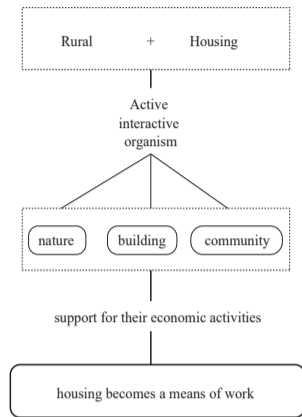


Sustainable Rural City in Chiapas, México: Urban intervention-house prototype-urban multifunctional module

BACKGROUND

In 2007 the Chiapas (Mexico) government established the Sustainable Rural Cities project (CRS) that proposed to rearrange the town of Ostuacán and Santiago El Pinar in population centers with infrastructure, basic services, and housing because they were considered, for various factors, risk areas. The inhabitants of these communities accepted the resources that the project brought, but they did not contribute to improving their quality of life. This situation responds to several social, political, and property conflicts, but we could point out also that the facilities they received were not well designed to adapt to their economic activities and their different practices and customs, as they came from different towns.



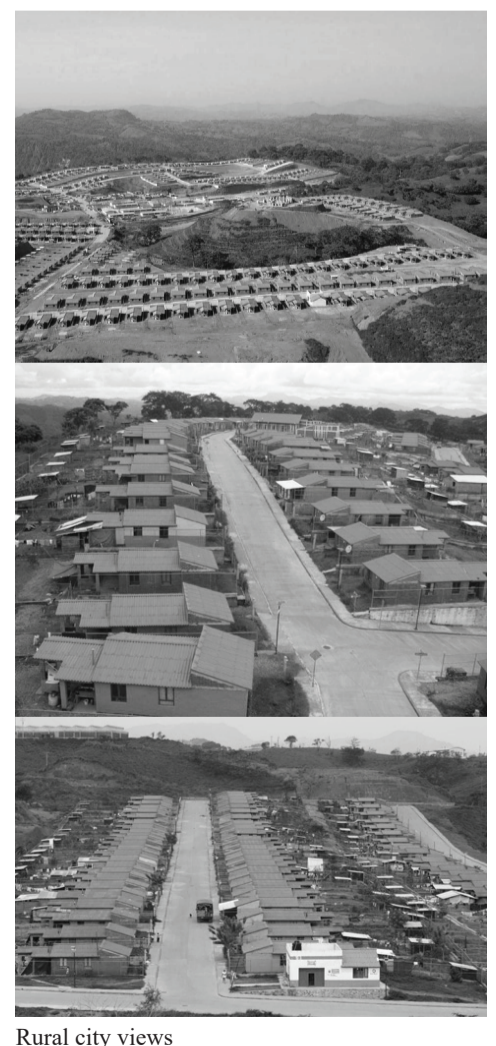
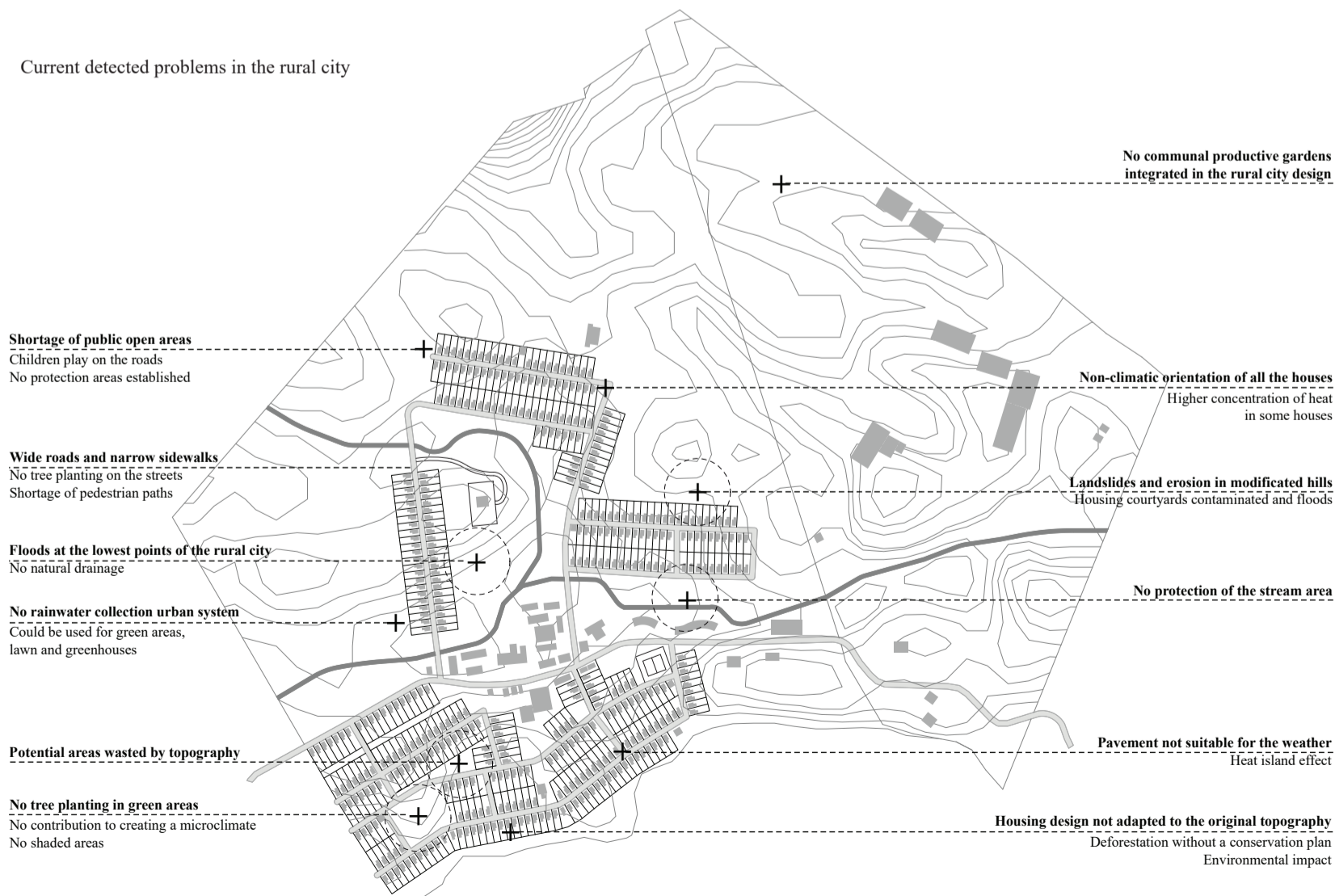
Facts

- 410 number of household units
 - 4 - 9 members of one family
 - 2,192 inhabitants
 - 10 different towns gathered
 - 80 hectare total area
 - 30 hectare productive projects area {abandoned}
 - 50 hectare urban infrastructure
 - 900m2 prior housing plot area
 - 300m2 current housing plot area {10x30m}
- Climate hot humid with rains all year round



- Existing buildings
- 1 Housing (410)
 - 2 Clinic
 - 3 Rural Inn
 - 4 Community Child Care Center
 - 5 Community Development Center
 - 6 Basic Education Center
 - 7 Multipurpose courts
 - 8 Neighborhood Garden
 - 9 Park
 - 10 Temples
 - 11 Catholic Church
 - 12 Module of Nixtamalization with Tortilleria
 - 13 Bakery
 - 14 Supermarket
 - 15 Commercial Corridor (16 micro-businesses)
 - 16 Micro Industrial Park (Carpentry, Blacksmith)
 - 17 Dairy processing plant
 - 18 Poultry Farms
 - 19 Greenhouses
 - 20 Horticultural Packer
 - 21 Cocoa Fermentation and Drying Plant
 - 22 Public Transportation Terminal
 - 23 Municipal Agency
 - 24 Public Ministry Agency
 - 25 Command
 - 26 Aztec Tower
 - 27 Water Treatment Plant
 - 28 Wastewater Treatment Plant
 - 29 Communications Tower
 - 30 Government Module

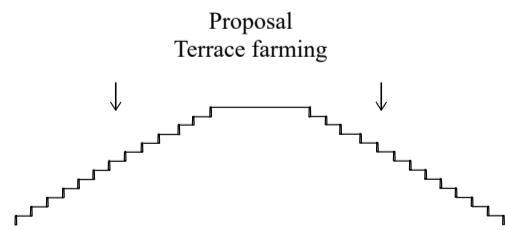
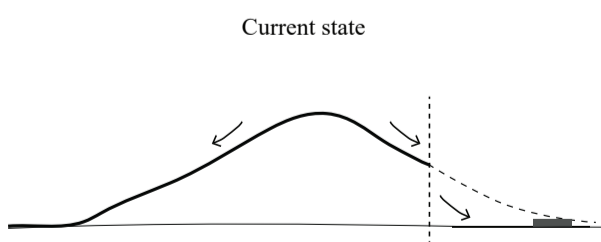
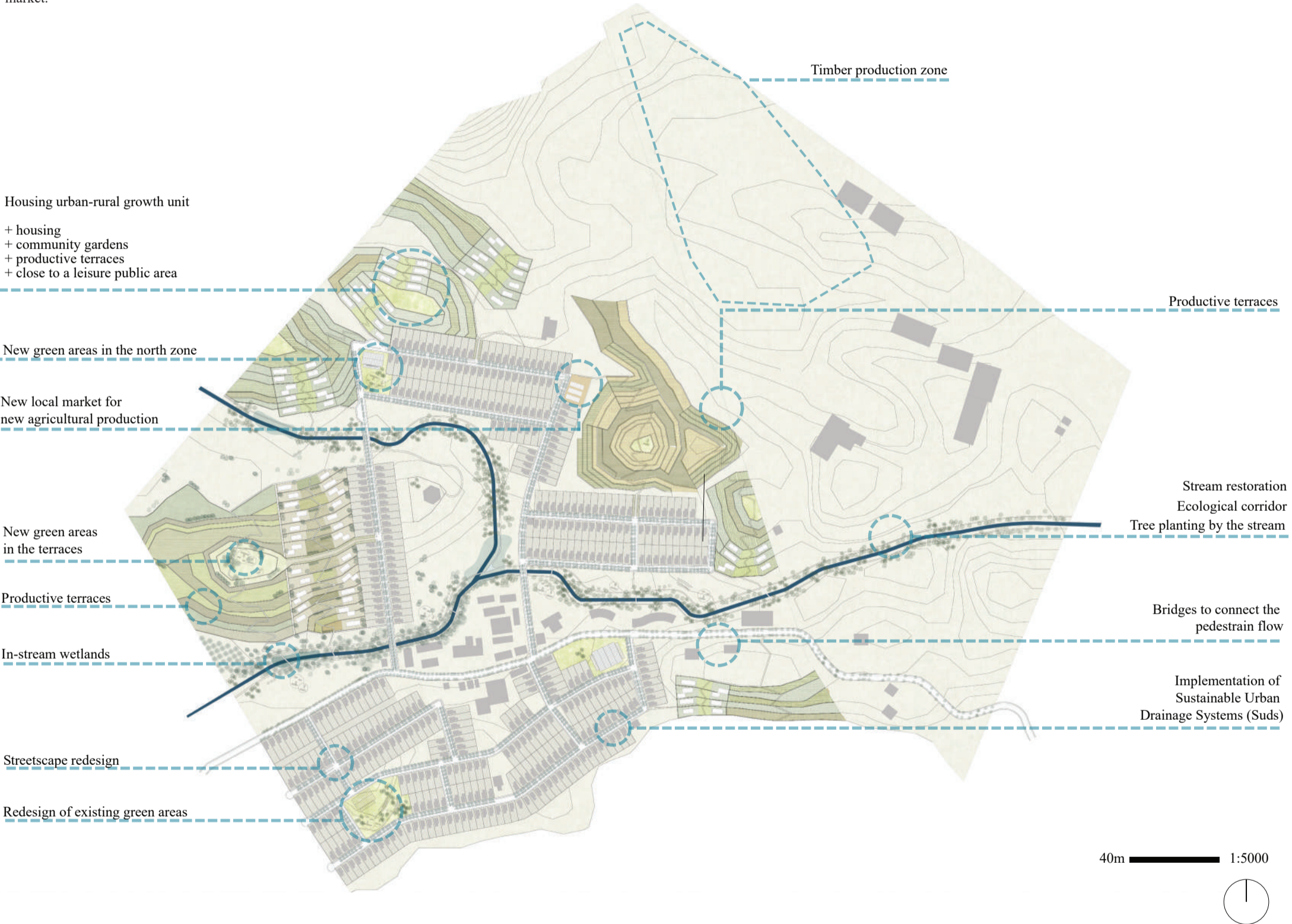
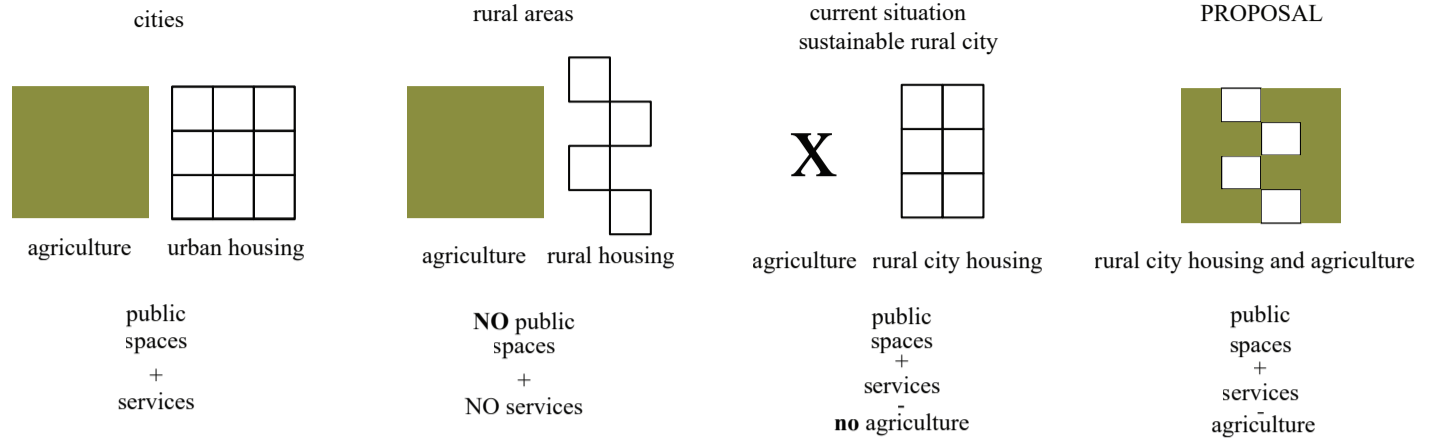
Current detected problems in the rural city



Rural city views

REVITALIZATION PLAN FOR THE RURAL CITY

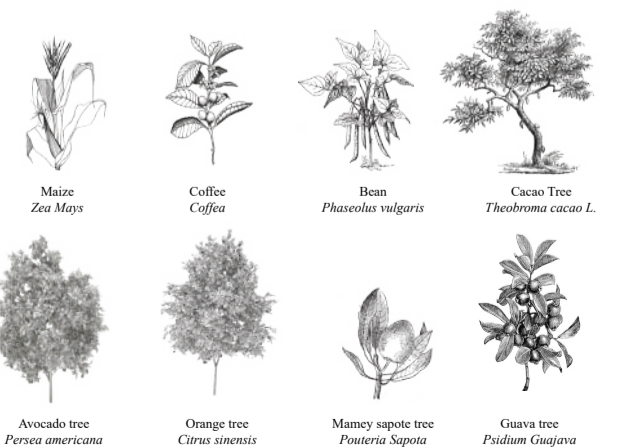
Taking into account that the city was designed without thinking about families and their economy, the main proposal, in addition to peripheral actions, focuses on the creation of productive terraces that can provide families again with their economic support, and that they can live again the city in its entirety without having to return to their hometown to work. The productive terraces at the same time seek several objectives that go from landscape design, stormwater optimal use, and also it is part of the new housing model that can be reproduced on the perimeter of the city when it grows. With the transformation of the hills, it is also sought to avoid the problems of erosion and contamination that occur with constant rains. Some more specific interventions are added to this proposal, such as the restoration of the stream that crosses the city, and the redesign of streets that allows the inhabitants, who mostly use bicycles as a means of transportation, move around the city covered by the shade of the trees. In addition, the proposal of an urban multifunctional module of easy reproduction and adaptation is proposed to provide the users of the public space various functions, from a library box, playground, kiosk to picnic shelter, and the same structure can also be reproduced for the new local market.



- Erosion
- Contaminated plots

- Optimal stormwater use
- Control the erosion
- Conservation of the natural fertility of soils
- Food production
- Agrodiversity

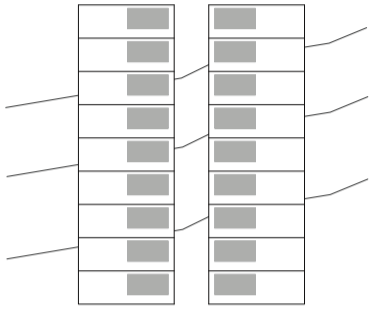
Plant Matrix



HOUSING REPLICABLE UNIT

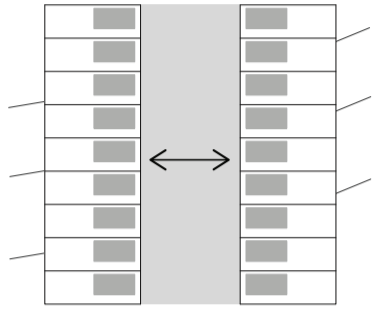
Existing layout

- Wide and ubiquitous roads
- Preference for cars
- Modified topography
- Erosion + contaminated plots

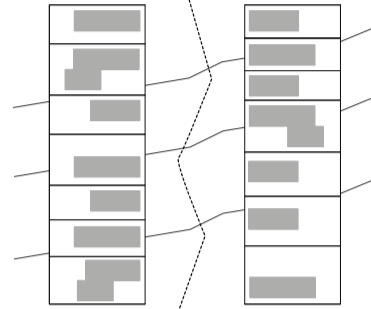


Proposal

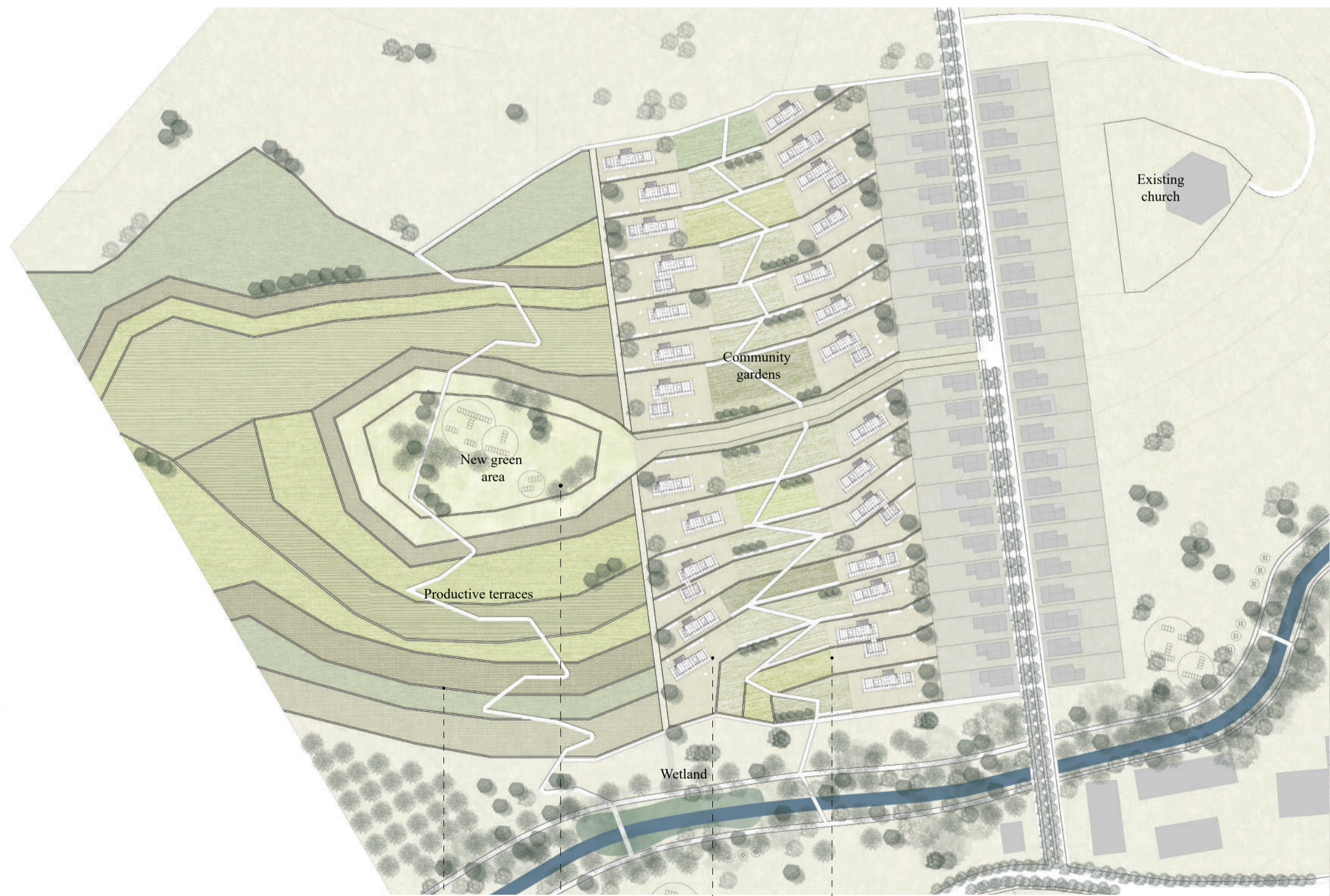
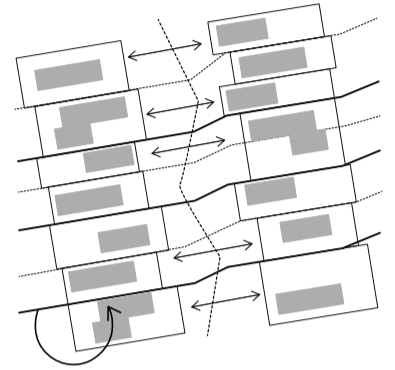
- Community gardens
- To improve neighborhood interaction
- More m2 for families food production



- Pedestrian path
- Different prototypes and plots sizes adapted for each family need



- Following the topography
- Terraced farming to prevent erosion

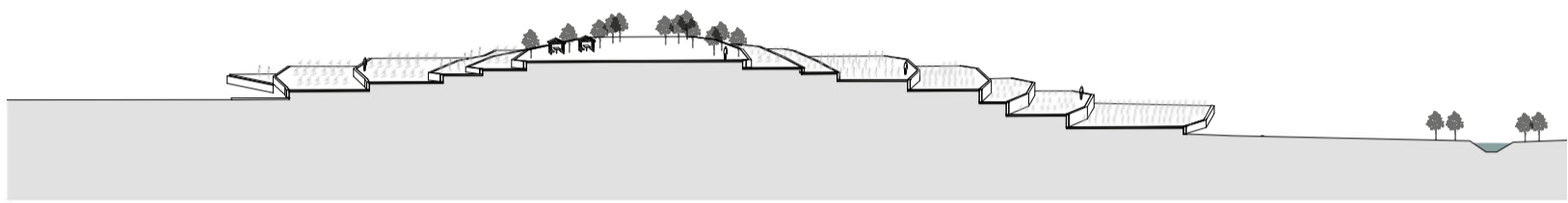


Productive terraces + Green area + Housing + Community gardens



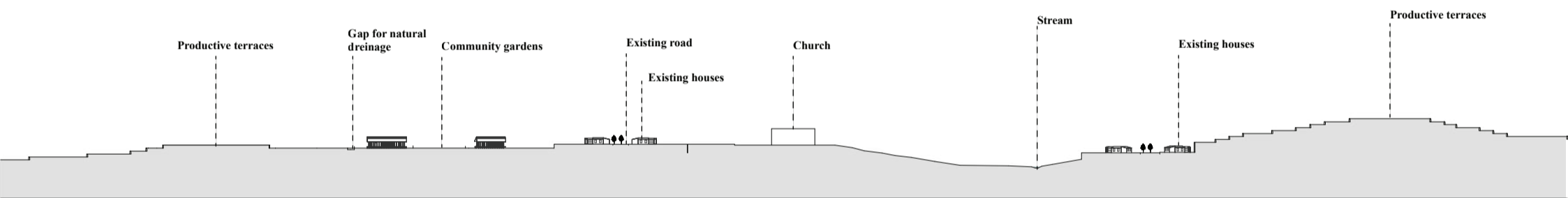
Quarter longitudinal section -
Housing

1:2000



Productive terraces longitudinal section

1:2000



Rural city section





Ecological corridor and bridges

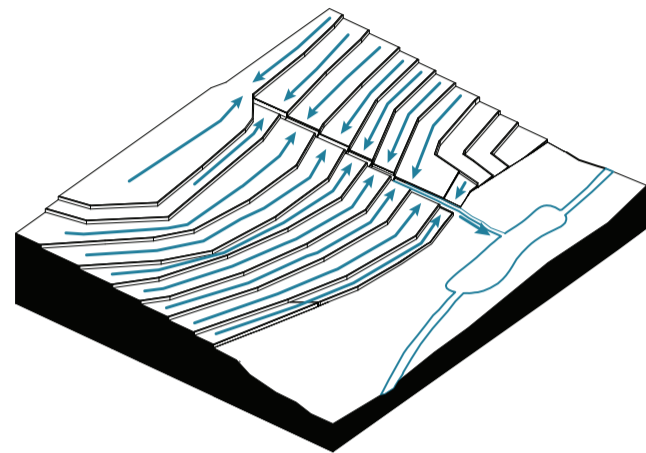
Riparian vegetation

Wetlands

Stream

In-stream wetlands

Located below the terraces receiving the run-off of stormwater allowing water quality treatment through infiltration, nutrient uptake and limited detention



Purifying plants



Carex densa



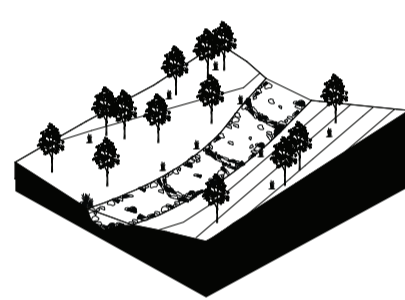
Phragmites australis



Juncus tenuis

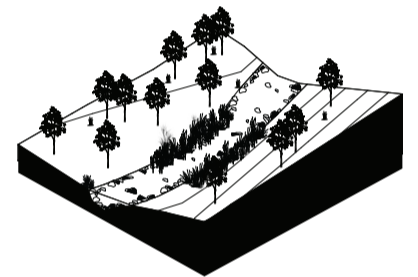


Festuca arundinacea



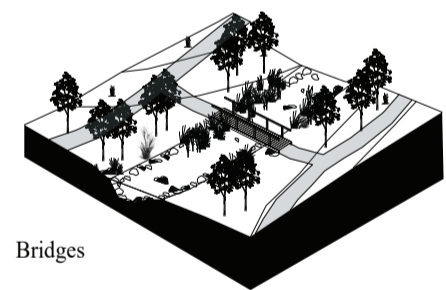
Cross vane

Located strategically after each wetland to direct the flow of the water at the center of the stream in order to protect the stream banks

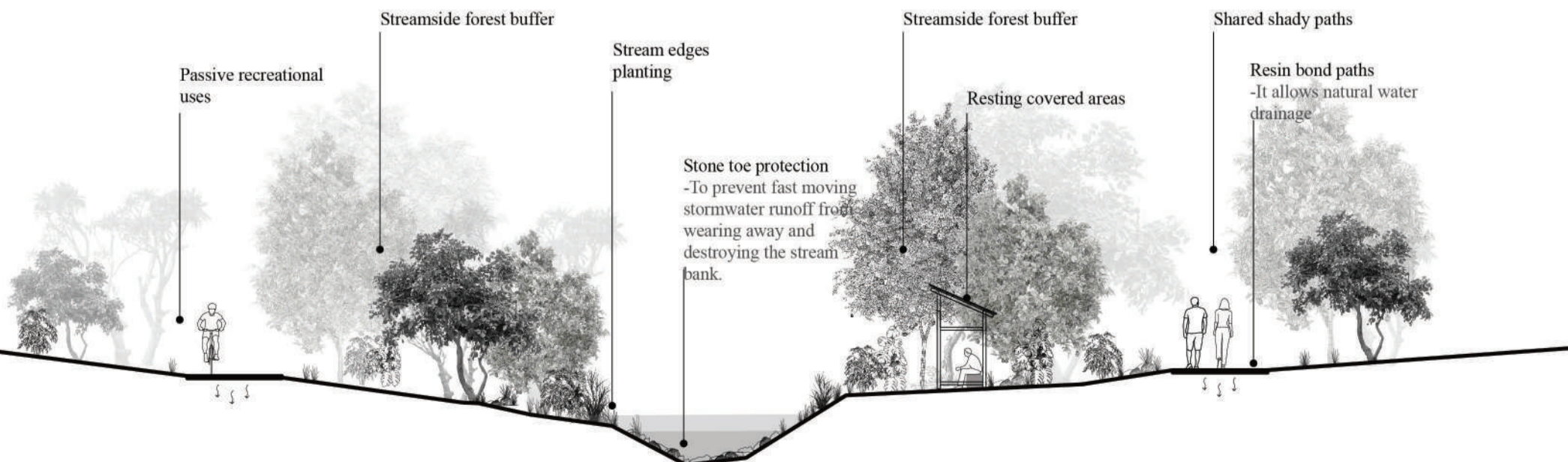


Brush layering

Located at the curves of the stream stabilizing eroded stream bank slopes



Bridges



Passive recreational uses

Streamside forest buffer

Stream edges planting

Stone toe protection
-To prevent fast moving stormwater runoff from wearing away and destroying the stream bank.

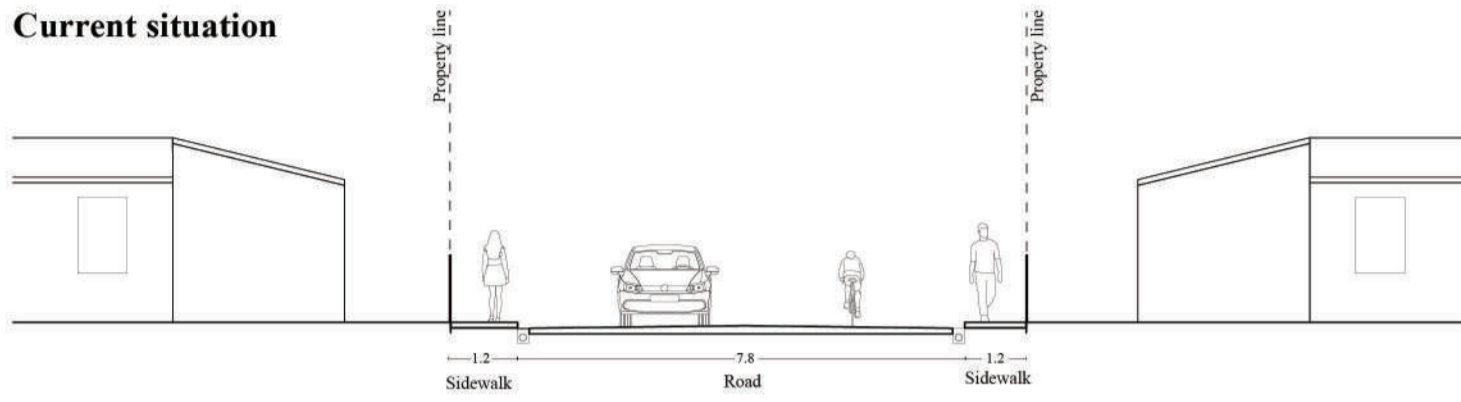
Streamside forest buffer

Resting covered areas

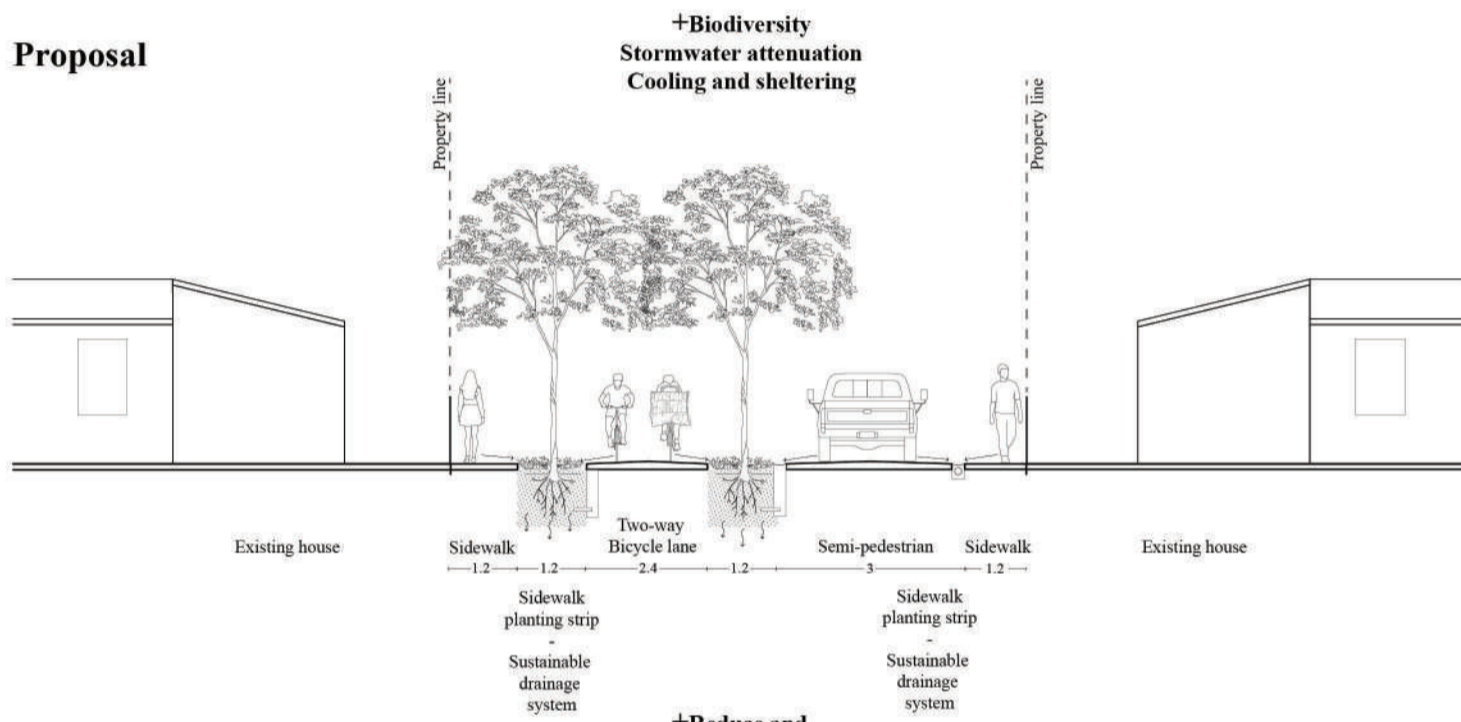
Shared shady paths

Resin bond paths
-It allows natural water drainage

Current situation

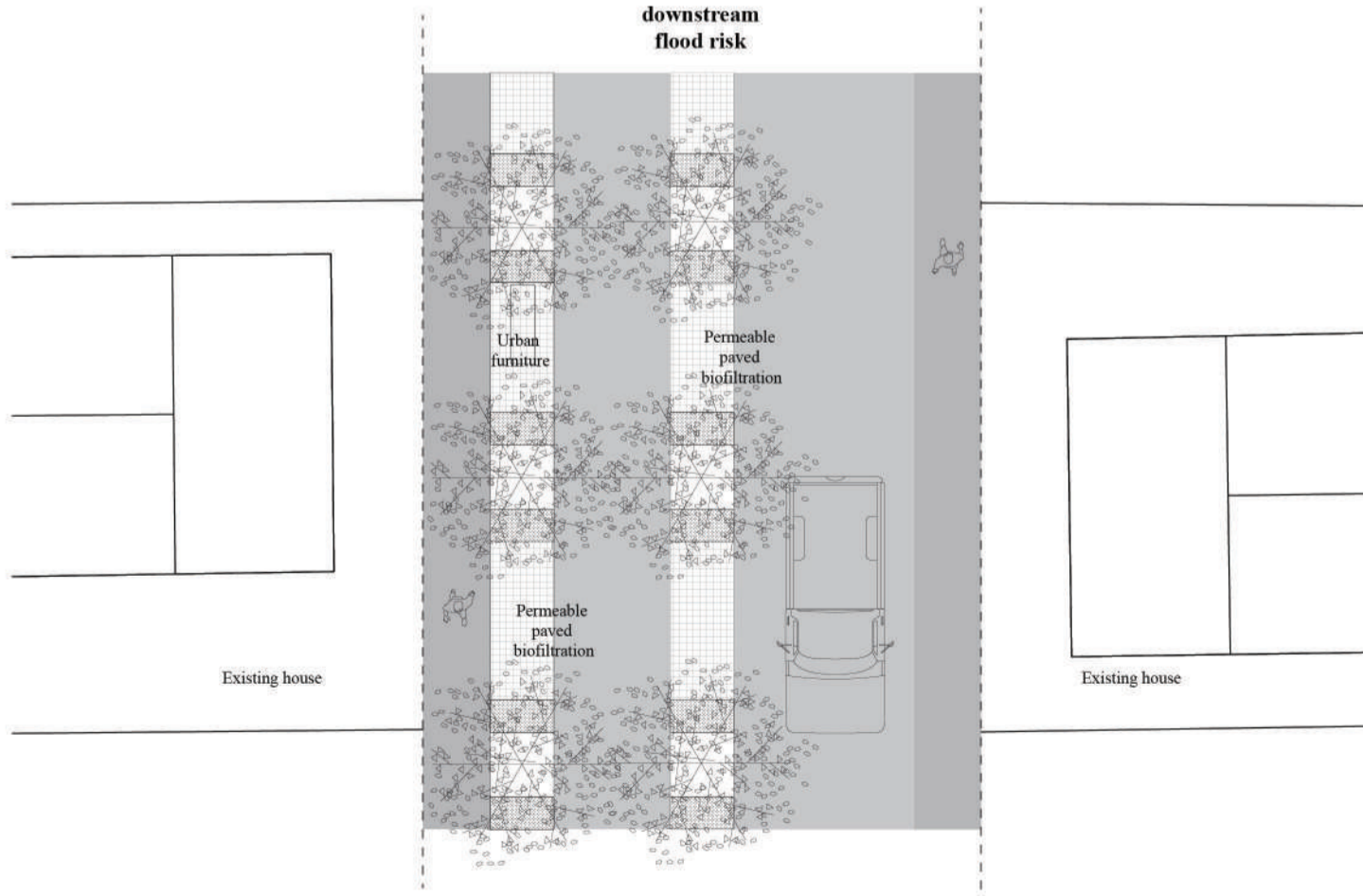


Proposal

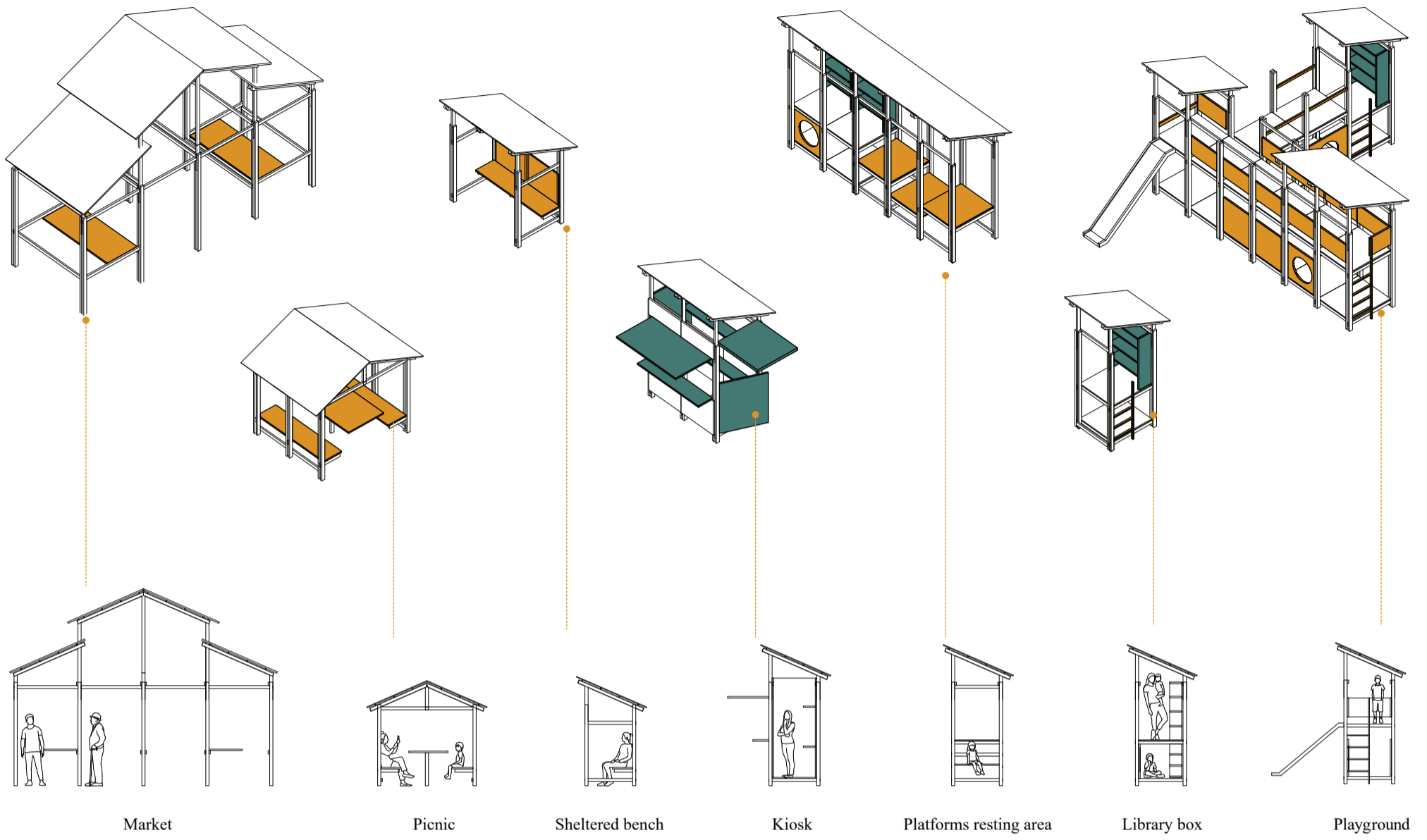


+Reduce and slow runoff from storms

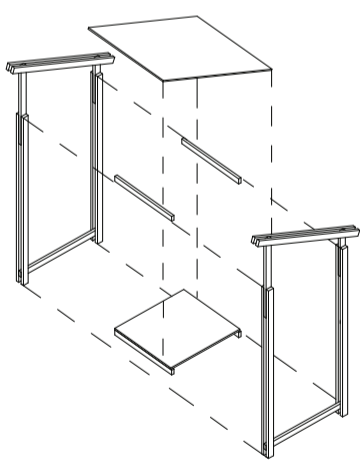
Reduce local and downstream flood risk



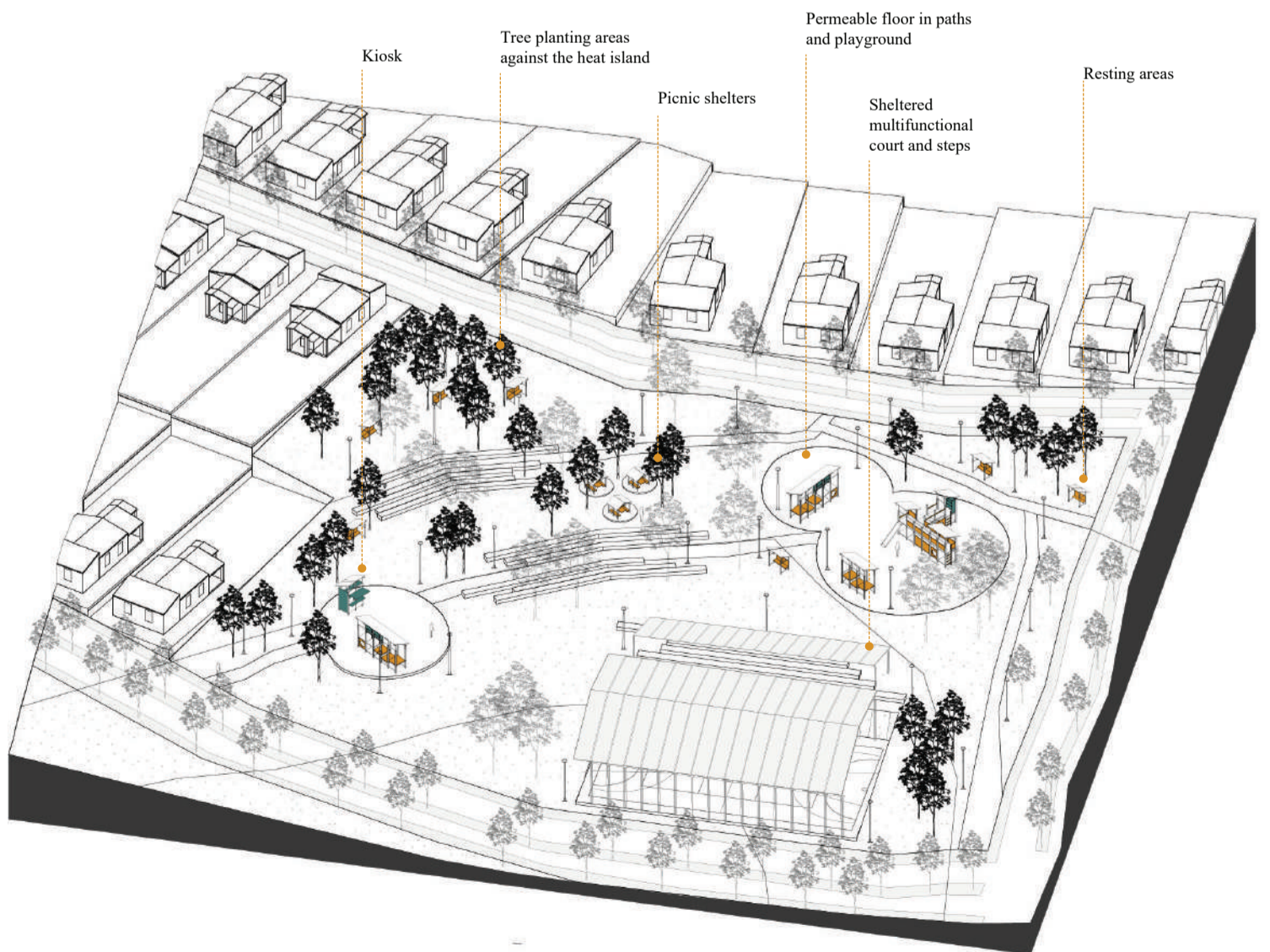
URBAN MULTIFUNCTIONAL MODULE



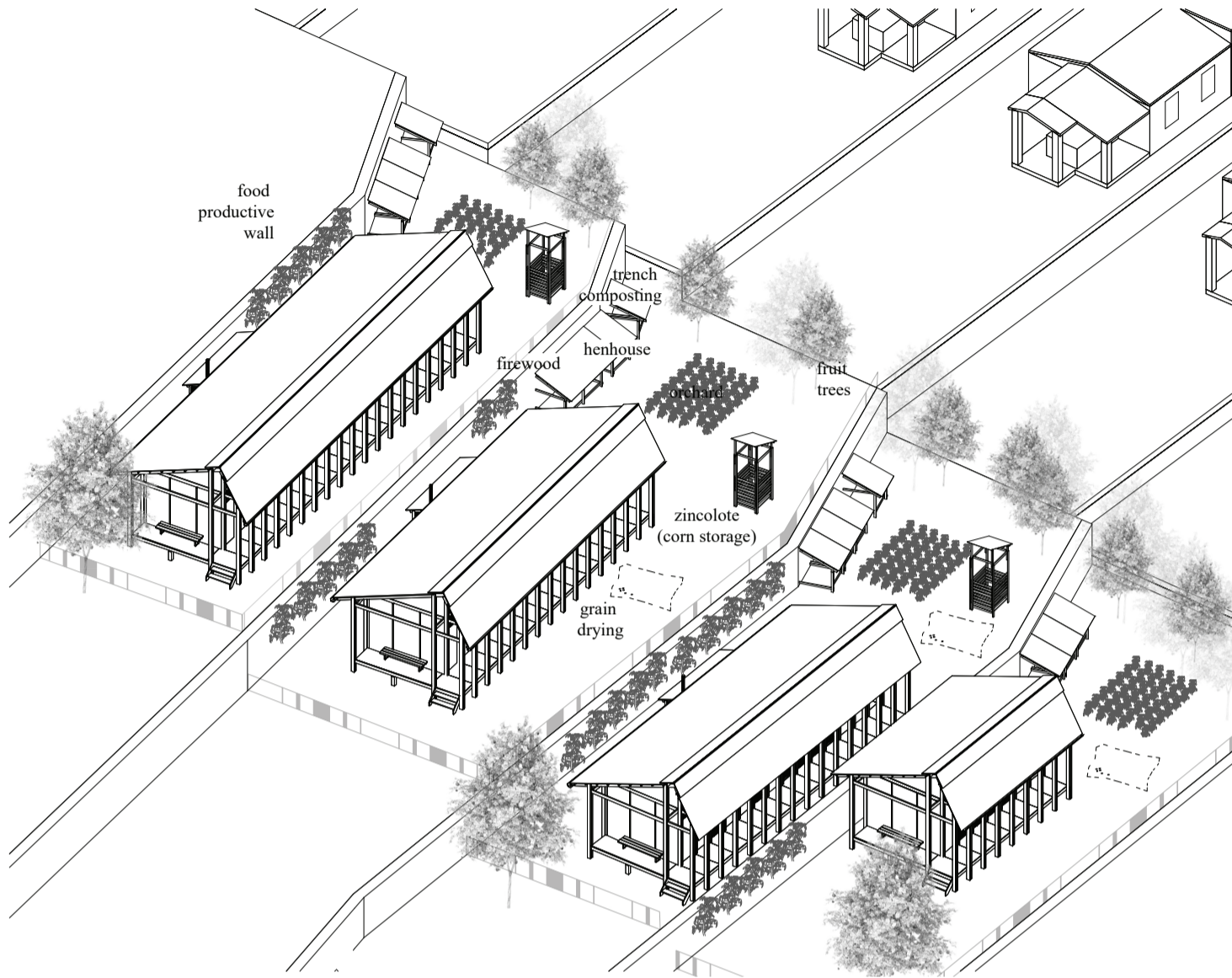
GREEN AREAS REDESIGN



- +Improves urban life by generating identity and sense of belonging of the inhabitants
- +Same structure principle of the housing prototypes
- +Each module could be use separately or together
- +Easy to assemble and maintenance



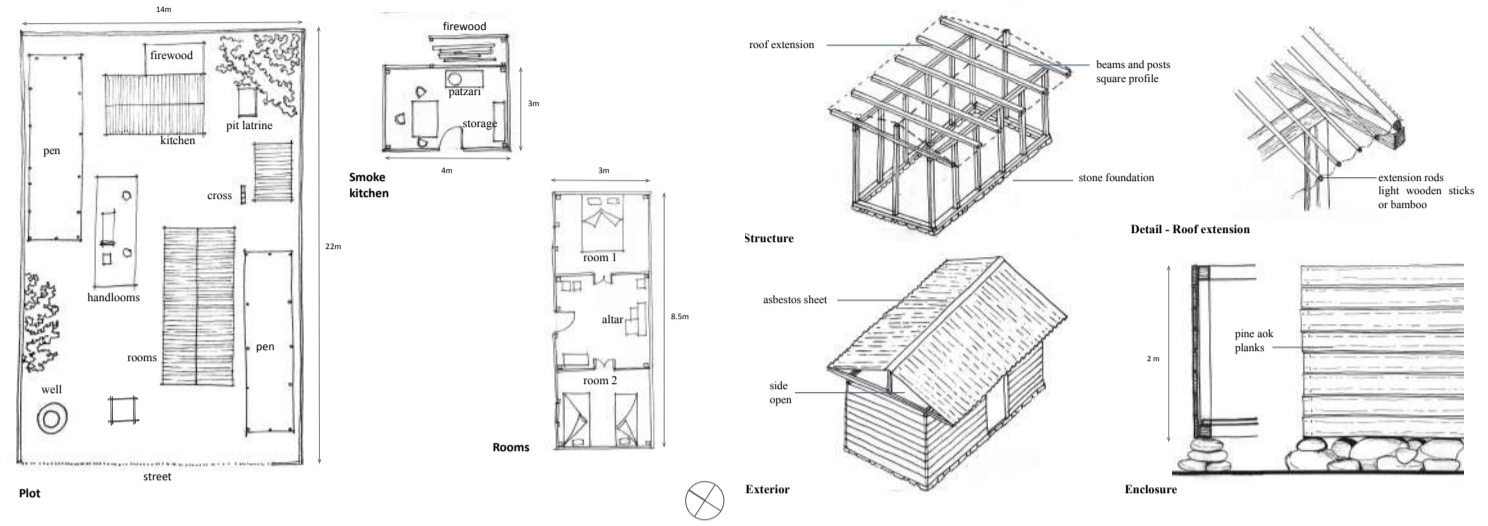
USE OF THE PLOT



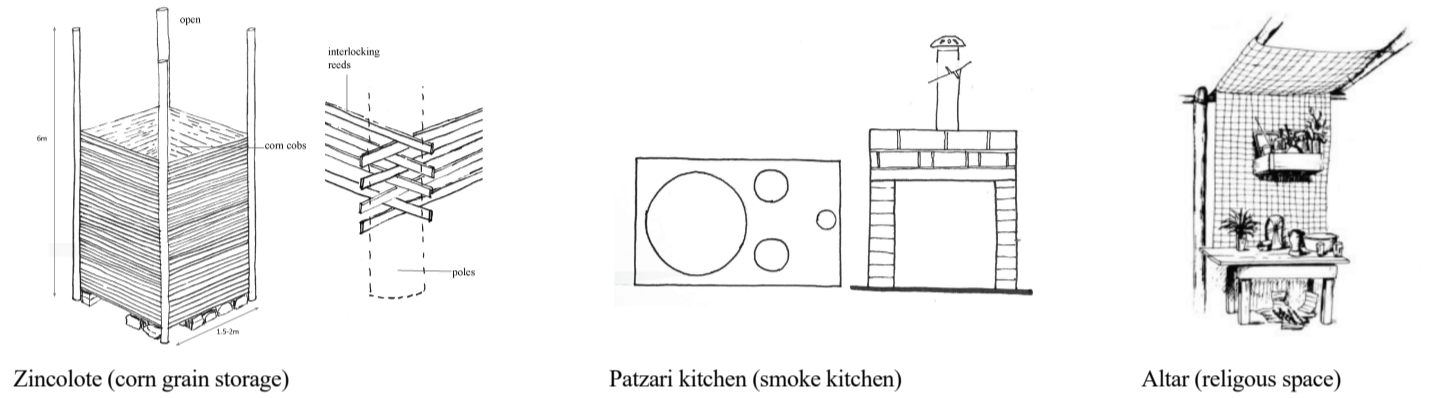
BACKGROUND: RURAL HOUSING IN CHIAPAS

Prior to the development of this thesis, an investigation was carried out to determine the characterization of the use of wood in rural houses throughout Mexico. In this research, spatial and structural elements were found that were repeated in houses from different regions located in different climatic zones. A case study was carried out in the region that this thesis studies. Through the sketches made, we found a certain point to consider such as the importance of the use of the patio, the meeting spaces, the arrangement of the elements of the house, for example, the bathroom is rarely integrated into the living spaces, the kitchen and still use of wood stoves. All these characteristics have been taken into account to find a model of house that can respond to the uses and customs, but also that provides flexibility for future changes. The prototype originally proposed to the inhabitants of the rural city has left families unsatisfied because it is not designed for them nor does it propose clear guidelines for growth with spatial or structural quality, so families have adapted some of the houses, but the solutions have been improvised and in general terms they do not mean an improvement for the house.

Specialization Project research - Case study in Chiapas



Common elements

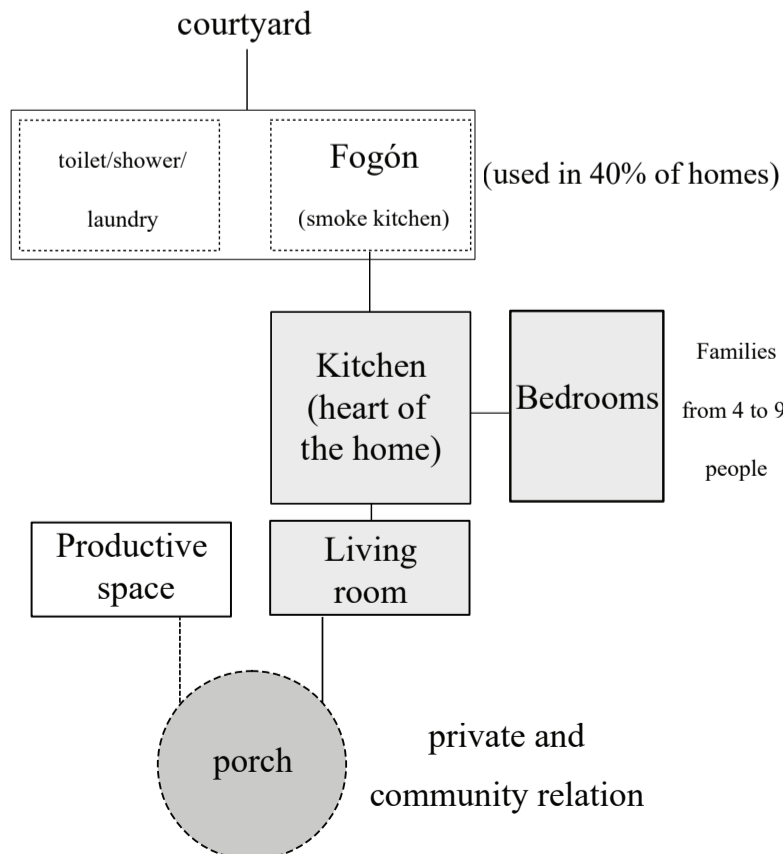


Typology of prior houses of the rural city families

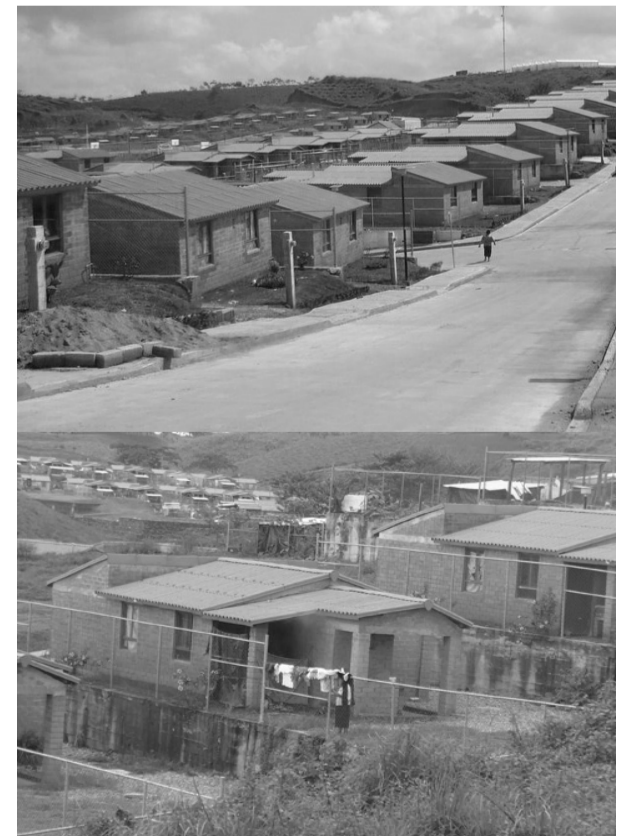


Fogón space

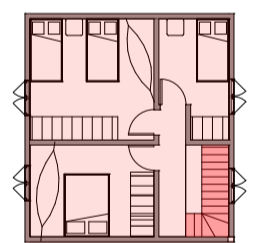
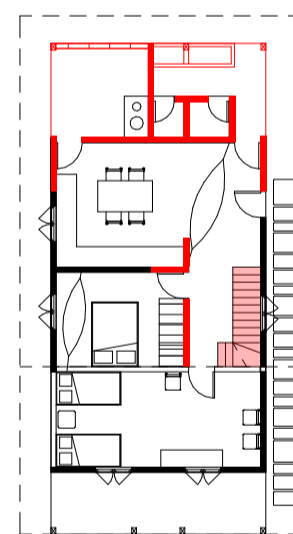
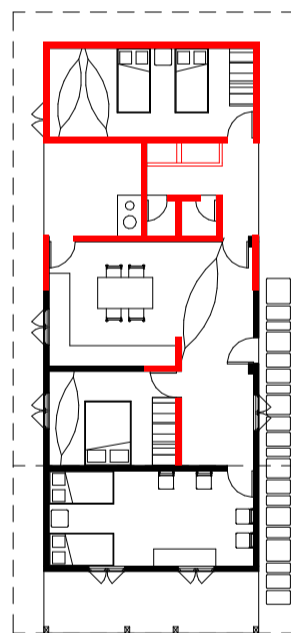
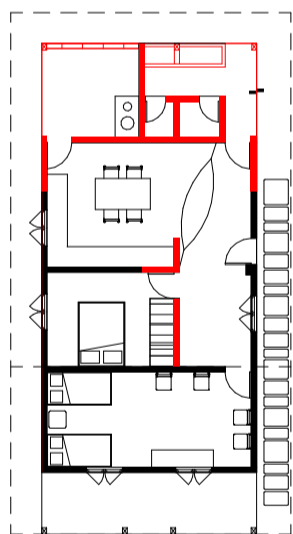
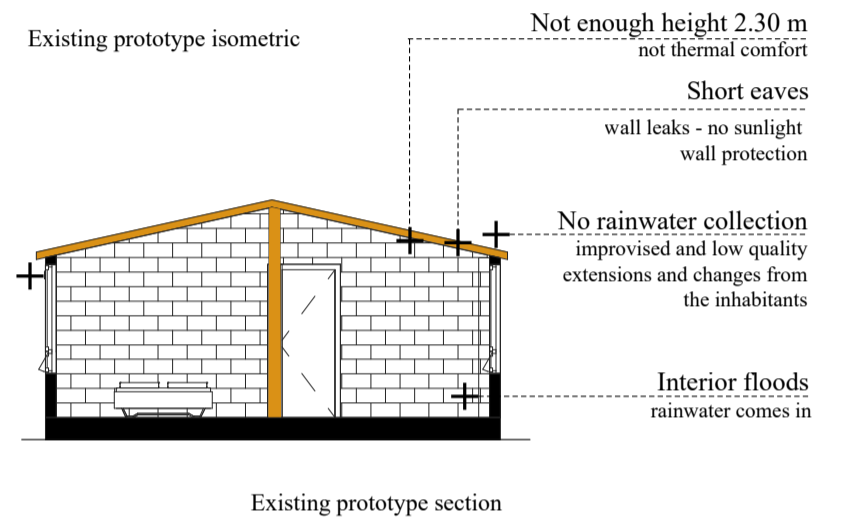
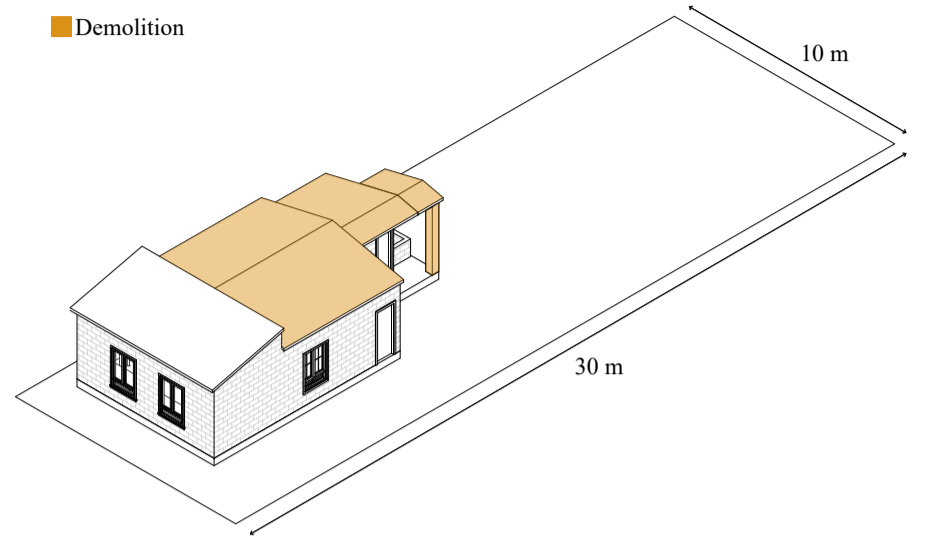
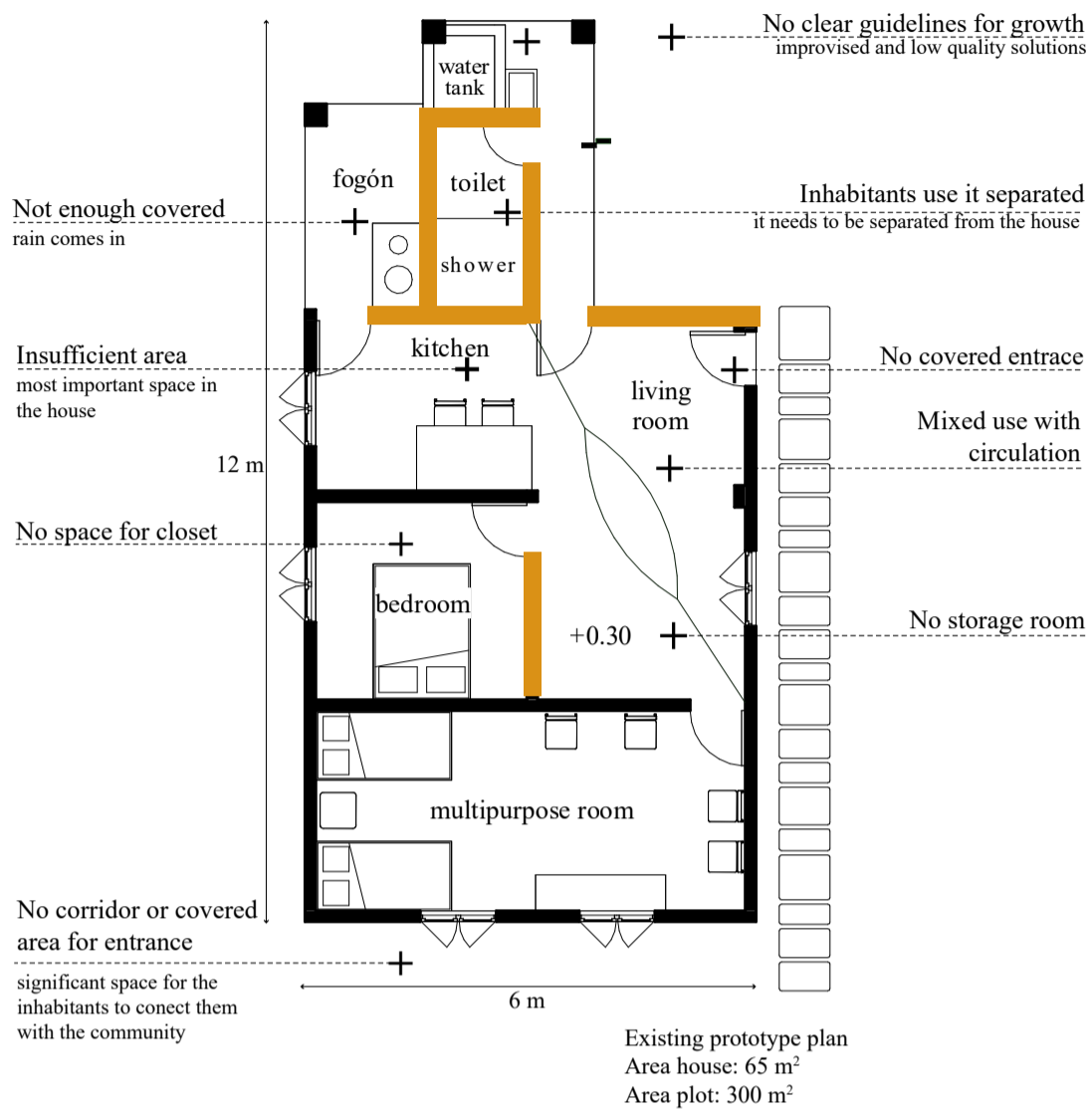
Relationship diagram



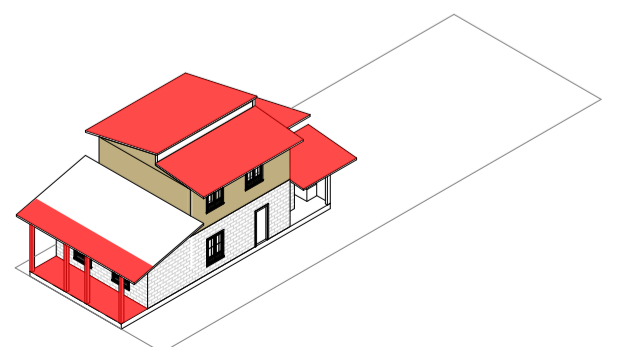
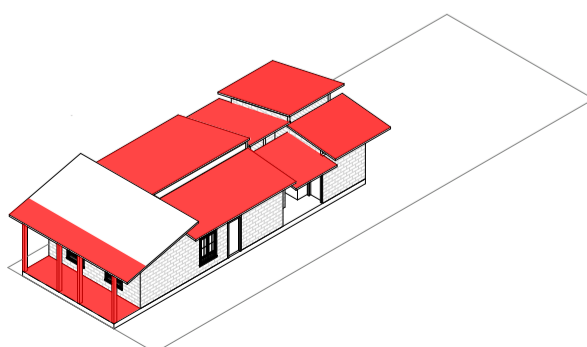
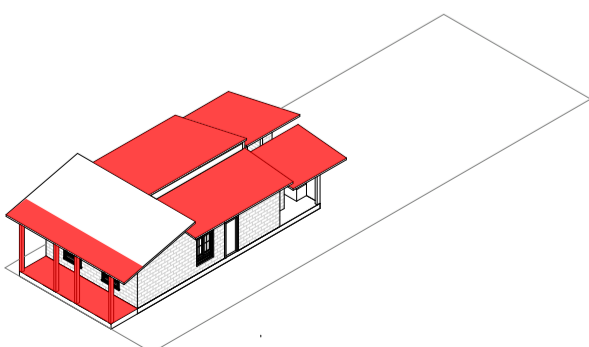
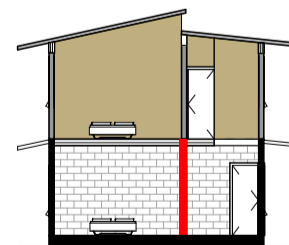
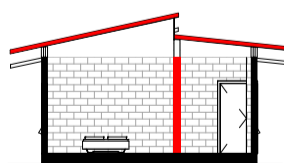
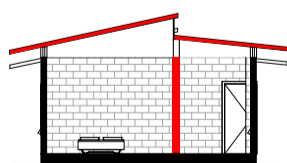
Existing prototypes in the city



EXISTING PROTOTYPE IN THE CITY AND PROPOSAL



■ Addition

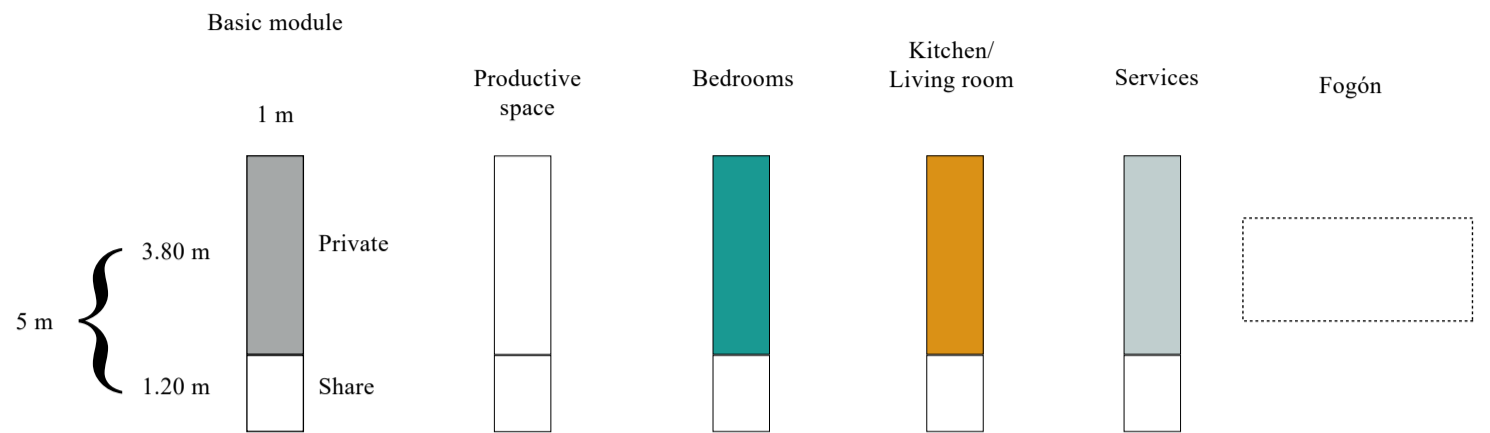


4m 1:200

CONCEPT

The objective is to provide stable but lightweight and flexible homes. The concept is to combine modular components that help control quality and cost and future mass production. Timber frame and precast concrete foundation guarantee predetermined stability and accuracy. The lightweight structure allows a smaller foundation and transportability. Light timber frames with simple bolted connections also encourage dwellers to participate in construction. Locally sourced, finishing materials can all be assembled and replaced easily by dwellers and neighbors for future change or extension.

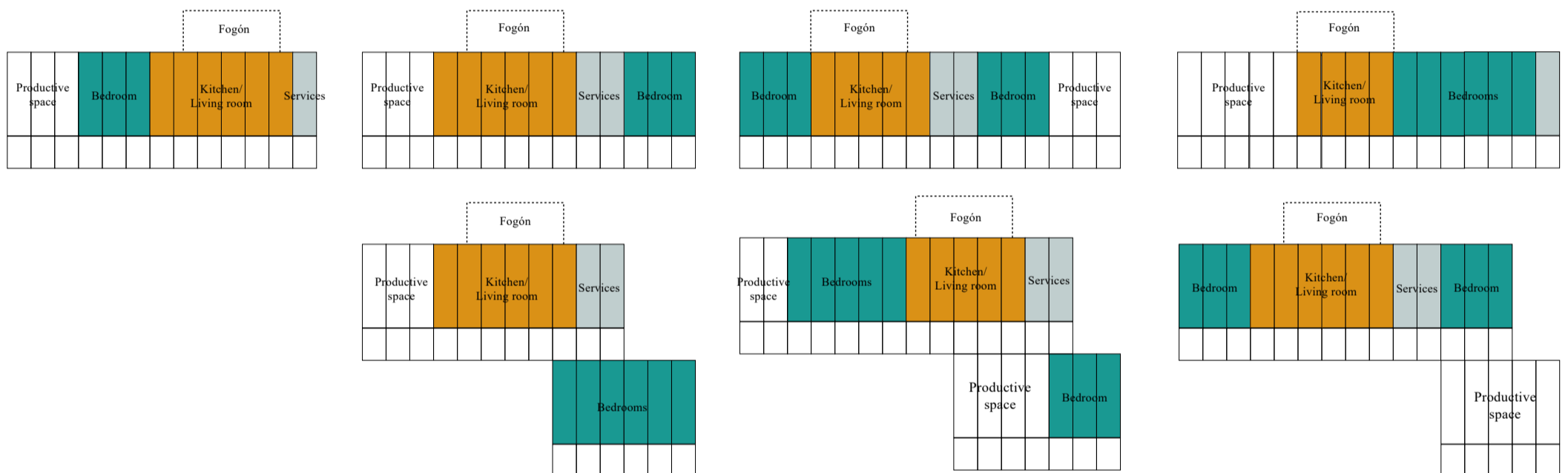
To cope with harsh weather of the region, the project utilizes passive design strategies. Polyal corrugated sheets and insulated ceiling in rooms combined to form a "double roof", helps protect dwellers from excessive rain while providing sufficient thermal comfort. Window and door panels allow natural light to enter and reduce the need for artificial lighting, while the gap between the roof and walls is to promote natural ventilation.



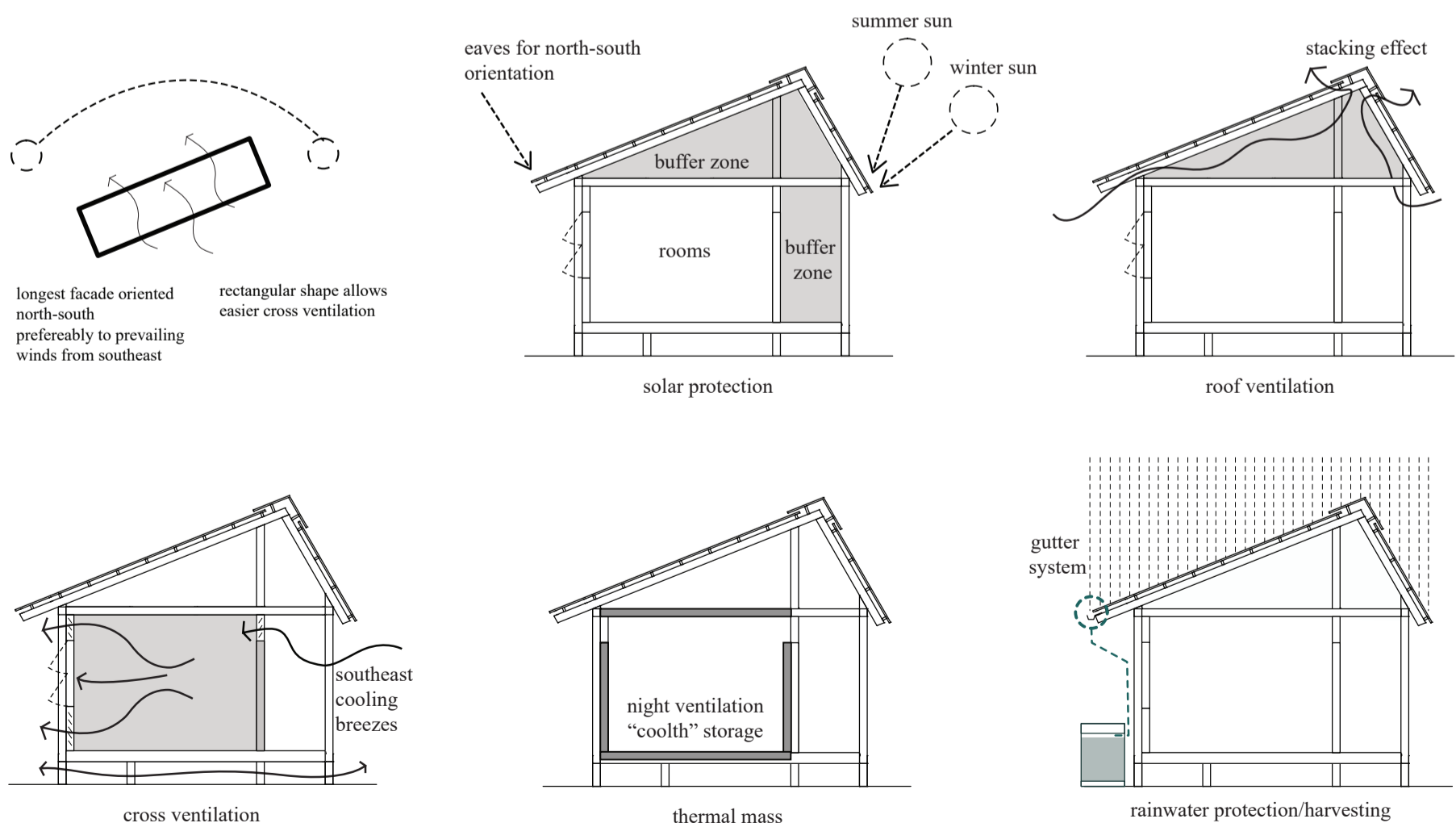
FLEXIBILITY OF LAYOUT

Basic proposal

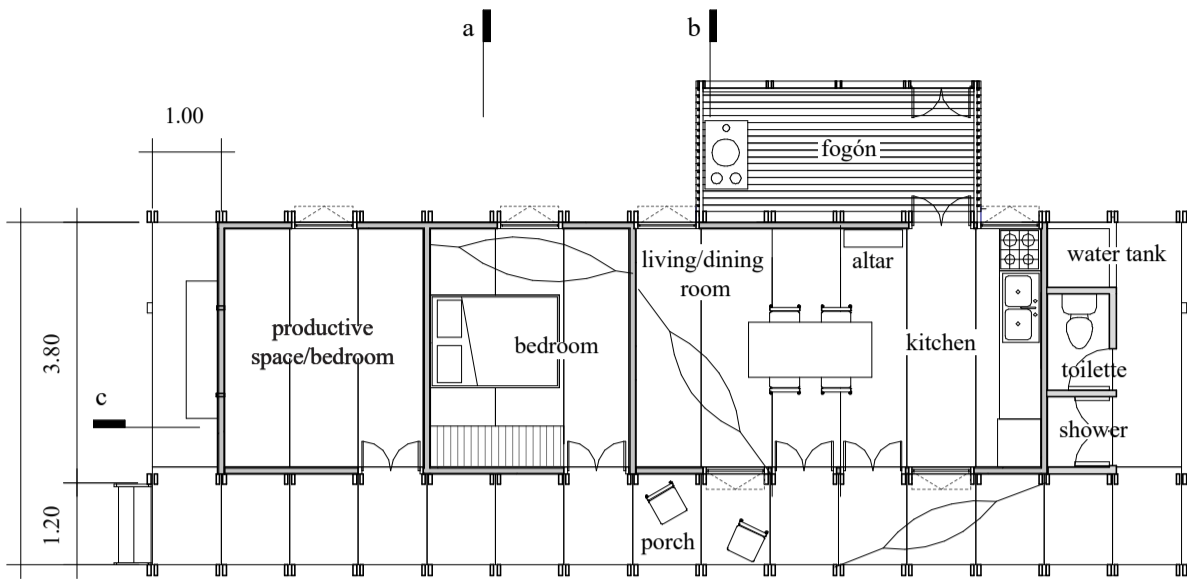
Adapted to the needs of a family home...



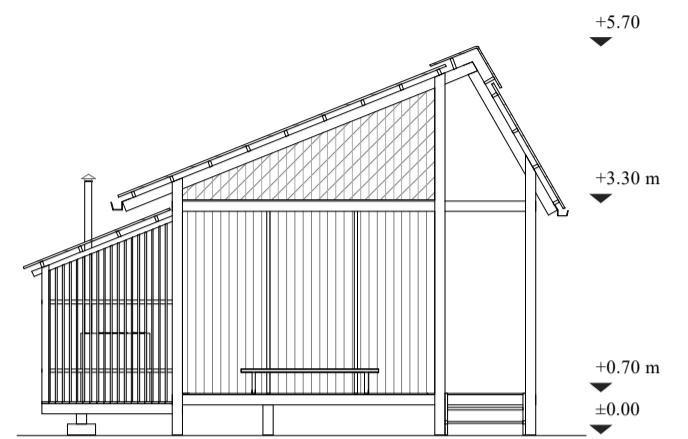
BIOCLIMATIC APPROACH



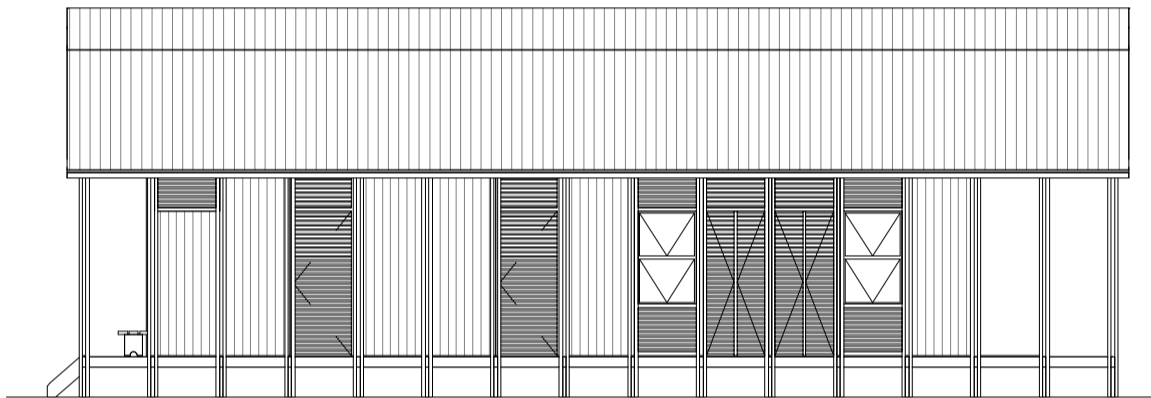
BASIC PROTOTYPE



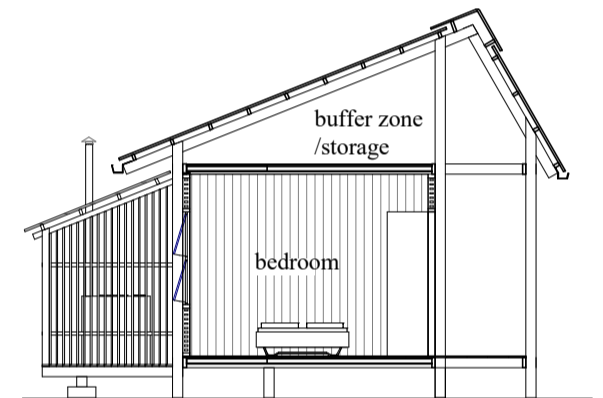
Basic unit - Groundfloor
Area: 75 m²



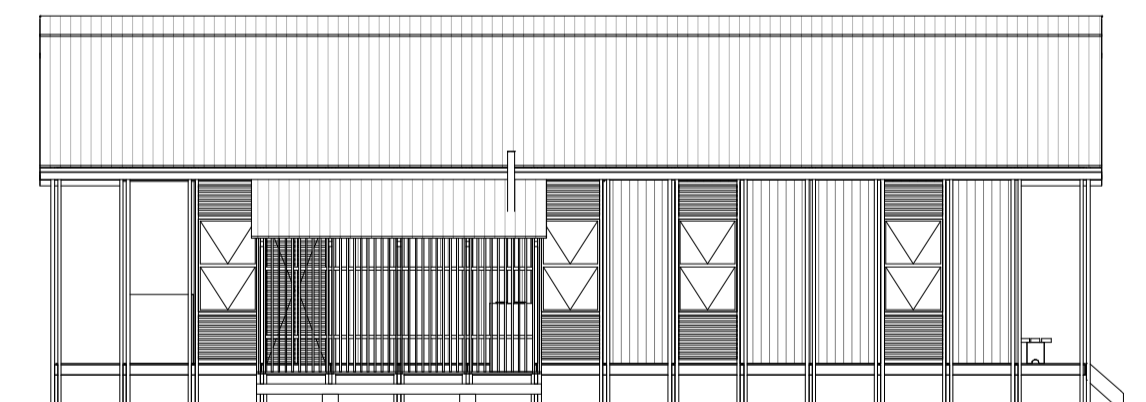
East elevation



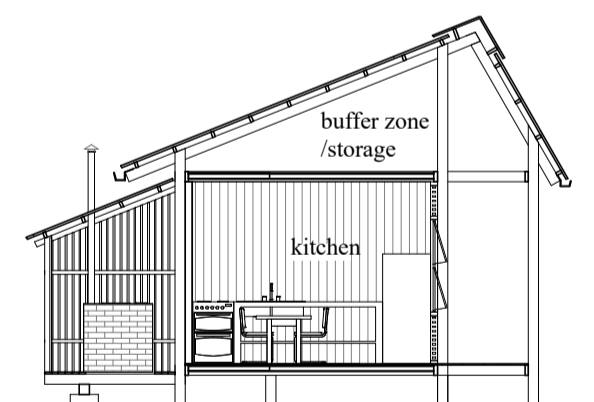
North elevation



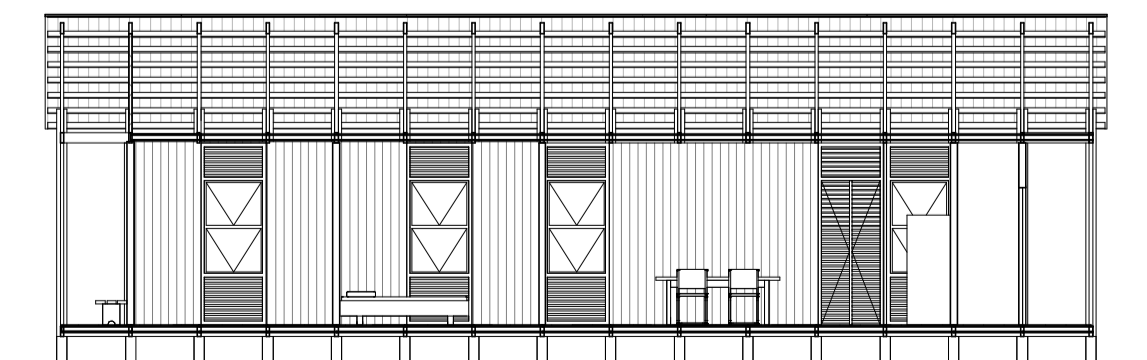
Section A



South elevation



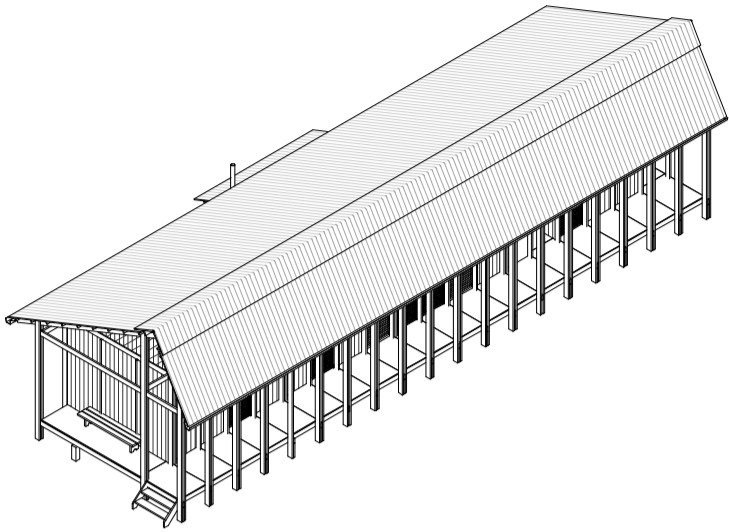
Section B



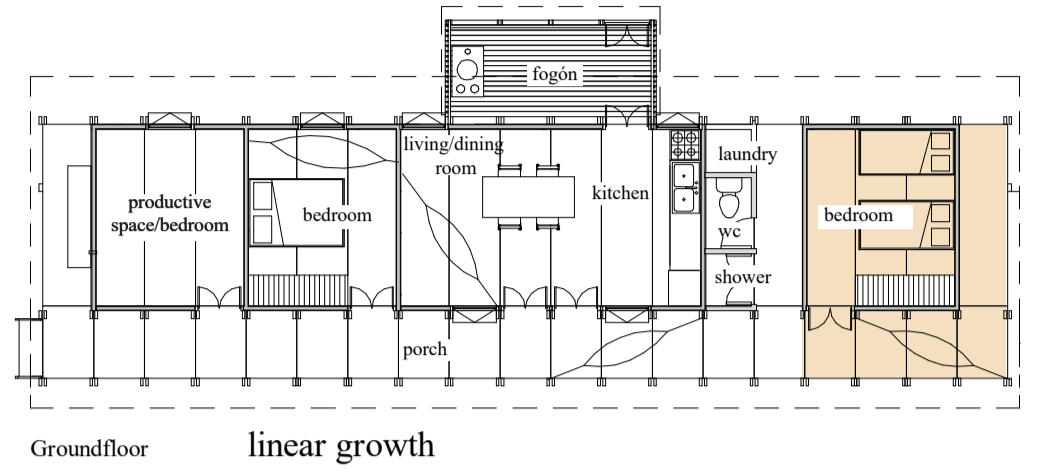
Section b

2m  1:100

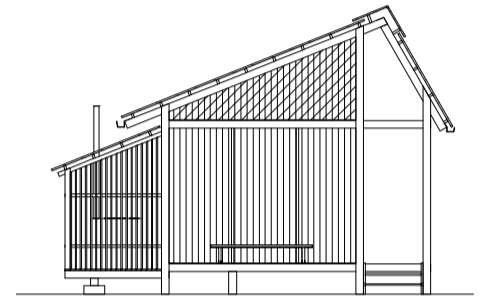
GROWTH PROPOSALS - ONE LEVEL



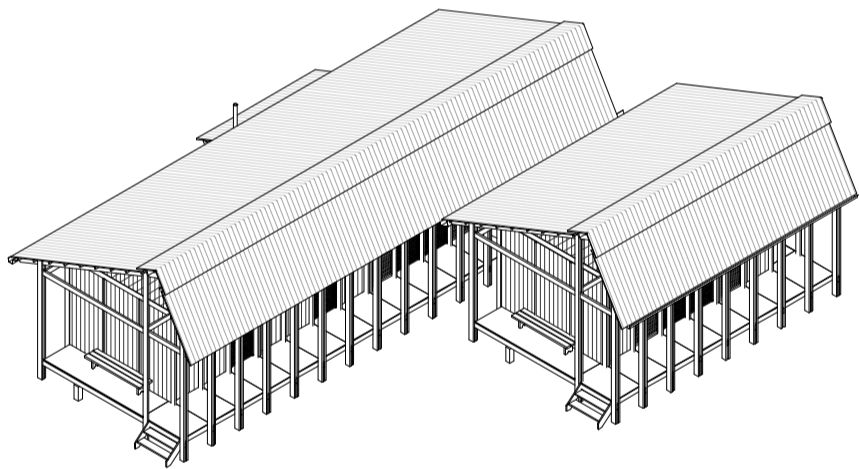
Linear growth
Area: 95 m²



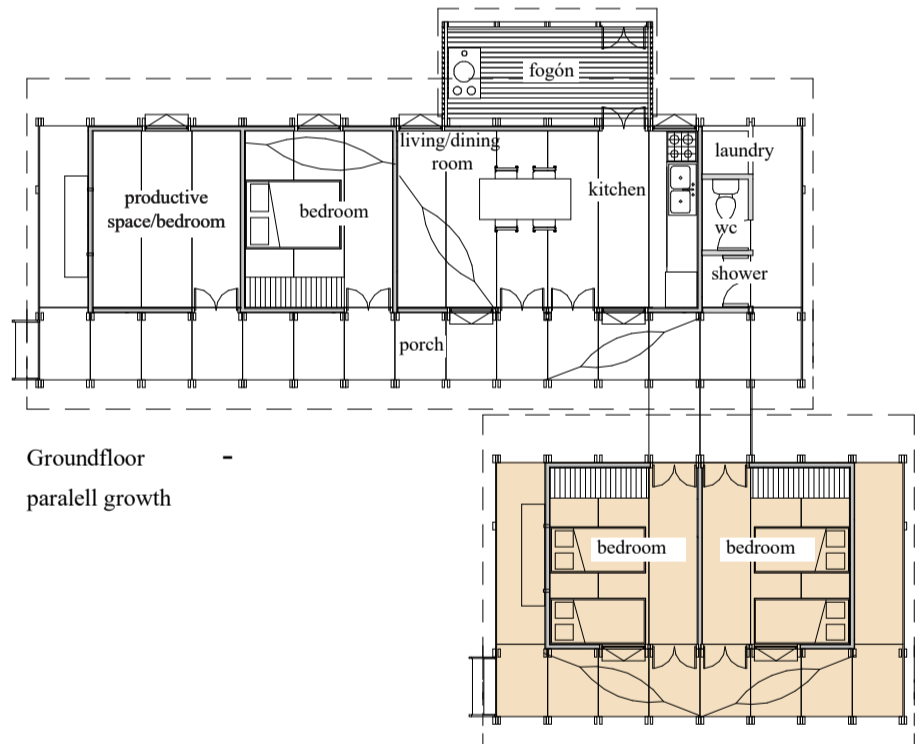
Groundfloor linear growth



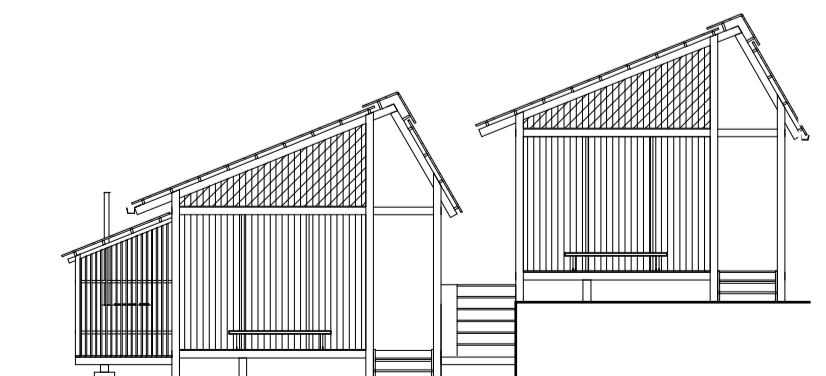
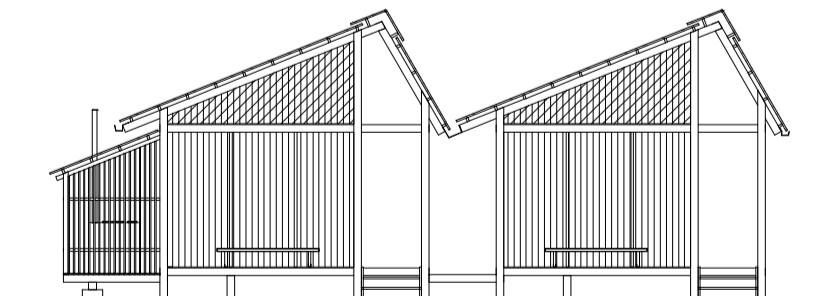
Side elevation



Parallel growth
Area: 115 m²

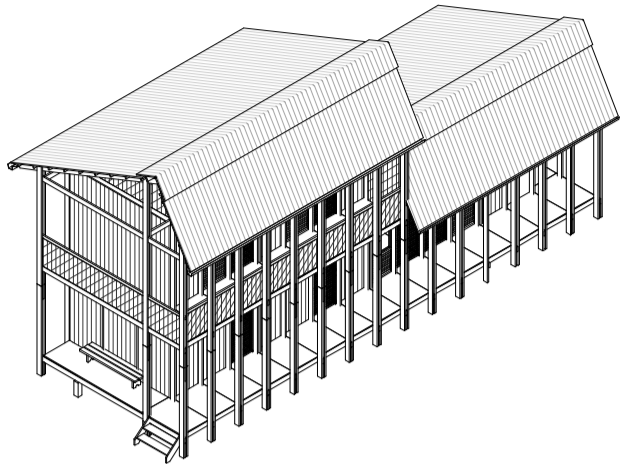


Groundfloor -
paralell growth

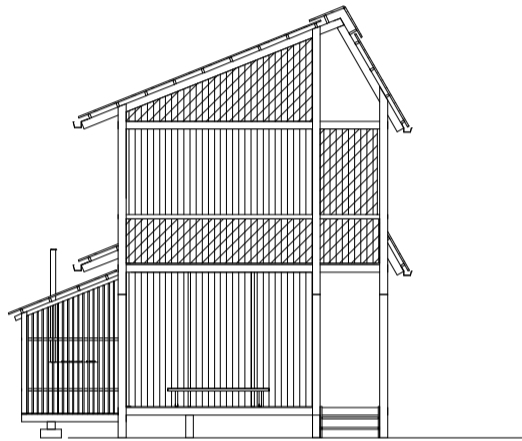


Side elevation

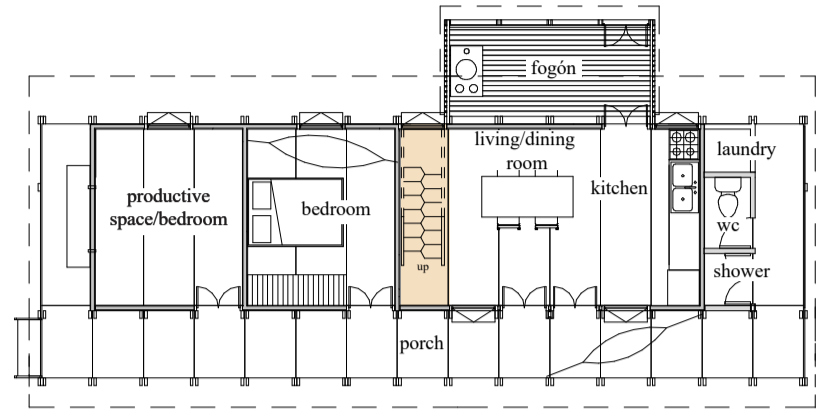
GROWTH PROPOSALS - TWO LEVELS



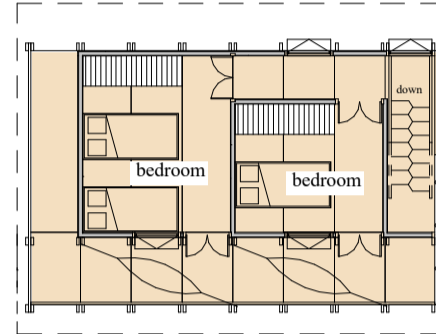
Vertical linear growth
Area: 115 m²



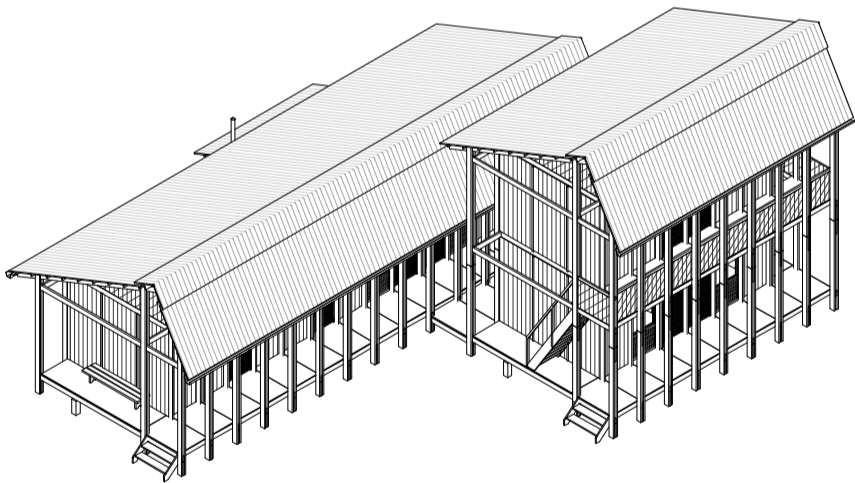
Side elevation



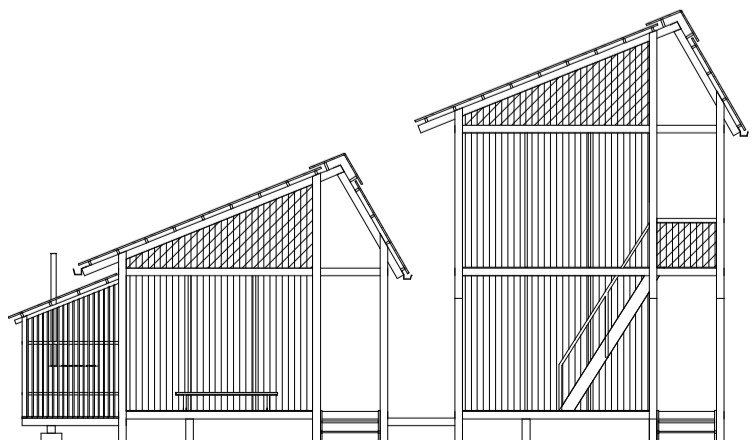
Groundfloor - linear growth



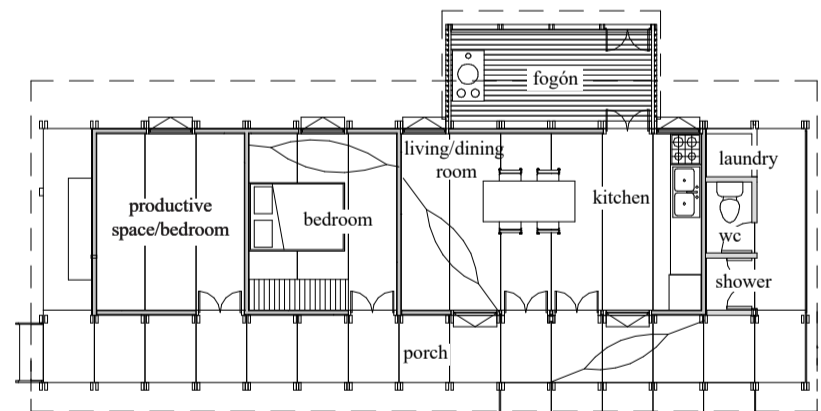
First floor - linear growth



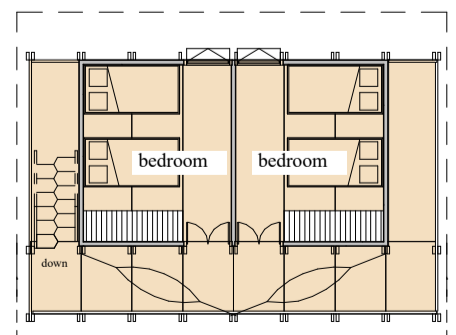
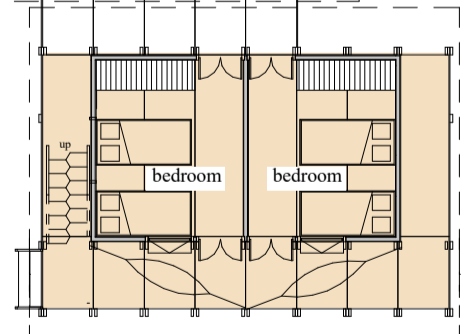
Vertical parallel growth
Area: 155 m²



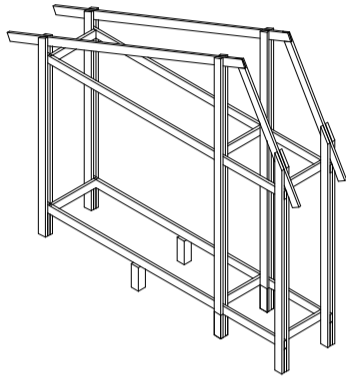
Side elevation



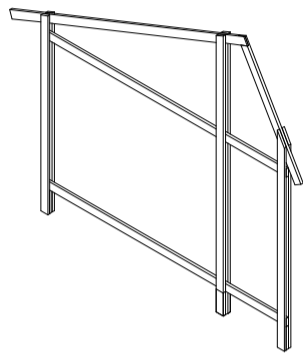
Groundfloor parallel growth



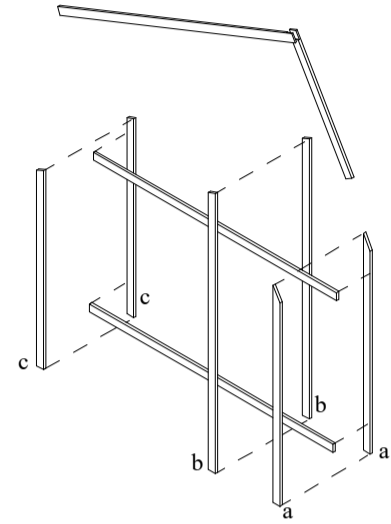
First floor - parallel growth



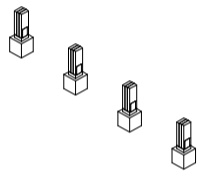
Modelo frame union



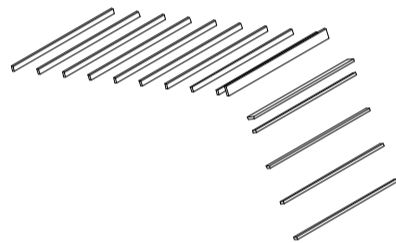
Frame (doble timber column)



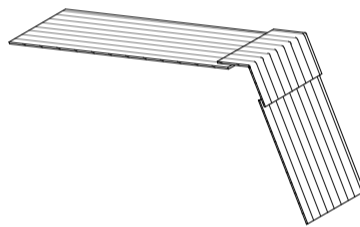
Exploded frame



Concrete pier blocks with metal bracket



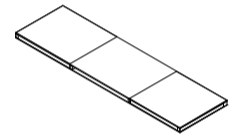
Roof battens 2"x3"
Chimney roof battens 2"x6"



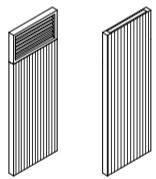
Polyal roofing sheets



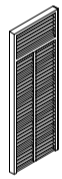
Metal gutter



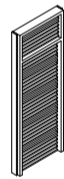
Floor panels
(1.20x0.95)



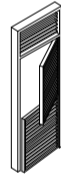
Wall panels
(1.00x2.65m)



Doble door v.
(1.00x2.65m)



Single door
(1.00x2.65m)



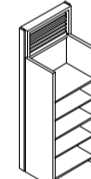
Doble door h.
(1.00x2.65m)



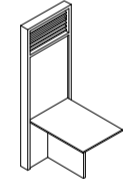
Window
(1.00x2.65m)



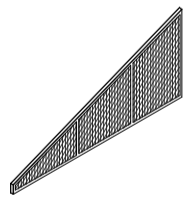
Closet
(1.00x2.65m)



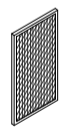
Shelves
(1.00x2.65m)



Folding door
(1.00x2.65m)



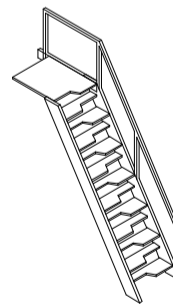
Natural fiber
gable panel



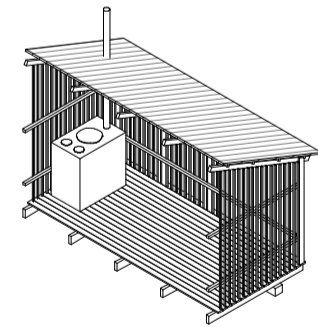
Natural fiber
side panels
(0.85mx1.70m)



Platform steps

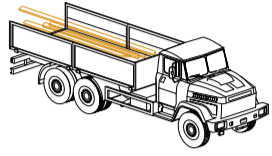


First floor stairs

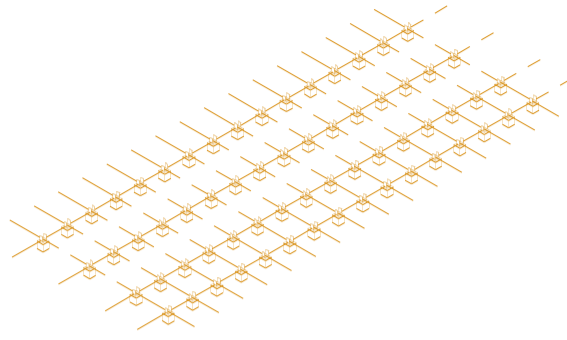


'Fogón' module (2.00x 4.00m) +
patzari kitchen

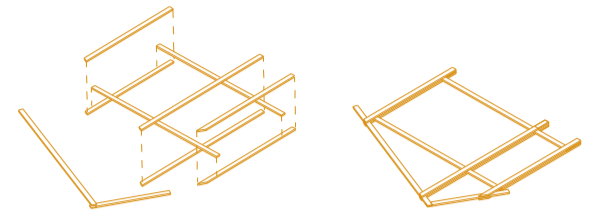
CONSTRUCTION PROCESS



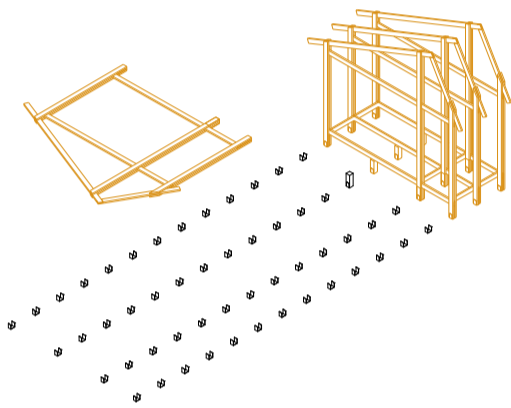
1. Easy transportation
Timber pieces and factory assembled panels



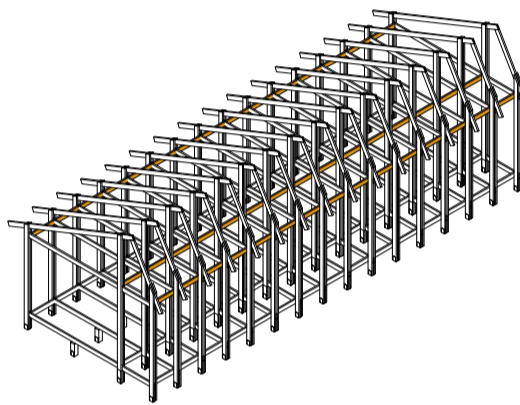
2. Foundation
Excavation for concrete pier blocks with metal brackets



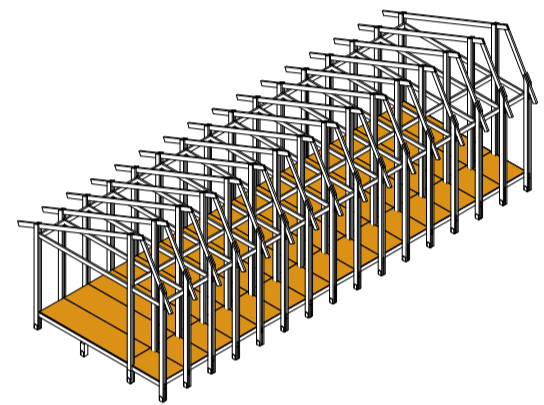
3. In-situ timber frames assembly following to the manual



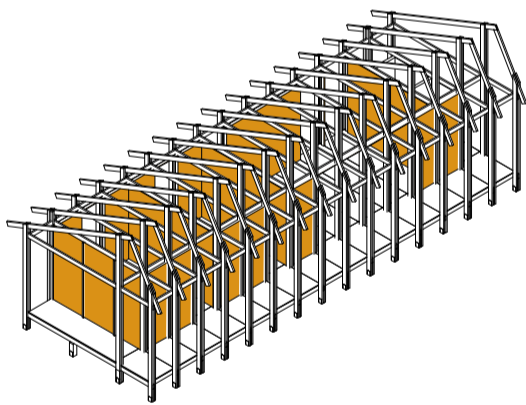
4. Mount frames joining them with ledgers



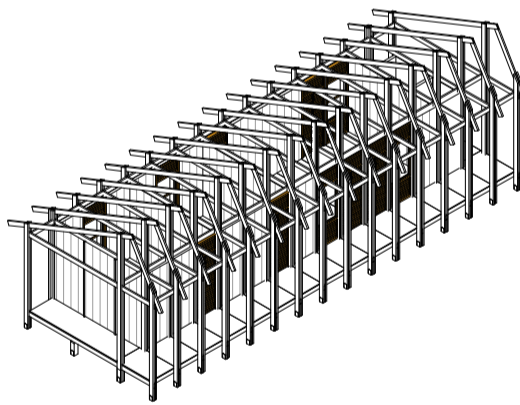
5. Place top ledgers



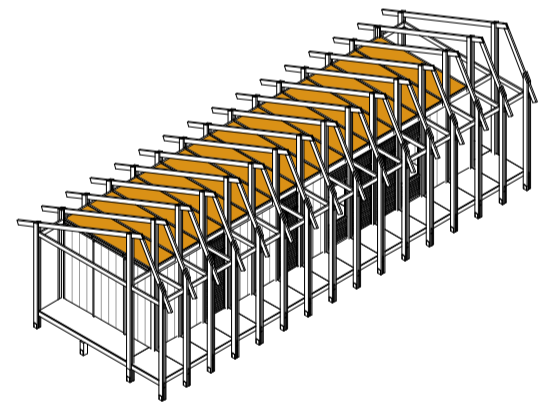
6. Mount floor panels



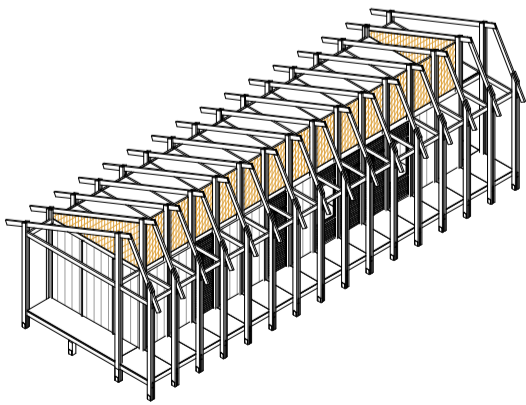
7. Mount wall panels



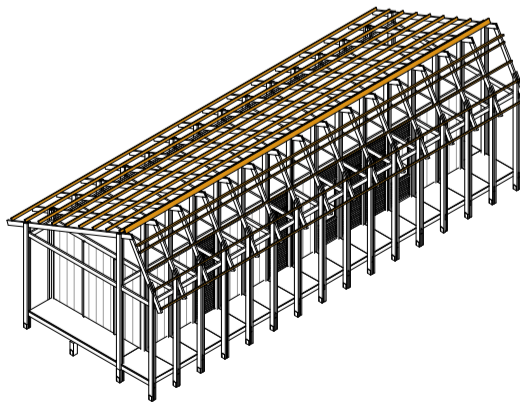
8. Mount windows and doors panels



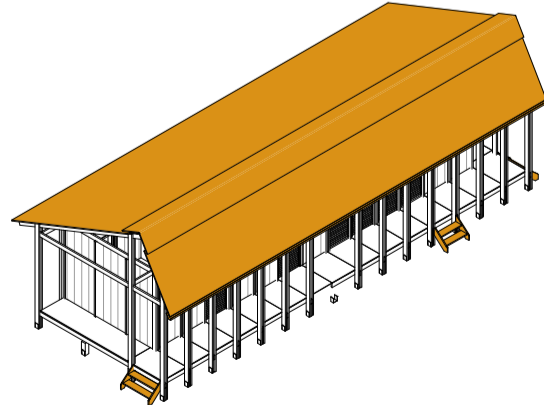
9. Mount ceiling panels



10. Optional gable and side frames

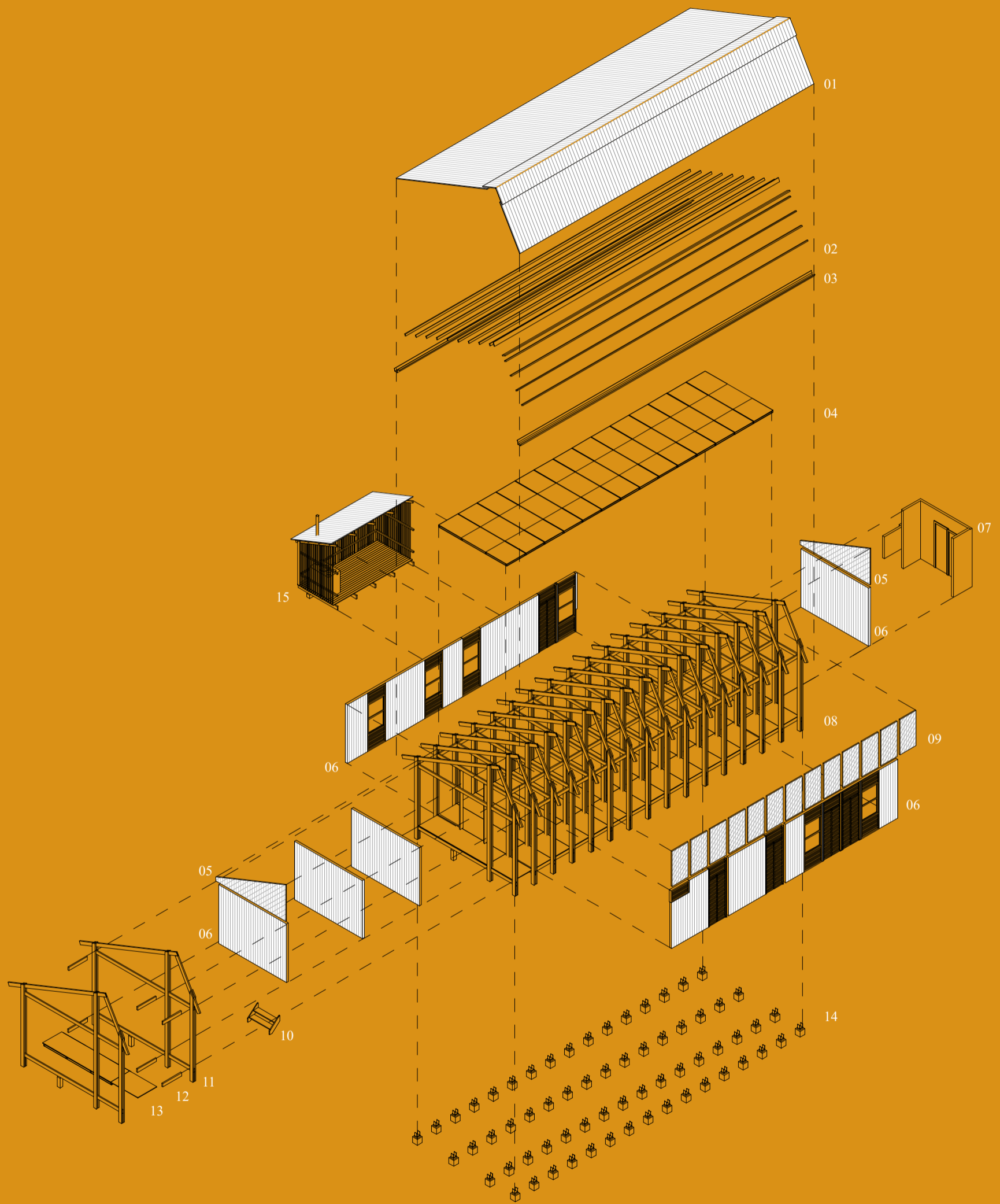


11. Place roof battens



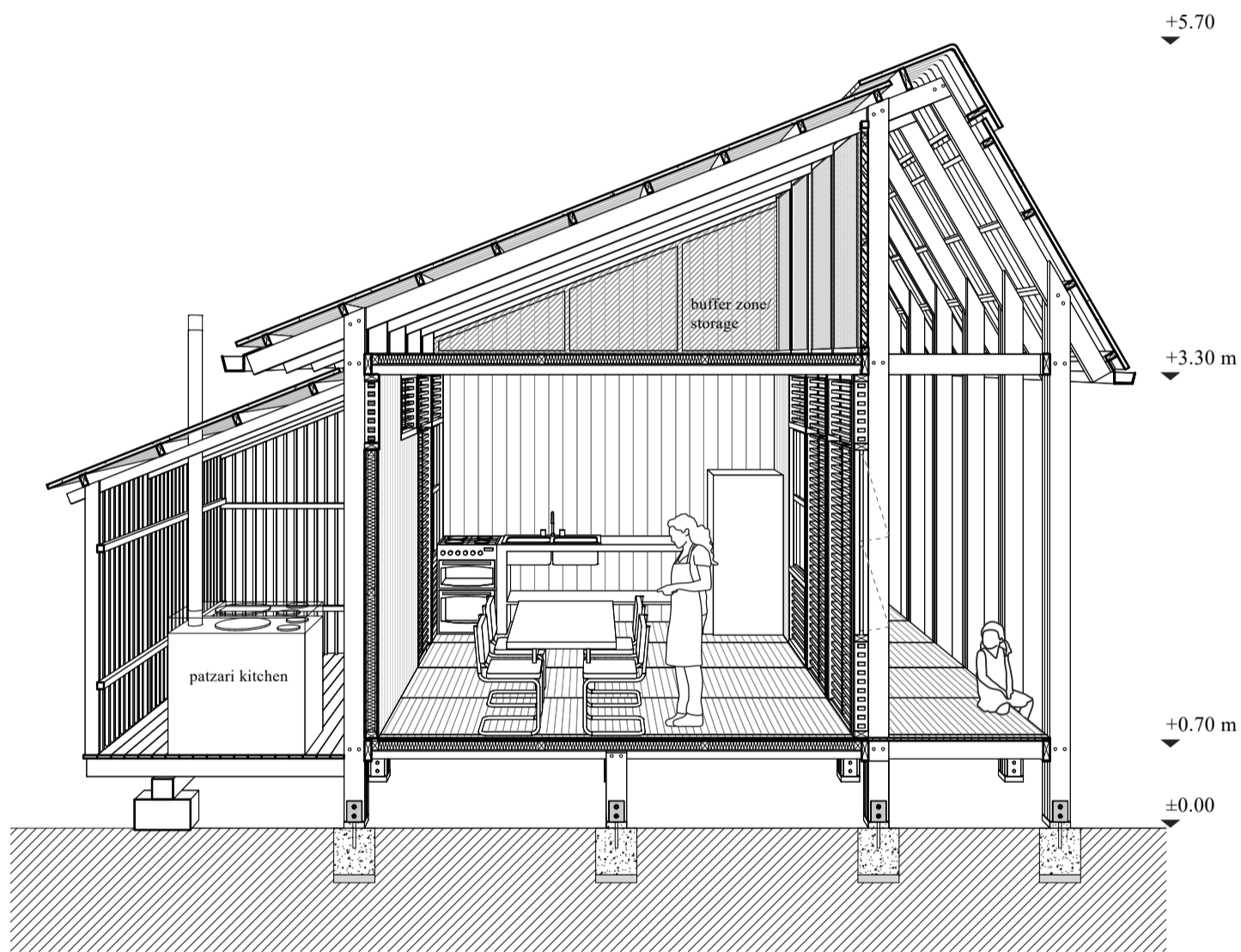
12. Install roof sheets, gutters and steps

EXPLODED BASIC UNIT PROTOTYPE



- 01 Roof
- 02 Roof battens
- 03 Gutters
- 04 Ceiling panels
- 05 Gable frame
- 06 Wall panels
- 07 Wall service panels
- 08 Mounted frames
- 09 Side frames
- 10 Steps
- 11 Assembled frame
- 12 Ledgers
- 13 Floor panels
- 14 Foundation
- 15 Fogón module

PERSPECTIVE FACADE SECTION



Roof
 Polyal (Green Roof) recycled tetra pack corrugated roofing sheets
 Steel gutter style B
 Roof battens 2"x3" every 60 cm
 Chimney roof battens 2"x6"
 Wooden beam 6"x2"

Celing
 Structural plywood plate 15 mm
 Compact straw insulation 80mm
 Asphalt felt 15 lb
 OSB structural board 9mm
 Wooden beam 6"x2"

Wall
 Vertical pine board siding 1"x 4"
 Straw insulation 80mm
 Nature screening

Floor
 Pine floorboards 1" x 5"
 Structural plywood plate 15 mm
 Straw insulation 80mm
 Asphalt felt 15 lb
 OSB structural board 9mm (exterior side black carboline)
 Wooden beam 6"x2"

Foundation
 Impregnated wooden pile
 Metal bracket 6mm
 Hex head bolt 1/2" x 7"
 Concrete pier block 30 x 30 x 35 cm
 Gravel bed

1m  1:50