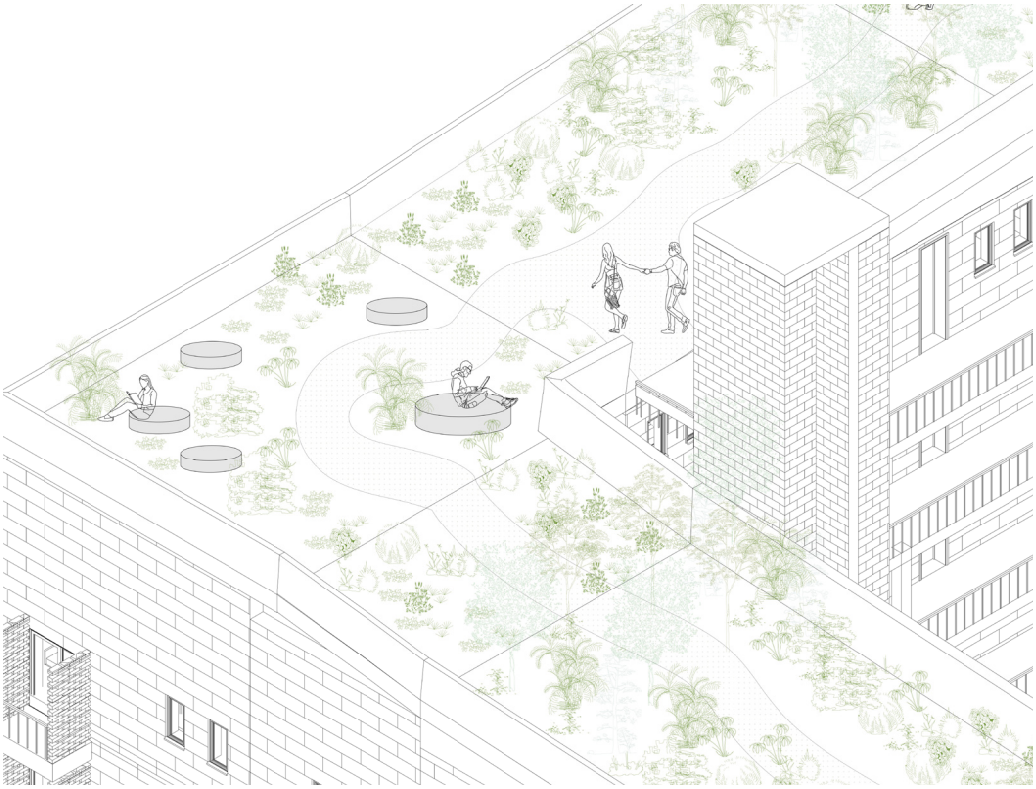
Elevation



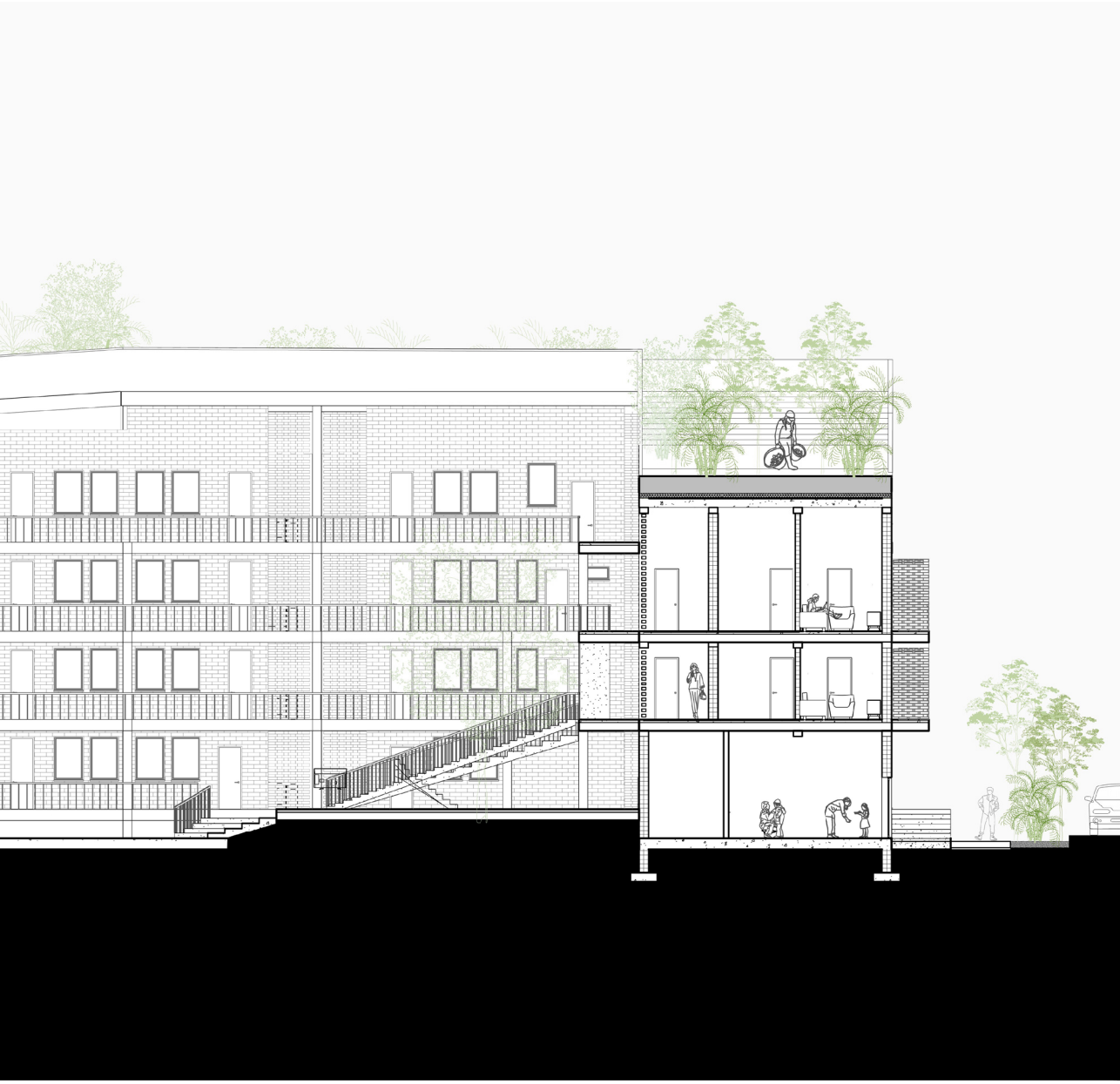
Communal agro-
foresty

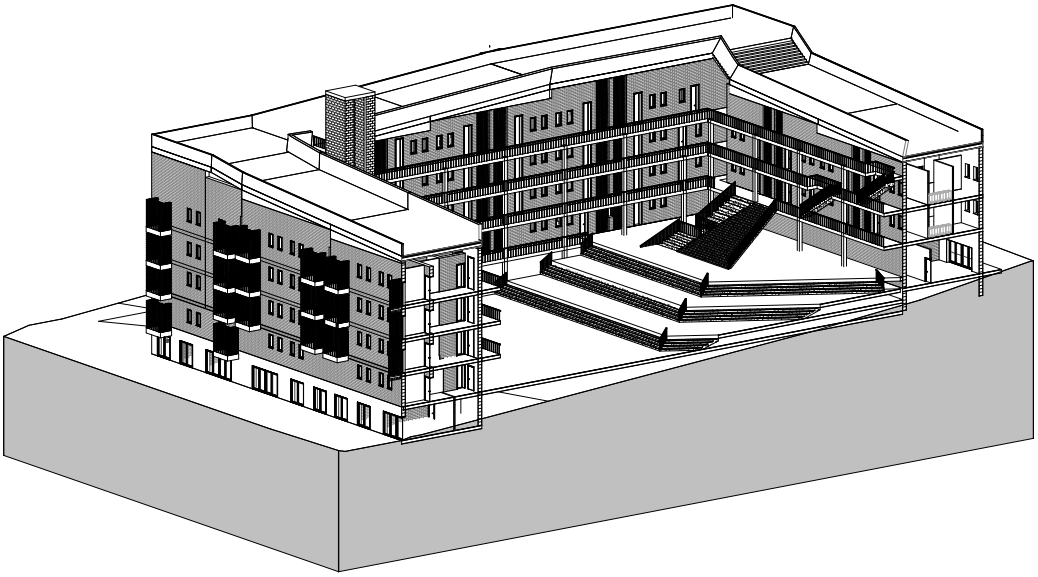
Private
allotments

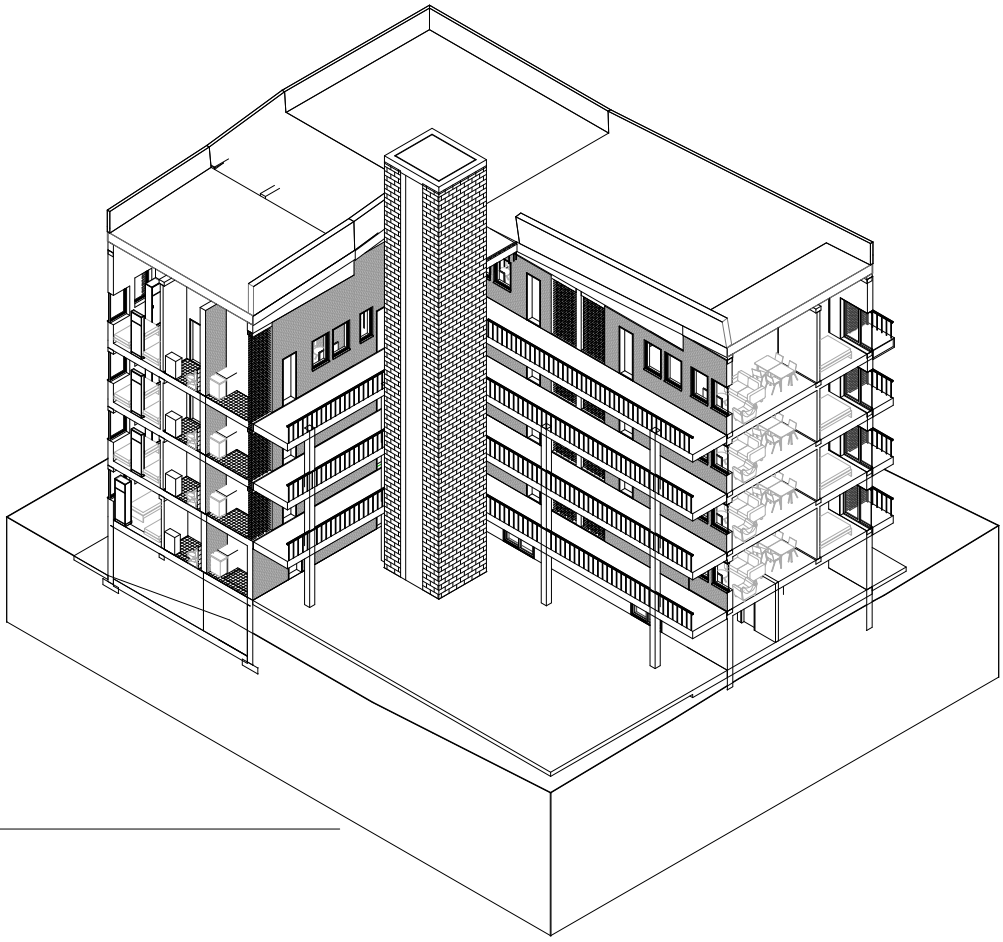
Communal hydroponic



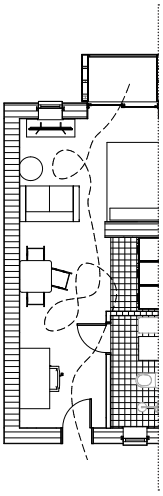
Section





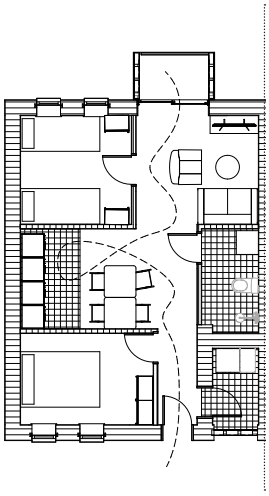


Courtyard block
Apartment types



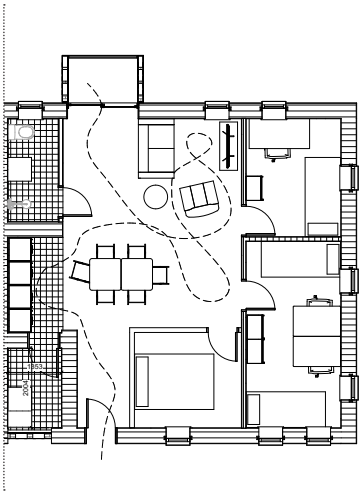
Studio

One bedroom
32 m²
HIS 1



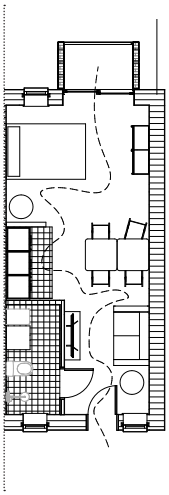
One story app

Two bedroom
52 m²
HIS 1&2



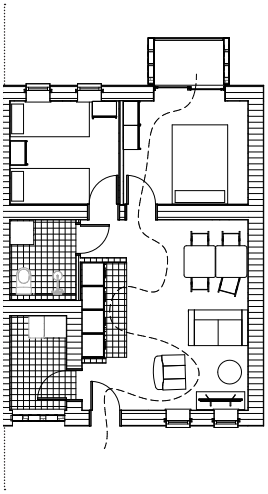
One story app

Three bedroom
72 m²
HIS 2&3



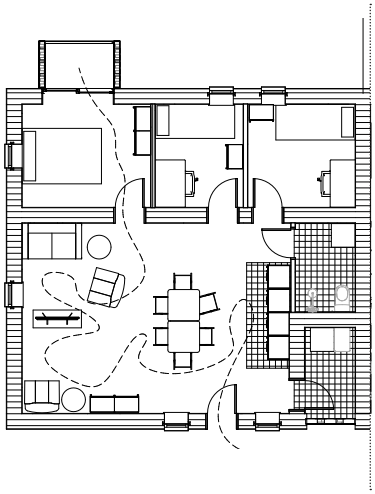
Studio

One bedroom
32 m²
HIS 1



One story app

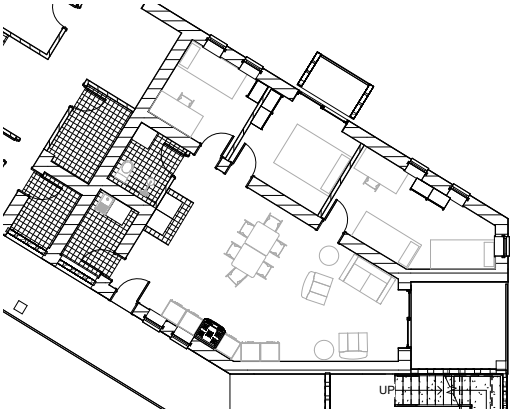
Two bedroom
52 m²
HIS 1&2



One story app

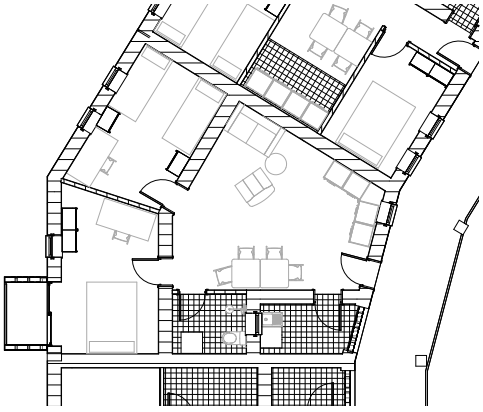
Three bedroom
72 m²
HIS 2&3

Courtyard block
corner apartments



One story app

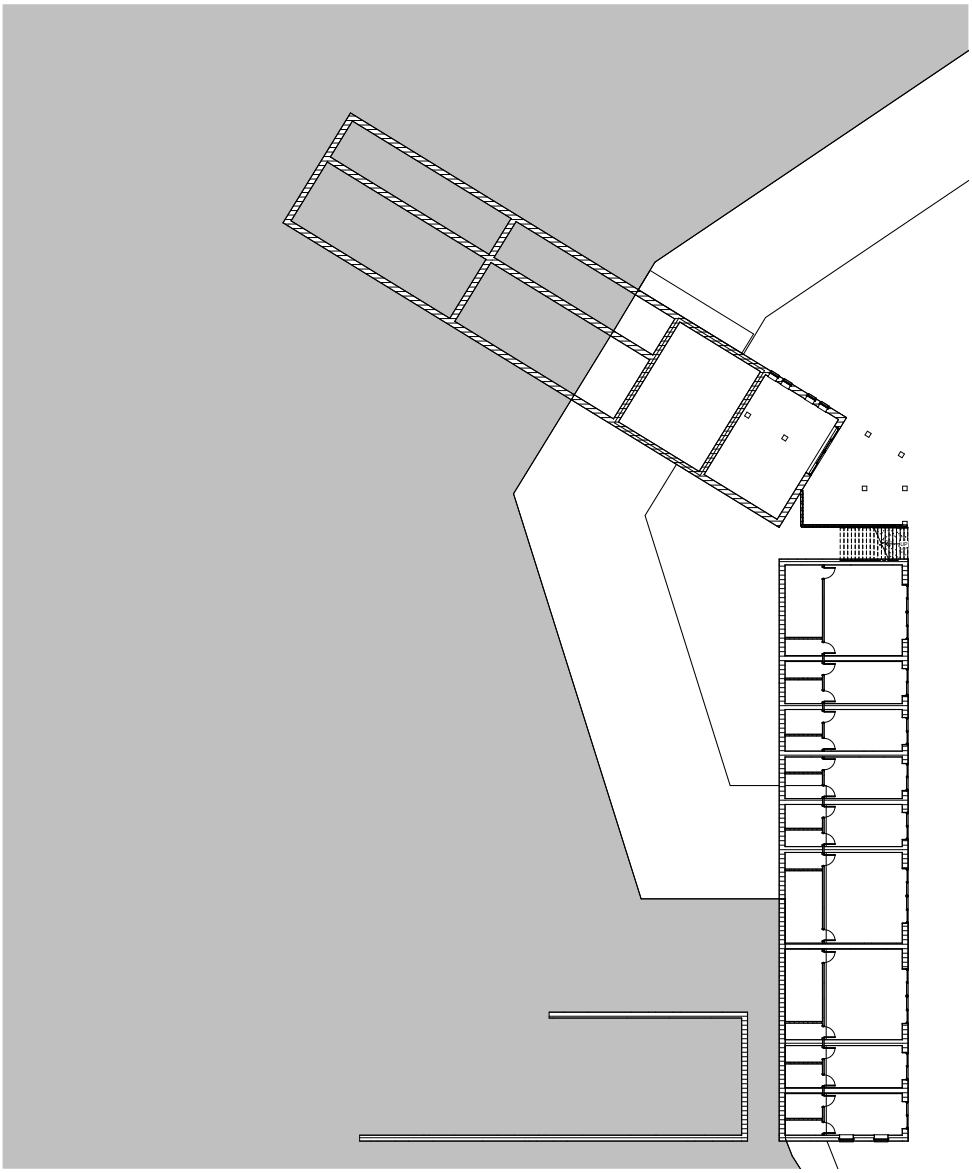
Three bedroom
82 m²
HIS 3



One story app

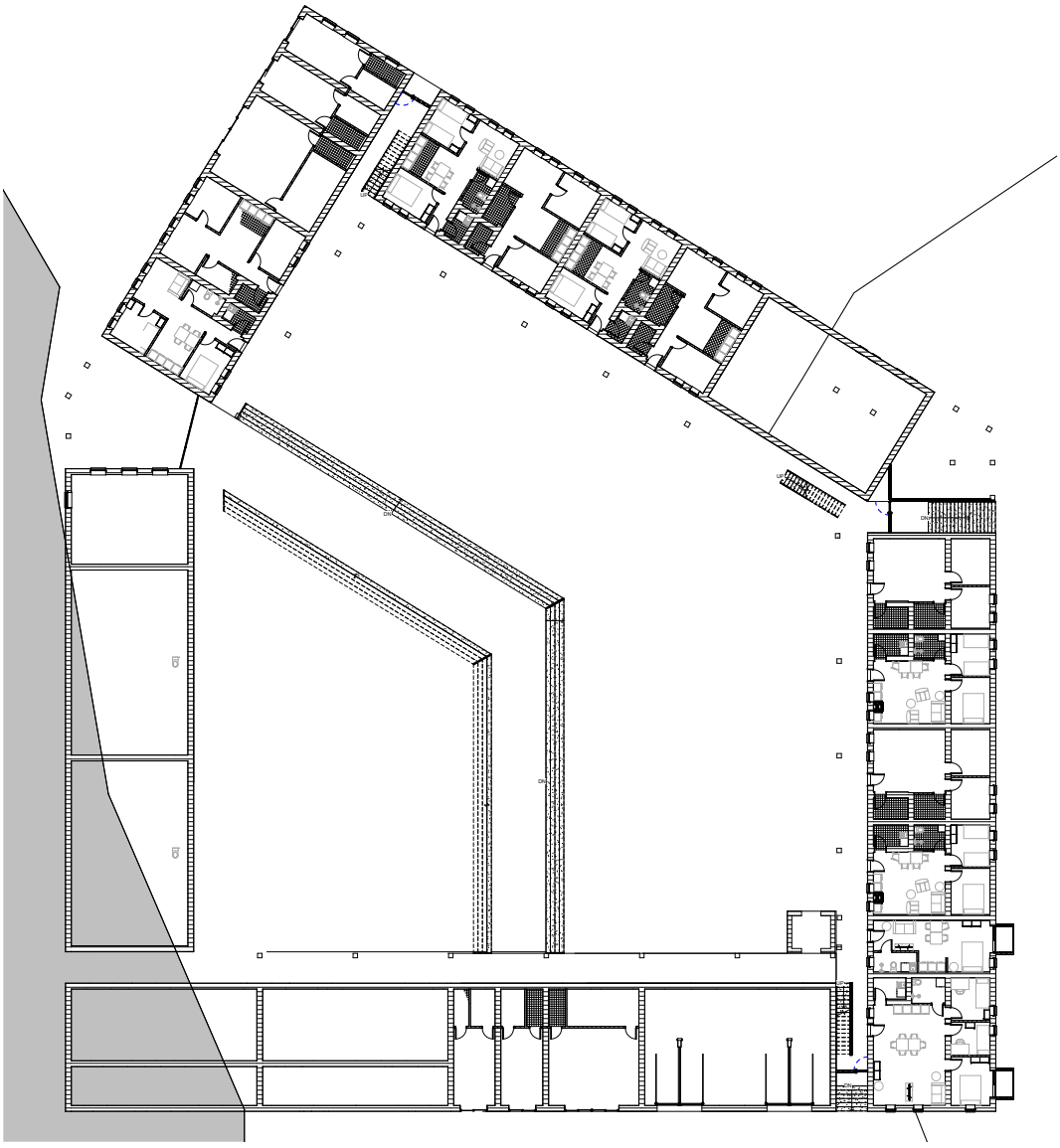
Two bedroom
52 m²
HIS 2&3

Courtyard block
Level -2



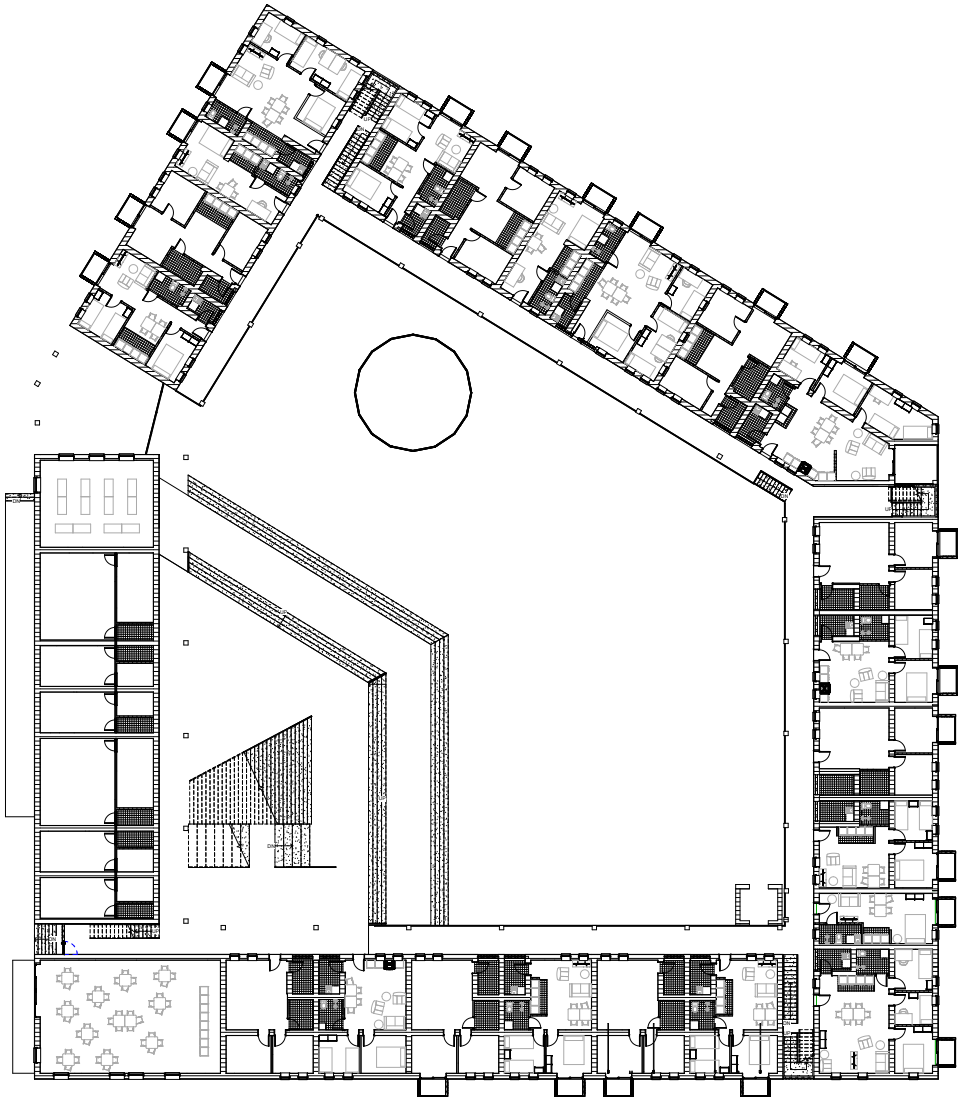
Courtyard block

Level -1



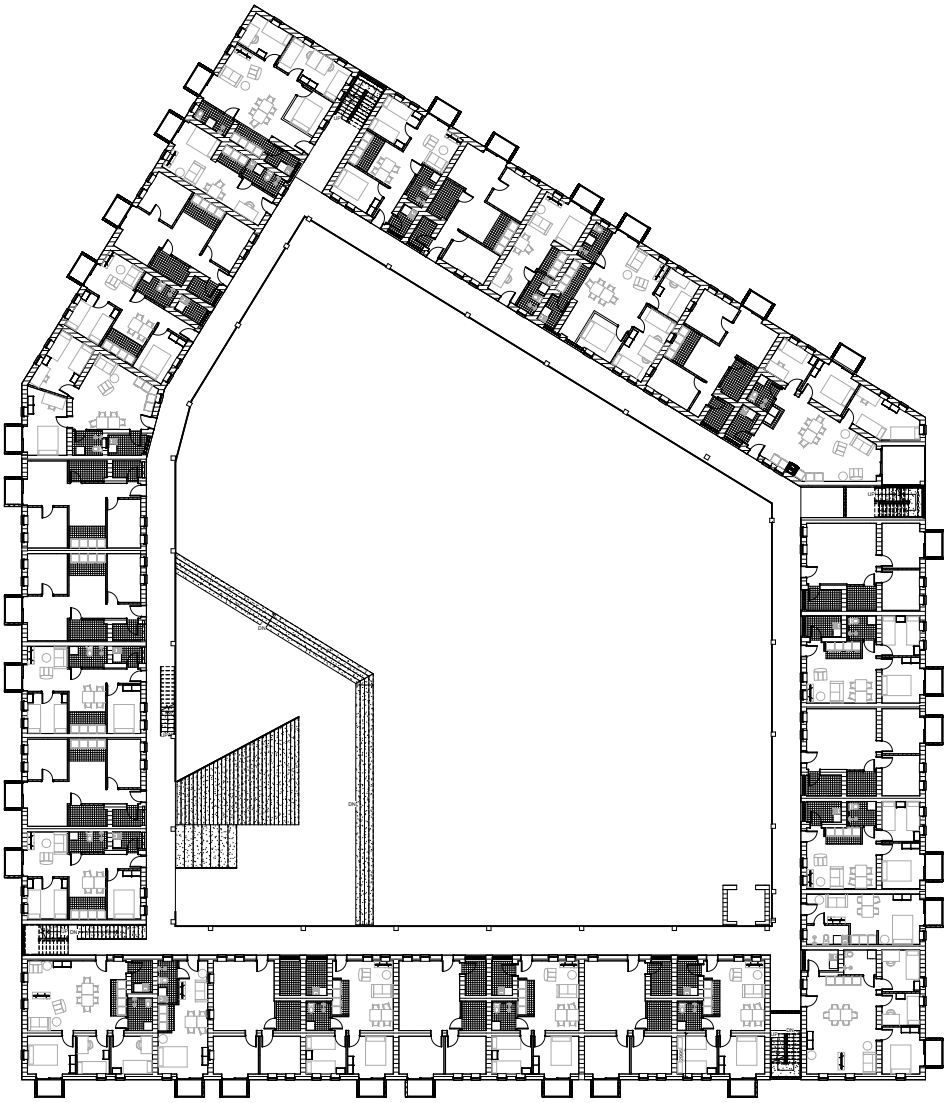
Courtyard block

Level 0



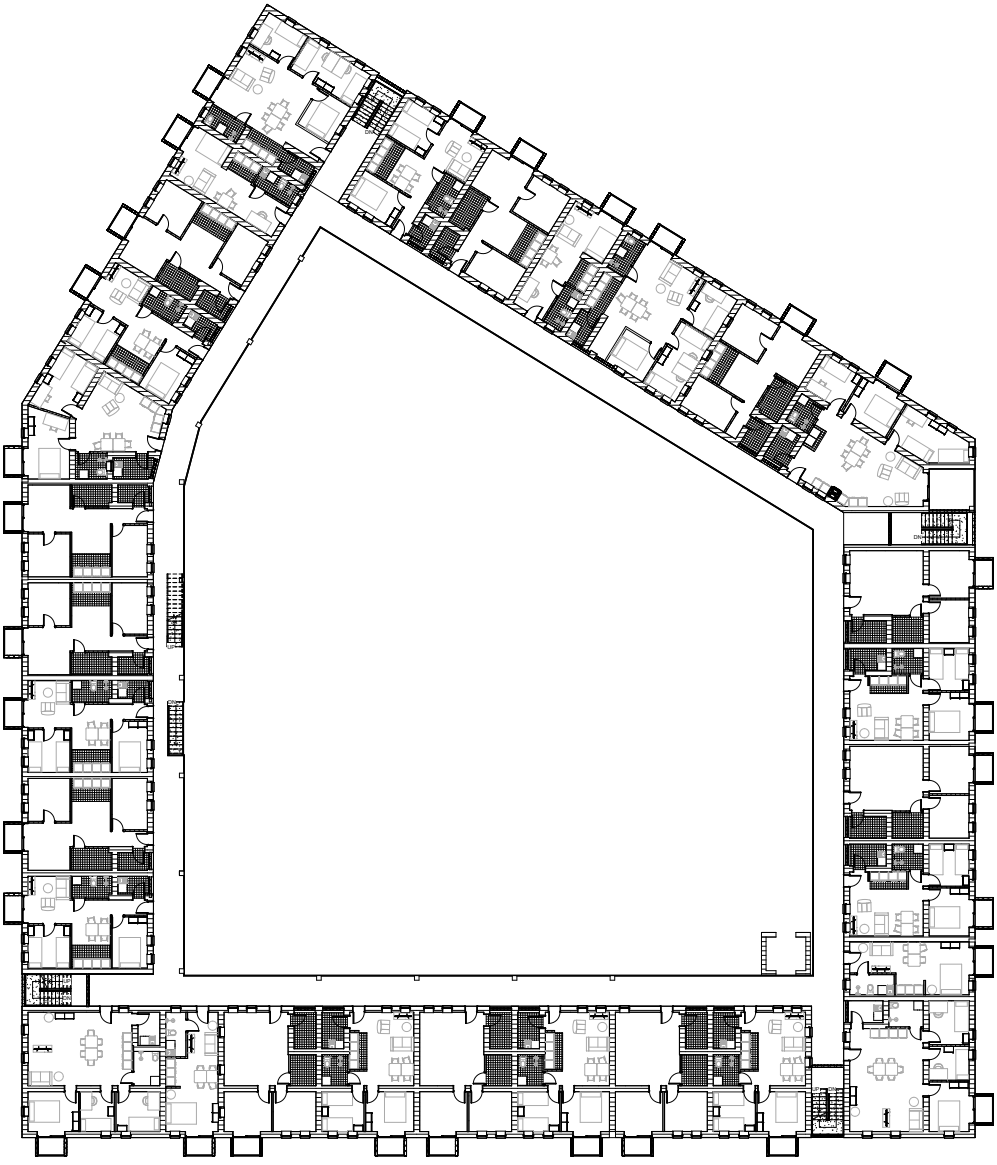
Courtyard block

Level 1

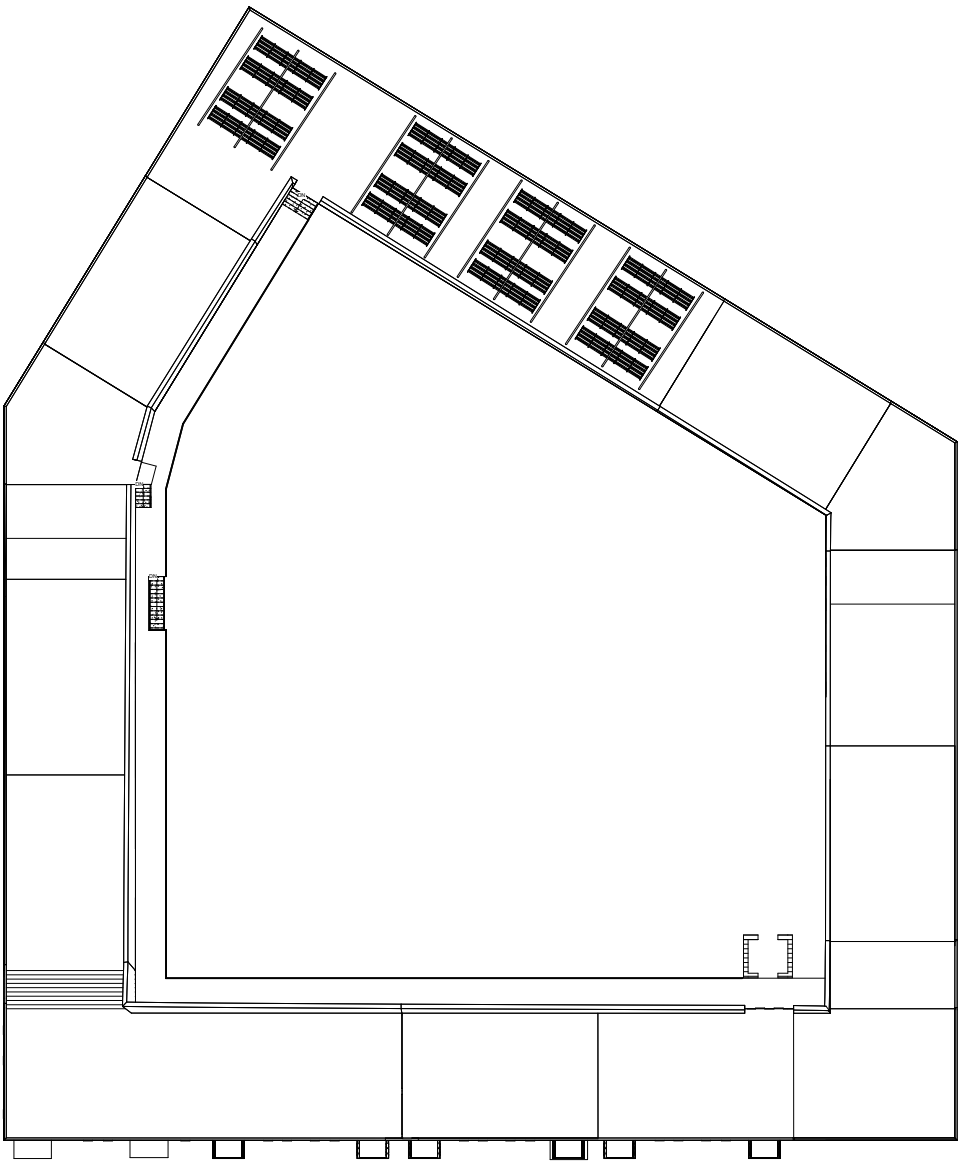


Courtyard block

Level 2

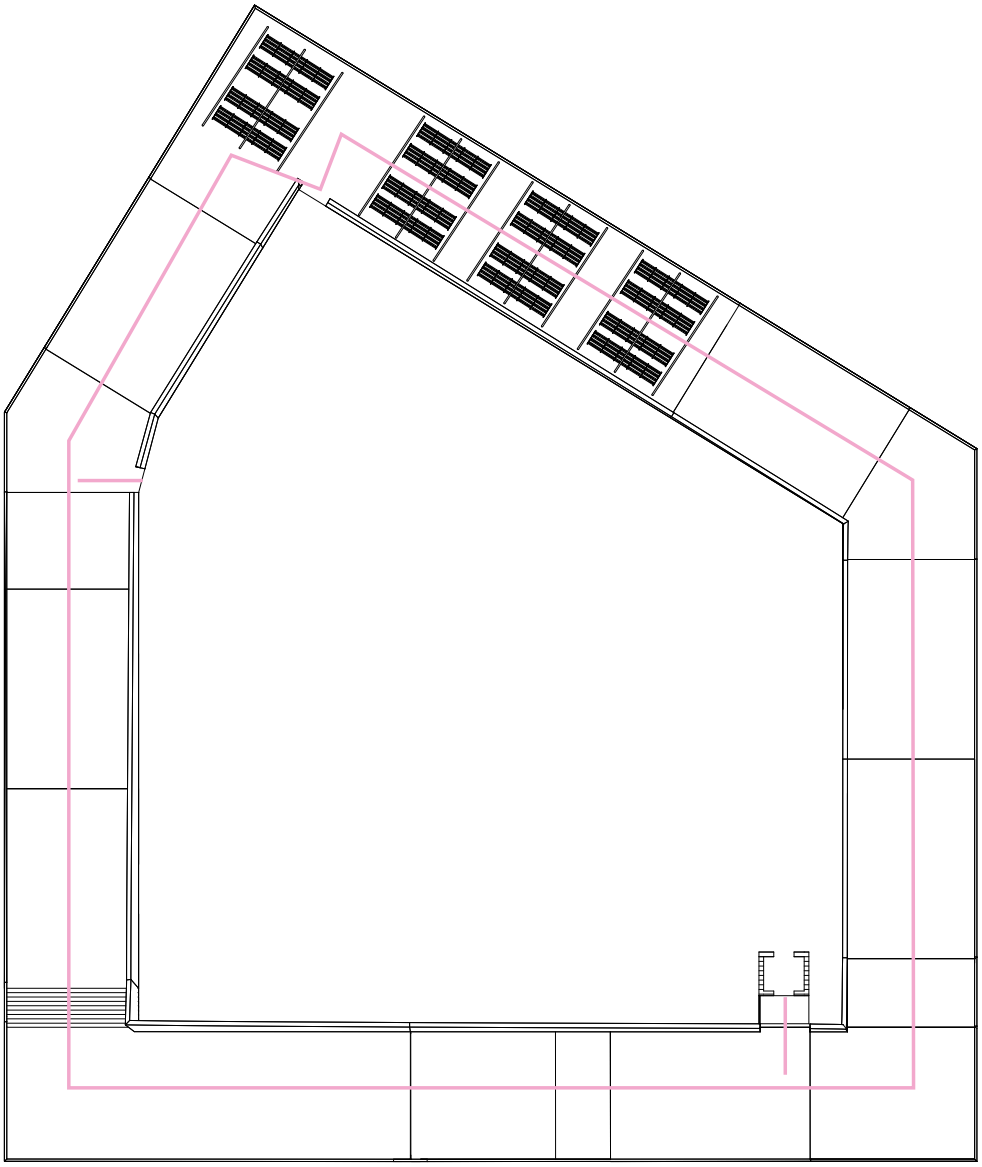


Courtyard block
Level 3



Courtyard block

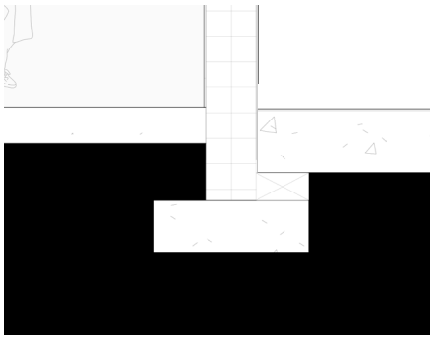
Roof



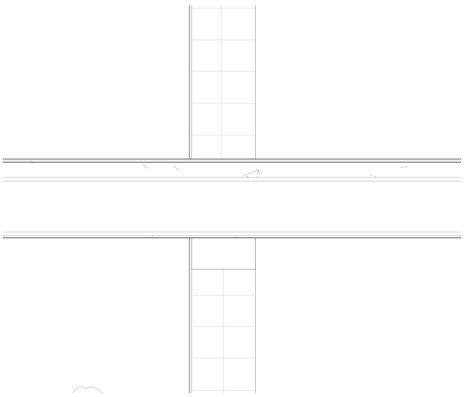
Roof

Section

Details



Foundation detail

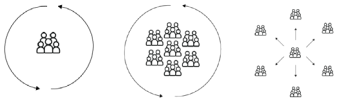


Level connection detail

Green roof detail

Masterplan
Farming types/scales

Couryard block



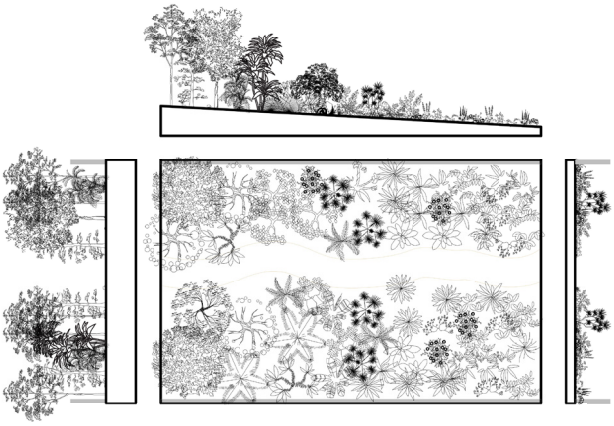
Row housing

Agroecological farm

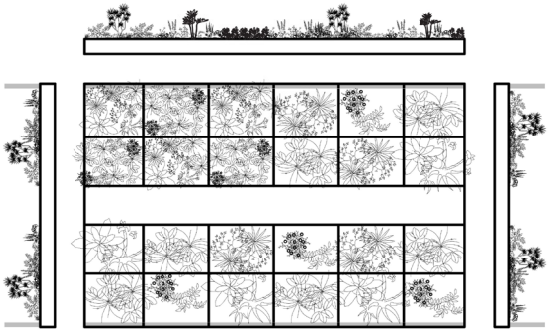
Vertical farm


RUA
SANTA
CECÍLIA
NATAL
RUA BEIJA-FLOR
SÃO
PLUTARCO
JUSTO
URGEL
SIGISMUNDO
MERCEDÁRIOS
APOLINÁRIO
SIDÔNIO
RUA SAN'A FÉ
RODRIGUES
SOUZA
BARRO
BRANCO
SAMUEL
KHURI
AVENIDA
SANTOS
DOS
ANTÔNIO
CARLOS
46°41'52.50"W
23°45'56.25"S

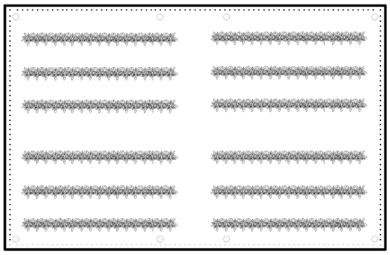
Roof elements



Community agro roof



Allotment roof



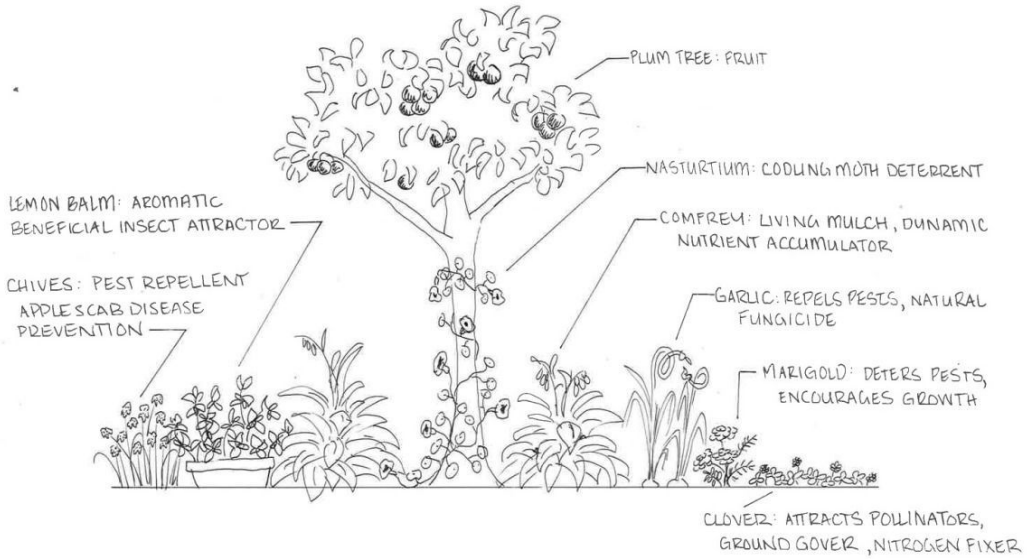
Hydroponic roof

Agroforestry
Principles

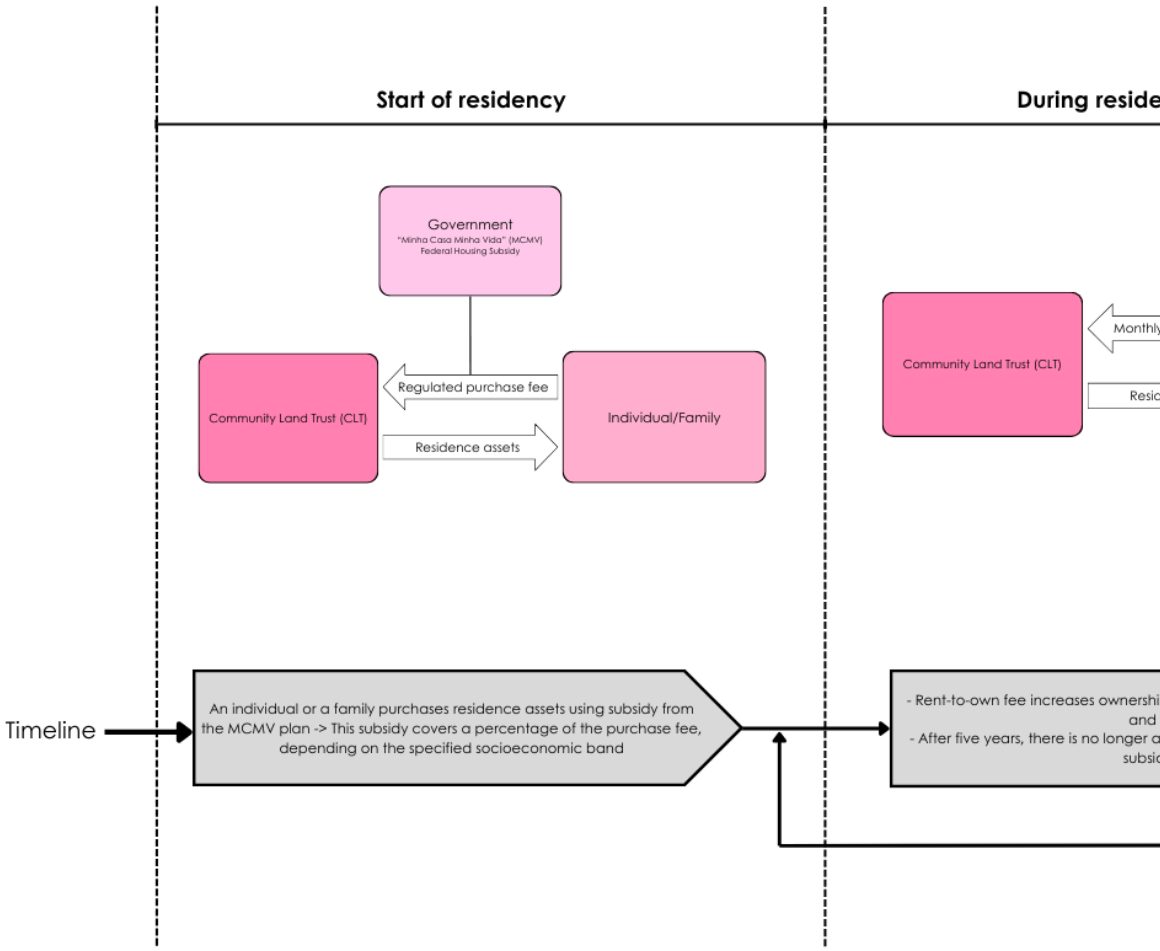
UN Food & Agriculture definition:
"Land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals"

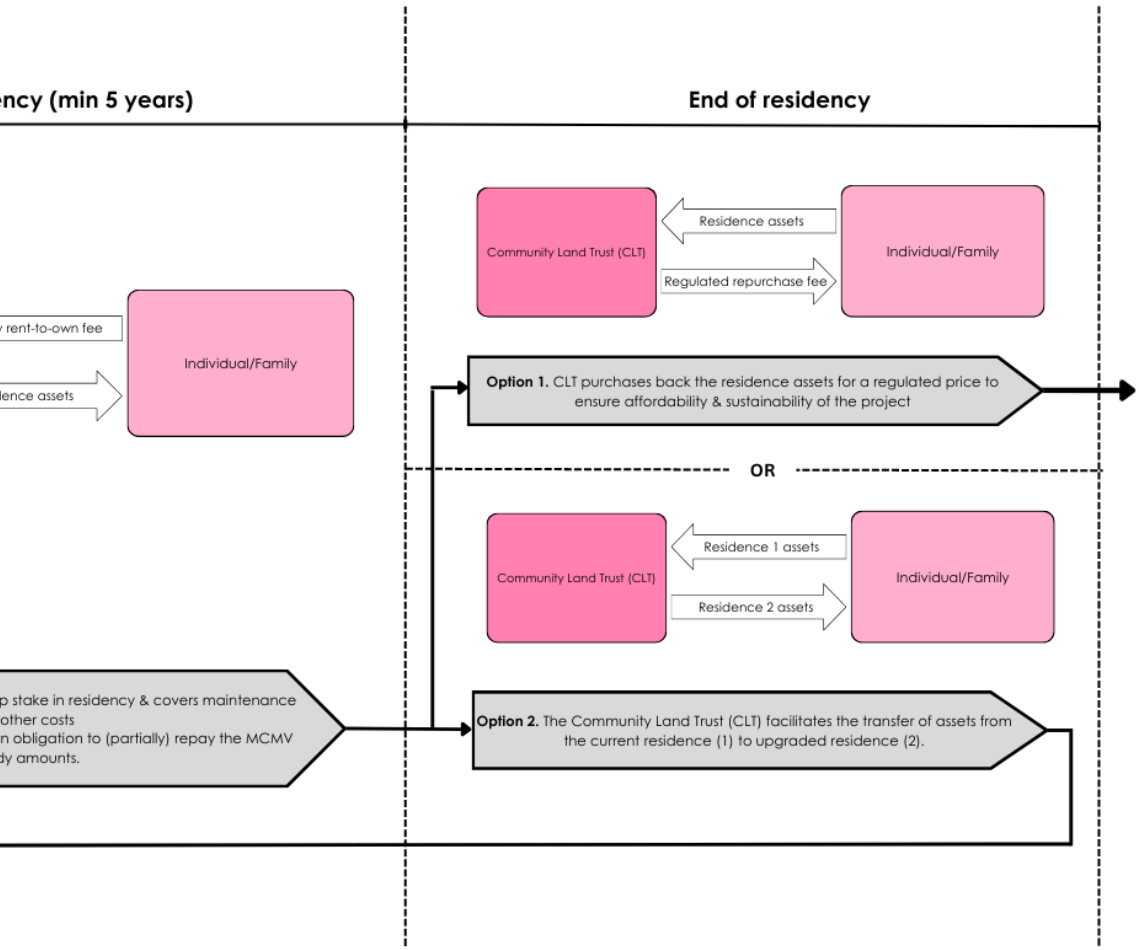
Reasons for Adoption:
- Chemura et al (2021): Climate-resilient agricultural systems

- Kuyah et al. (2019): Yield/productivity enhancement:
"*Studies reviewed suggest agroforestry can significantly increase crop yield through improved soil fertility, improved water regulation, improved microclimate and better soil properties*"

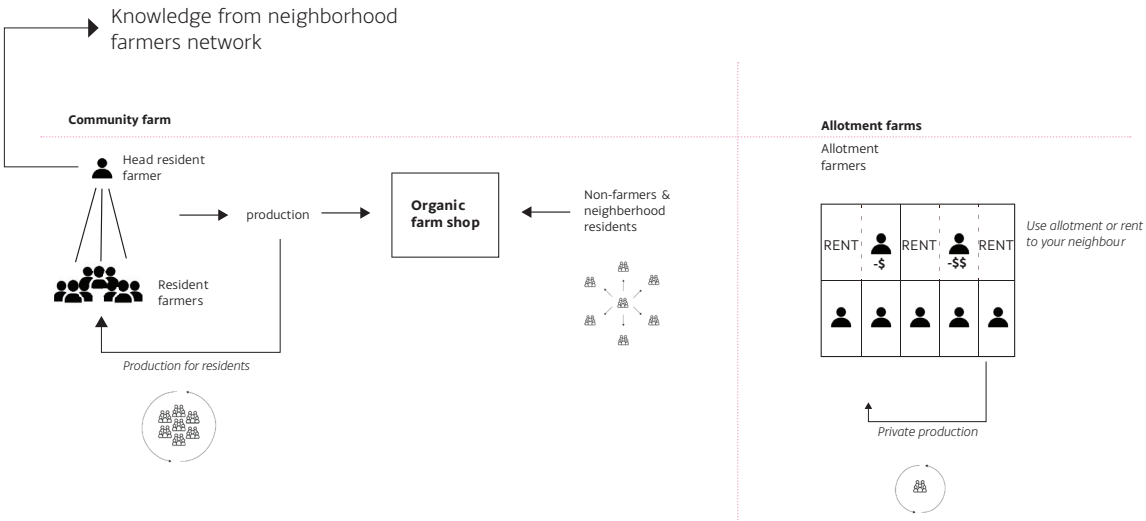


Ownership strategy




ncy (min 5 years)
End of residency
Community Land Trust (CLT)
Residence assets
Regulated repurchase fee
Individual/Family
rent-to-own fee
lence assets
Individual/Family
Option 1. CLT purchases back the residence assets for a regulated price to ensure affordability & sustainability of the project
OR
Community Land Trust (CLT)
Residence 1 assets
Residence 2 assets
Individual/Family
p stake in residency & covers maintenance
other costs
n obligation to (partially) repay the MCMV
dy amounts.
Option 2. The Community Land Trust (CLT) facilitates the transfer of assets from the current residence (1) to upgraded residence (2).

Courtyard farming strategies



PDRS
Municipal Plan for Sustainable Rural Development

FEMA
Special Fund for the Environment and Sustainable Development

Funding

The Agriculture Patrol

Provides agricultural machines for collective use

ATER
Technical Assistance and Rural Extension Program

Edu

Payment for Environmental Services

Funding

Environmental and Land Regularization Program

facilitating registration and regularization of rural properties

CAR
Rural Environmental Register

INCRA
National Institute of Colonization and Agrarian Reform

PRONERA
National Program for Education in Agrarian Reform

Edu

DAP
Declaration of Aptitude

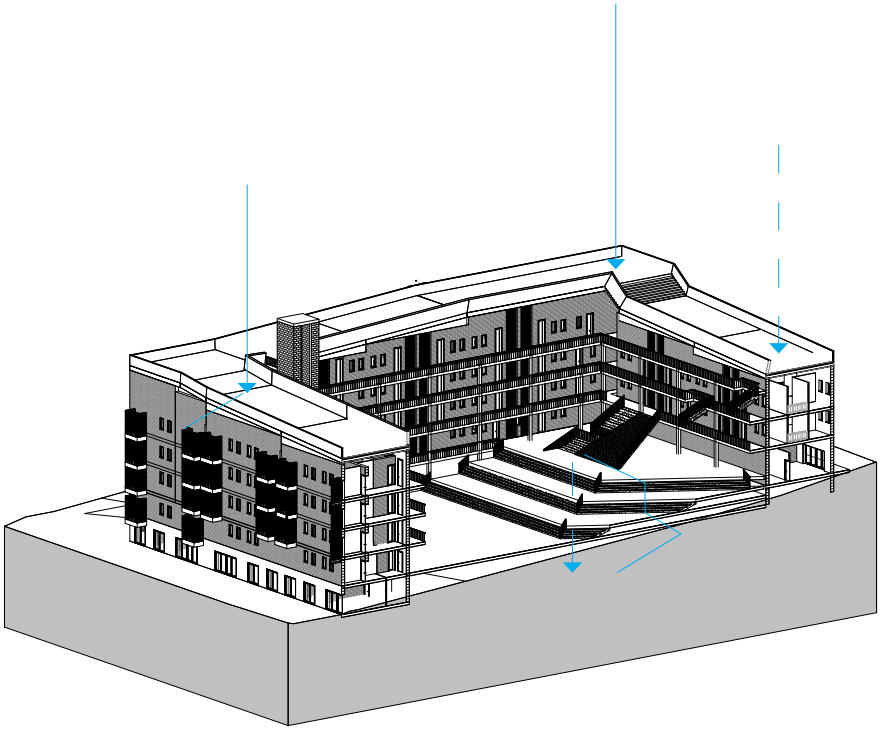
supervises DAP emission process

MDA
The Ministry of Agrarian Development

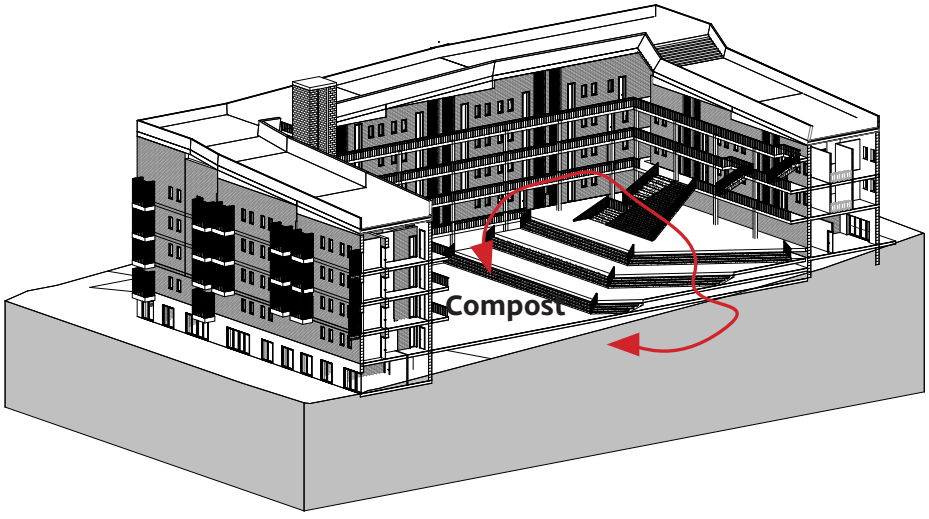
PRONAF
National Program for Strengthening Family Farming

Funding

Waste cycles courtyard

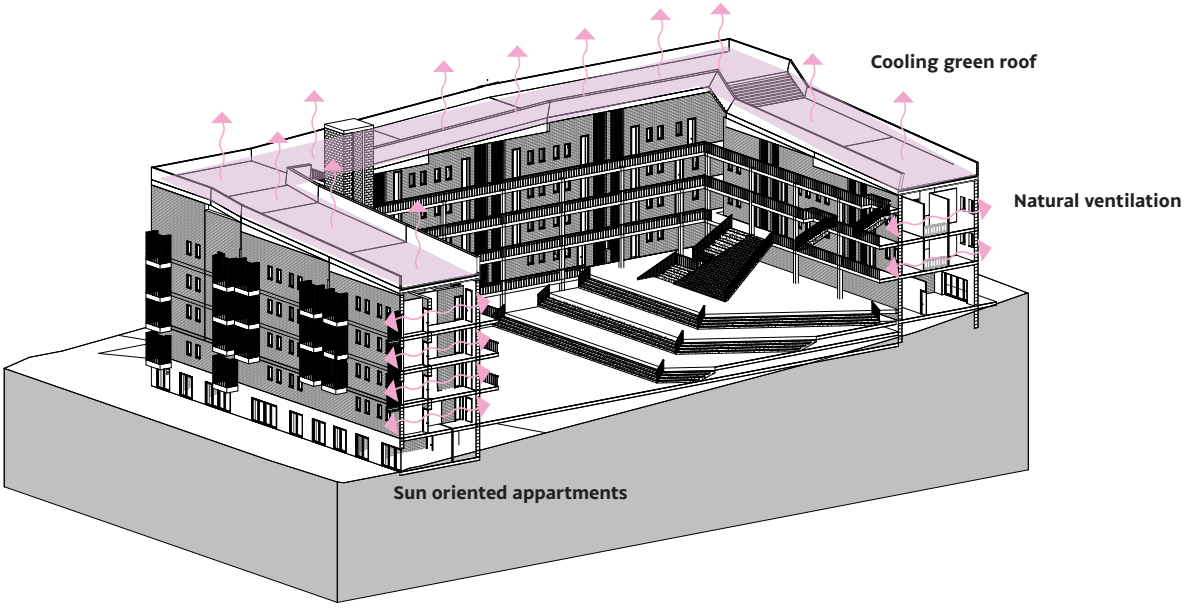


Rain Water

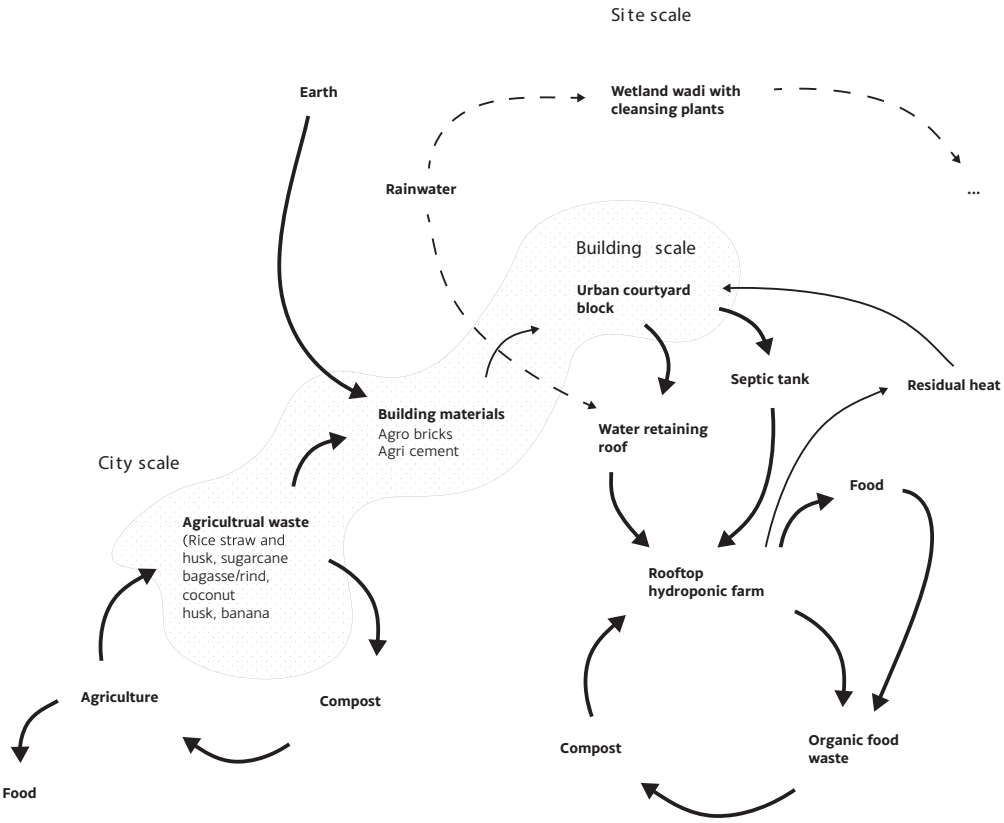


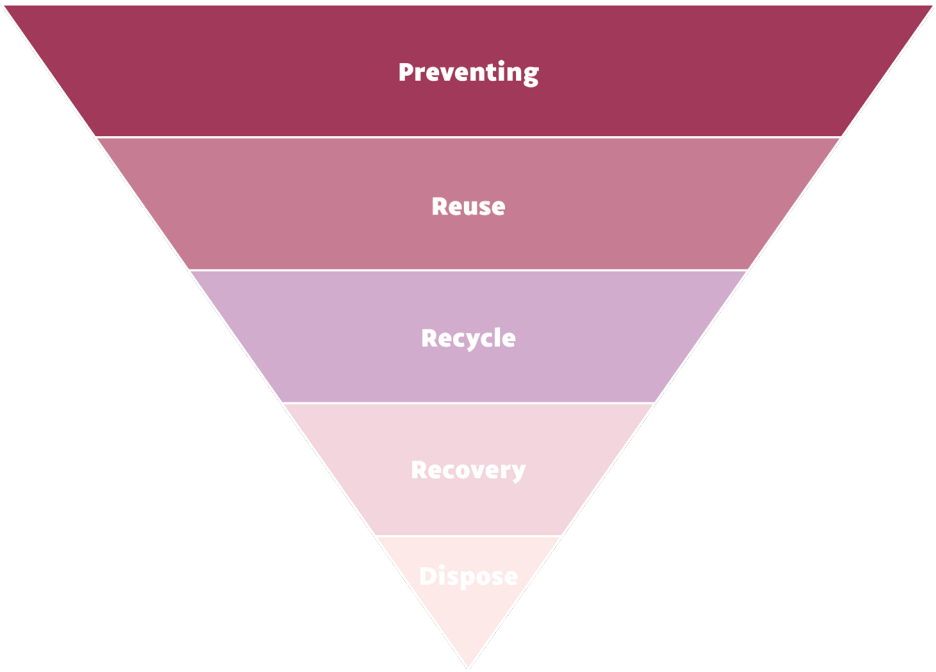
Food waste

Climate control



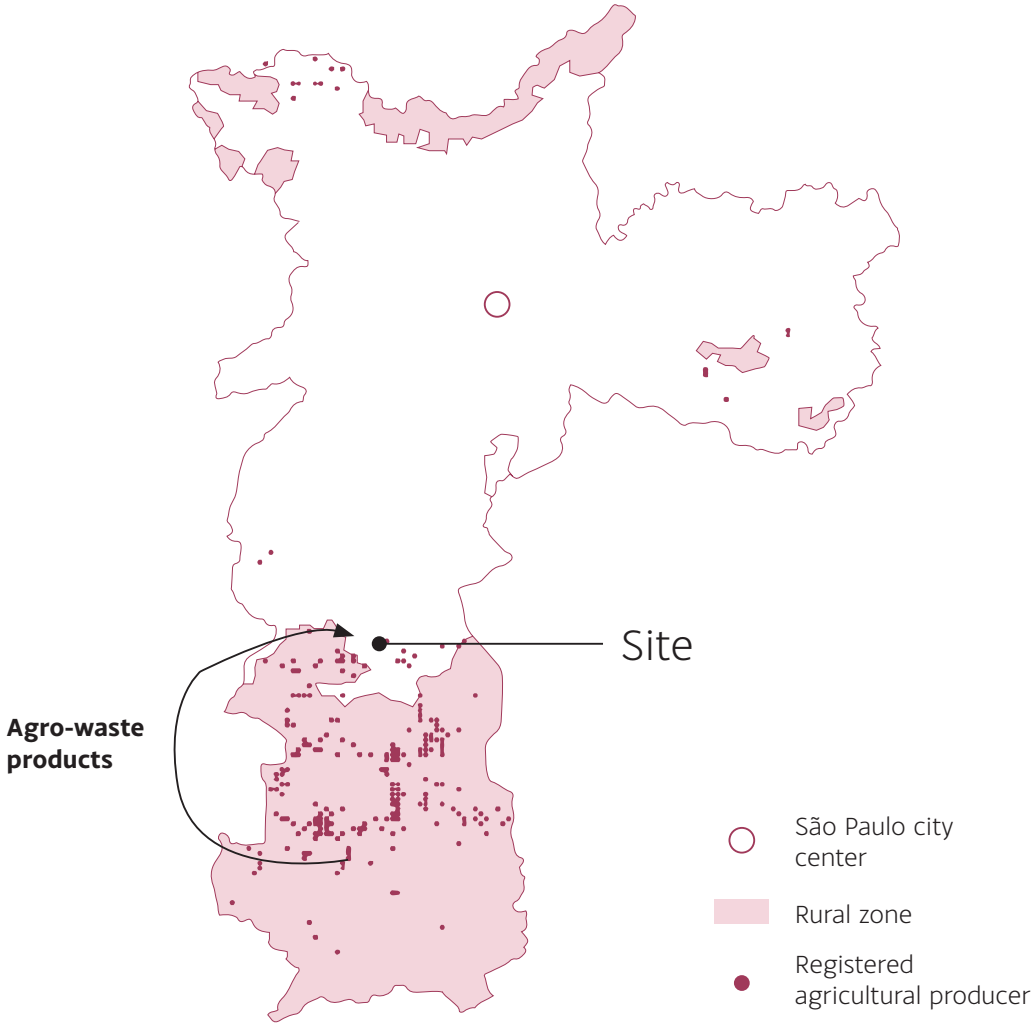
Waste cycles





Food waste[1]	Construction[2]
Avoiding food waste, food banks, consumer awareness	Using less material in desing and manufacturing. Keeping products for longer. Using less hazardous material
Processing and reprocessing for human food, use for animal food, raw materials for industry	Checking, cleaning, repairing, refurbishing
Composting for fertilizer or generating fertilizer and sustainable energy with cofermentation	Turning waste into a new substanceor product
Burning as waste (objective is destruction, energy production possible)	Anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy

Rural zone & Agriculture



Agro-waste to construction

Rice straw and husk

Biofuel, packaging films, conducting paper, cellulose nanofibrils, cellulose nanocrystals, ceiling boards, soil stabilizer, paper, paperboard, tableware

Coconut husk

Cellulose nanowhiskers, bricks, soil stabilizer

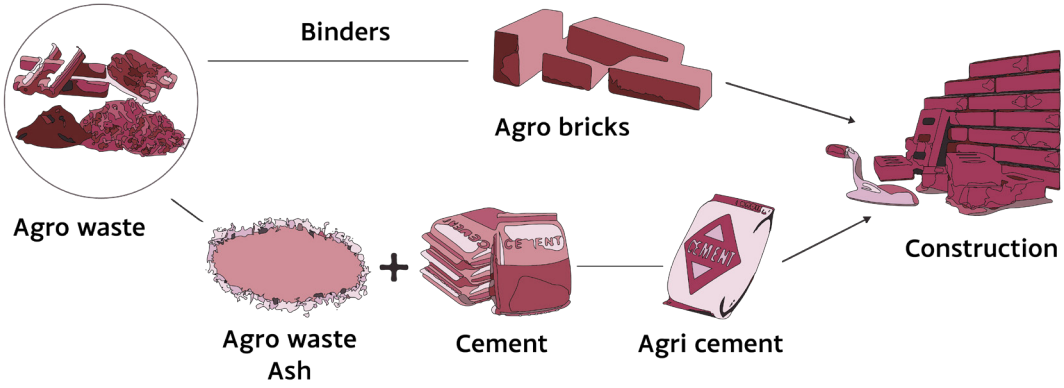
Sugarcane bagasse, rind

Biofuel, conducting paper, cellulose nanofibrils, cellulose nanocrystals, bricks, soil stabilizer, paper, tableware

Banana pseudostem

Packaging films, cellulose nanofibrils, cellulose nanocrystals, soil stabilizer, paper

Terra roxa



Phasing

Phase 1: commercial building

Phasing

Phase 2: Courtyard blocks with commercial amenities

Phasing

Phase 3: Residential blocks

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