Resilience inbetween the plasticscape

Energy and resource efficient social housing for migrant workers in Almeria, Spain.

P5 Presentation

MSC4 Architectural engineering

Tutors

Mo Smit
Paddy Tomesen
Eric van den Ham

Pablo Miguel Gómez Ceelen
4611470

Why?

Context and design problematization

Research problematization and research results

Design proposal

Design objectives

How?

Design process and design strategies

Urban scale

Building scale

Material scale

What?

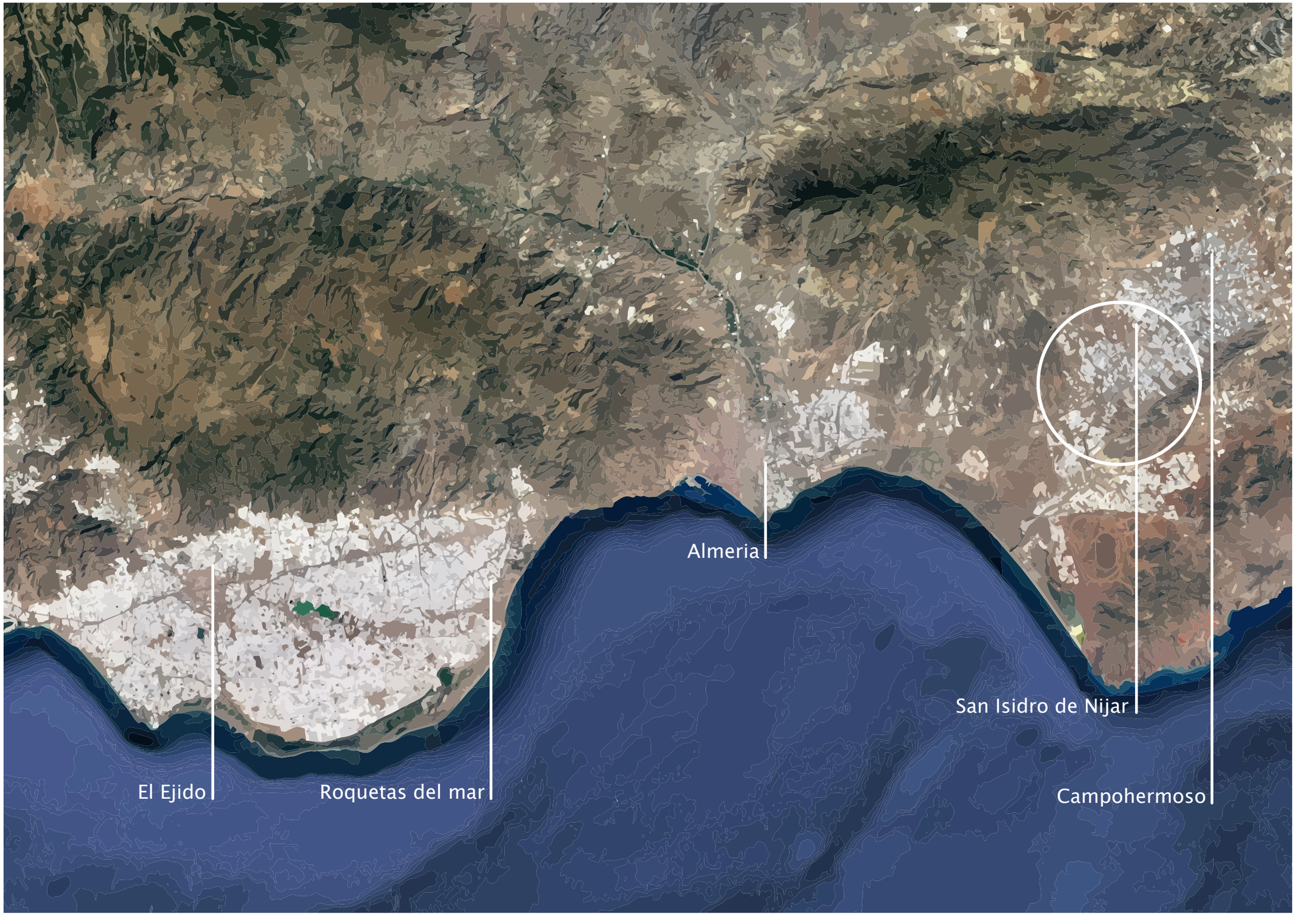
Urban scale

Building scale

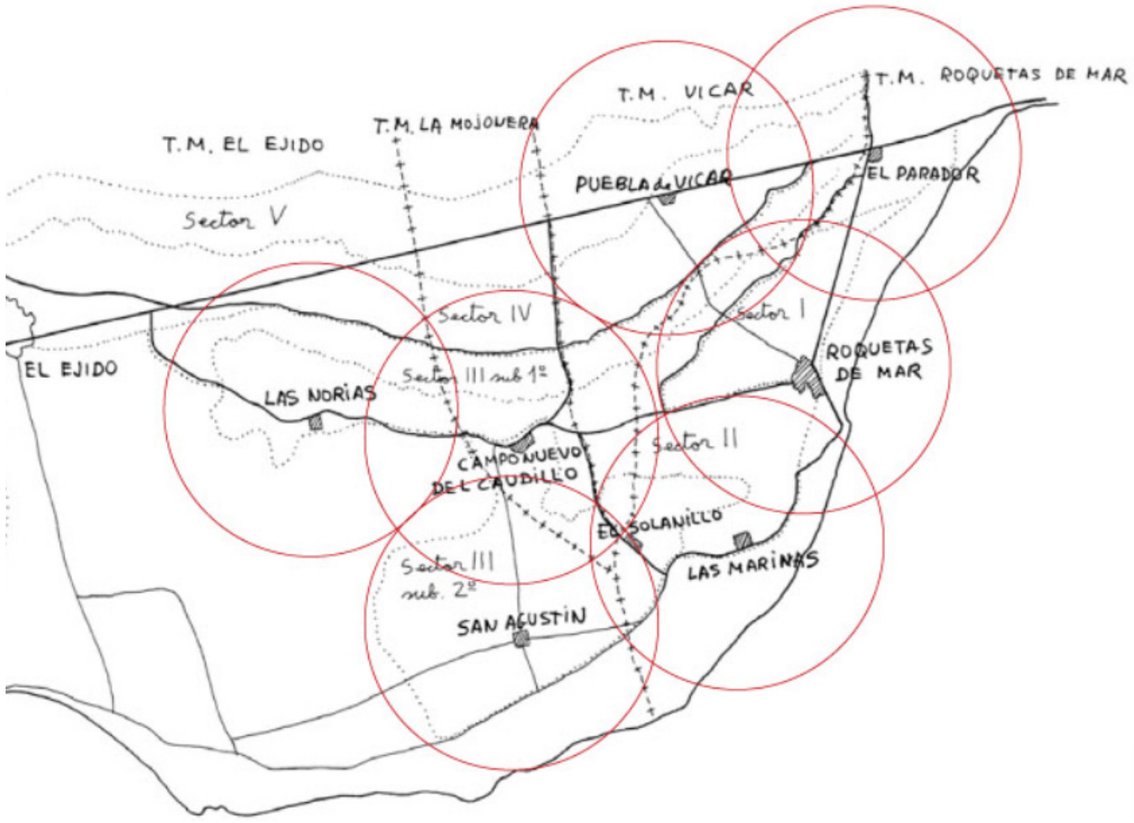
Details

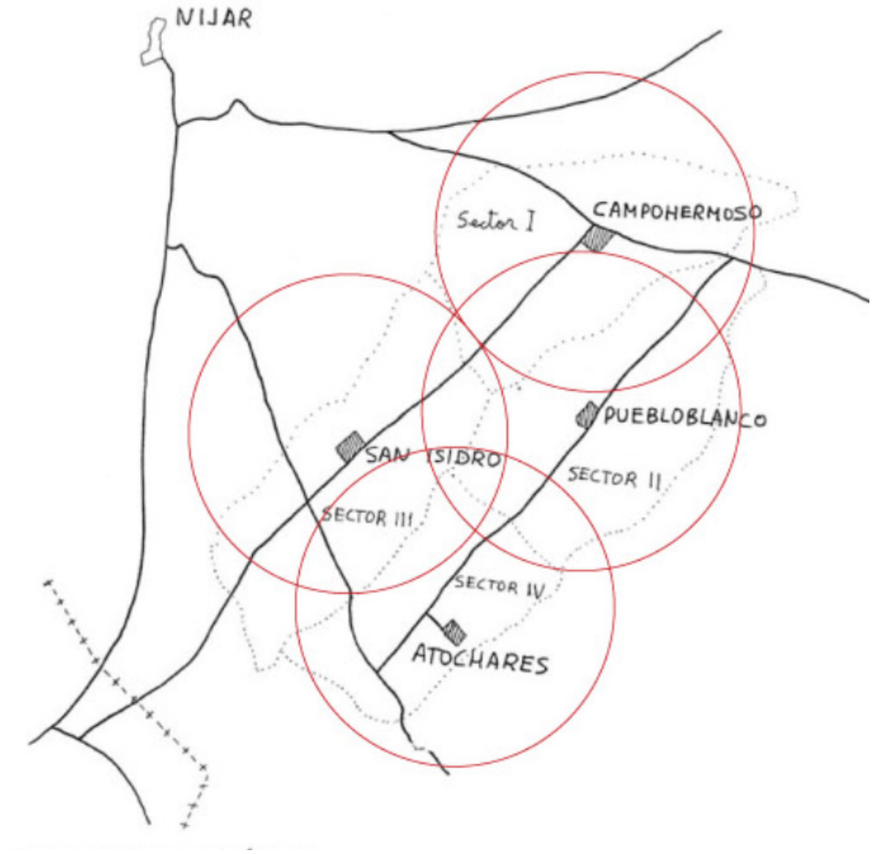
Context

Context


Almeria
El Ejido
Roquetas del mar
San Isidro de Nijar
Campohermoso

First urban settlements for the agriculture sector in Almeria

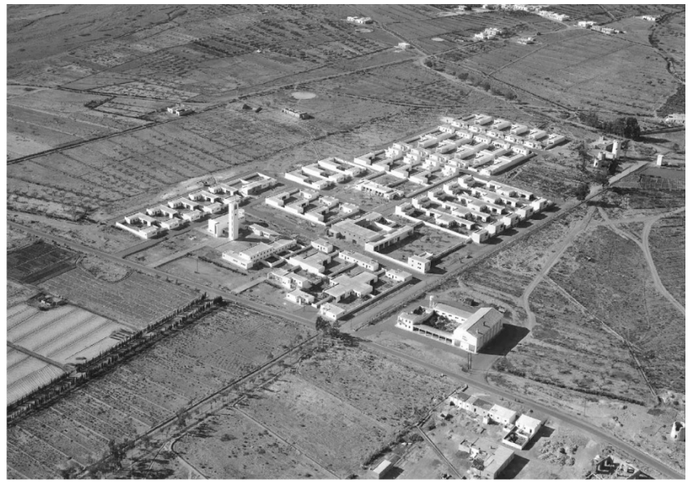




https://www.dipalme.org/Servicios/cmsdipro/index.nsf/informacion.xsp?p=iea&documentId=1A844CD9FCFEC407C12580F0005D27FA

First urban settlements for the agriculture sector in Almeria

Campohermoso 1958.
88 Dwellings
Architect: José Luis Fernández del Amo

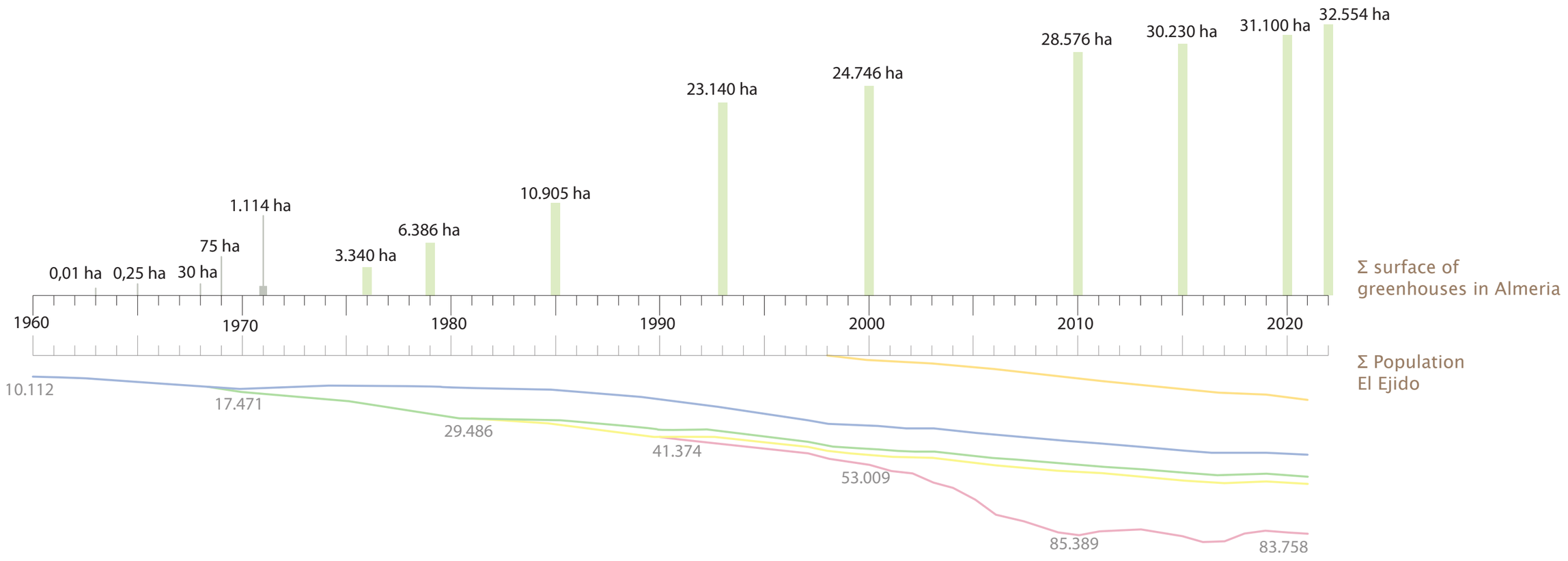


San Isidro 1959.
70 Dwellings
Architect: Agustín Delgado de Robles

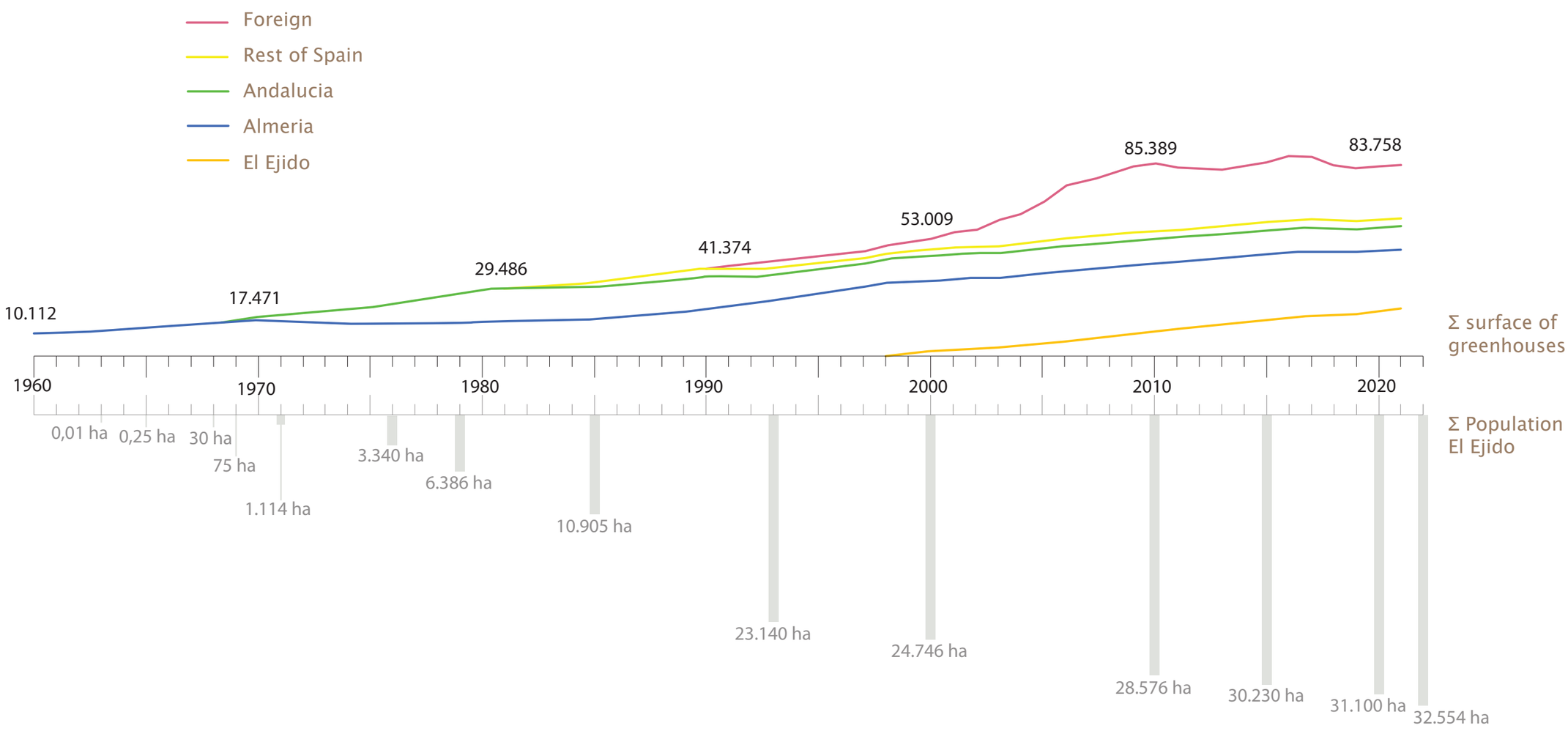
Atochares 1959.
41 Dwellings
Architect Agustín Delgado de Robles

Las Marinas 1958.
62 Dwellings
Architect José Luis Fernández del Amo

Growth of the agriculture sector in Almeria

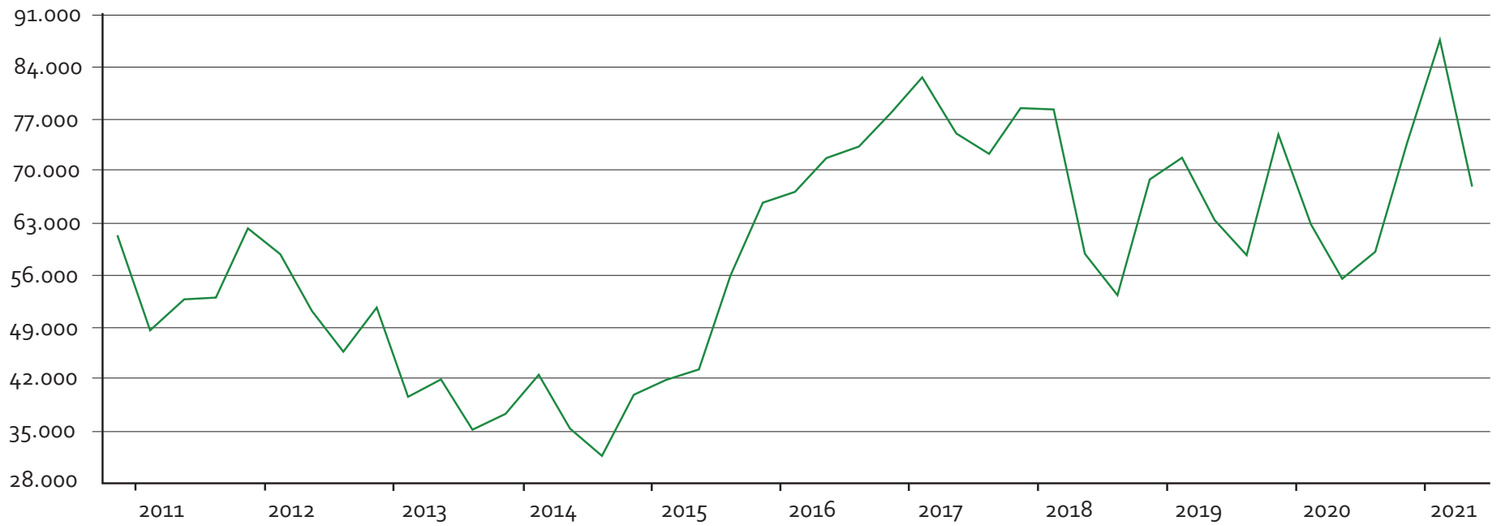


Population growth and development of the agriculture sector

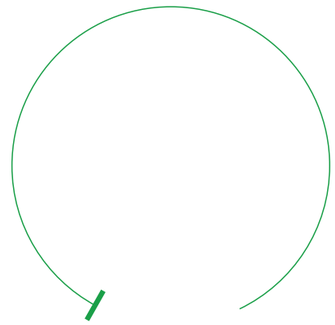


Fluctuations of employment in the agriculture sector in Almeria

Σ People employed Agriculture sector Almeria



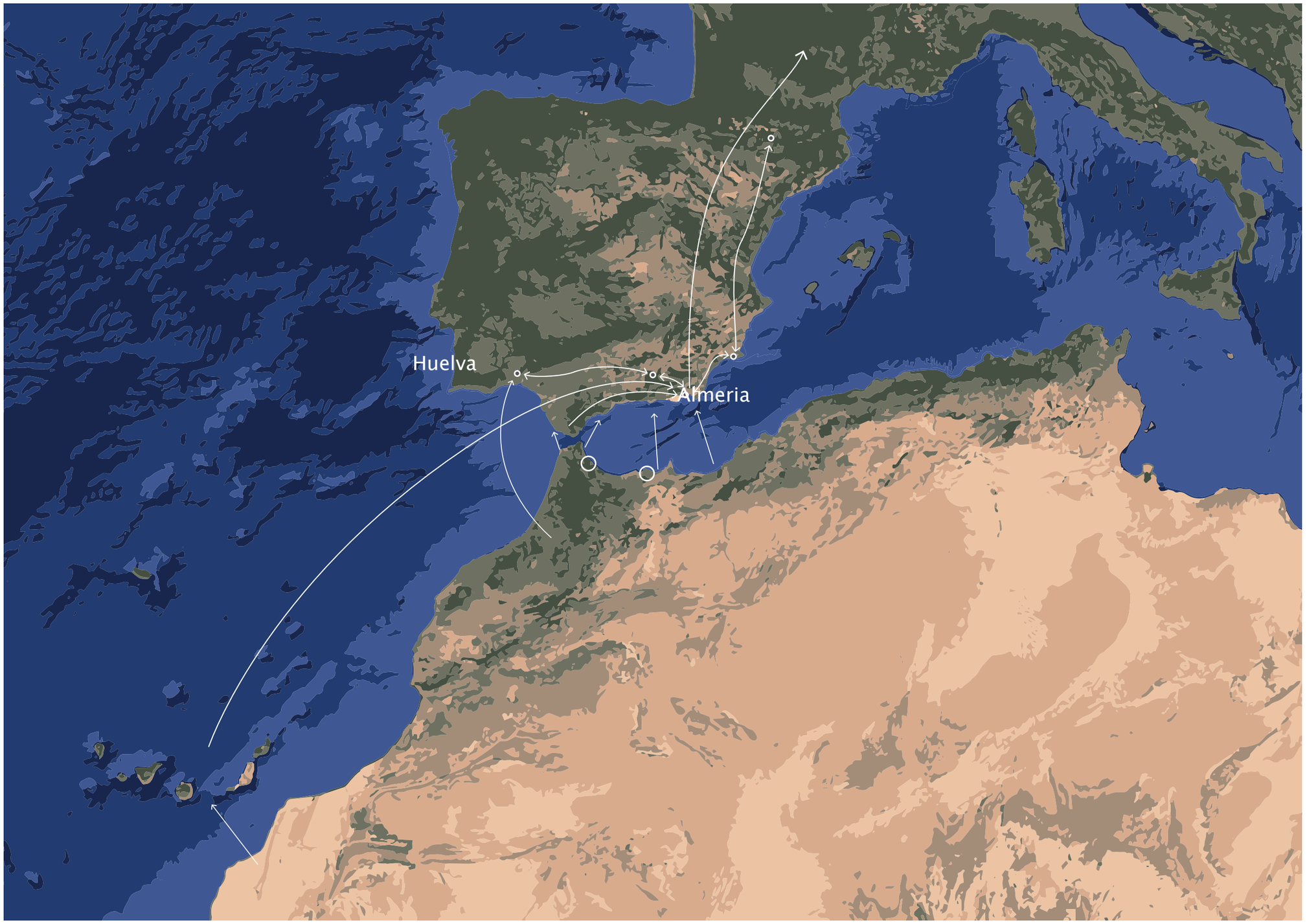
Crop rotation



July & August

(INE, 2021)

Almeria, a stop in the migration route



https://www.lasvocesdelpueblo.com/los-asentamientos-de-los-inmigrantes-en-almeria-sin-ningun-caso-de-coronavirus/

Informal settlements

Vertical settlements

In overcrowded housing in urban areas

Horizontal settlements

Shantytowns outside urban areas

Abandoned dwellings outside urban areas

Rented farmhouses in inapropiate conditions

https://elpais.com/elpais/2020/05/06/migrados/1588766943_372073.html

Informal settlements

Informal settlements

Informal settlements

Fluctuating every year, between 5000 and 7000 migrants recieve atention from the Red Cross in Horizontal informal settlements.

Demographics of migrants living in informal settlements

Men

Morroco about 65 %
Senegal
Mali
Ghana

Women

Morocco
Nigeria
Guinea Ecuatorial

Solitary people	73,55%
People that form part of a family group	26,45%

https://www.lasvocesdelpueblo.com/los-asentamientos-de-los-inmigrantes-en-almeria-sin-ningun-caso-de-coronavirus/

https://elpais.com/elpais/2020/05/06/migrados/1588766943_372073.html

Ayuntamiento de Níjar. (2017). Plan municipal de vivienda y suelo. http://www.nijar.es/Servicios/Anexos/Anexos.nsf/A90DA33F9130238BC12582C20039DA8D/$file/Documento%20de%20informaci%C3%B3n%20y%20diagn%C3%B3sti-co_PMVS.pdf

The need for housing alternative

Problems that migrants experiencec living in informal settlements

Most of these informal settlements do not have access to sanitation, water and electricity. Although some have access to the general network in an irregular manner.

Fires.

Homelessness, being a stranger, having an addiction, having a mental health problem, are very difficult situations to overcome for many migrants.

Newly arrived migrants, who do not know the language, are socially excluded in settlements.

They live surrounded by agricultural waste,.

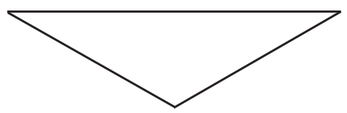
The distance between settlements and urban areas leads to segregation and marginalisation.

Design proposal

Housing alternative for migrants living in iformal settlements.

Developers

Municipality



Agriculture companies

NGOS

Financing

Municipality

Agriculture companies

Interests in the project

Migrant workers

Desire for affordable decent housing taking into account fluctuations in the employment market of the agriculture sector and low wages.

Desire for security and prosperity.

Municipality

Improve the public image of the current conditions of the settlements.

Improve the public life of the people of the municipality.

To promote employment through construction. Improvements in the quality of life of the inhabitants.

Agriculture companies

Improve the living conditions of workers, with a possible improvement of their employment benefits.

Improve the image of their companies and the conditions of their employees.

NGOS

Reduce the workload in relation to the problems faced by migrants residing in informal settlements.

Housing alternative for newly arrived migrants in Almeri.

Design objectives

Environmental resilience

Reduce the environmental footprint during construction and use of the buildings.

Comfortable low tech climate design with low tech climate design strategies.

Materialization with local materials with a minimum carbon footprint.

Resilience against environmental hazards: torrential rains.

Promote biodiversity inbetween the plasticspace

Social resilience

Promote social interaction and integration of the migrant community

Generate local employment with low tech and low skilled construction methods.

Adaptation to the fluctuating demand of housing for seasonal agriculture workers

Other objectives

Contextualization of the project in relation to the local popular vernacular architecture.

Research for design: Low tech climate design

Research problematics and research question

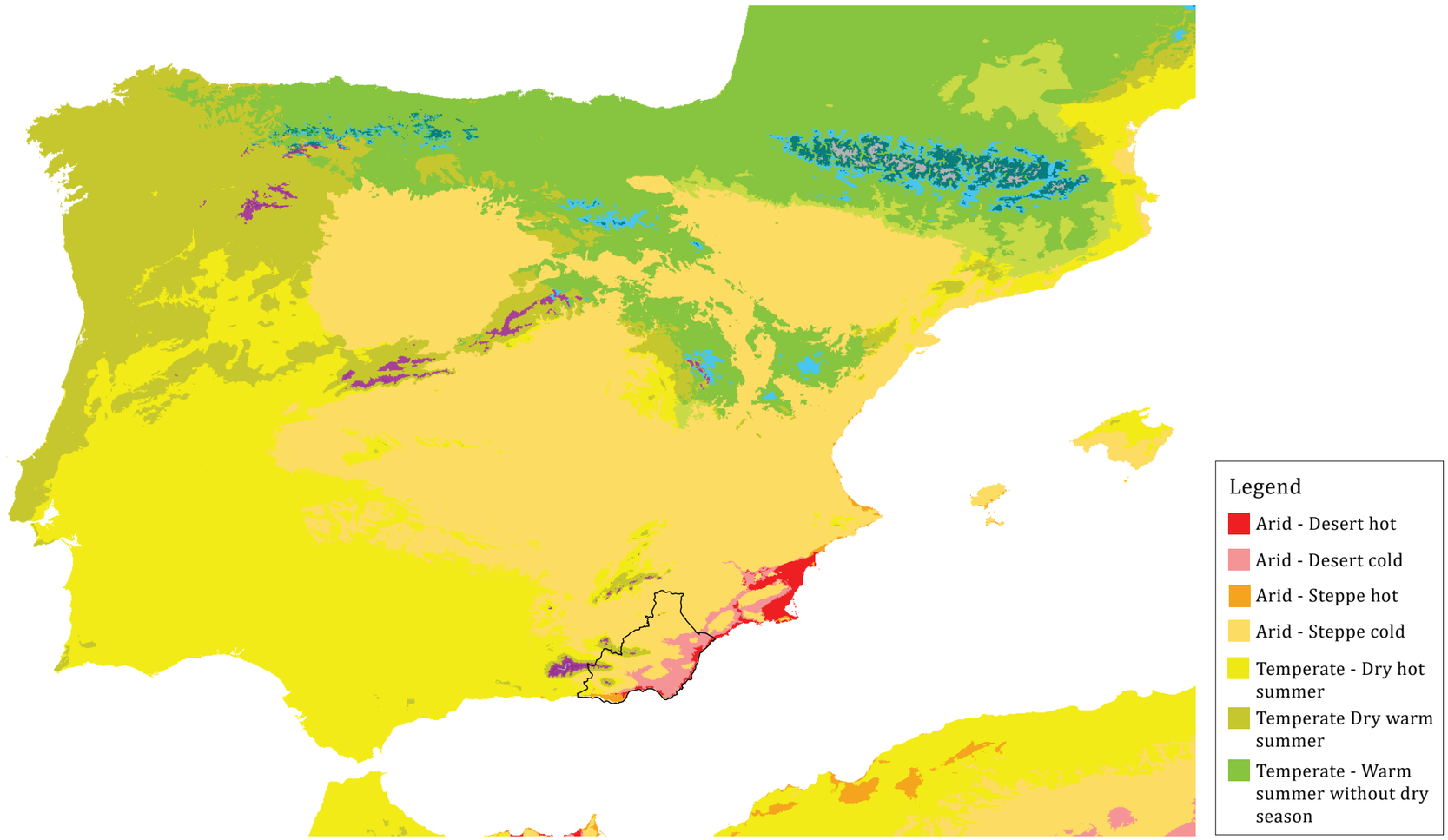
18% of the population suffers **energy poverty** **in Almeria.**

Construction sector is responsible for **40%** of the total **C02 emissions** generated.

Research question

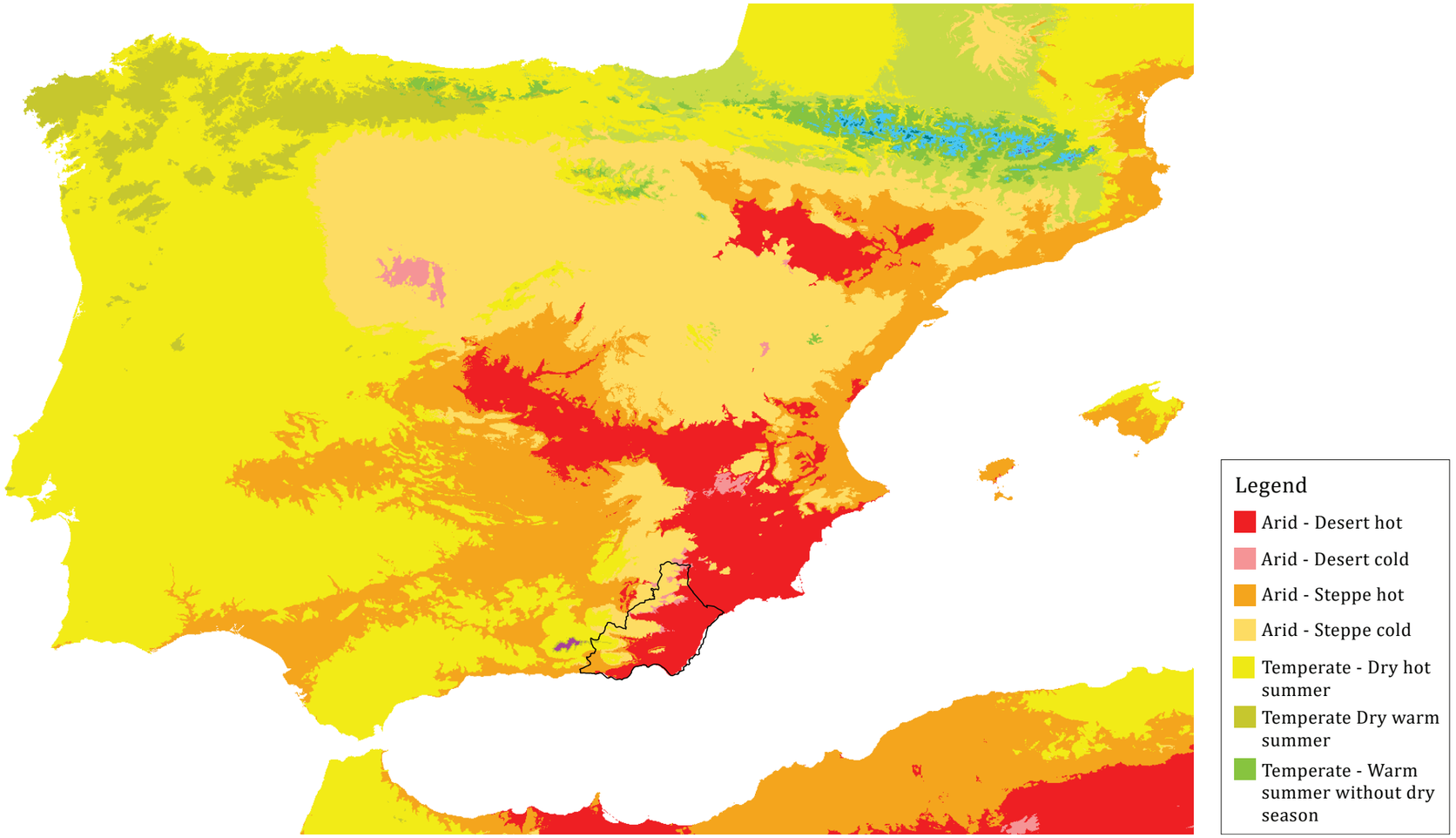
How could low-tech passive urban and housing design achieve comfortable exterior and indoor climates in the arid hot desert climate of Almeria?

Climatic zones Iberian peninsula



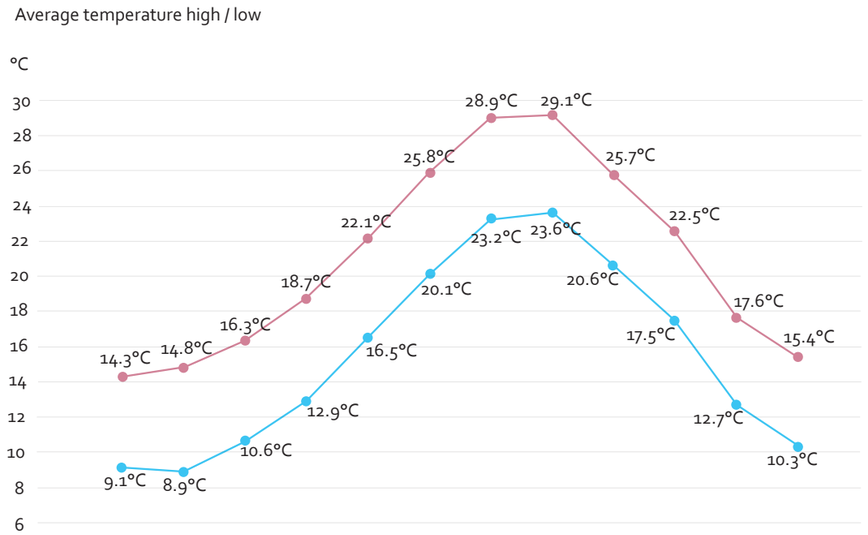
Beck, H.E., N.E. Zimmermann, T.R. McVicar, N. Vergopolan, A. Berg, E.F. Wood: Present and future Köppen-Geiger climate classification maps at 1-km resolution, Scientific Data 5:180214, doi:10.1038/sdata.2018.214 (2018).

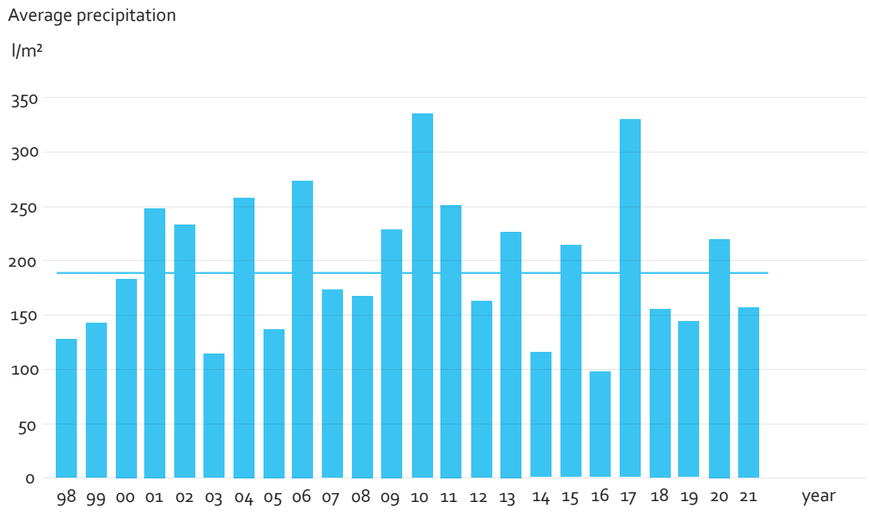
Climatic zones Iberian peninsula in the context of climate change

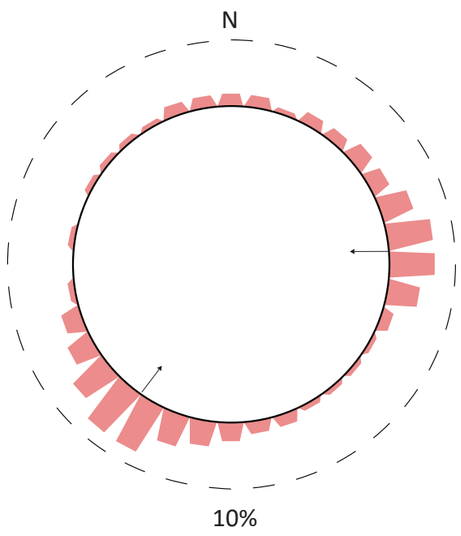


Beck, H.E., N.E. Zimmermann, T.R. McVicar, N. Vergopolan, A. Berg, E.F. Wood: Present and future Köppen-Geiger climate classification maps at 1-km resolution, Scientific Data 5:180214, doi:10.1038/sdata.2018.214 (2018).

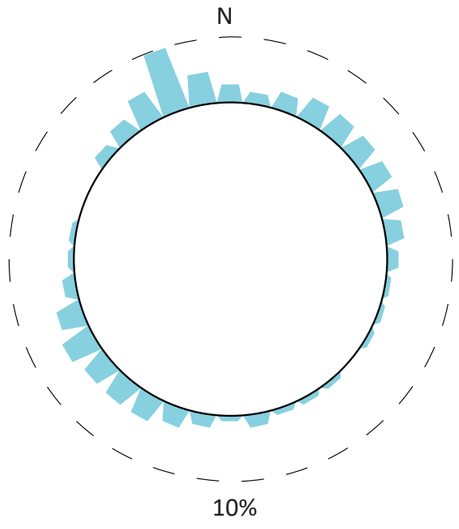
Climatic parameters in Almeria



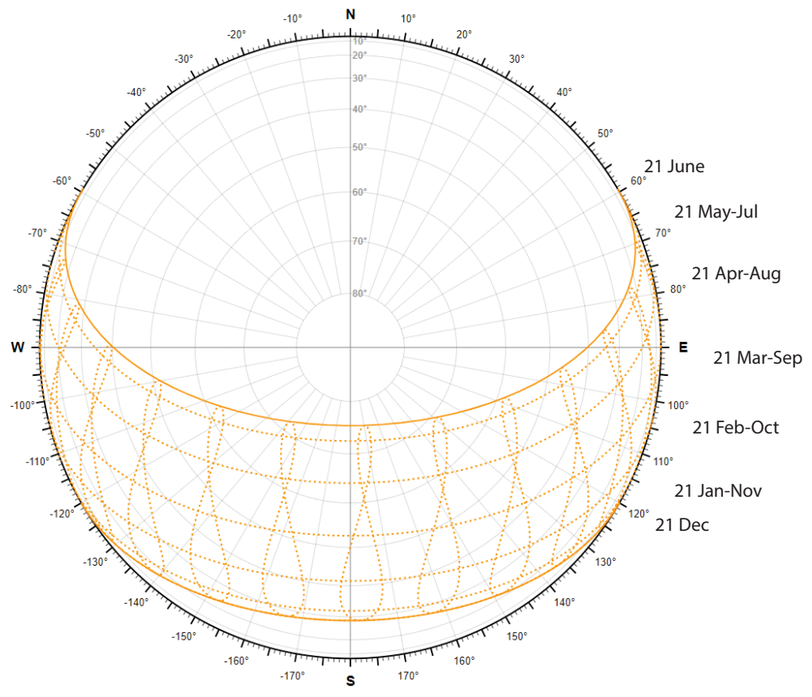




Wind directions June - October

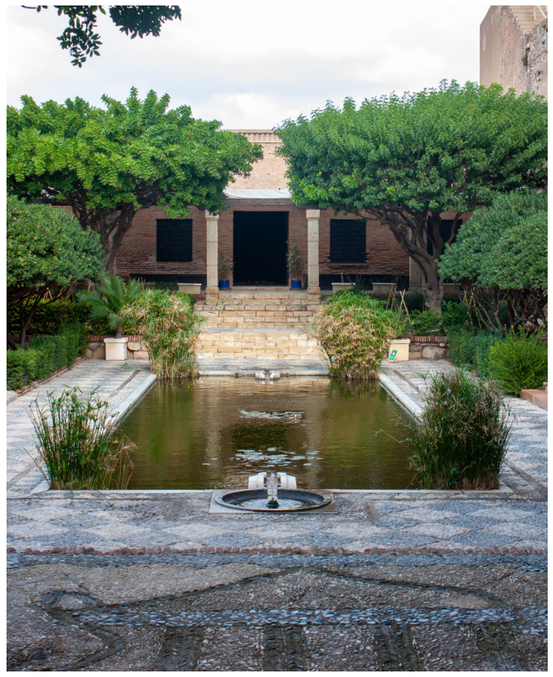


Wind directions November - May







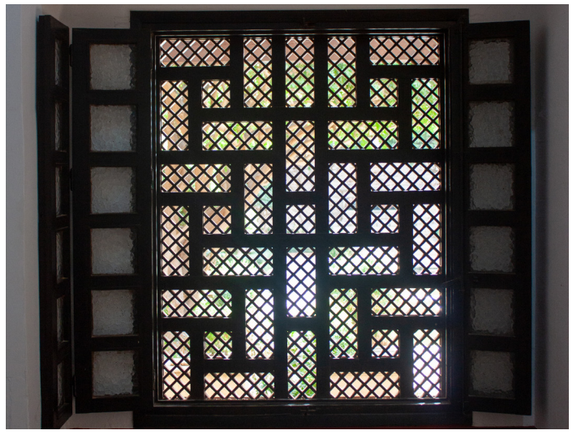






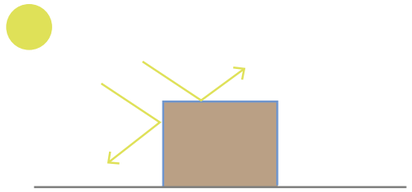


5



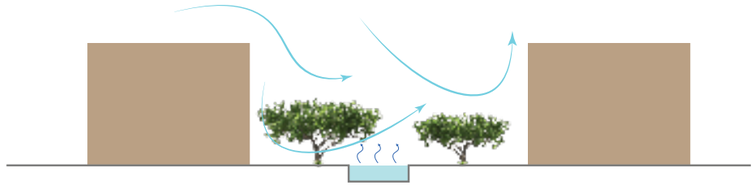
Research results: Urban scale

Vernacular climate adaptation: Cooling

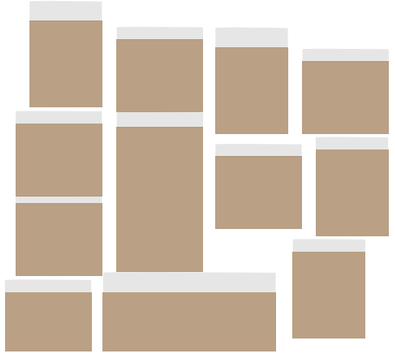


White facades with lime mortar to reflect solar radiation.

Protecting constructions againts solar radiation with vegetation .

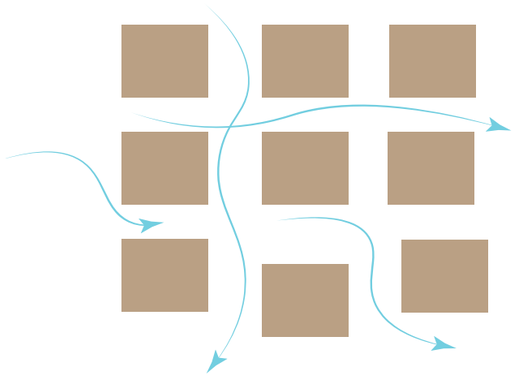


Open courtyards to promote ventilation and water ponds to generate evaporative cooling.

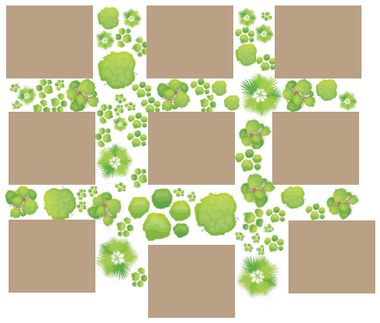


Narrow strees to create shadowed streets.

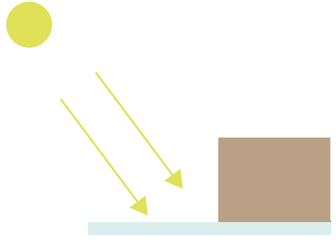
Passive design strategies: Cooling



Generate inbetween spaces for wind circulations.



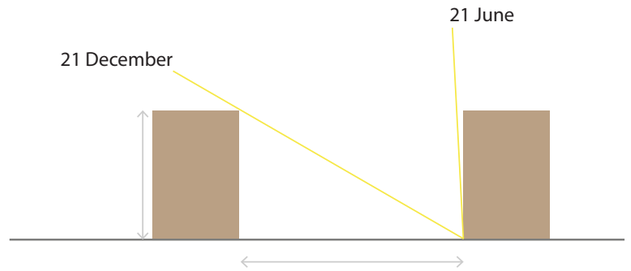
Creating microclimate zones with vegetation.



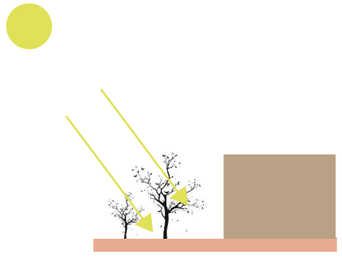
Avoid materializations around buildings with heat absorbing materials.

Generate evaporative cooling with facade systems.

Passive design strategies: Heating



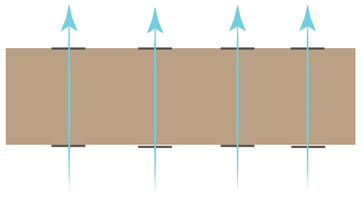
Ensure solar radiation during the winter.



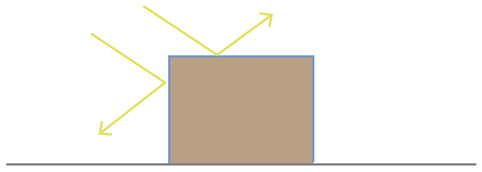
Use of decidious trees to allow solar radiation on buildings during the winter.

Research results: Building scale

Vernacular climate adaptation: Cooling

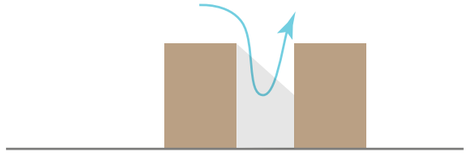


Promote cross ventilation.

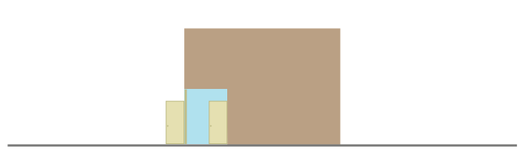


White facades to reflect solar radiation.

Stereotomic architecture with small window openings.

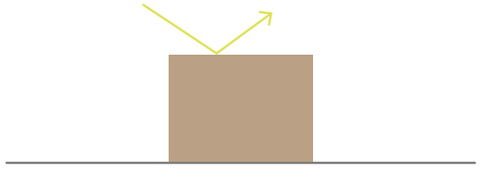


Interior patios for ventilation and entrances of daylight.

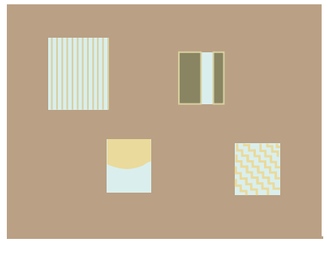


Protected entrance and buffer zones.

Vertical clearstories to allow the acces of natural daylight while avoiding solar radiation.



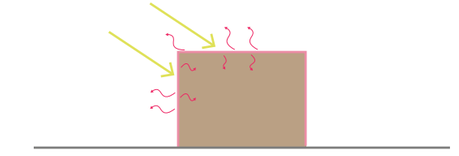
Flat roofs to minimize sun exposure.



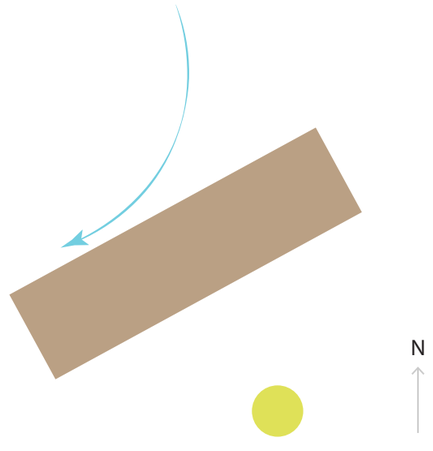
Exterior window shuttes from wood and mashrabiyas to create an adaptative crontrol solar radiation.

Terraces and pergolas to create shaded exterior spaces.

Vernacular climate adaptation: Heating



Materialization with stones and earthmortar, creating a thermal mass shell to heat interior spaces.



Avoid building orientations towards prevaling winds during winter season.

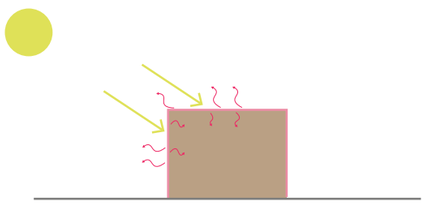
Research results: Building scale

Passive design strategies: Heating

Narrow and long typologies with north south orientation to maximize exposure towars solar radiation

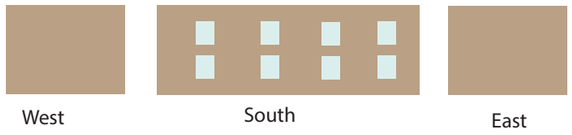
WWR 20%

Window wall ration below 20% to reduce heat loss.



Materialization with stones and earthmortar, creating a thermal mass shell to heat interior spaces.

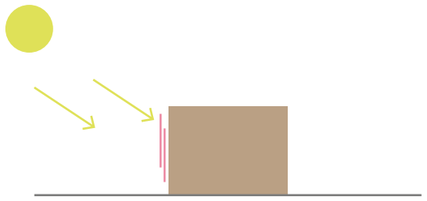
Passive design strategies: Cooling



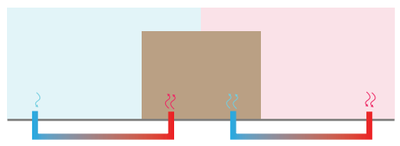
Avoid window openings on east and west facades to minimize uncontrolled heat gain when the sun position is low.

WWR 20%

Window wall ration below 20% to avoid heat gain from solar radiation.



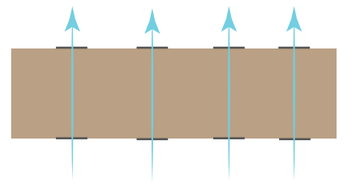
Avoid heat absorbing materials.



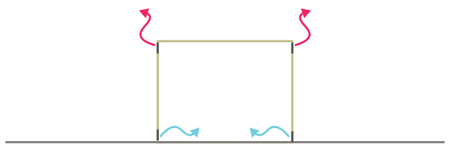
Heat exchange with underground ventilation.

Passive design strategies: Cooling / Ventilation

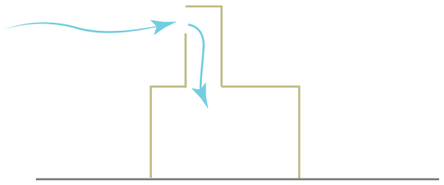
Openings oriented towards prevailing winds to promote air ventilation



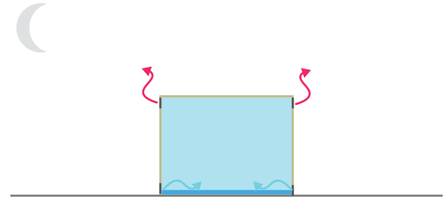
Promote cross ventilation.



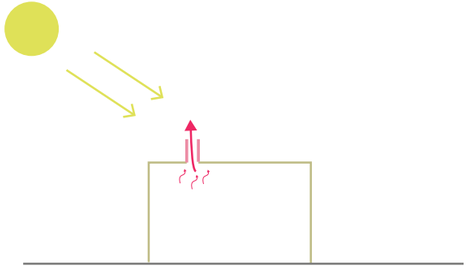
Openings for natural ventilation.



Wind catchers for interior air ventialtion

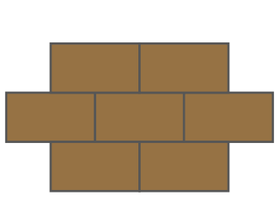


Night flushing: ventilating during night time

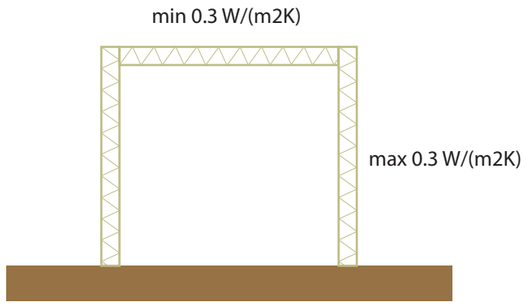


Solar chimneys to exhaust heat in interior spaces.

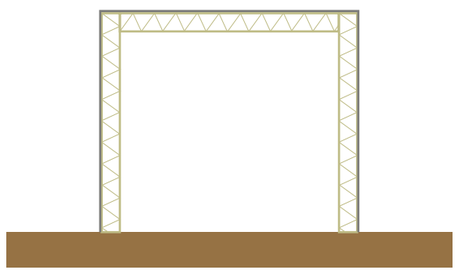
Research results: Material scale

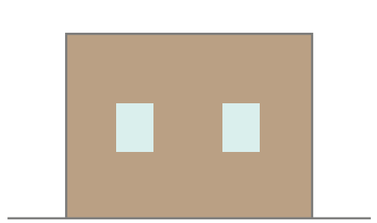


Materialization with thermal mass materials.



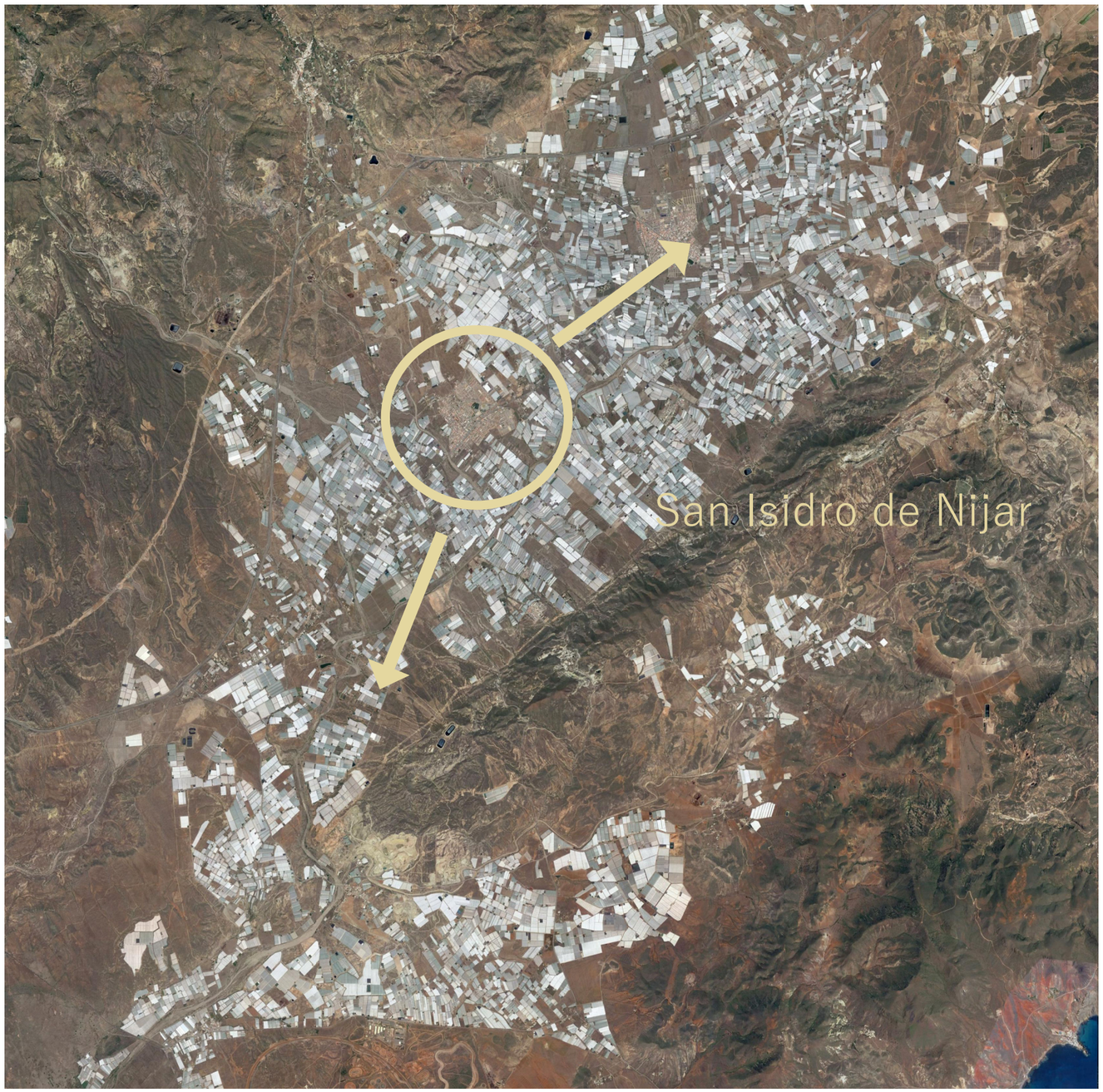
Thermal insulation.





How? Design process and strategies

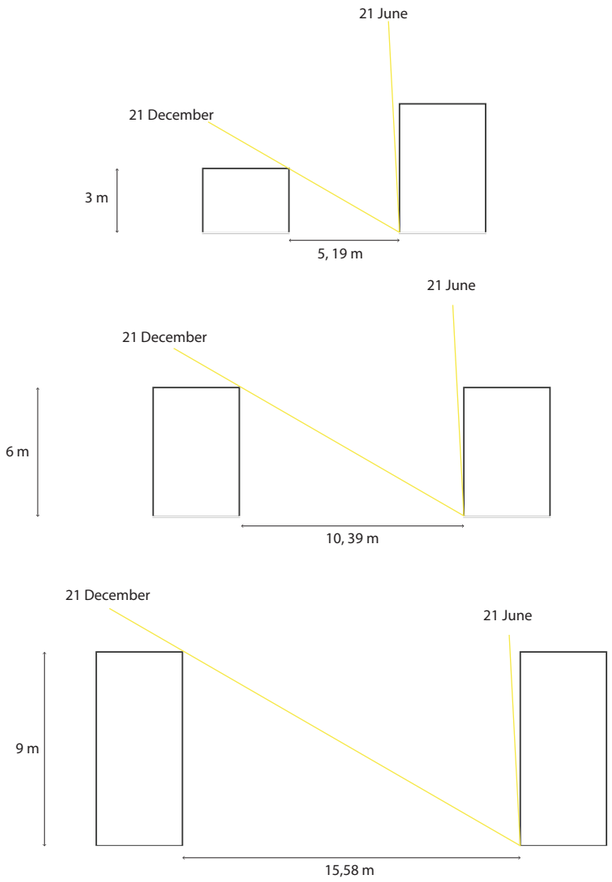
Urban scale strategies – Intervention site and the agriculture sector

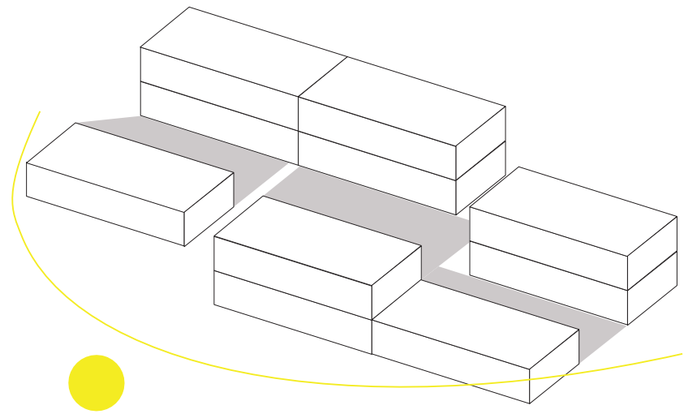


Urban scale strategies – Context – Connection with public transport and facilites

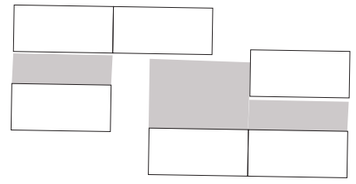
Urban scale strategies – Context – Connection with public transport and facilites

Urban scale strategies – Climate design –Enable sun radiation on every dwelling during the winter season for passive solar heating

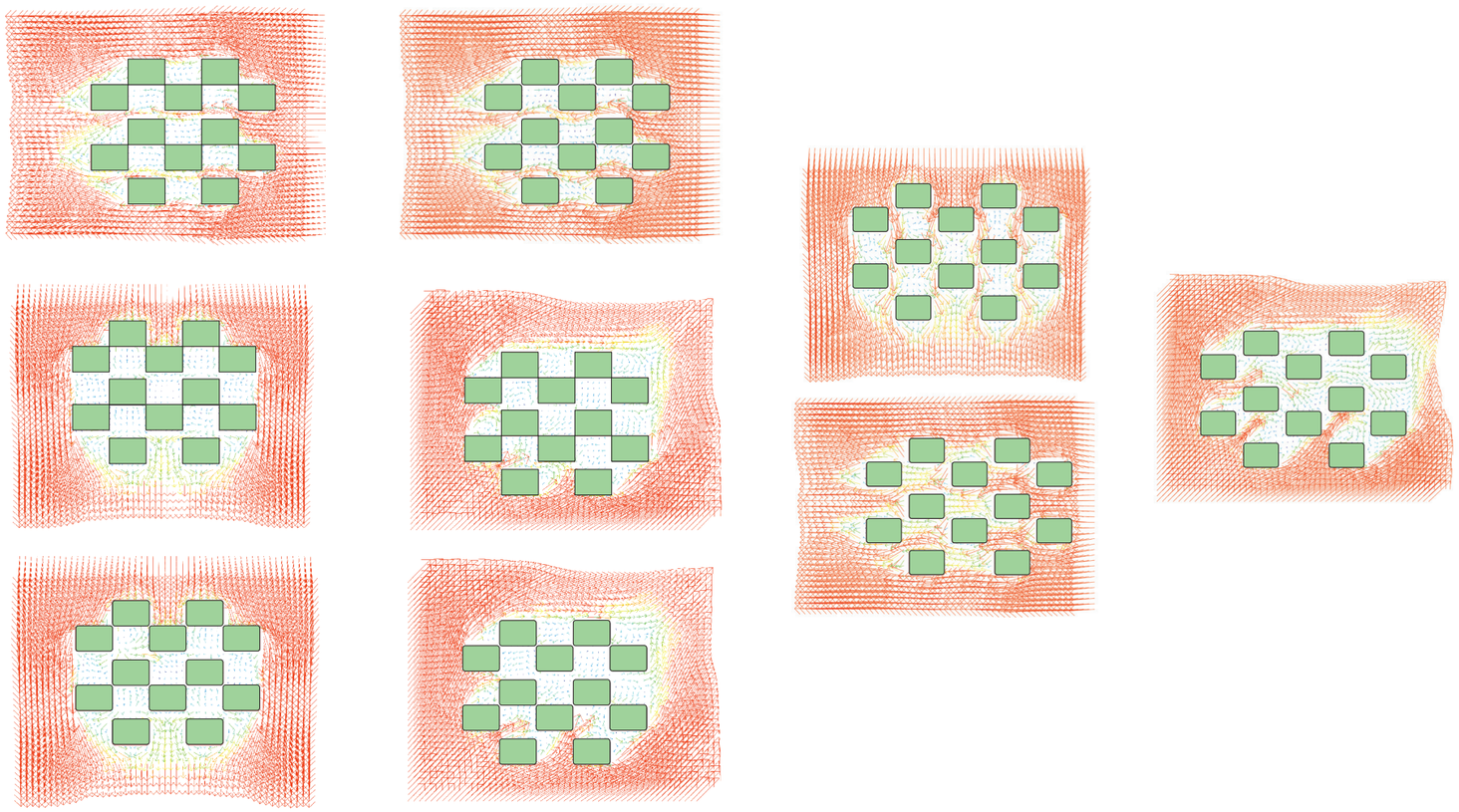




21 December

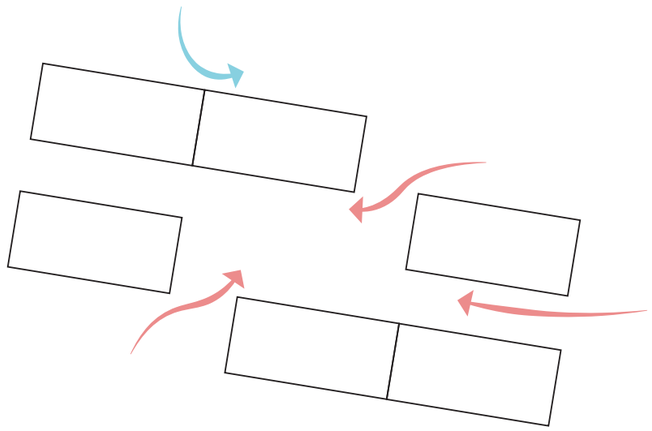


Urban scale strategies – Climate design – Wind analysis

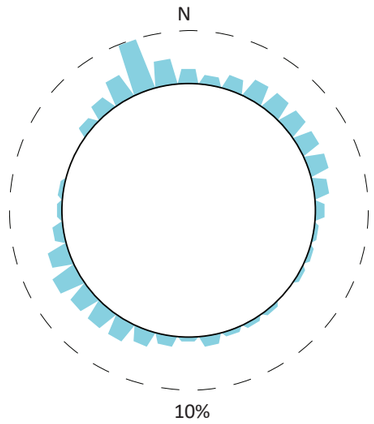


Kastner, P., & Dogan, T. (2021). Eddy3D: A toolkit for decoupled outdoor thermal comfort simulations in urban areas. Building and Environment, 108639.

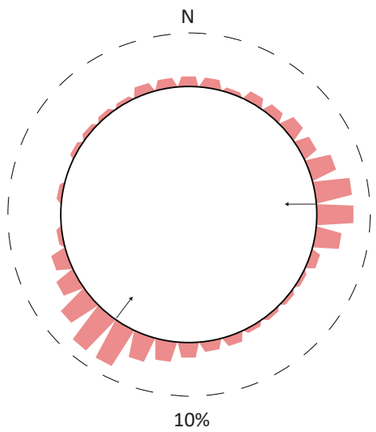
Urban scale strategies – Climate design –Promote prevailing wind circulations during the summer season through inbetween spaces and towards the building volumes.



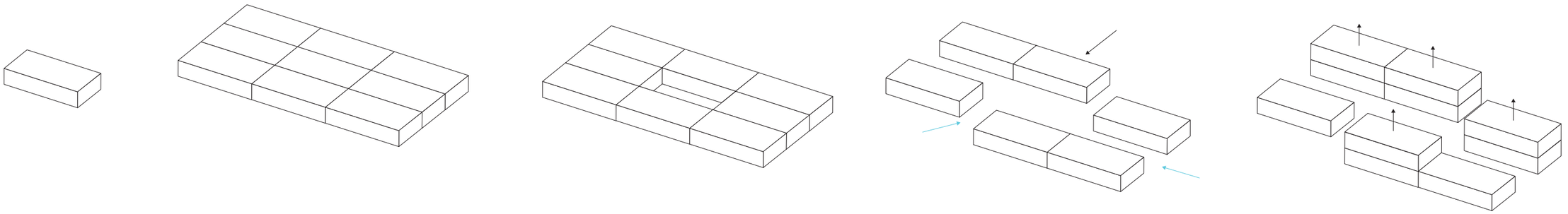
Wind directions during cold season



Wind directions during warm season



Urban scale strategies – Cluster typology



Urban scale strategies – Climate design –Creation of microclimates and ecology with endemic vegetation

Limonium sinuatum

Stipa tenacissima

Hyparrhenia hirta

Helichrysum stoechas

Asteriscus maritimus

Thymus vulgaris

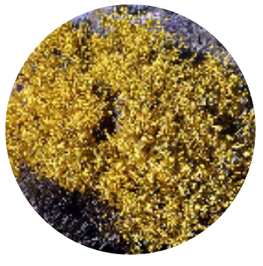
Asphodelus tenuifolius

Lycium intricatum

Ziziphus lotus

Ulex canescens

Thymelaea hirsuta



Genista spartoides

Urban scale strategies – Climate design – Creation of microclimates and ecology with endemic vegeta–

Olea europaea

Pinus halepensis

Ceratonia siliqua

Retama sphaerocarpa

Nerium oleander

Chamaerops humilis

Bougainvillea

Opuntia ficus indica

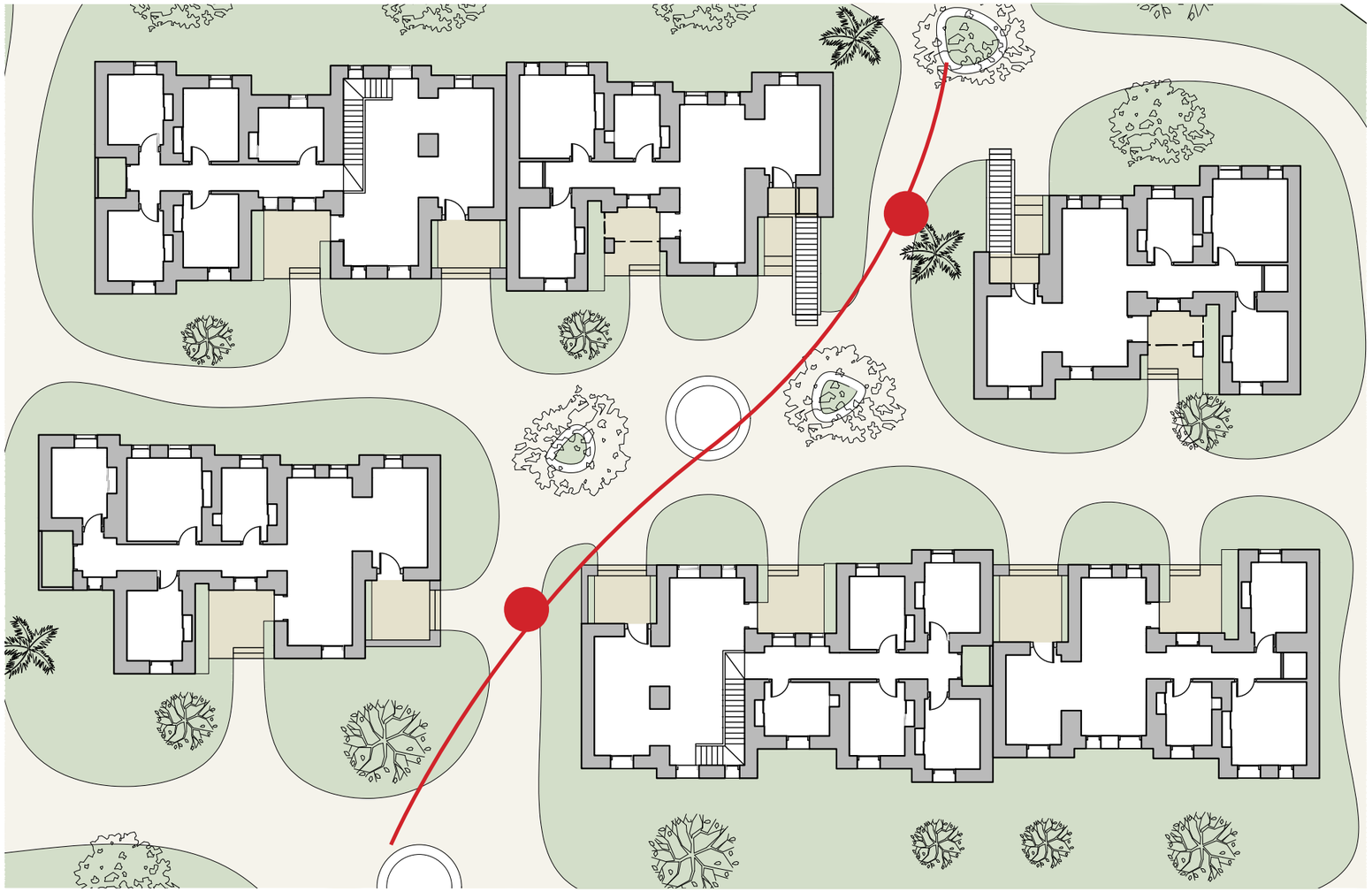
Urban scale strategies -Climate design - Creation of microclimates and ecology with endemic vegetation

Ficus carica

Eriobotrya japonica

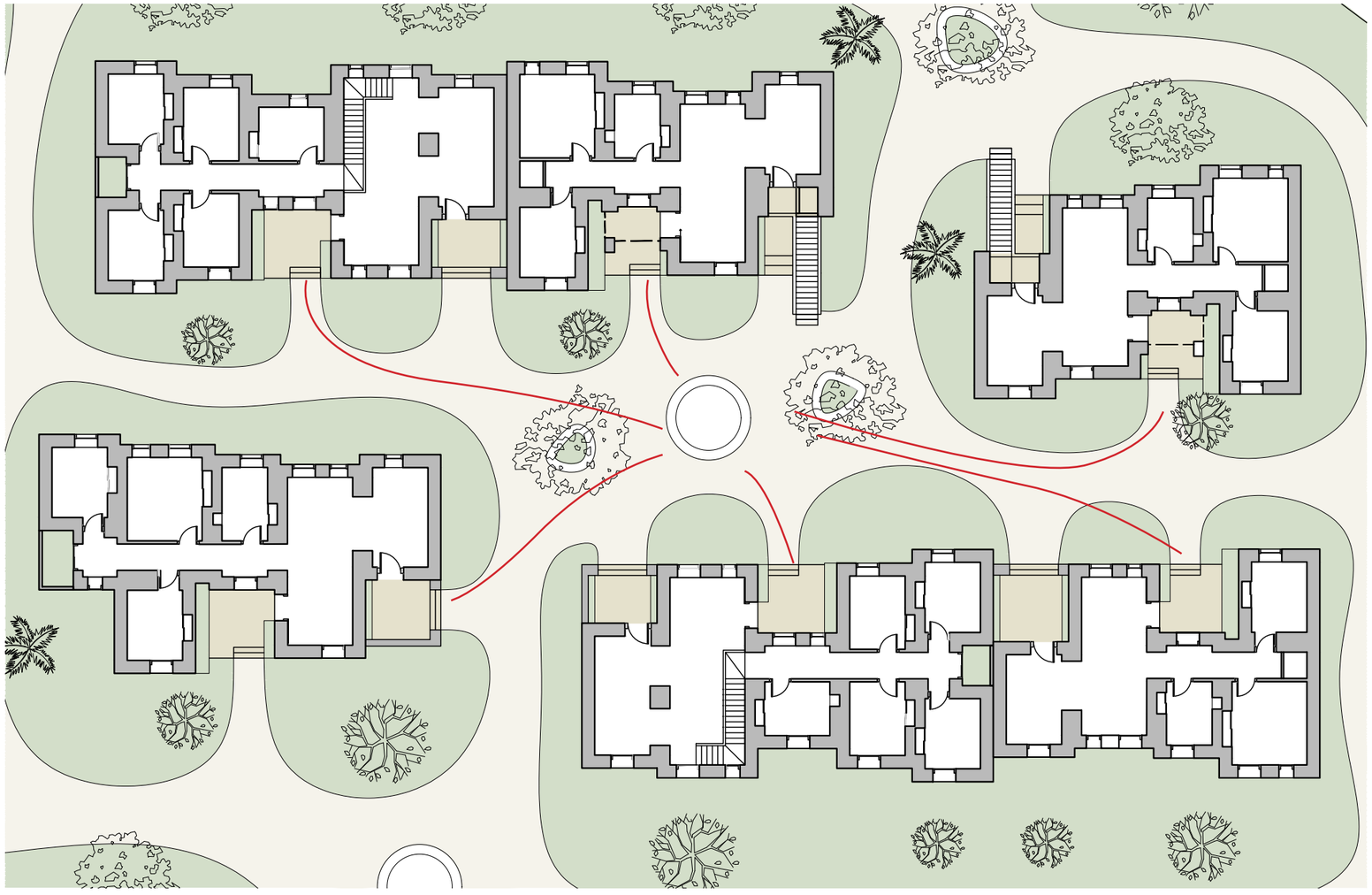
Urban scale strategies – Social strategies– Recreative spaces at the border of the

Urban scale strategies – Social strategies – Connectivity between circulation routes and dwelling entrances to promote interaction



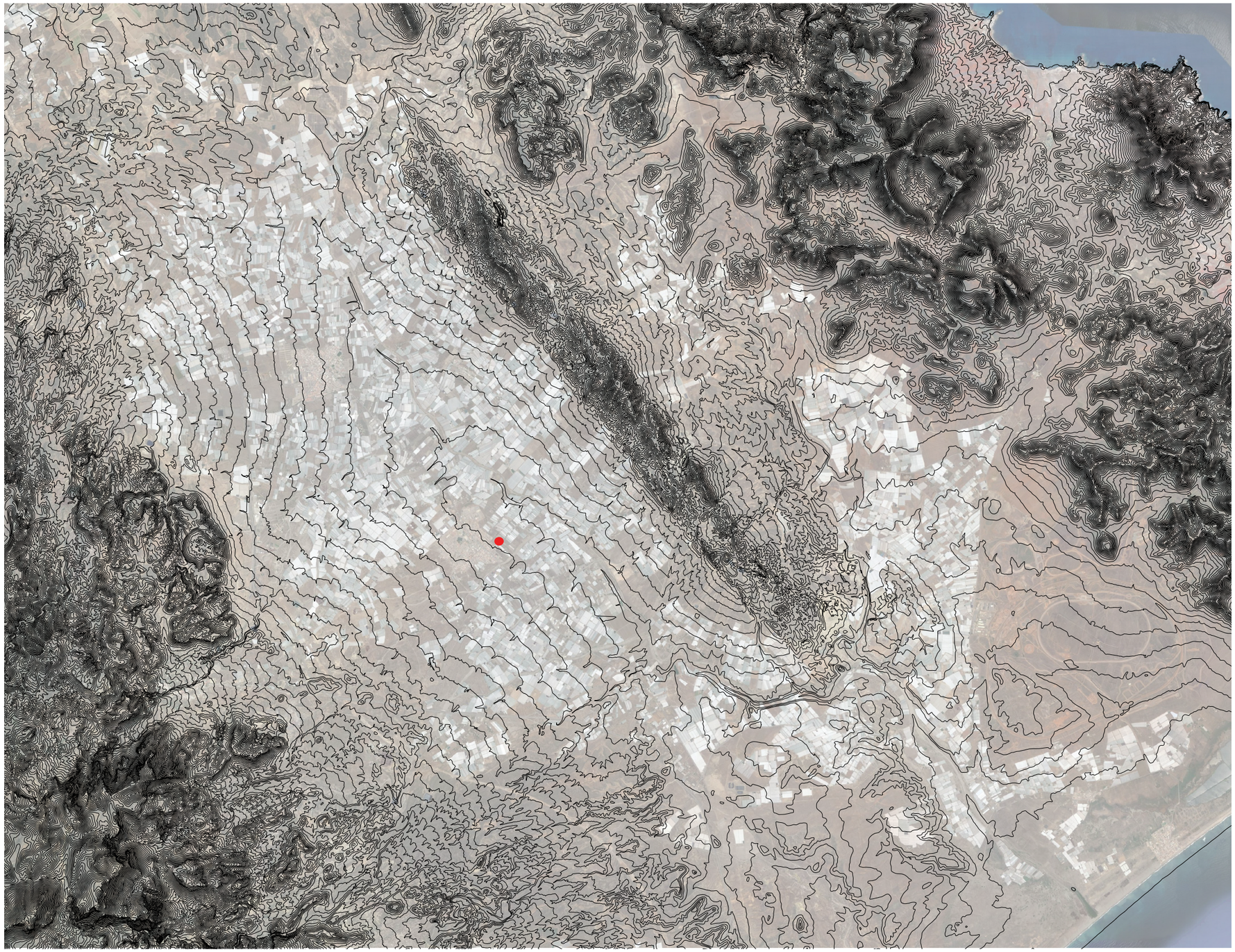
Urban scale strategies – Social strategies – Connectivity between circulation routes and dwelling entrances to promote interaction

Urban scale strategies – Social strategies – Collective courtyards

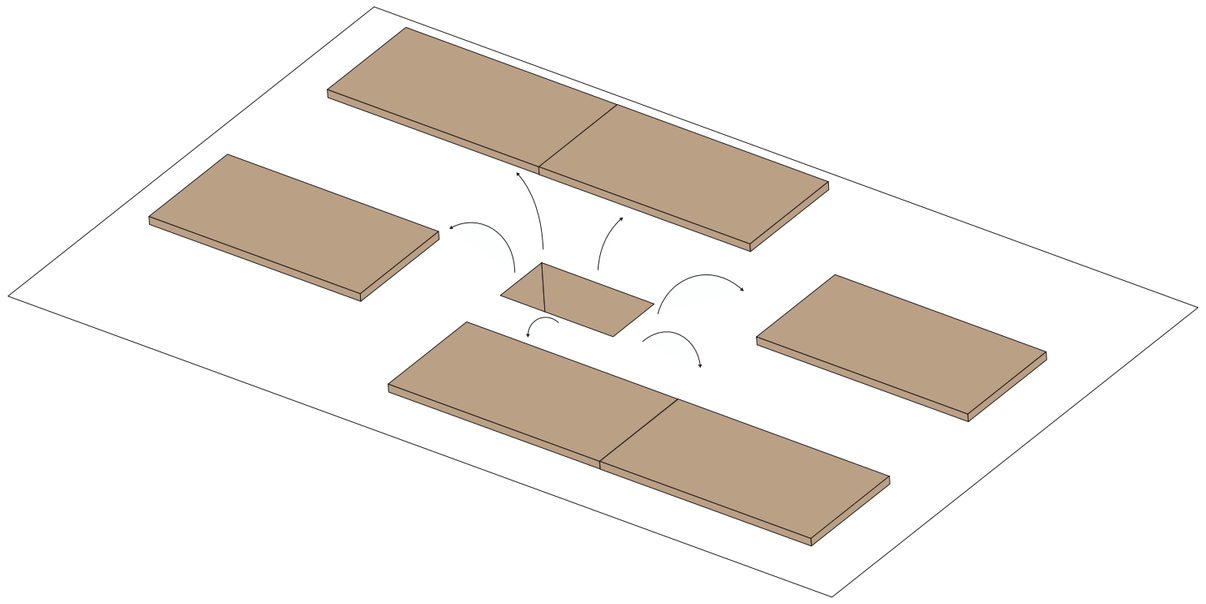


Urban scale strategies – Social strategies – Collective courtyards

Urban scale strategies –Resilience against torrential rains and water collection

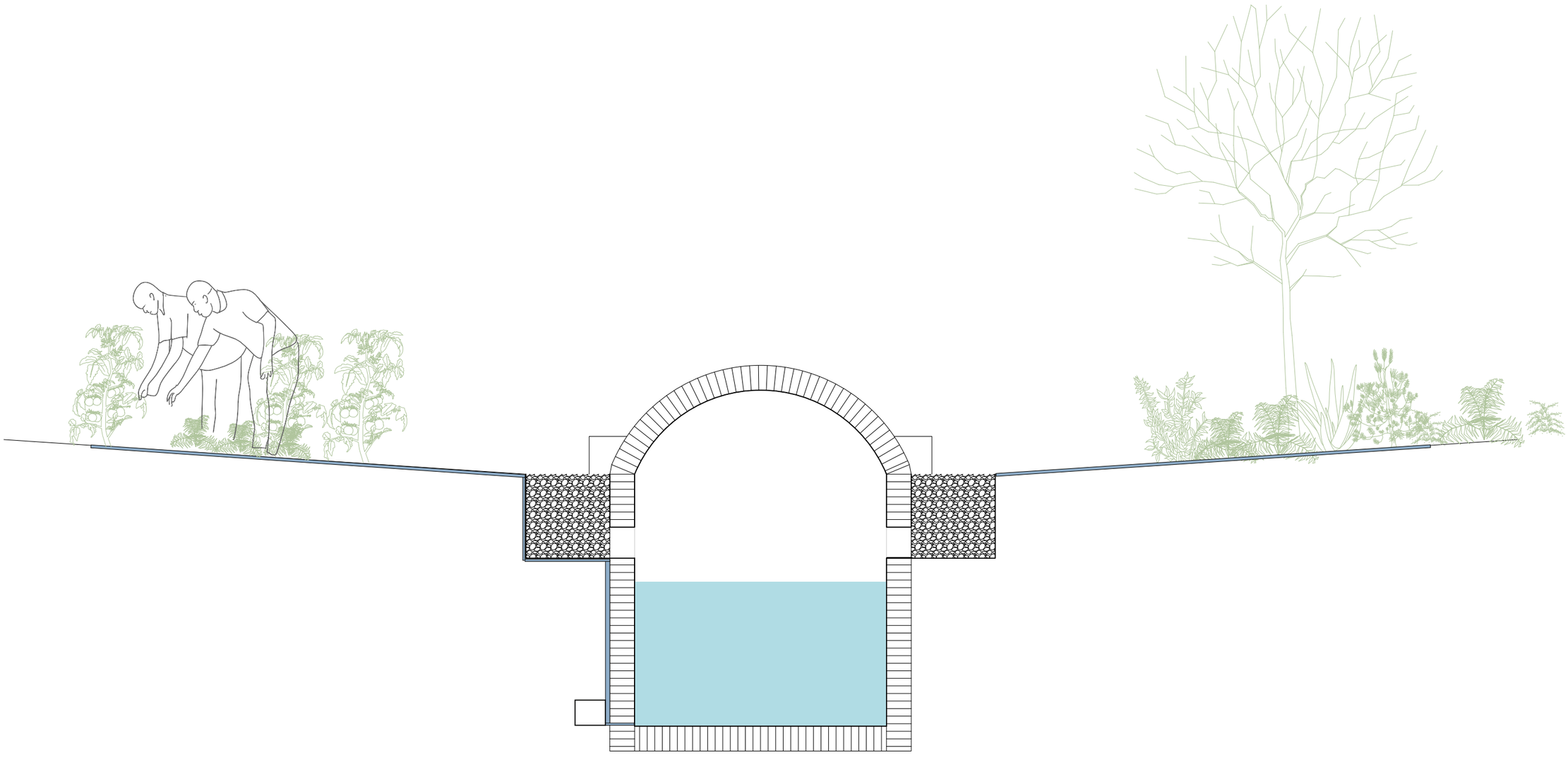


Urban scale strategies -Resilience against torrential rains and water collec-

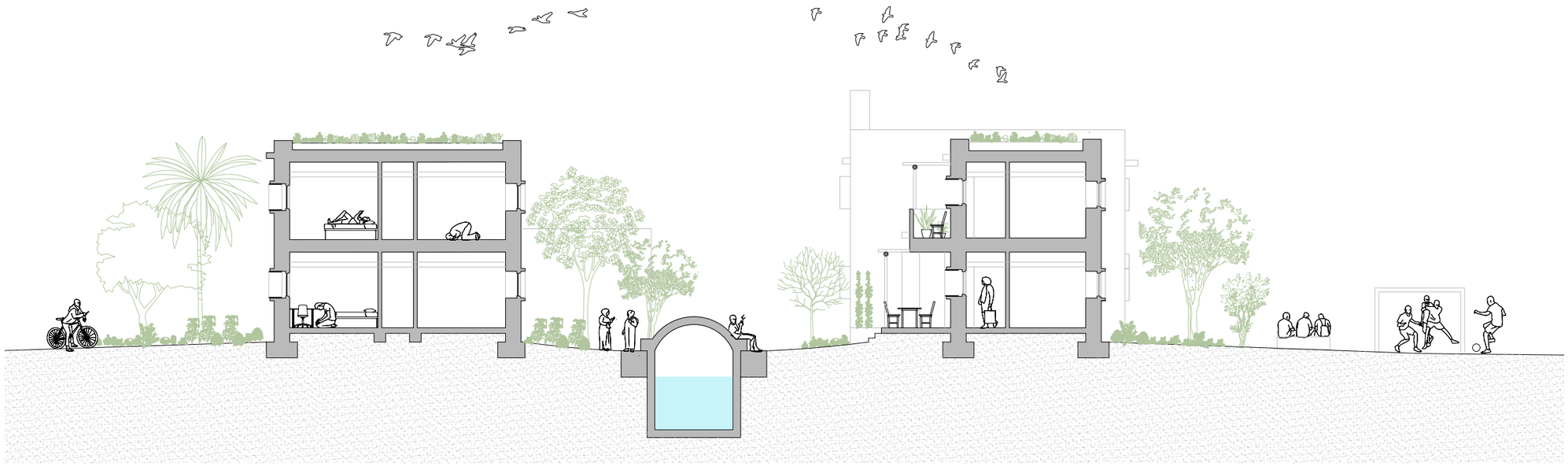


Urban scale strategies – Water collection aljibes

Urban scale strategies – Resilience against torrential rains and water collection

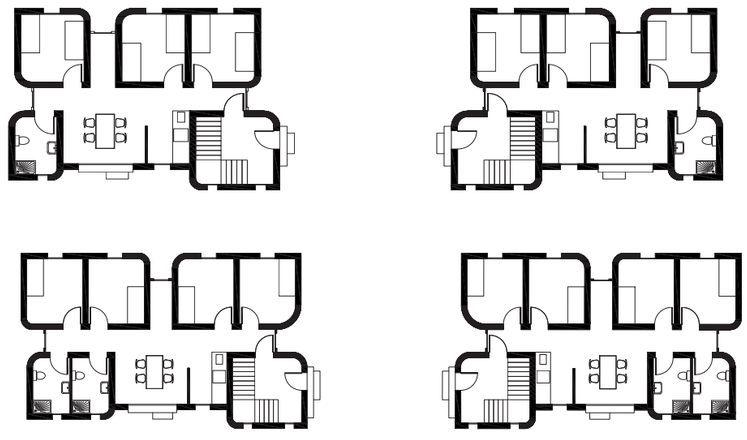


Urban scale strategies – Resilience against torrential rains and water collection

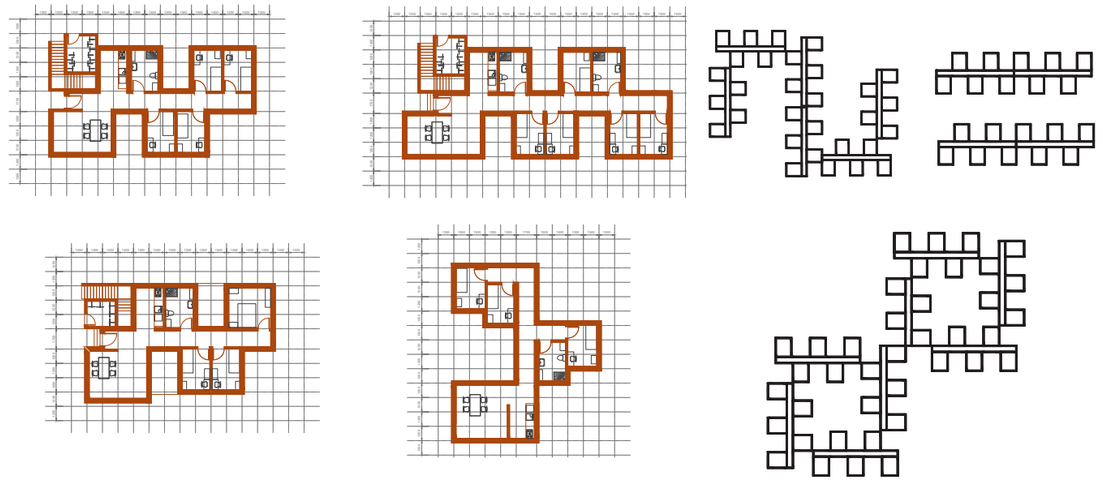


Building scale strategies – Climate design – Inspiration typology Cortijo

P2



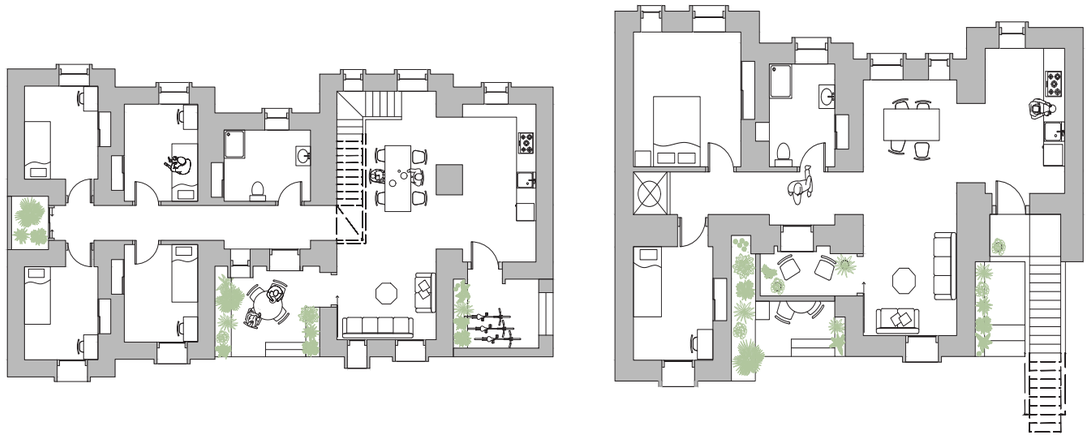
P3



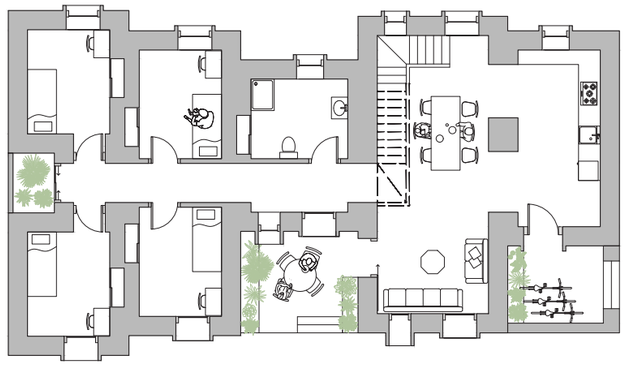
P4

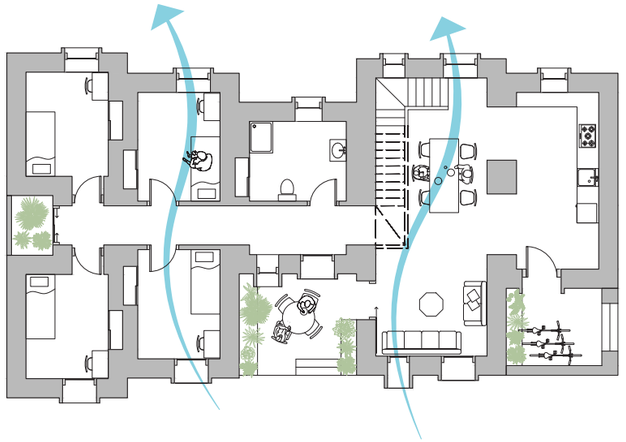

2560
2560
2560
2110
1500
2110
3235
915
1200
915
3235
2560
4000
5555
3455
2560
2110
2640
2560
3685
915
1200
915
3685
2560
3520
5555
2600

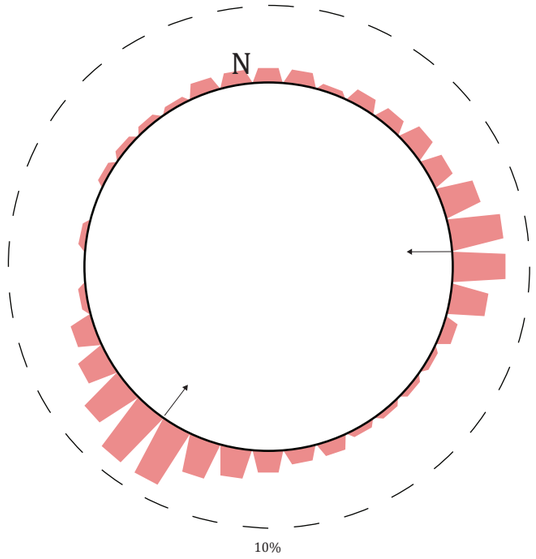
P5



Building scale strategies – Climate design – Typology inspired in the Cortijo

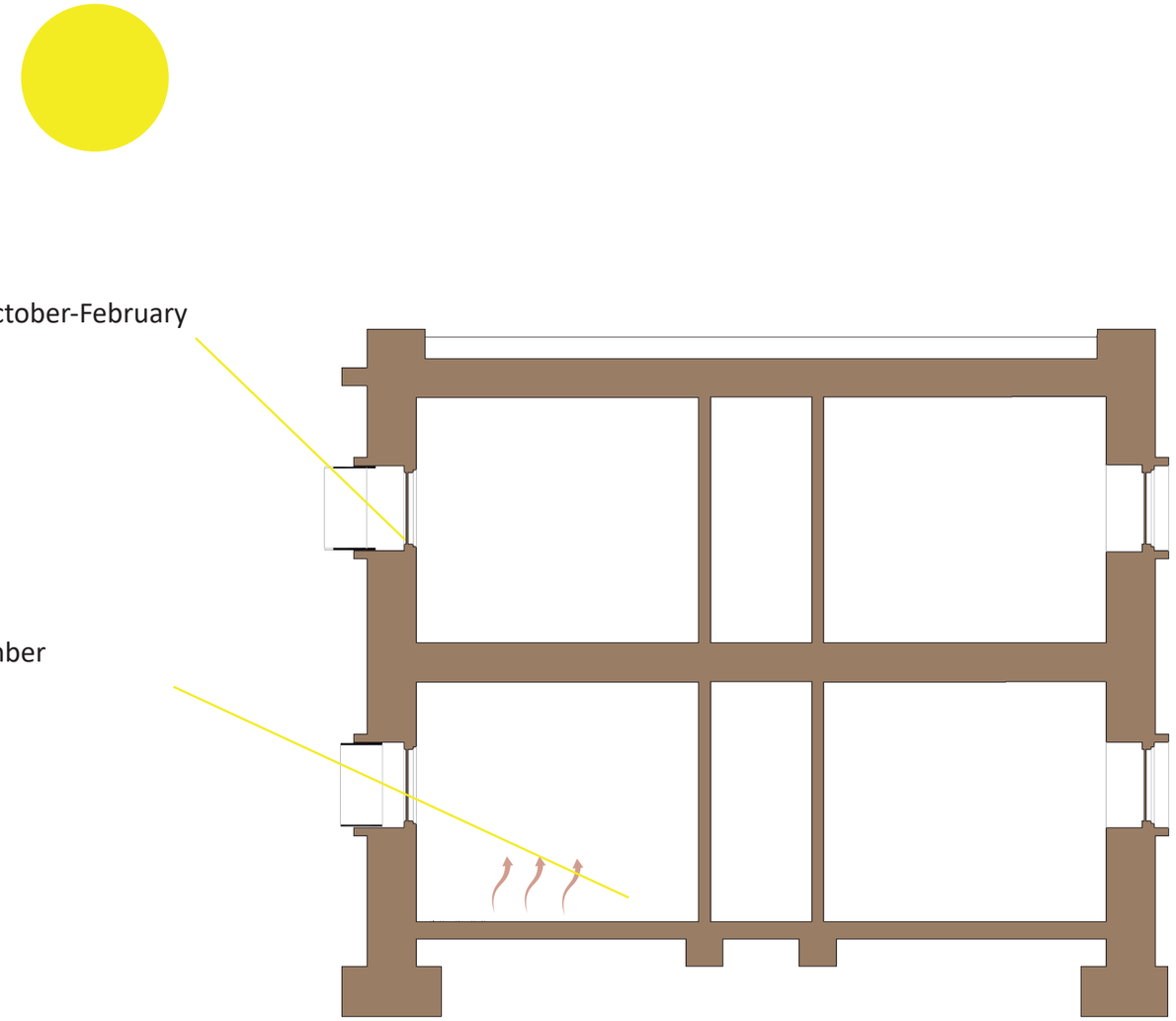






Wind directions during hot season

Building scale strategies – Climate design – Stereotomic architecture and white materialization


21 October-February
21 December

Building scale strategies – Climate design – Green walls on east and west facades

Vitis

Campis radicans

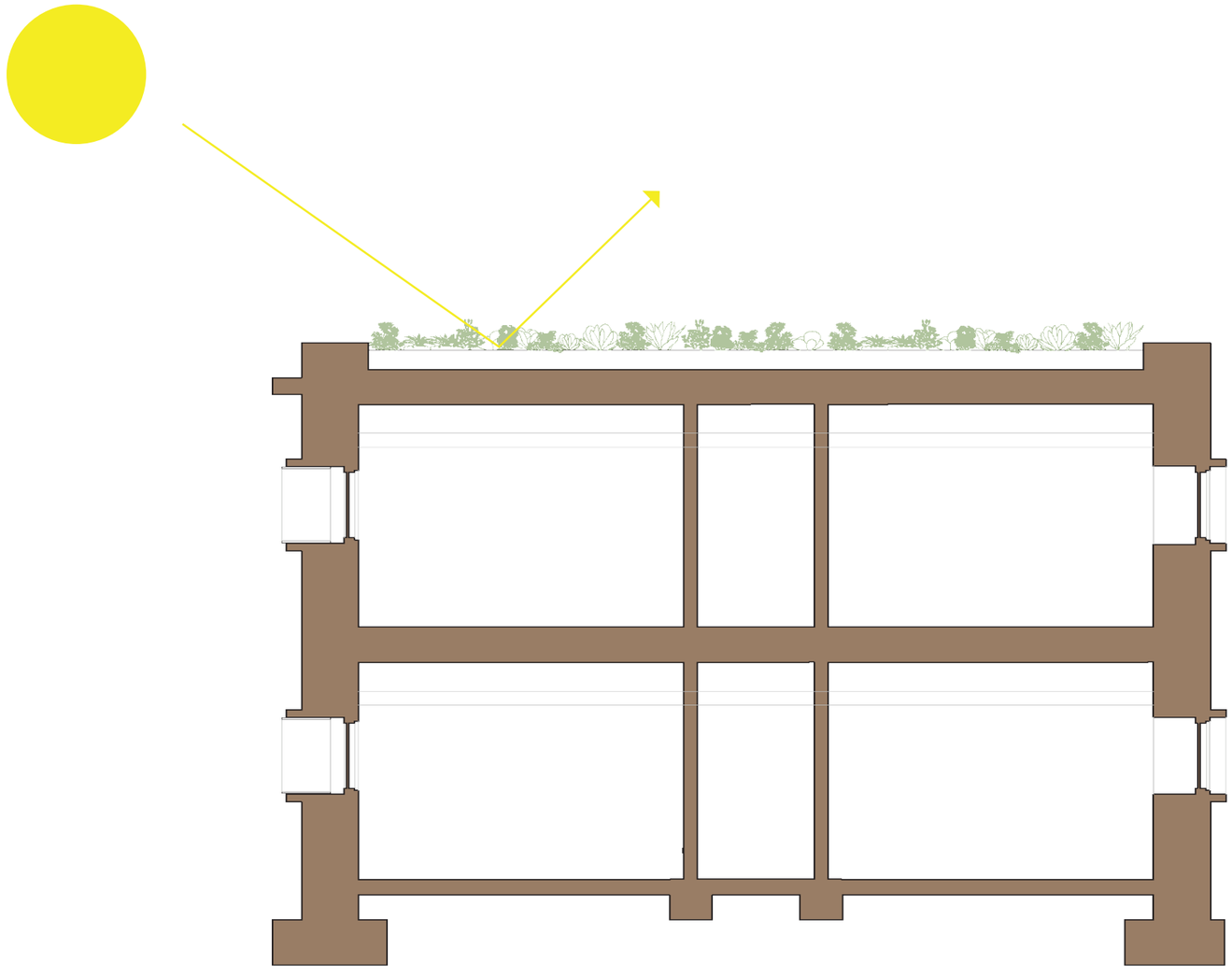
Plumbago

Wisteria sinensis

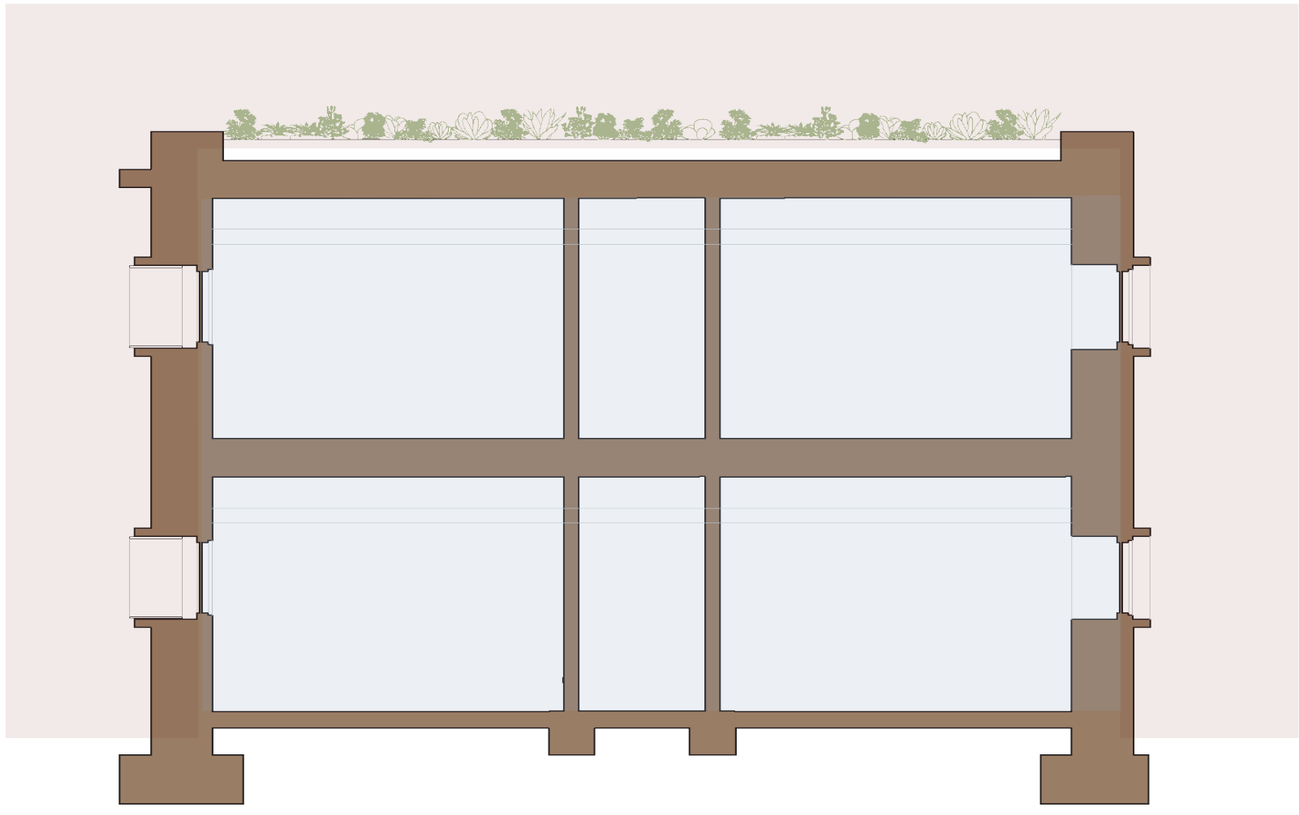
Clitoria ternatea

Ipomoea

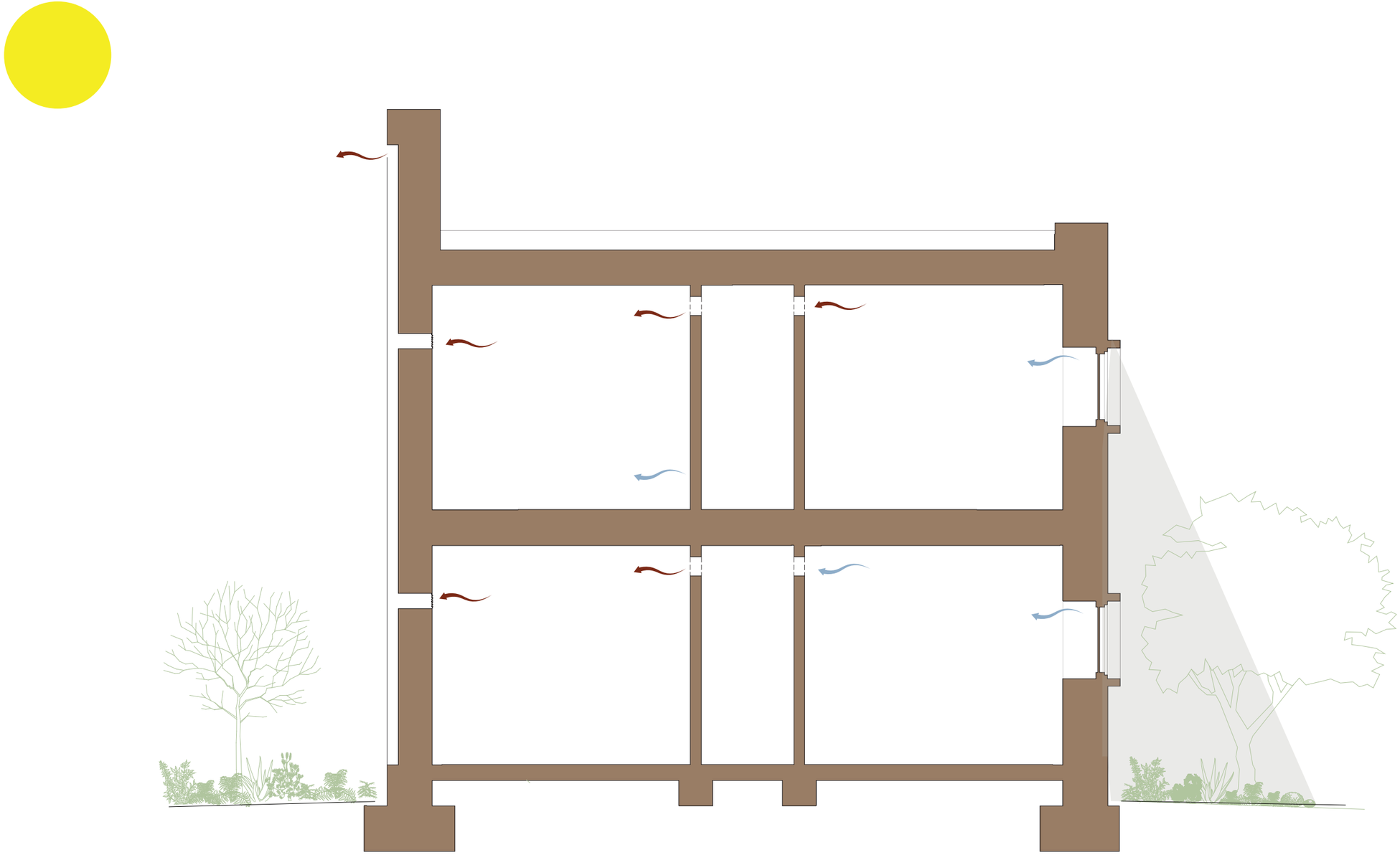
Building scale strategies – Climate design –Flat and green roofs



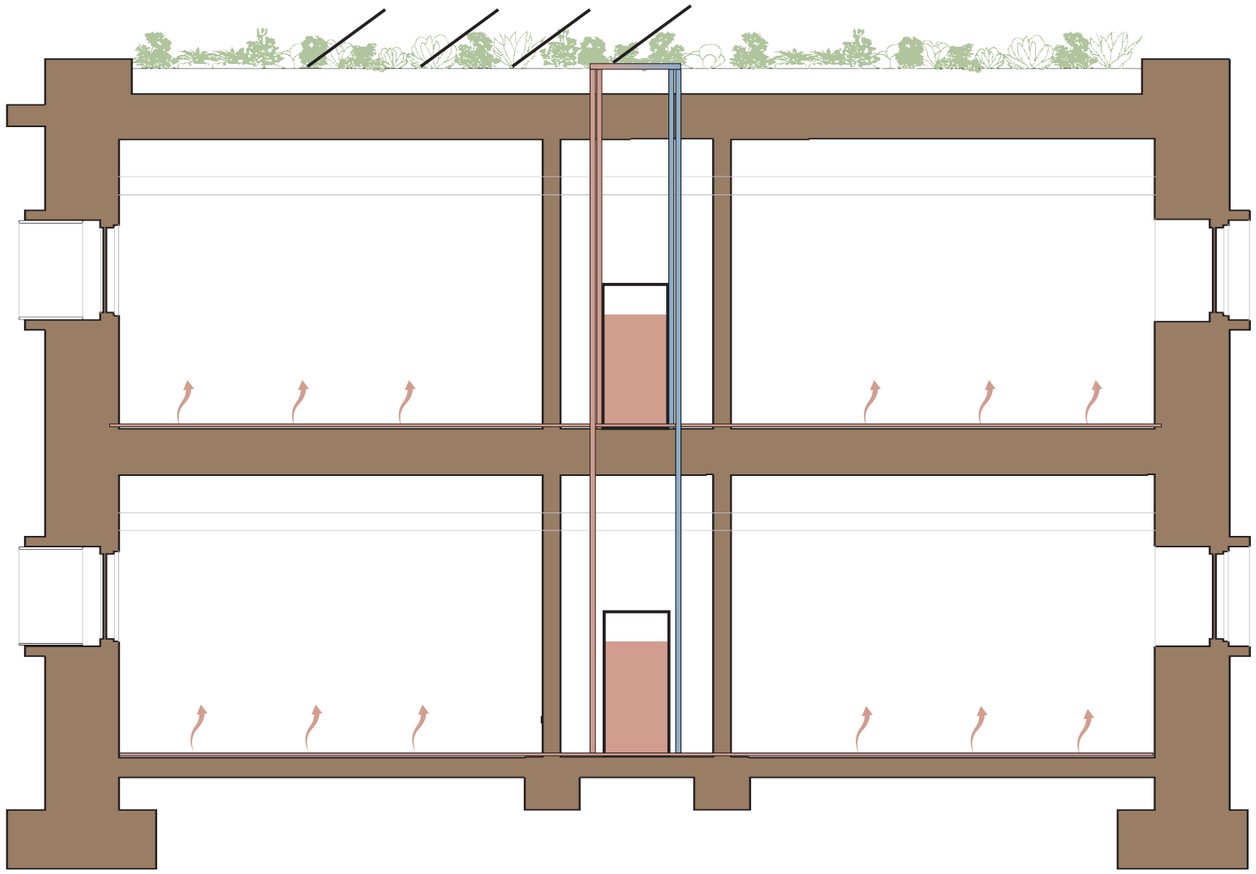
Building scale strategies – Climate design –Thermal mass materialization



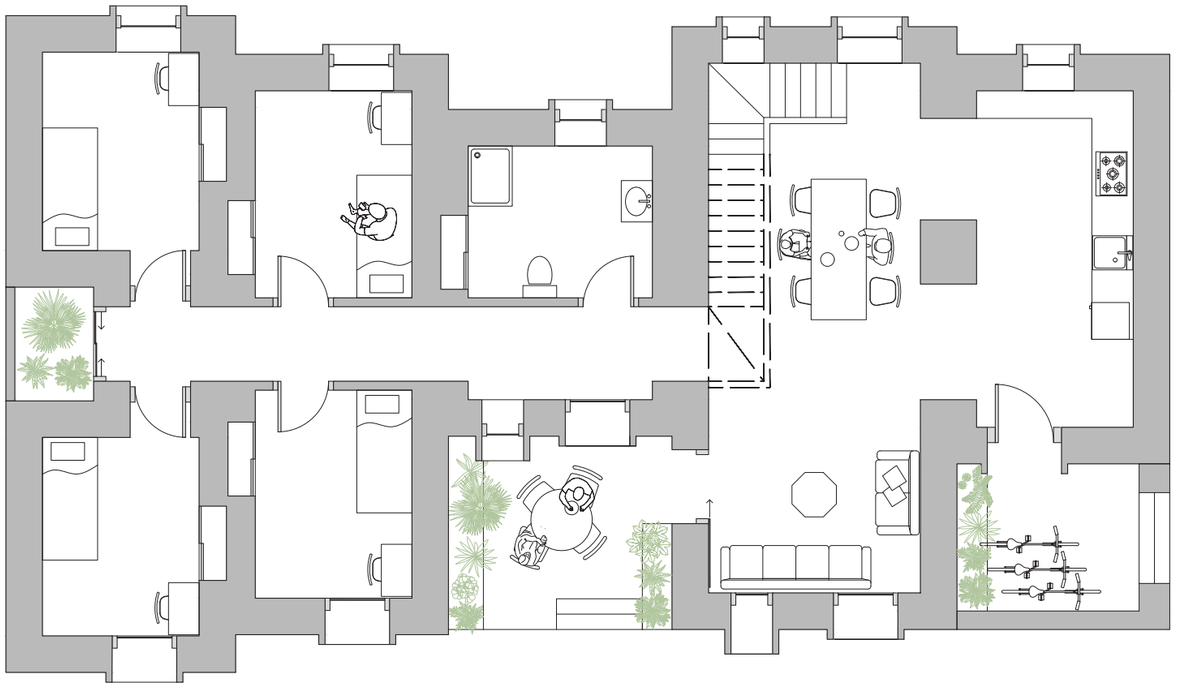
Building scale strategies – Climate design –Solar chimneys and night flushing



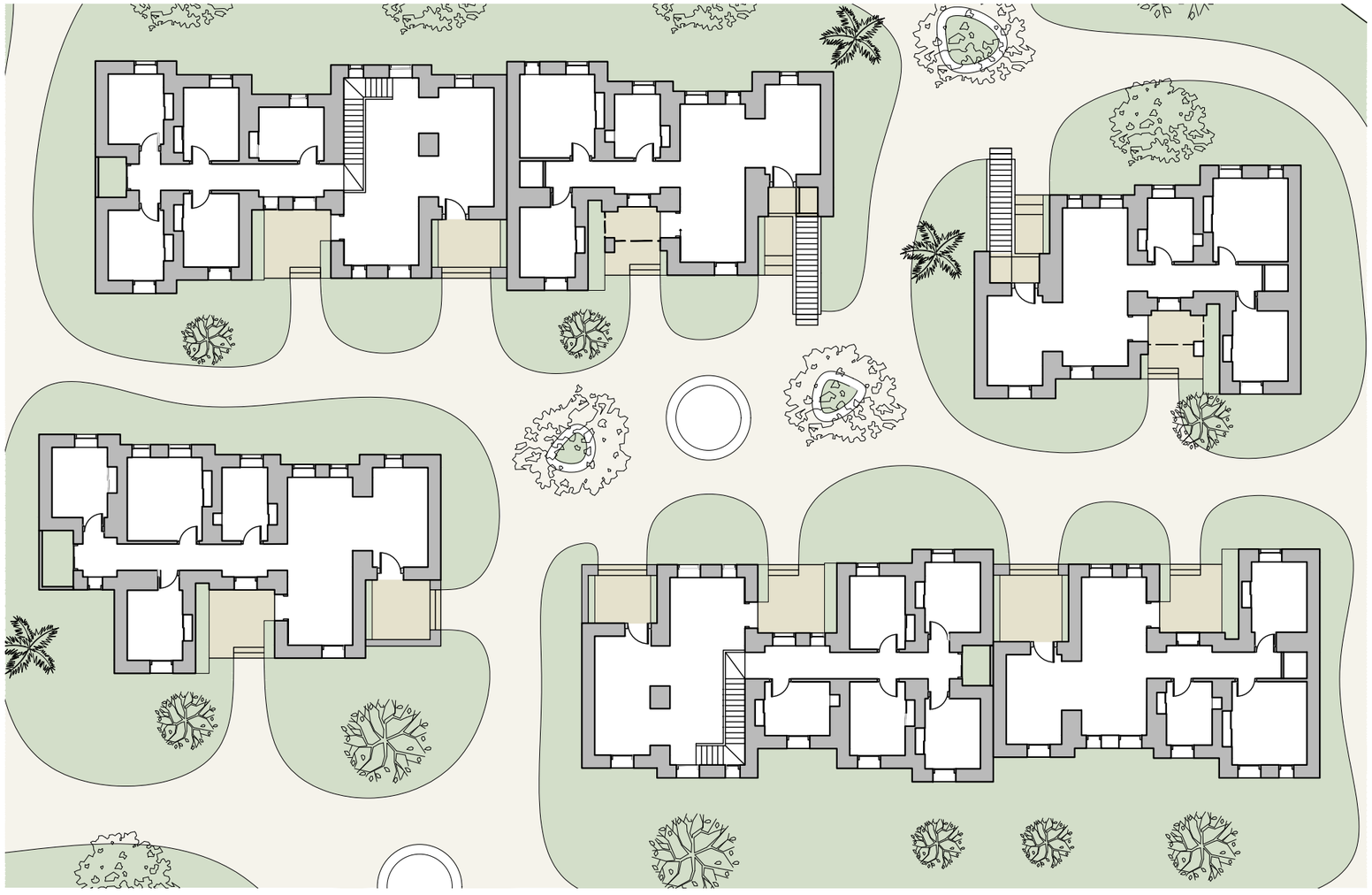
Building scale strategies – Climate design –Additional heating solar collectors



Building scale strategies – Social strategies – The floorplans

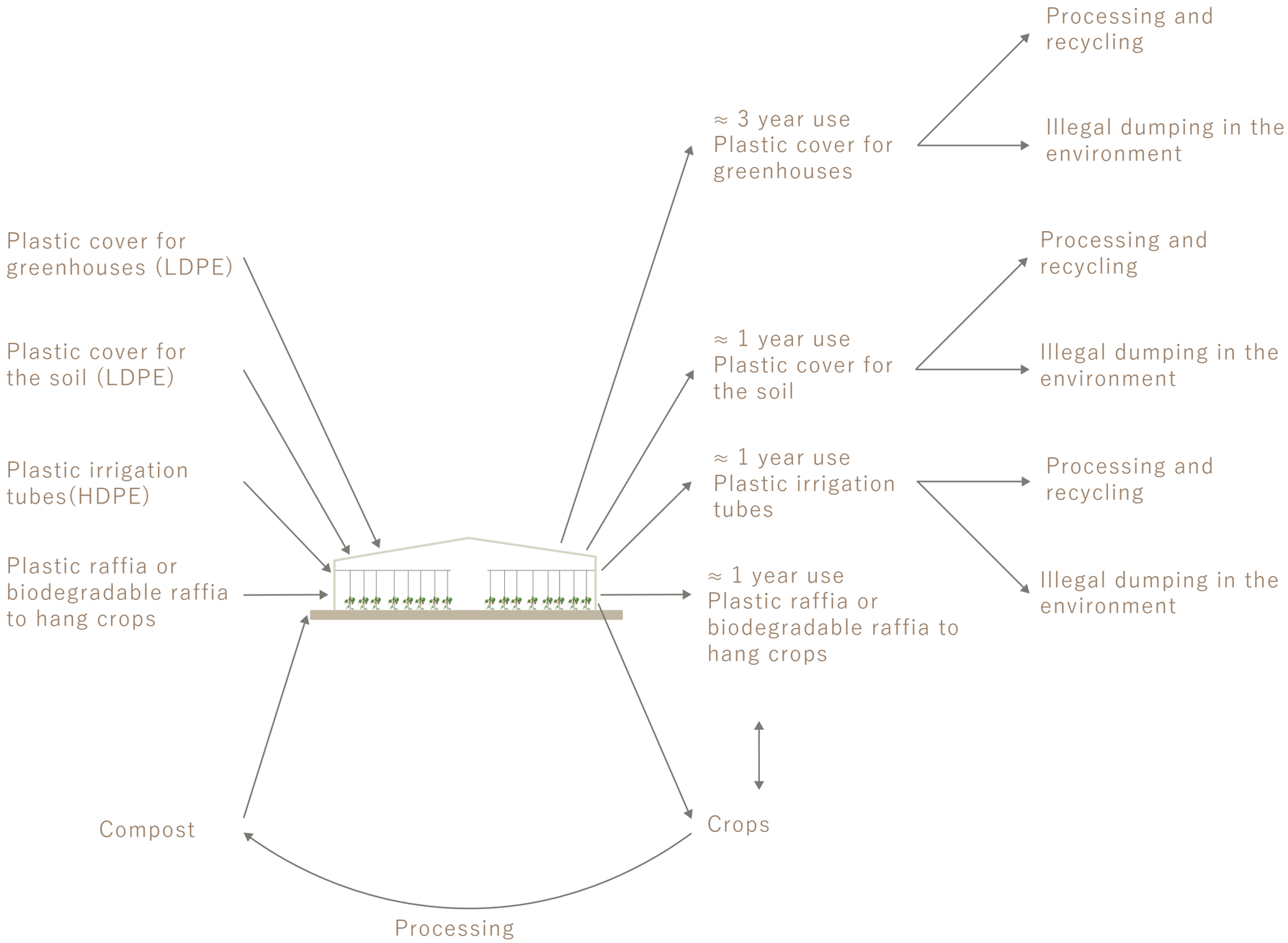


Building scale strategies – Social strategies – The floorplans



Material scale strategies – Material flow greenhouses in Almeria

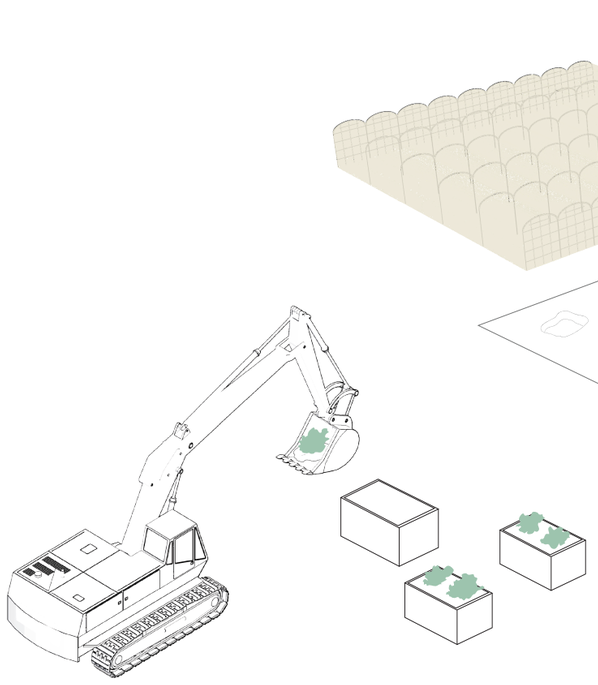
Material scale strategies – Material flow greenhouses in Almeria



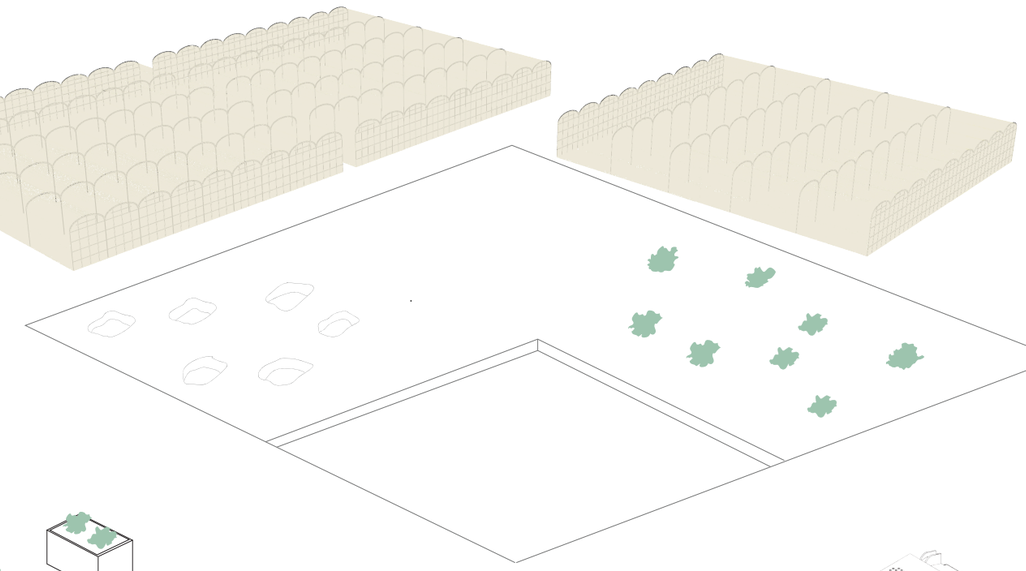
Material scale strategies – Using earth contaminated with microplastics to create CEB

Material scale strategies – Extraction process of earth for CEB

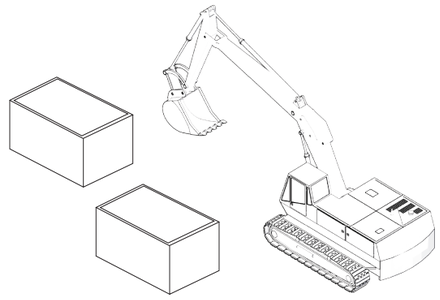
Soil extraction in areas with soil contaminated with micro and nanoplastics from plastic waste from the agriculture sector



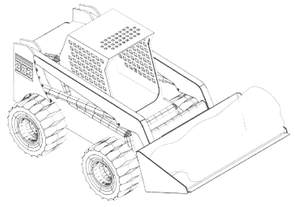
Transplant vegetation temporarily in plastic containes



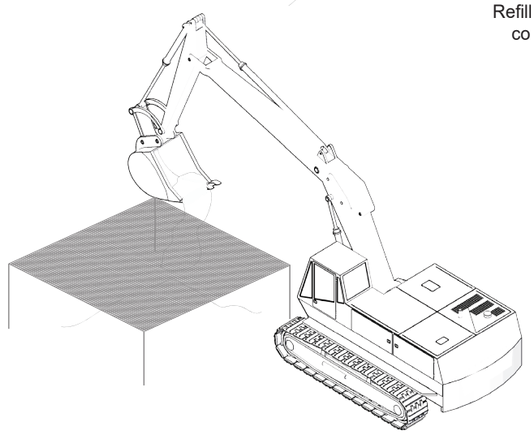
Refill soil extraction area with compost and clean sand



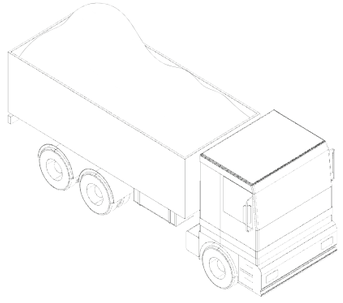
Replant vegetation in extraction site with more species to strengthen biodiversity



Extracting contaminated soil

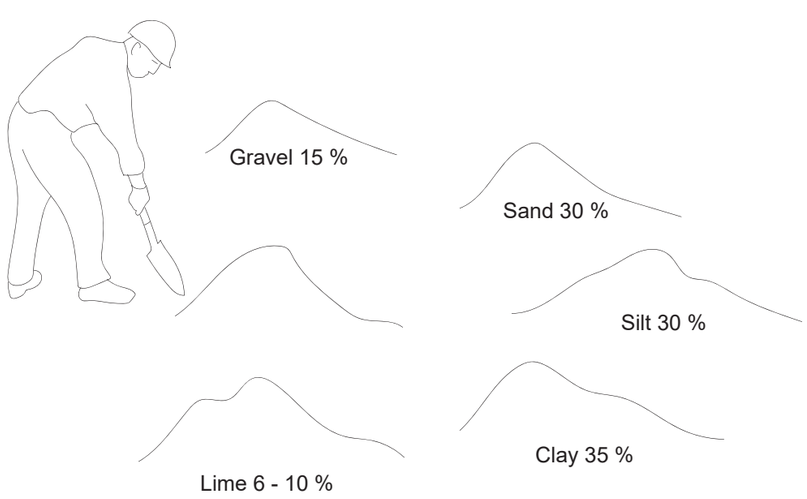


Filtering soil, extract stones and other waste



Transport soil to construction site

Material scale strategies – Process of CEB production



Mixing to achieve adequate proportions for mechanical compression

Mechanical compression

Drying

Material scale strategies – Economic, social and environmental advantages of CEB blocks

Low tech construction process

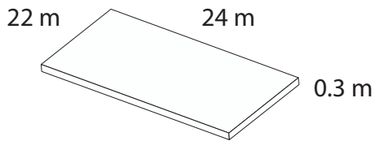
Create local employment in the process of making earth blocks

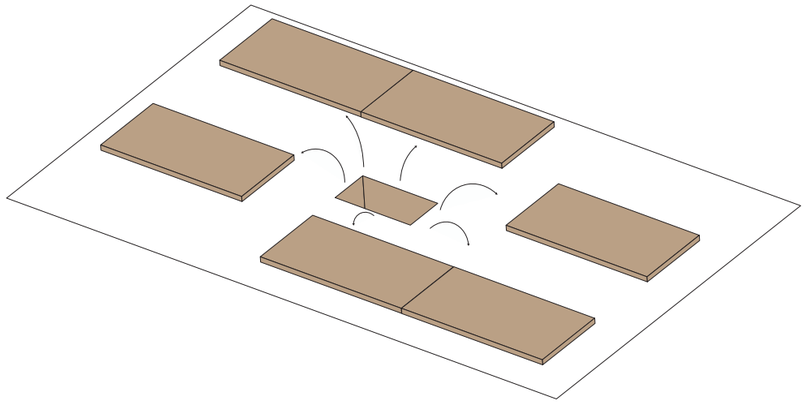
Affordable and abundant material

Recyclable

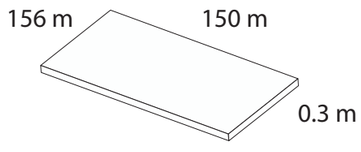
Material scale strategies – Extraction sites of earth

1 Dwelling 150-160 m3 volume of earth

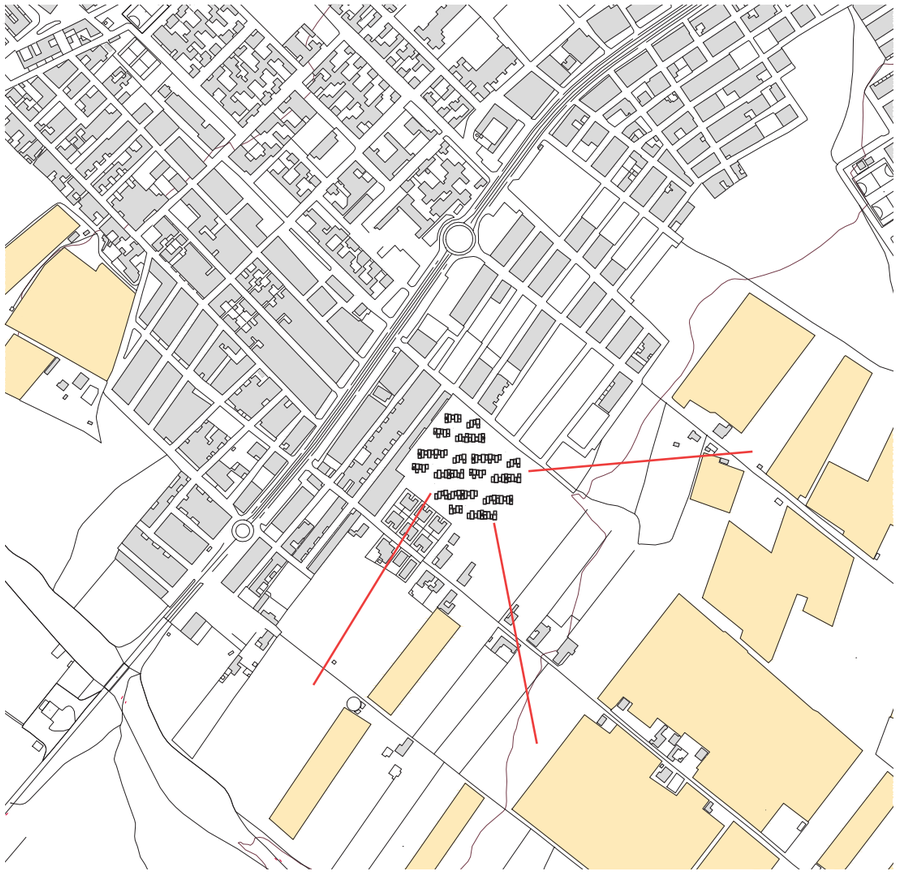




44 Dwellings 7000 m3 volume of earth



Using earth extracted on site to create water collectors to make earth blocks, closing the loop.



Areas with plastic contaminated soil

Watermelon 12.575 ha

Pepper 12.310 ha

Tomato 8.423

Courgette 8.061 ha

Lettuce 7.672 ha

Cucumber 5.280 ha

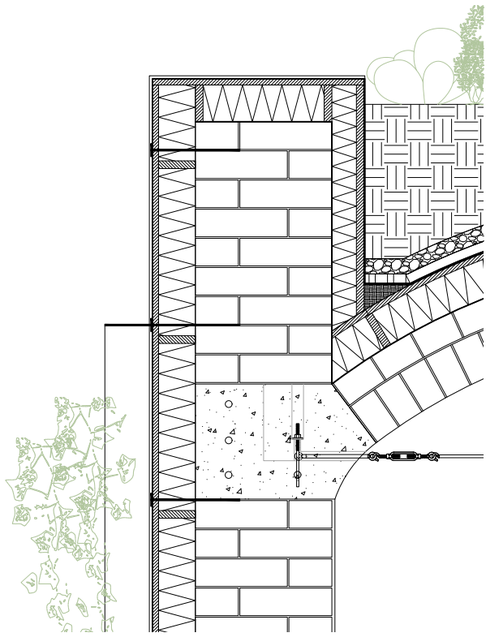
Melon 3.205 ha

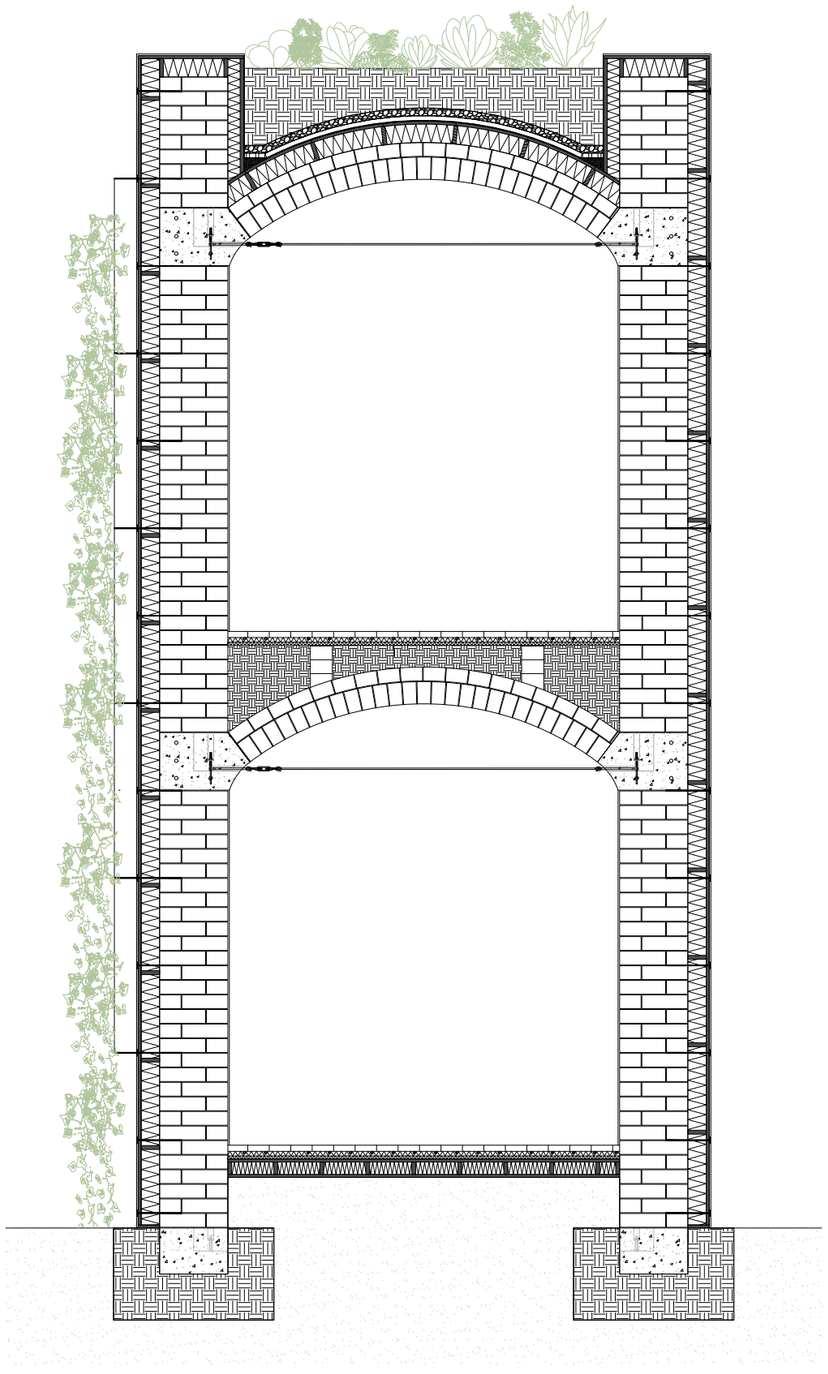
Aubergine 2.277 ha

Green bean 219 ha

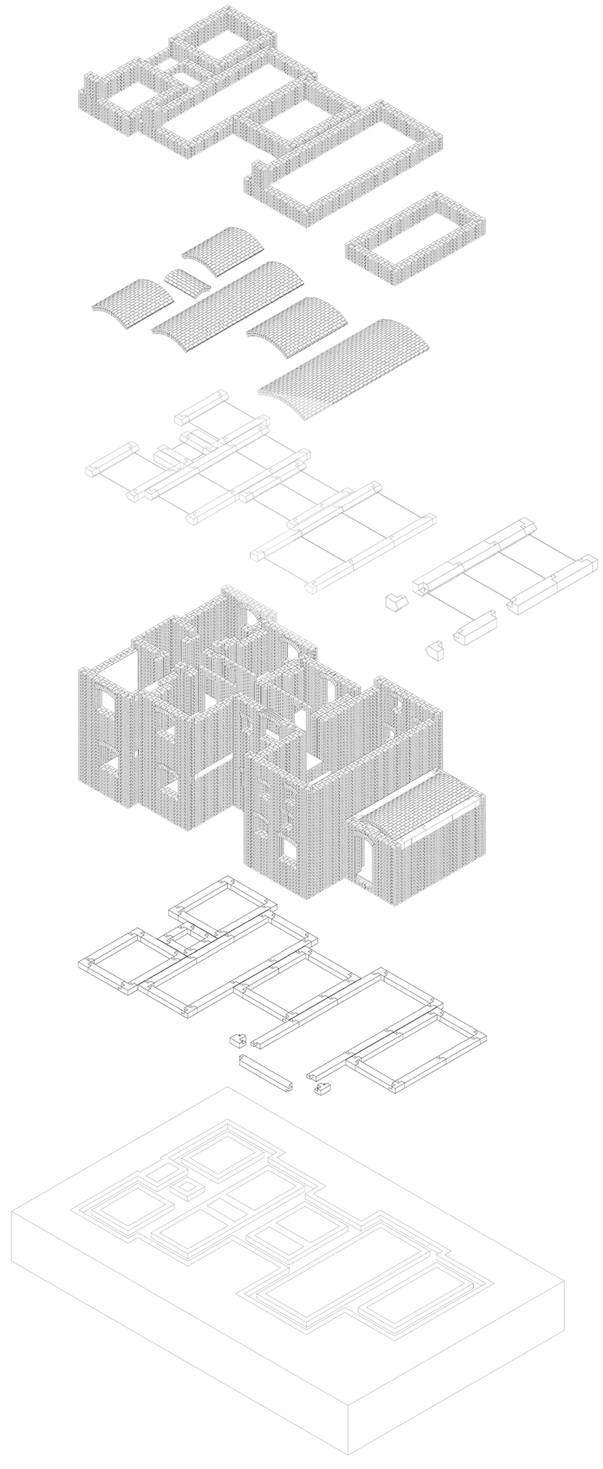
Others 4.650 ha

Material scale strategies – Organic waste of the agriculture sector and thermal insulation

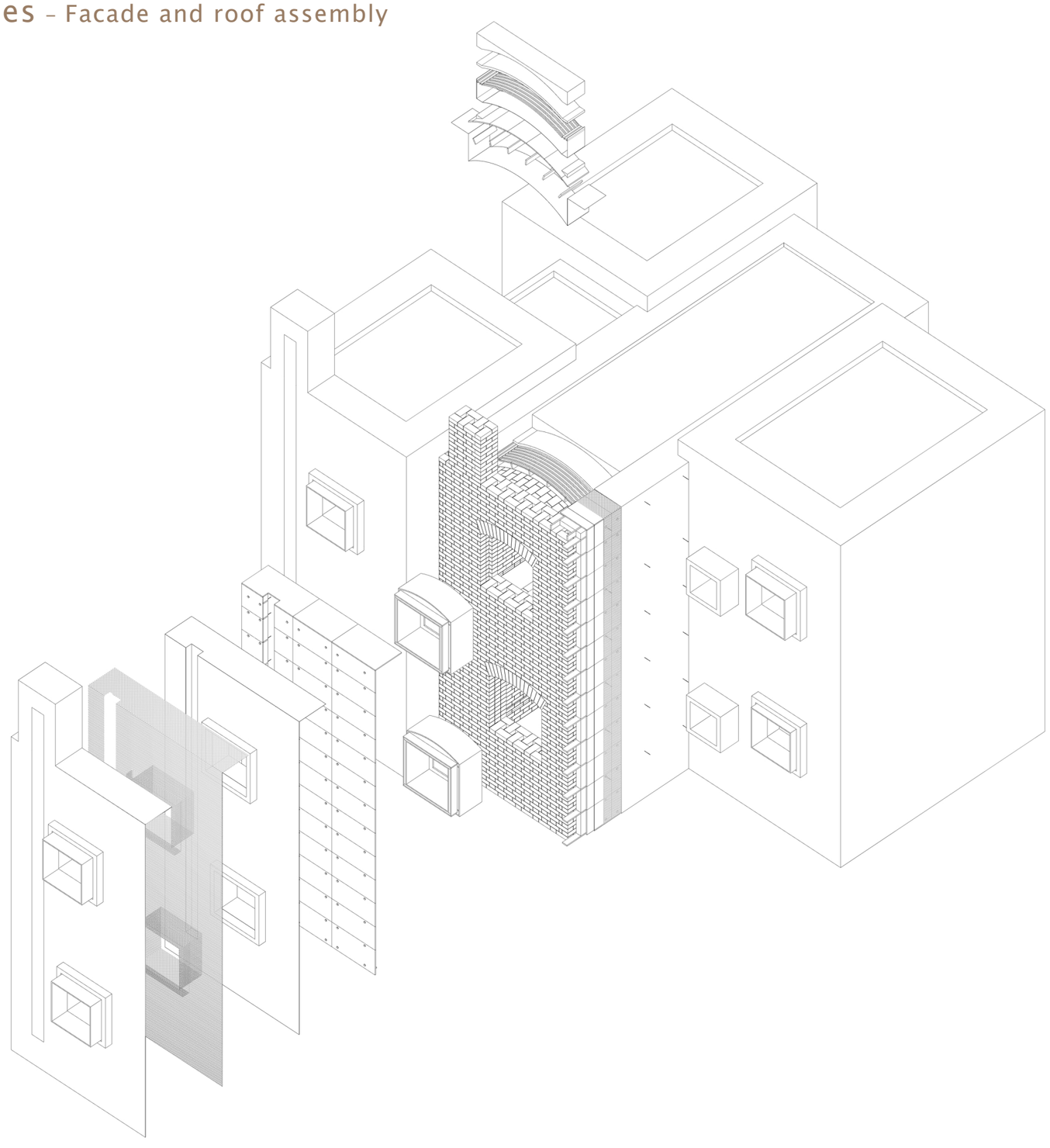




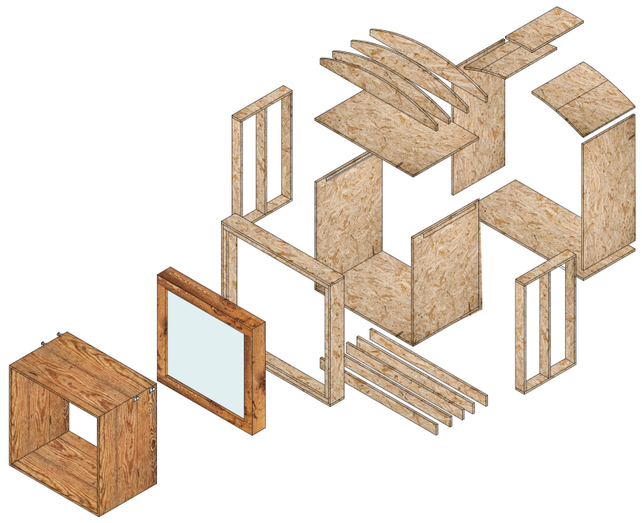
Material scale strategies – CEB structure and modular prefabricated and demountable concrete supports



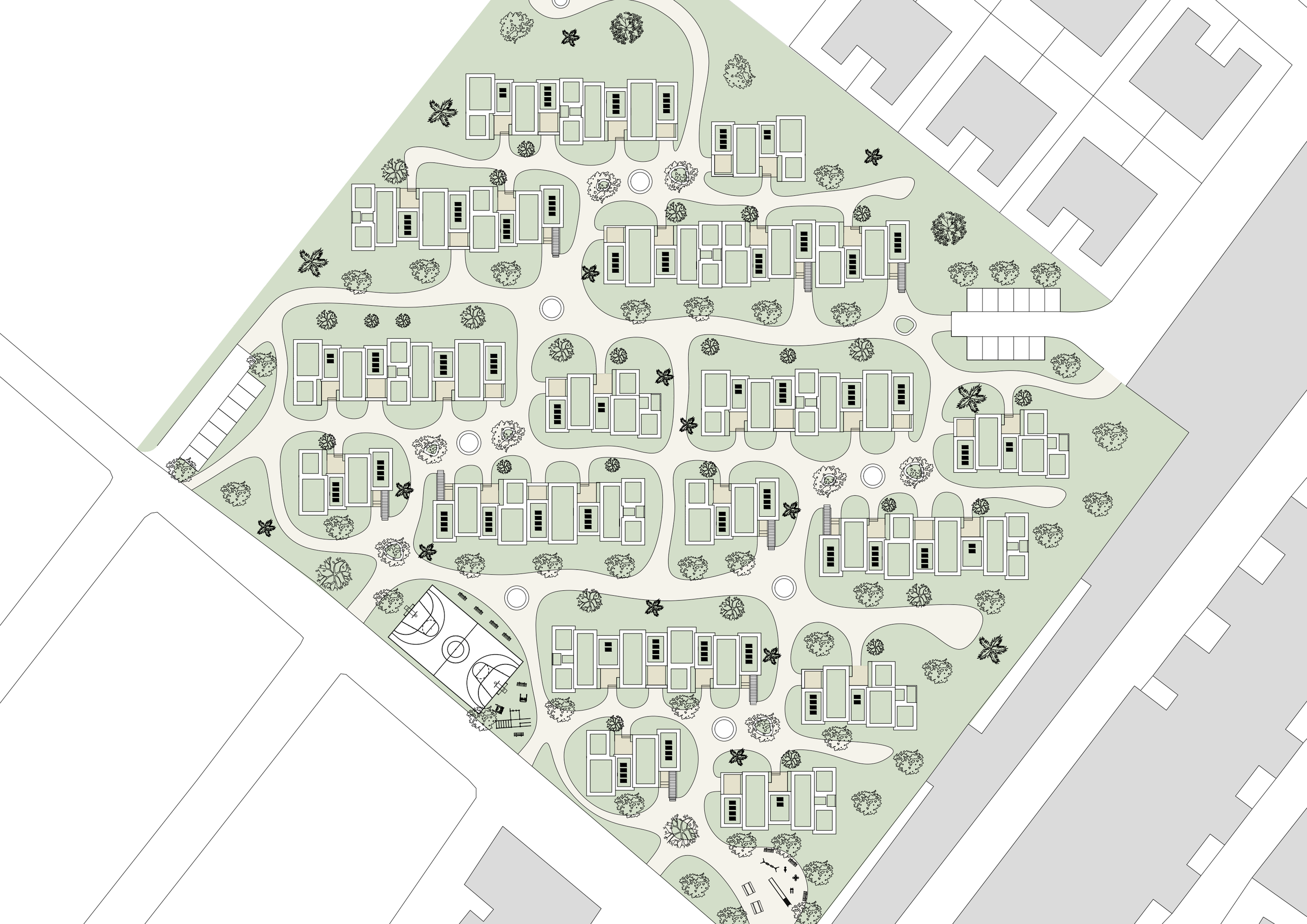
Material scale strategies – Facade and roof assembly



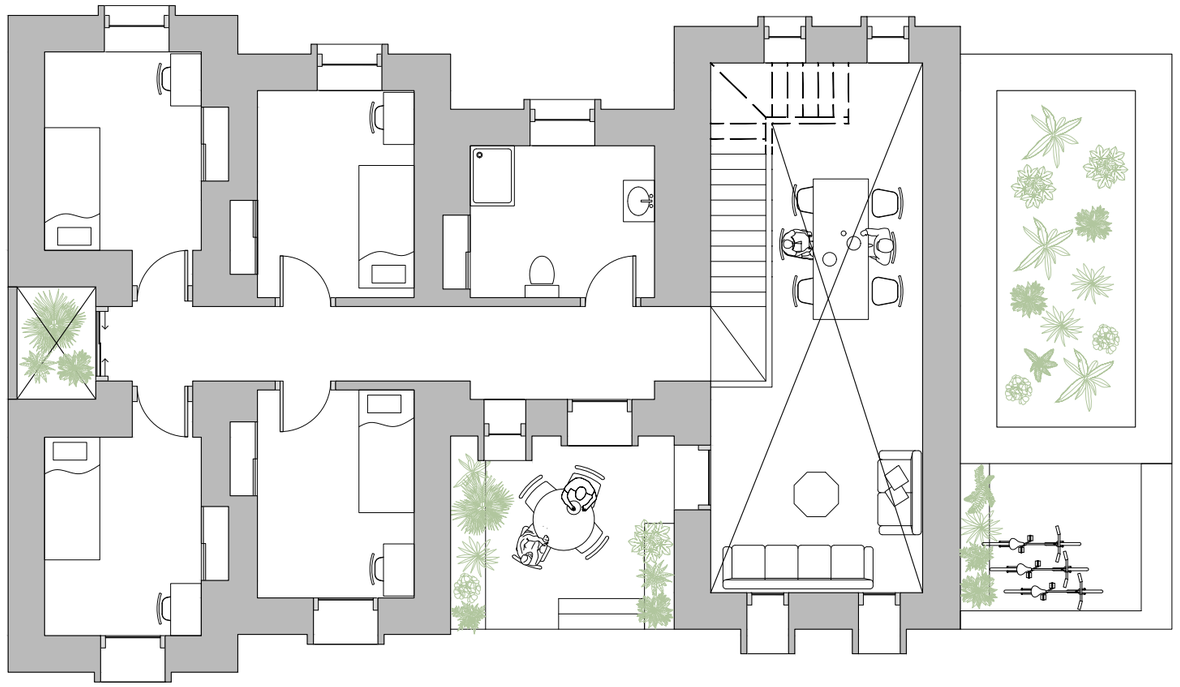
Material scale strategies – Window assembly

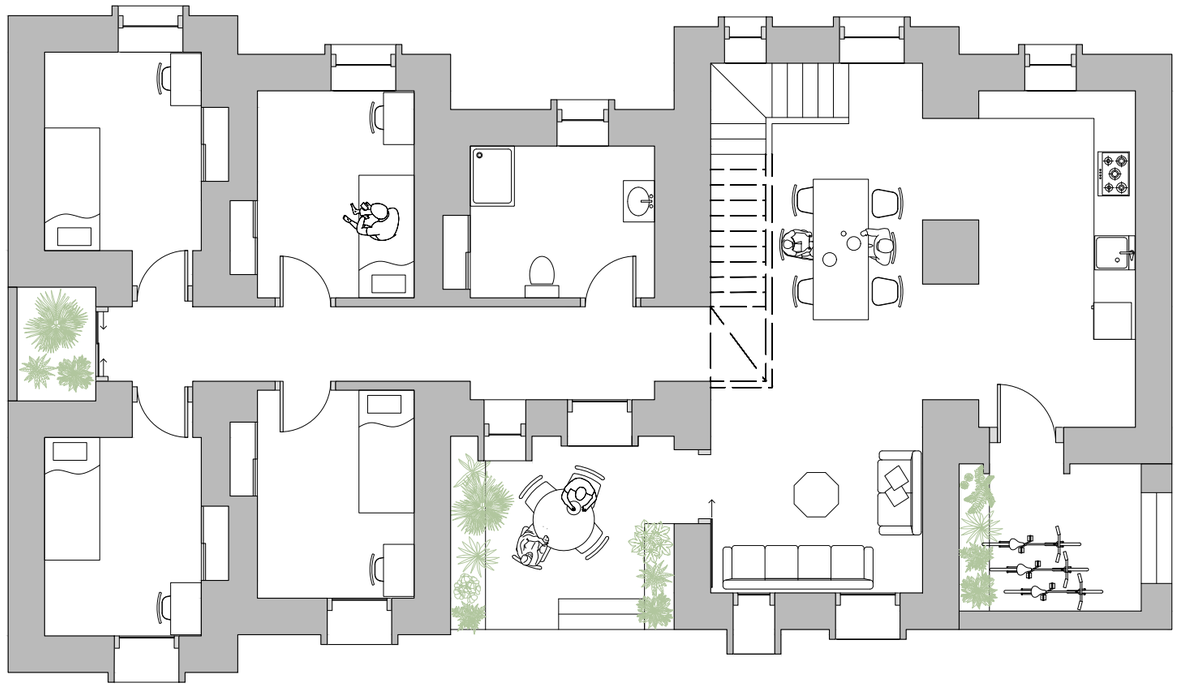


What? Design results

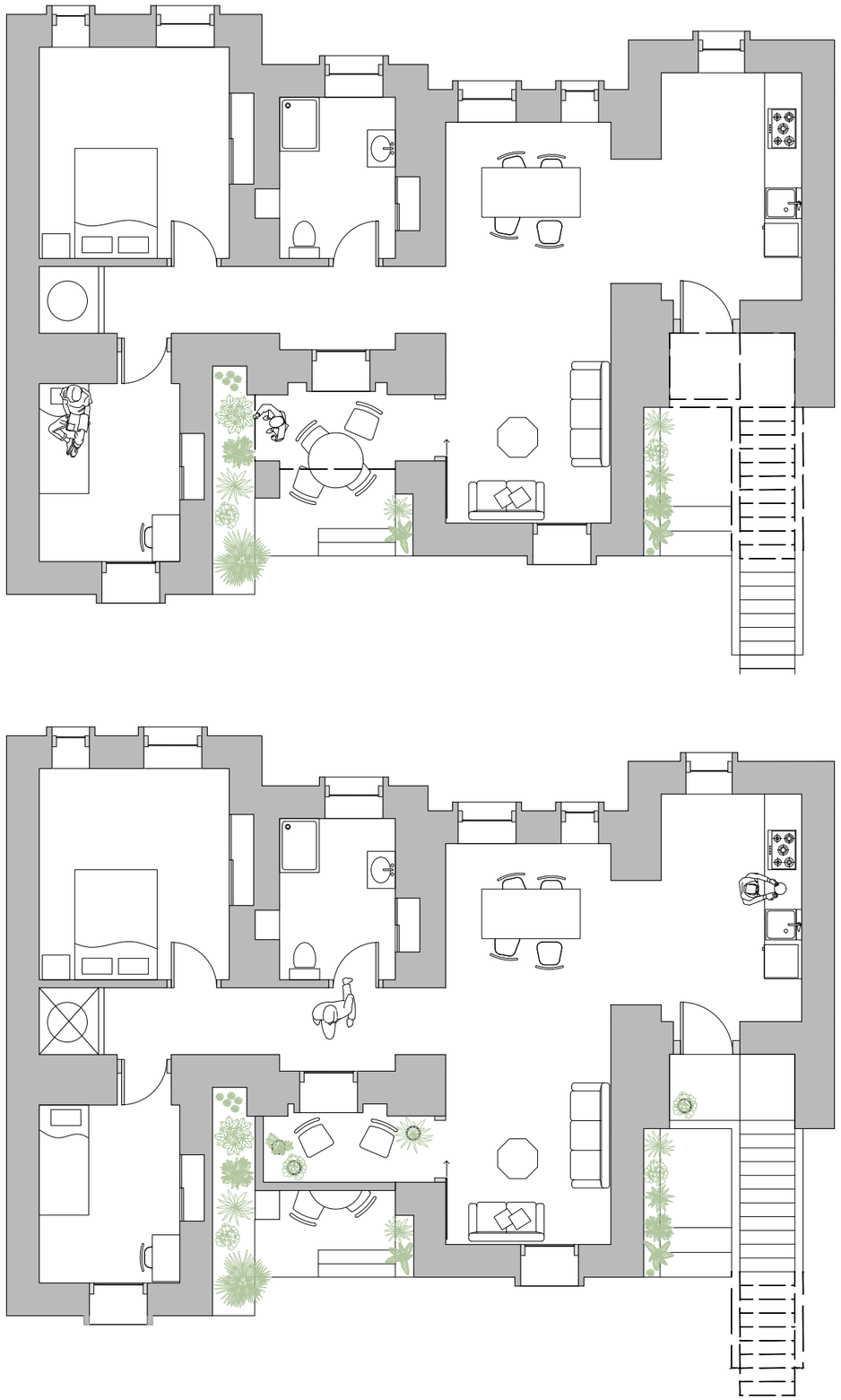


Typologies – Collective typology for migrant workes

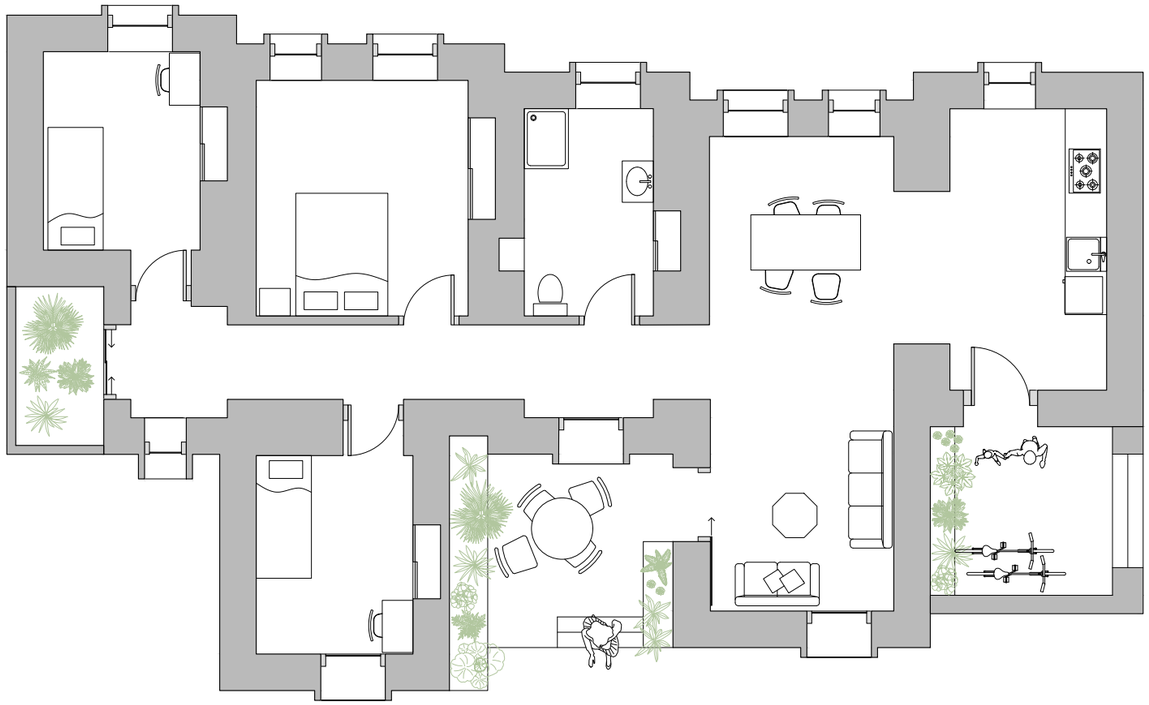




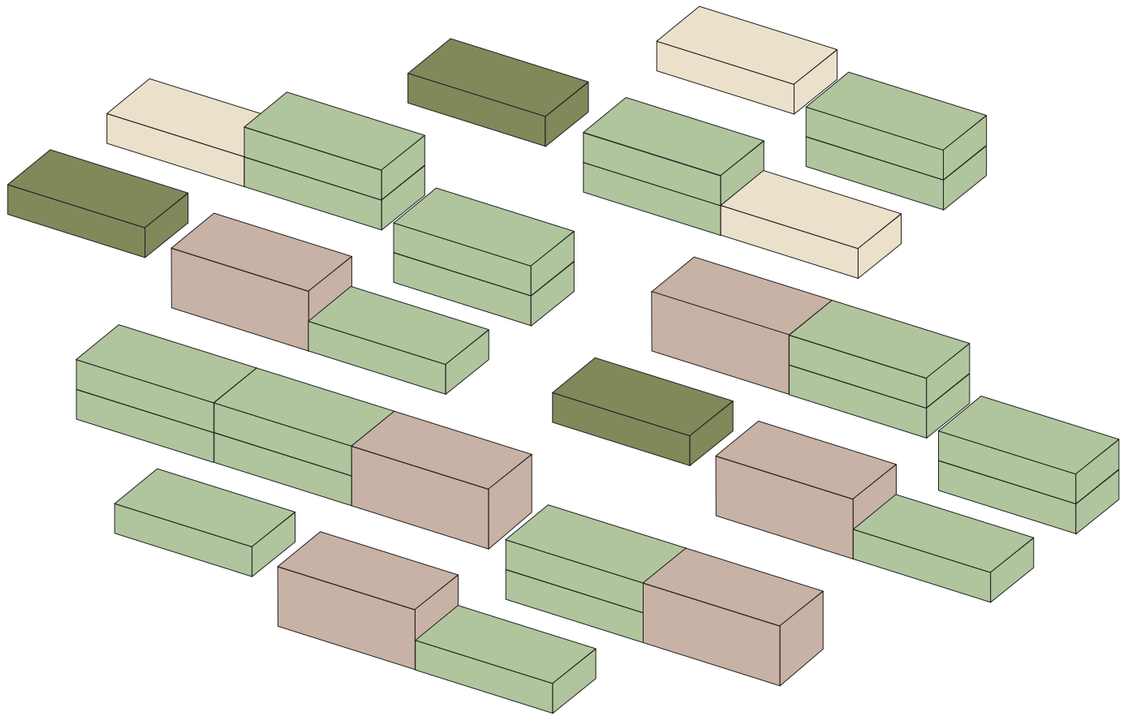
Typologies – Family dwelling typology



Typologies – Family dwelling typology



Distribution of typologies



Collective dwellings

4 Rooms

8 Rooms

Family dwellings

2 Rooms

3 Rooms

End

Appendix - Structure assembly process