

# Food in floods



Christelle Miangaly Rarivo

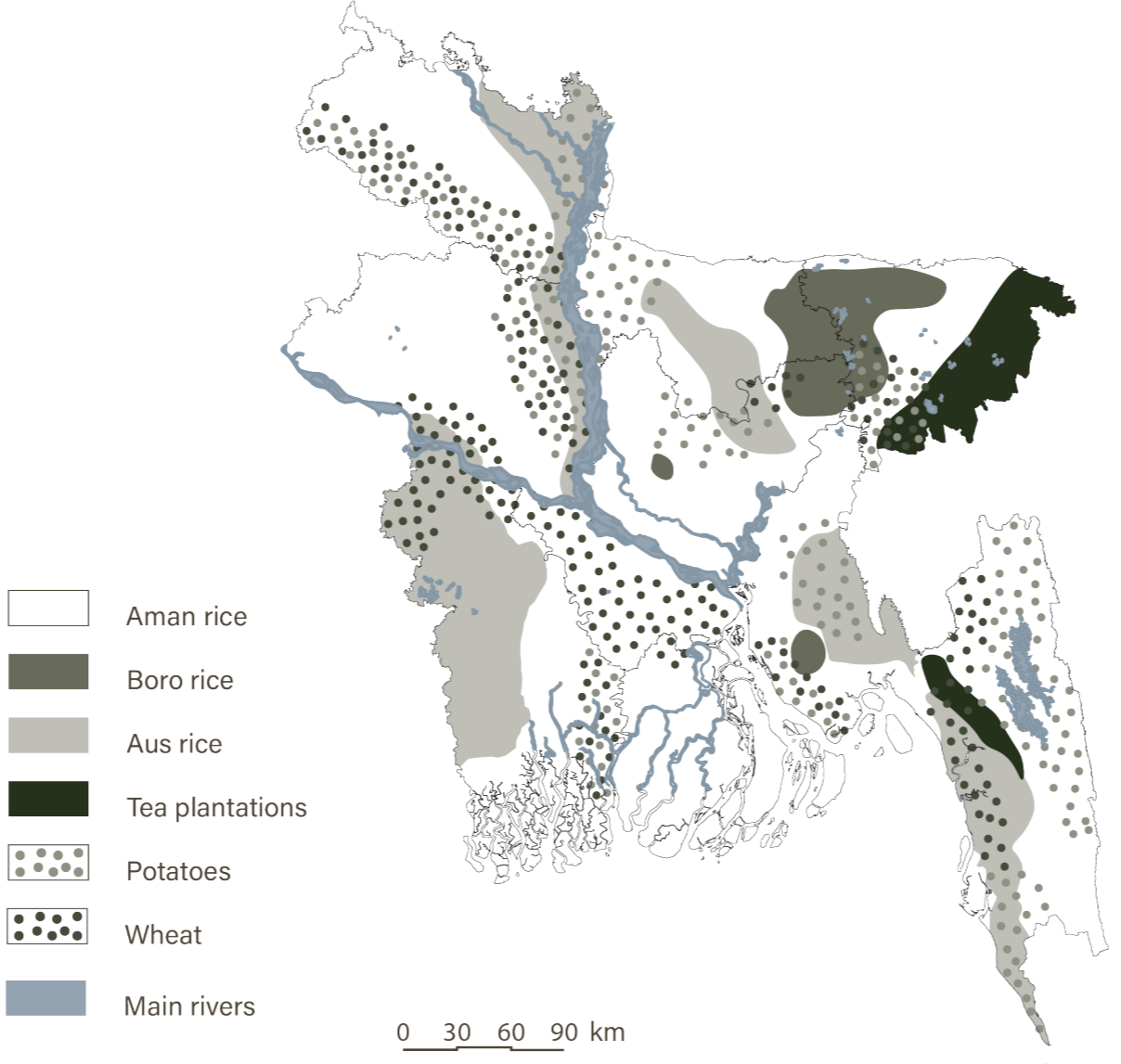
## *Problem statement*

During monsoon season, the limited amount of space in the wetlands ecosystems is not optimal to grow vegetables, essential for a balanced diet.

*Research question*

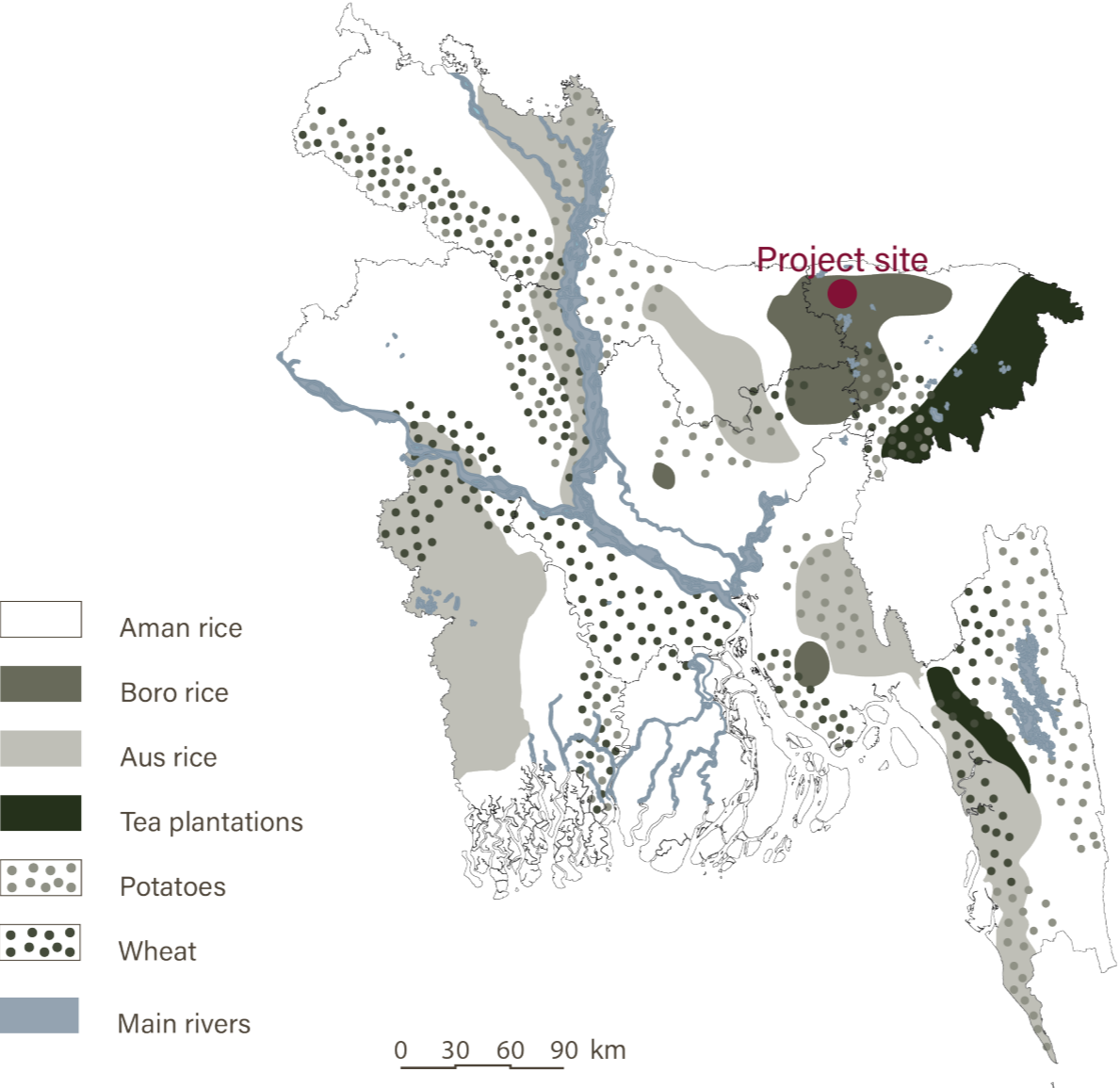
How can we enhance food security and dietary diversity while ensuring adequate housing for the local population?

# Site analysis



Map showing the main agricultural crops

# Site analysis



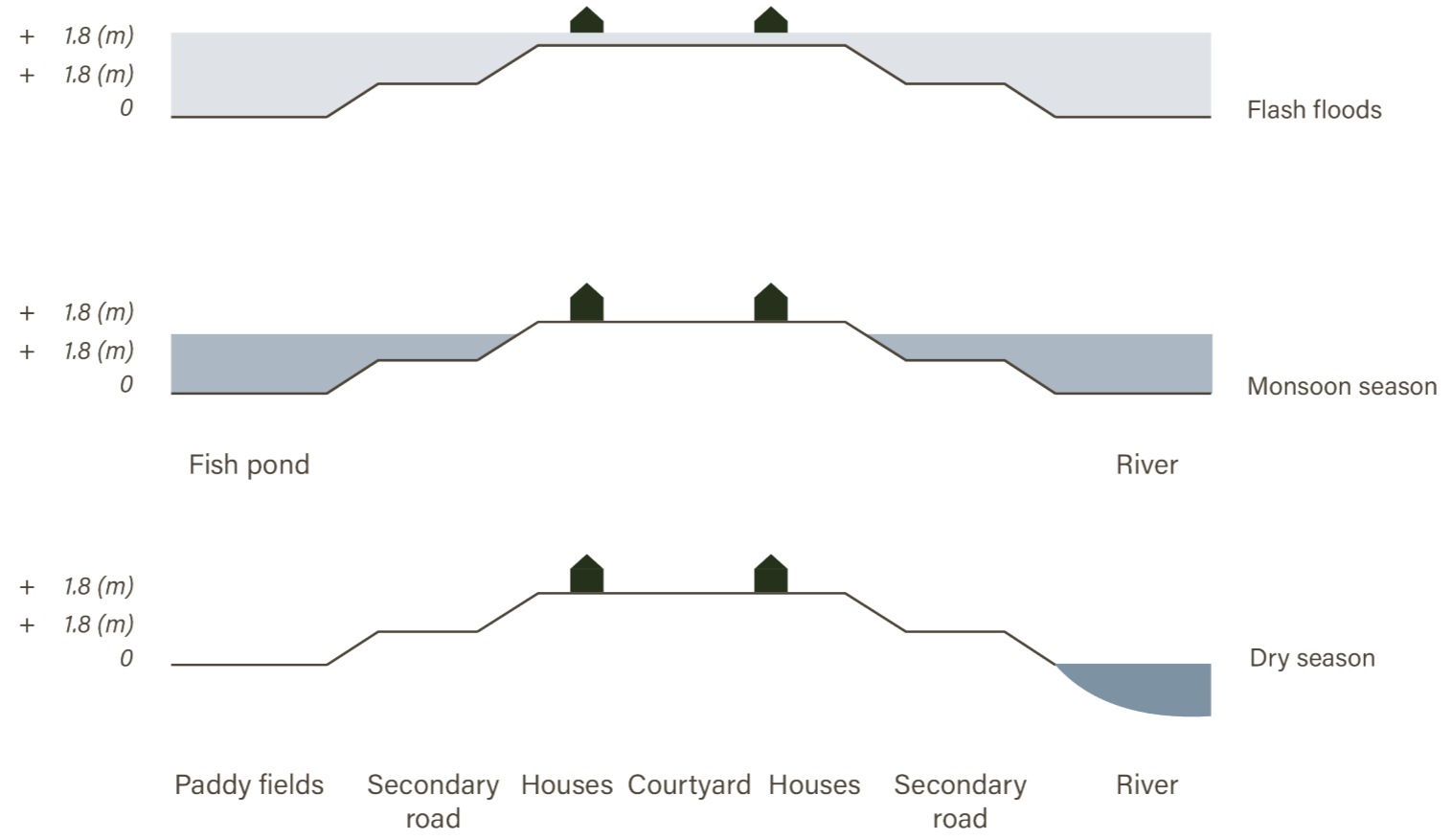
Map showing the main agricultural crops





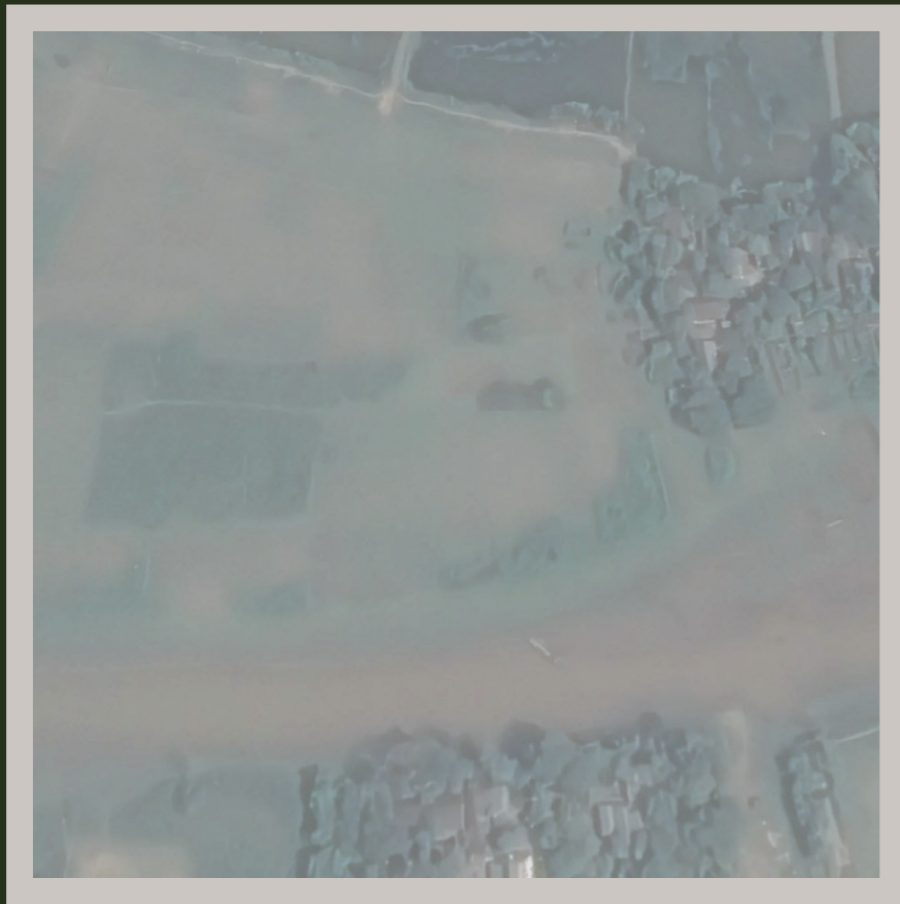
Project site

Tahirpur village



Embankment level





Project site in 2014







Project site in 2019



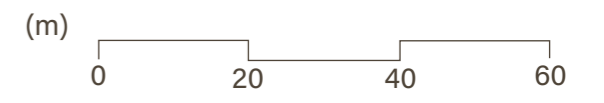
Project site in 2023

*Project site: 1.1 Ha  
Rice fields (dry season, November to May): 0.85Ha  
Fishing pond (monsoon season, June to October): 0.85Ha*



-  Existing buildings
-  Rice fields
-  Circulation space (earthy road)
-  Unoccupied space (forest and greenery)

Site characteristics



# Research

Granaries as a mean to improve food security during flash floods



Rice granaries, Mali



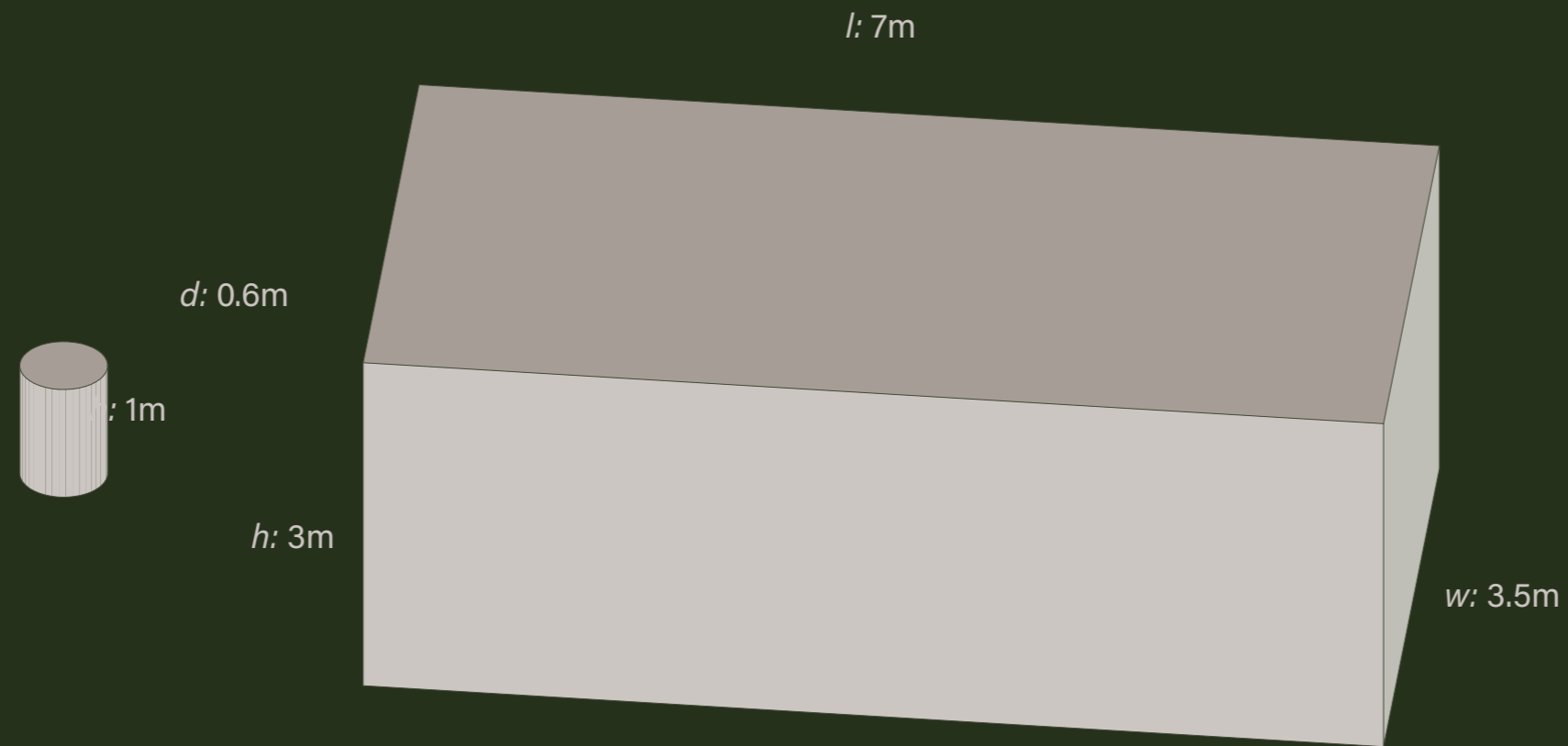
Fortified granaries, Tatouine (Tunisia)



Traditional granaries, Burkina Faso

1. Olivier, P (2017) *Rice granaries*
2. Lookphotos (2024) *Fortified granaries*
3. Shutterstock (2020) *Traditional granaries*

## Granaries in the Bangladeshi context



### Standard size of the Dole and Danghola

*The dole's storing capacity: 240kg of dried food in  $0.28274\text{m}^2$   
The danghola's storing capacity: 4000kg of dried food in  $24.5\text{m}^2$*

*Rice: 16,061 kg  
Fruits: 4,417 kg  
Food storage:  $24\text{m}^2$  to  $126\text{m}^2$   
for the entire settlement*

Choice of vegetables considering cultural practices, crop yield, nutritional value, season (Kharif) and available space

Gourd  
*Crop yield: 8,659 kg per Ha*



Beans  
*Crop yield: 9,373 kg per Ha*



Tomato  
*Crop yield: 13,744 kg per Ha*



Cucumber  
*Crop yield: 7351 kg per Ha*






Eggplant  
*Crop yield: 7,600 kg per Ha*

Choice of fruits considering cultural practices, crop yield, nutritional value, season (Kharif) and available space

Banana  
*Crop yield: 17,058 kg per Ha*



Papaya  
*Crop yield: 62 kg per Ha*

An aerial photograph of a jackfruit plantation. The trees are arranged in neat, parallel rows, creating a grid-like pattern. A central path or road runs through the middle of the plantation. The overall color palette is dominated by various shades of green, from light to dark, indicating the density and health of the crops. The lighting is bright, casting soft shadows between the rows.

Jackfruit  
*Crop yield: 27,215 kg per Ha*



Coconut  
*Crop yield: 17,473 kg per Ha*

Income generating activities related to food production which impact space



Fish farming



Duck farming



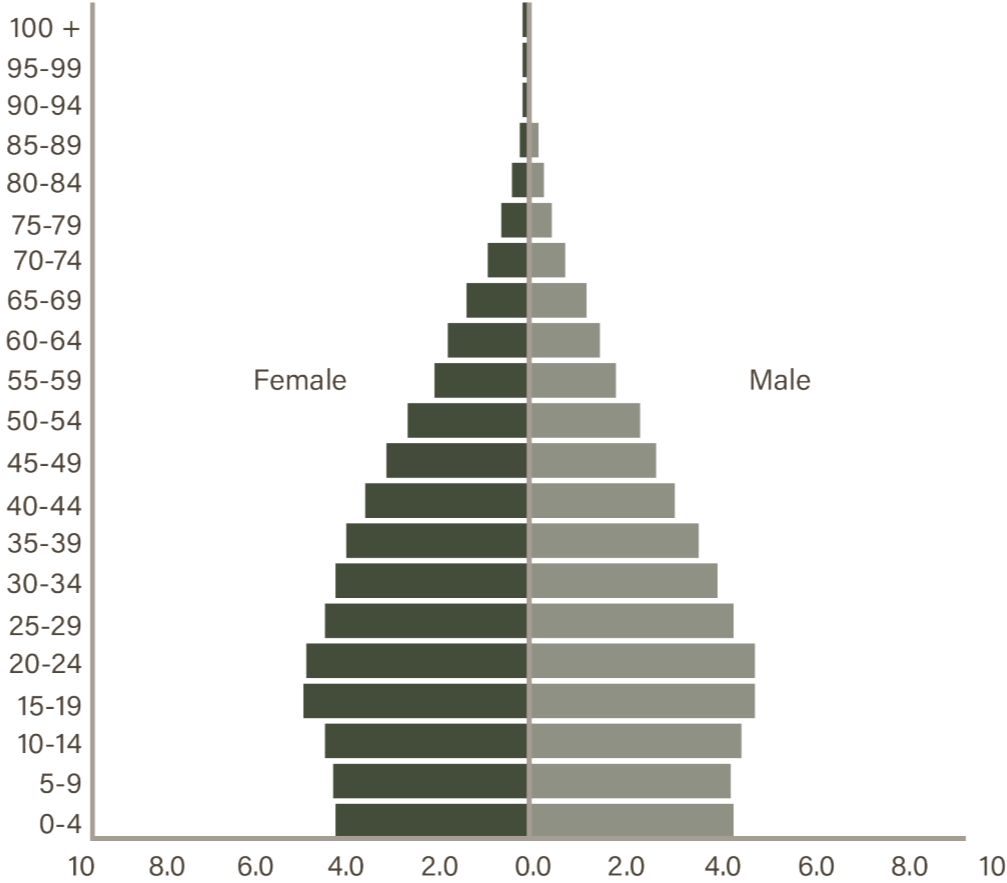
Other animal farming

1. WorldFish (2017) Conversion of agricultural land for fish cultivation

2. Mahalder, B (2008) Duck farming

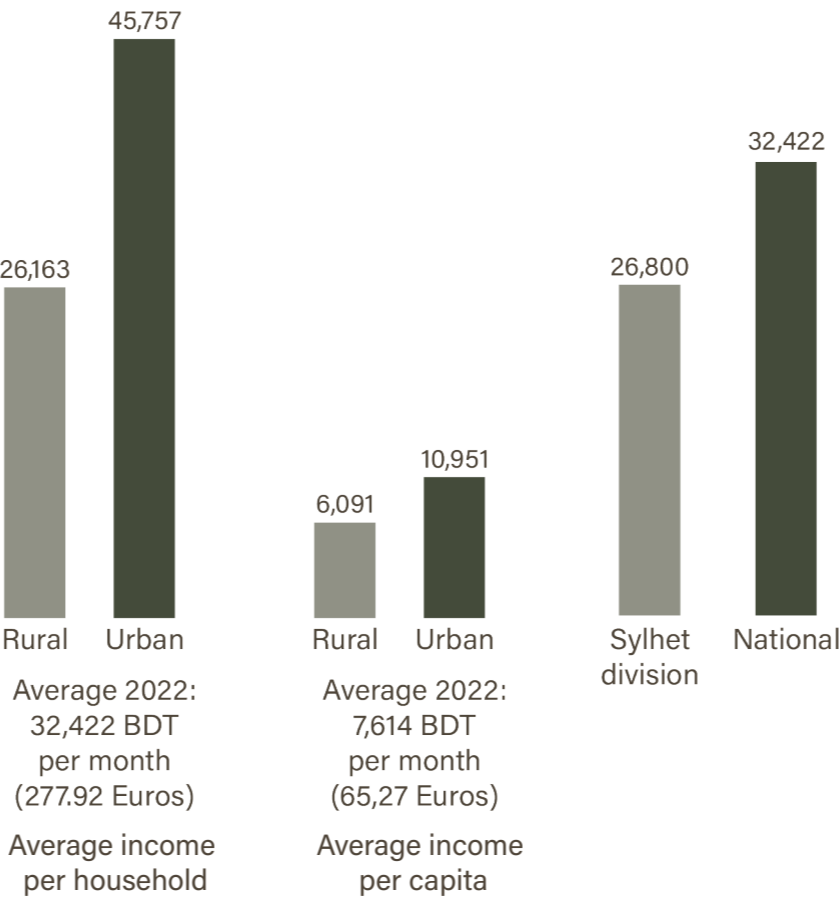
3. Rarivo, C.M (2023) Animal farming

People of Bangladesh



Age pyramid on a national level

People of Bangladesh





People of the wetlands



Small family  
4 to 5 people



Medium family  
6 to 7 people



Large family  
8 to 10 people

# Design

## Inhabitants of the new village



Small family  
4 to 5 people



Medium family  
6 to 7 people



Large family  
8 to 10 people

## Program of requirements

### 1) Housing:

- 696 people: 5, 7, and 10 people per household (30m<sup>2</sup>,45m<sup>2</sup>,60m<sup>2</sup>)  
6 m<sup>2</sup> per person (UN housing standards)
- 96 Dwellings for 1.1 Ha:
  - 24 houses for 5 ppl 25%
  - 48 houses for 7 ppl 50%
  - 24 houses for 10 ppl 25%
- Low rise building (G+1)
- FSI: 0.45 GSI: 0.22

### 2) Adaptation to climate change disasters:

- Shelter on upper floors in the event of flash floods
- Elevated Living facilities and storage

### 3) Income generating activities:

- Livestock (indoor space: 3.7m<sup>2</sup> per cattle, 0.37m<sup>2</sup> per chicken or ducks)
- Aquaculture (Fish farming: 0.85Ha)

### 4) Homestead gardens:

- Communal food gardens
- Composition of food gardens: Gourd, beans, tomatoes, cucumber, eggplants and diverse herbs.

### 5) Food security and homestead gardens:

- Rice fields (0.85Ha)
- Fruits trees: Banana, papaya, jackfruit and coconut
- Food storage for six weeks of flash floods (24m<sup>2</sup> to 126m<sup>2</sup>)
- Outdoor communal activities: Crop sorting area etc.

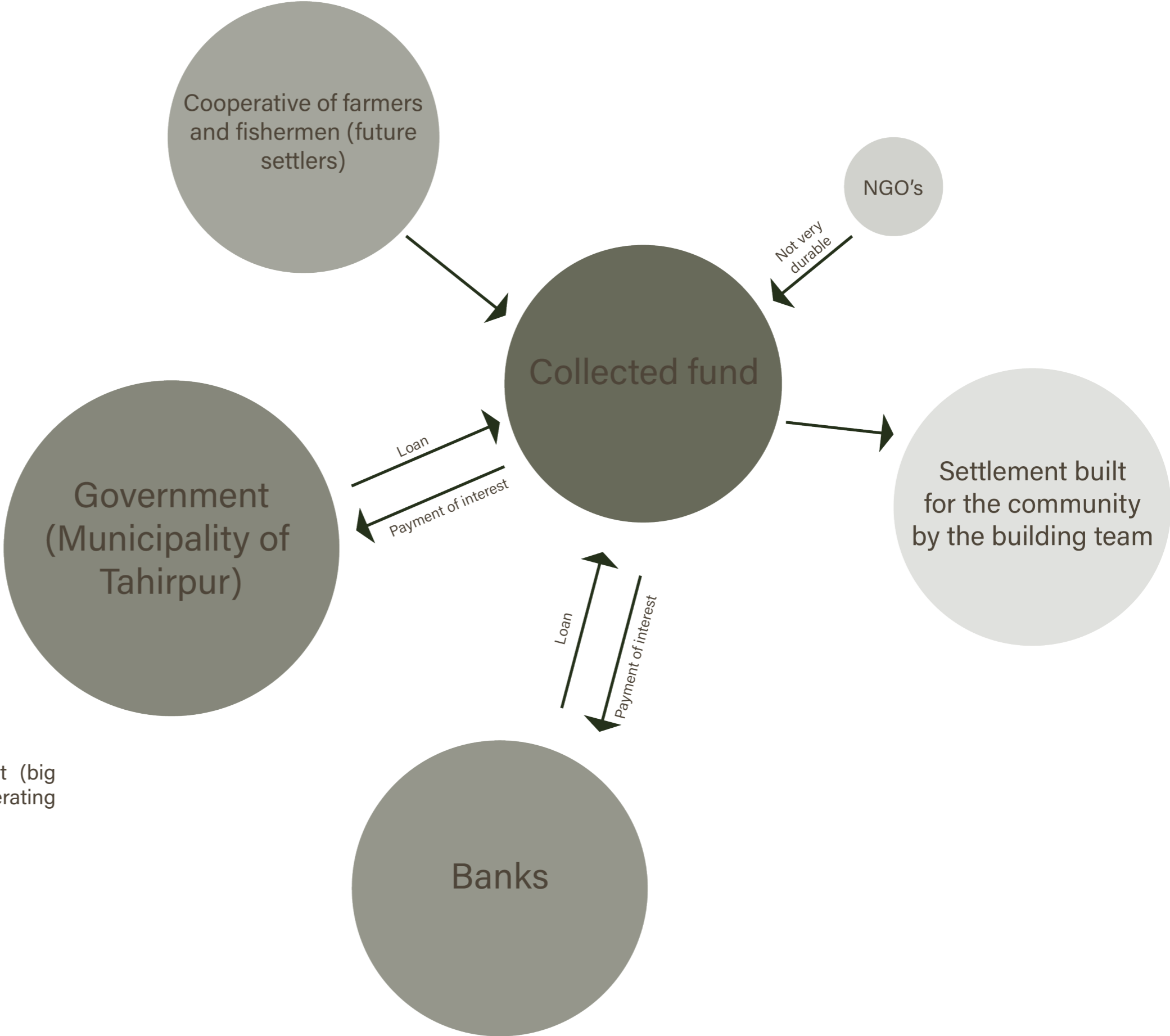
### 6) Public facilities:

- Mosque (200m<sup>2</sup>)
- Community centre including a little shop for basic needs, and rooms to sort agricultural production sent to the bazar (400m<sup>2</sup>)
- Meeting point (135m<sup>2</sup>)
- Multiple purposes space (135m<sup>2</sup>)

### 7) Public facilities available around the settlement:

- Tahirpur bazar (3.5km)
- Primary and High school (1.22km)
- Health care centre (3.5km)

Managerial strategy and phasing



STEP I: Collect fund

STEP II: Buying the empty plot from the government (big investment compensated by the future income generating activities.)

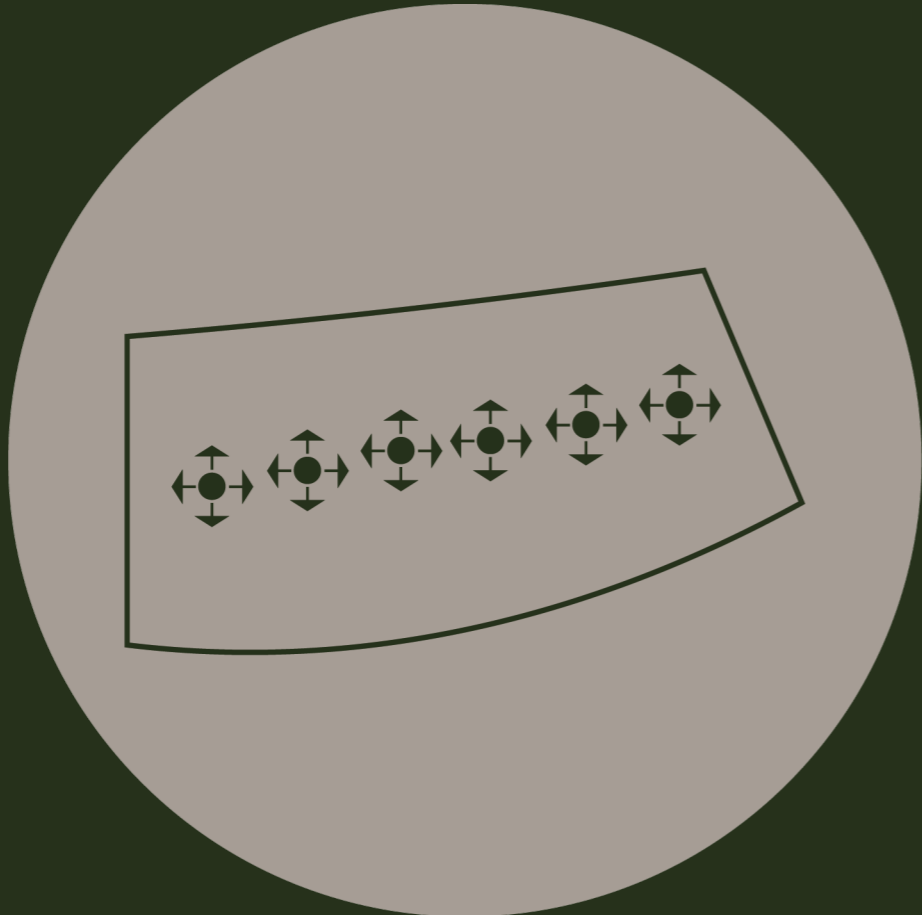
STEP III: Build foundation with the personal investment

STEP IV: Build the houses with the money from the loan

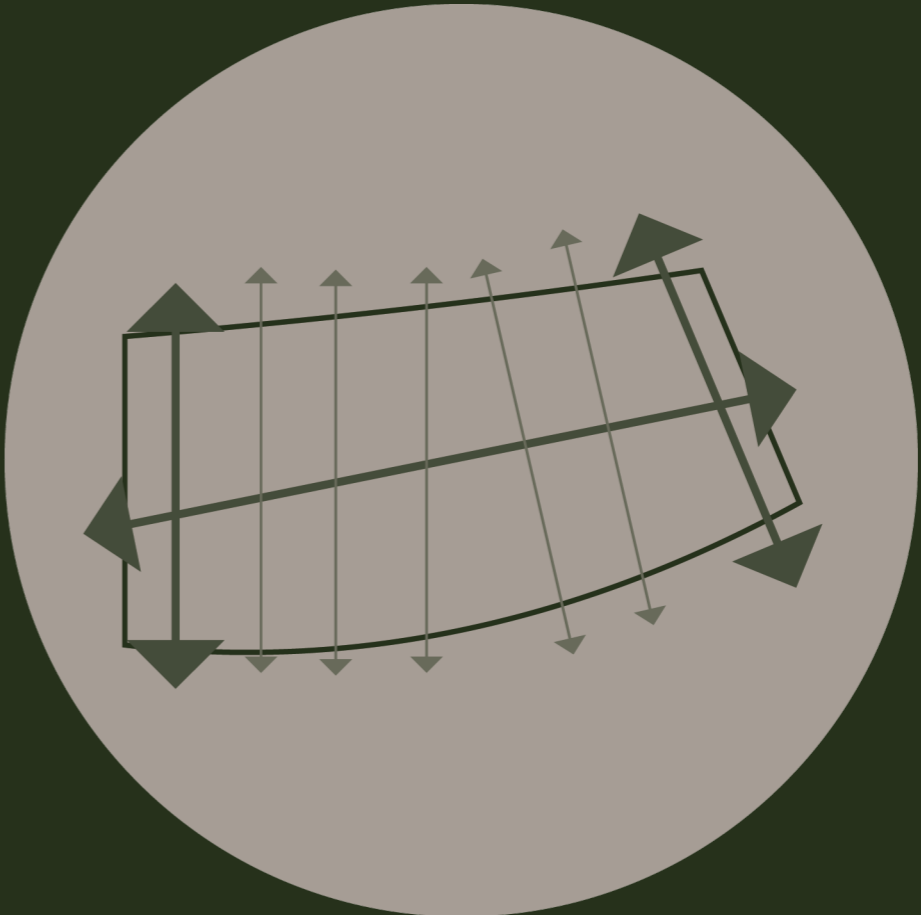
STEP V: Settlers come in when the buildings are ready

STEP VI: Pay back the loan with small interest

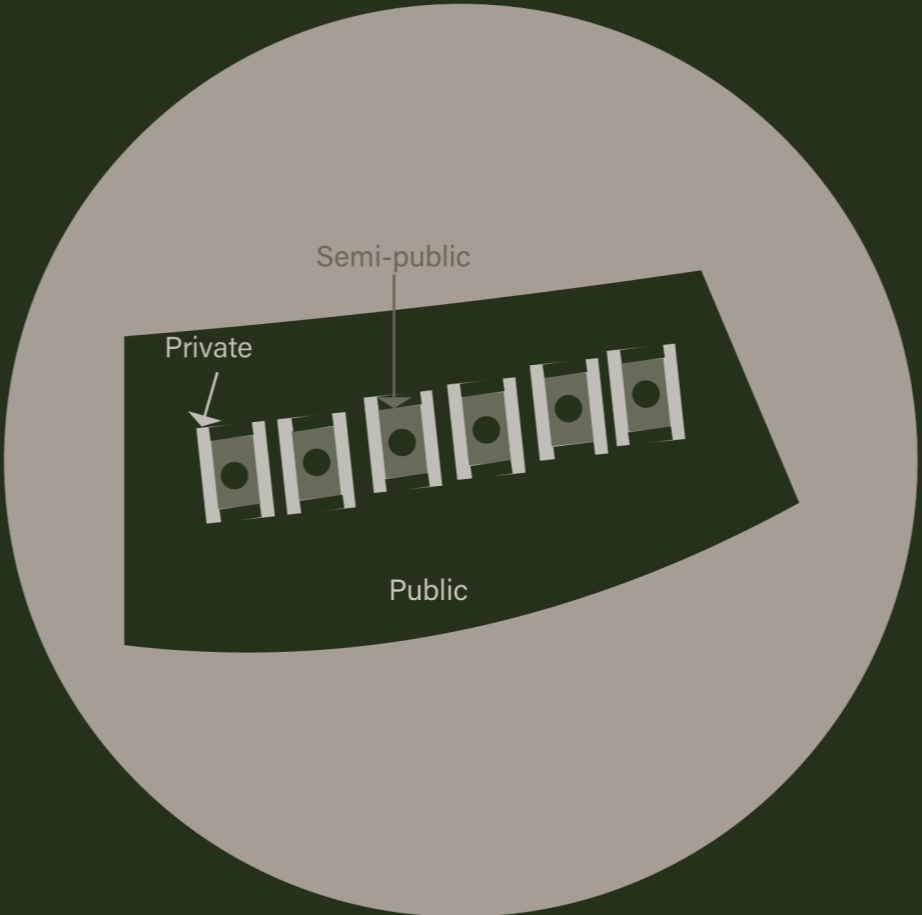
Urban scale



Polycentric

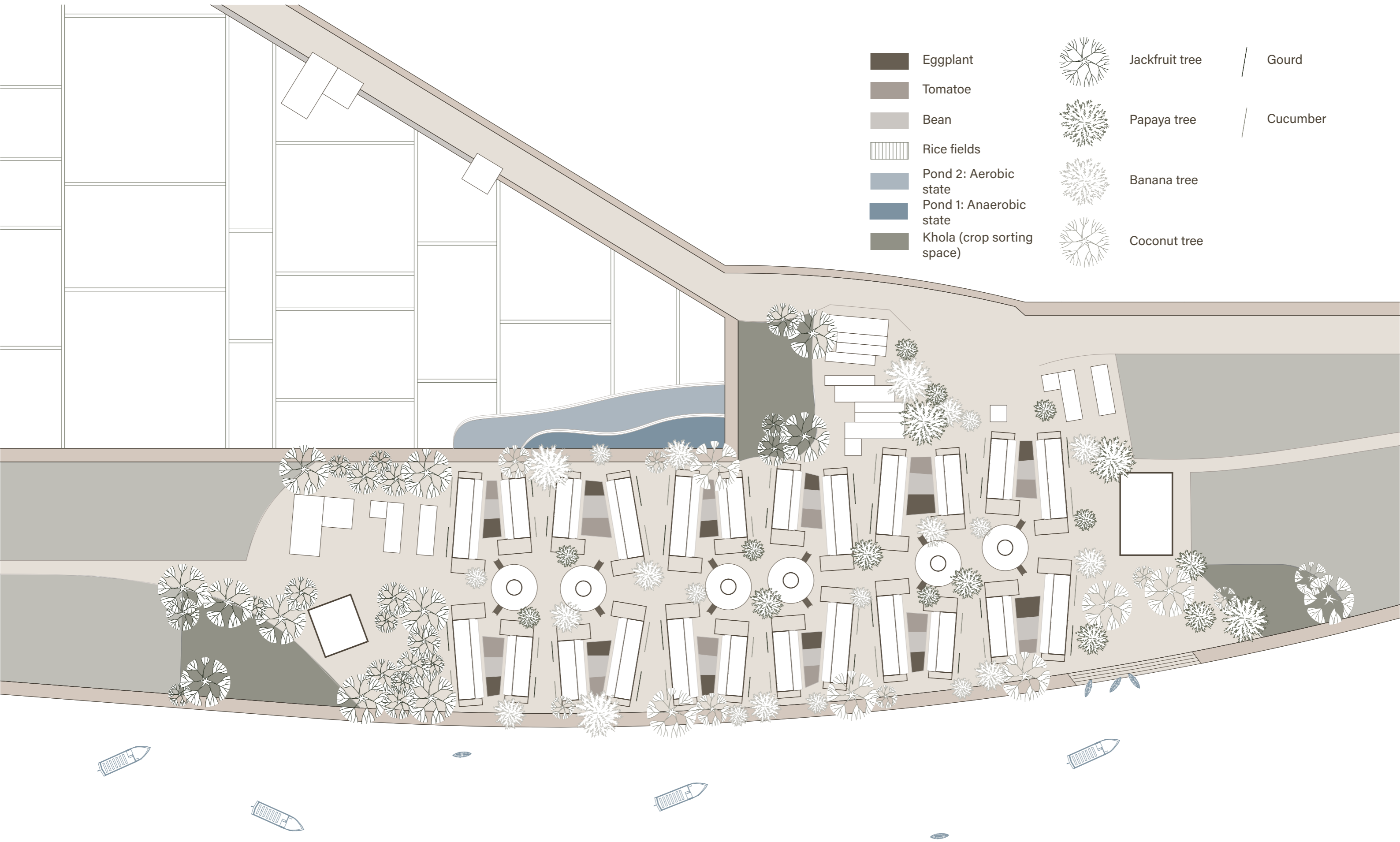


Accessibility



Zoning

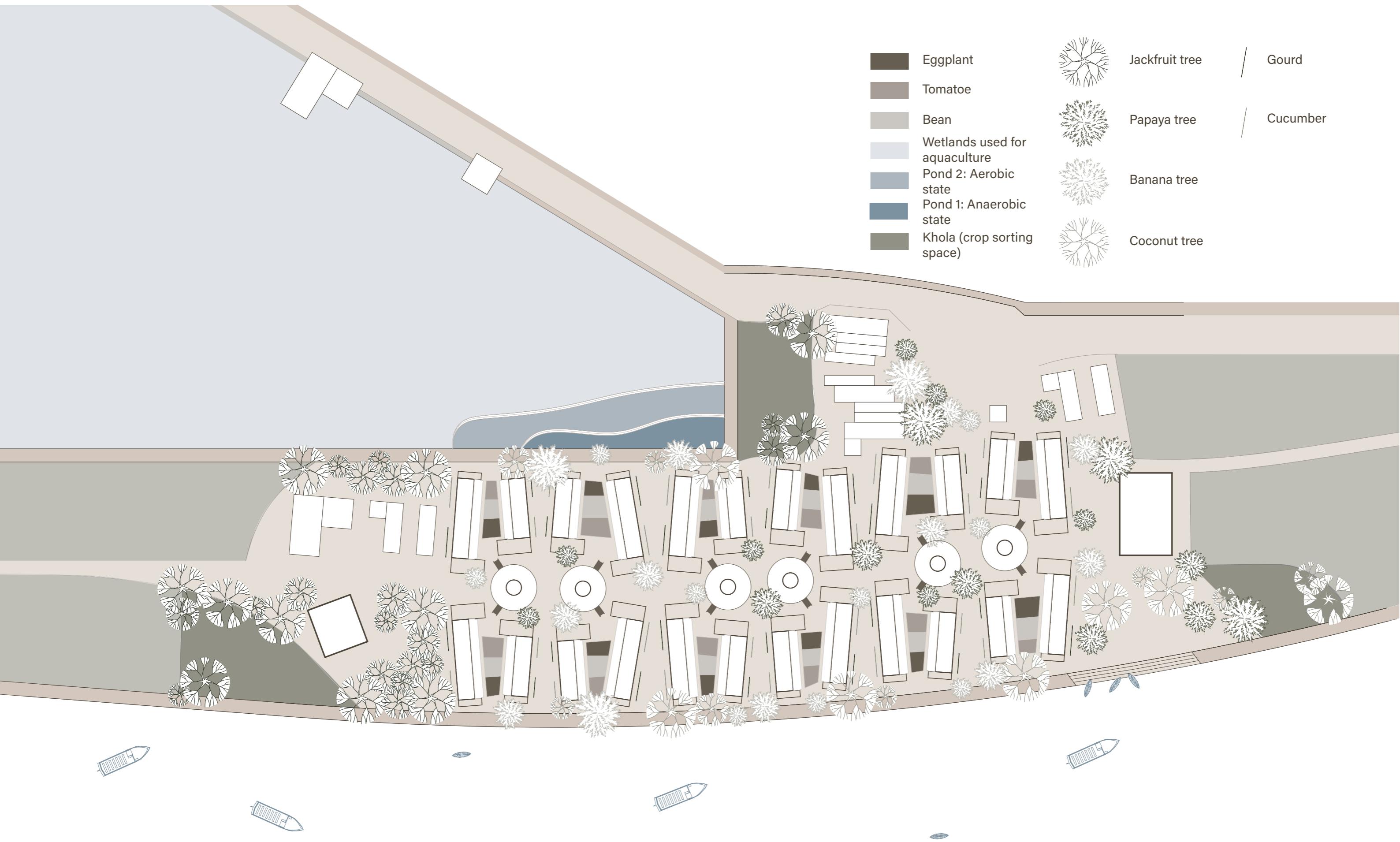
Urban strategy



- Eggplant
- Tomatoe
- Bean
- Rice fields
- Pond 2: Aerobic state
- Pond 1: Anaerobic state
- Khola (crop sorting space)
- Jackfruit tree
- Papaya tree
- Banana tree
- Coconut tree
- Gourd
- Cucumber

Master plan during dry season (November to May)

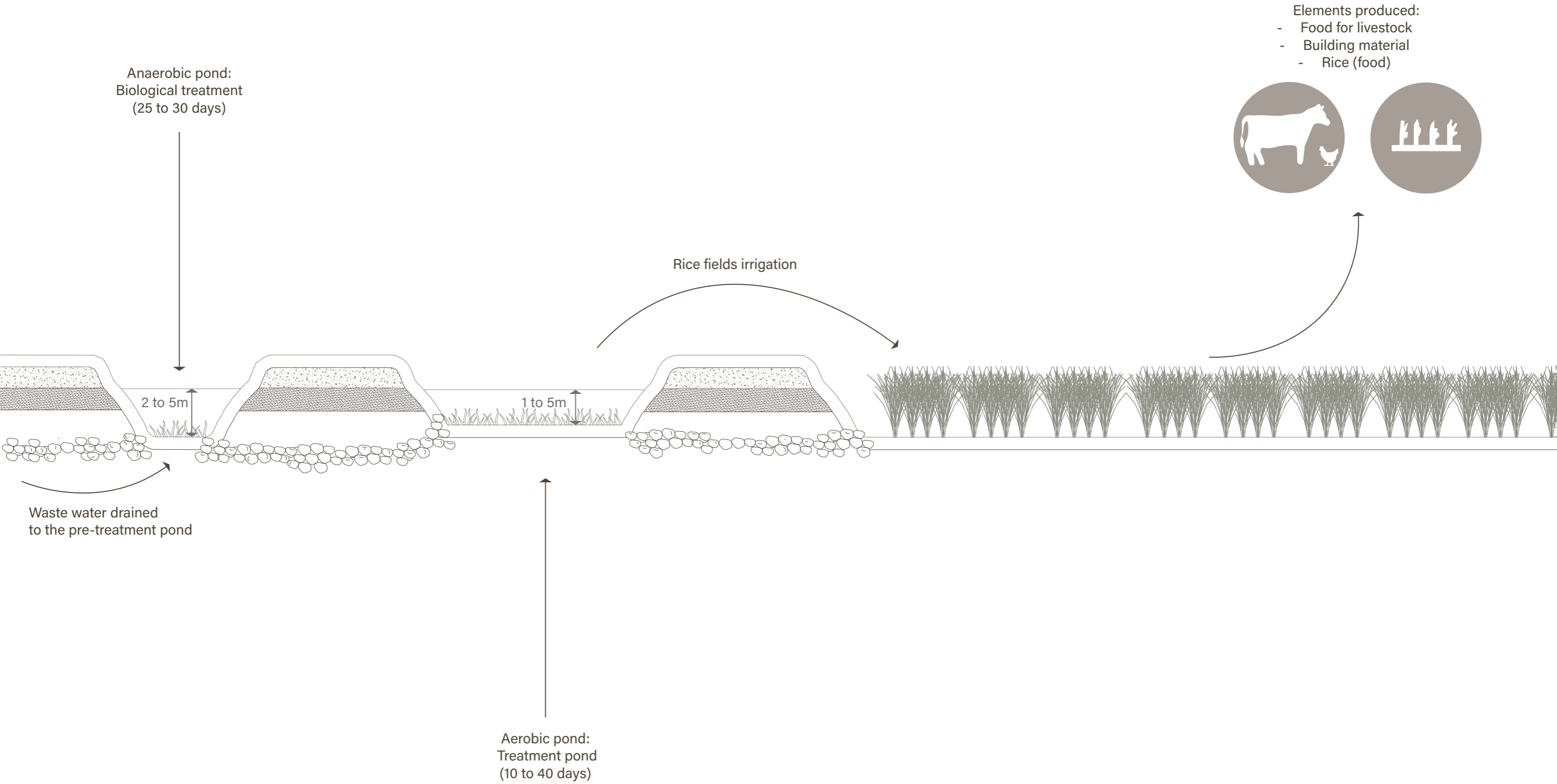




- Eggplant
- Tomatoe
- Bean
- Wetlands used for aquaculture
- Pond 2: Aerobic state
- Pond 1: Anaerobic state
- Khola (crop sorting space)
- Jackfruit tree
- Papaya tree
- Banana tree
- Coconut tree
- Gourd
- Cucumber

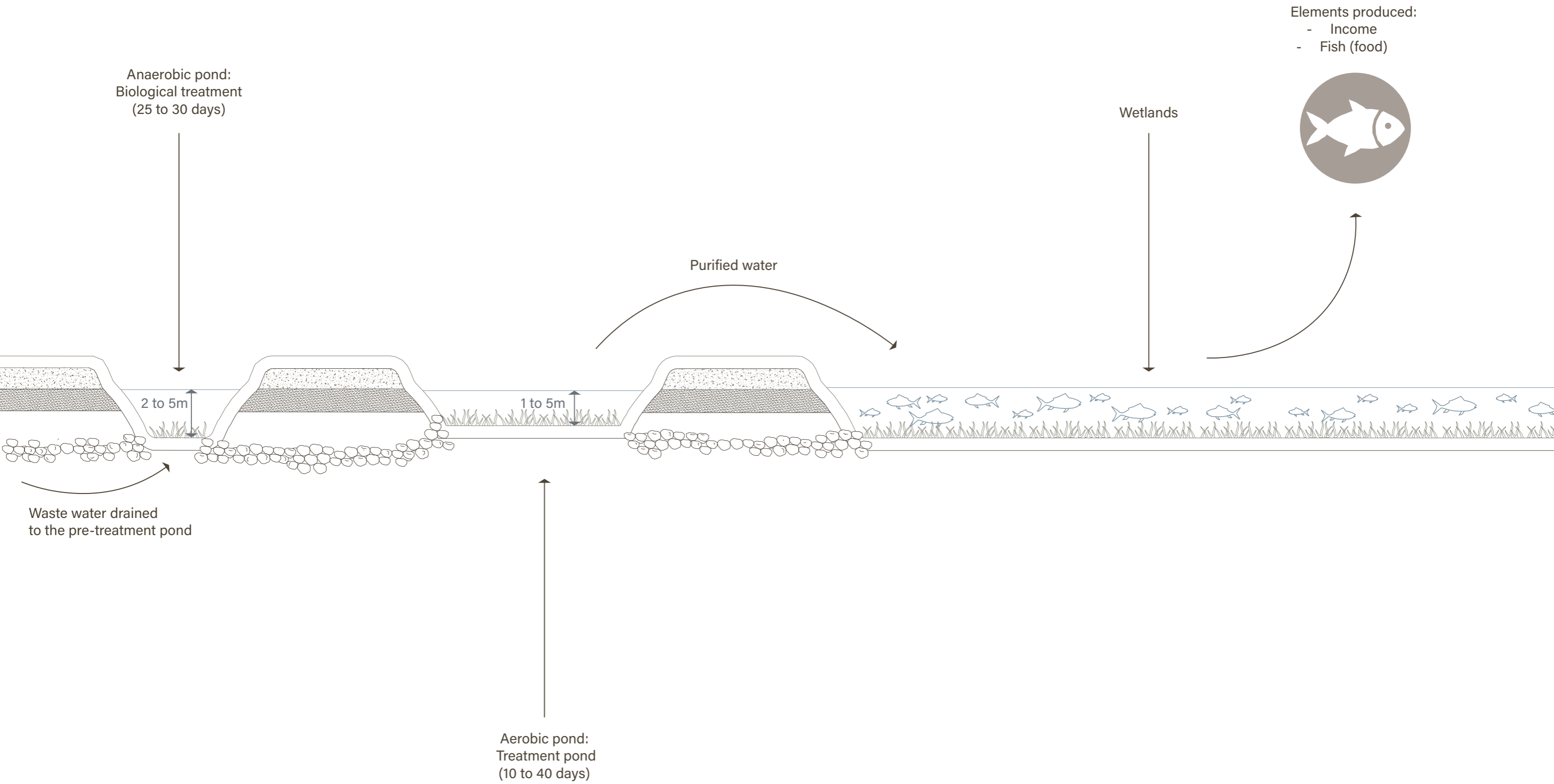
Master plan during monsoon (June to October)



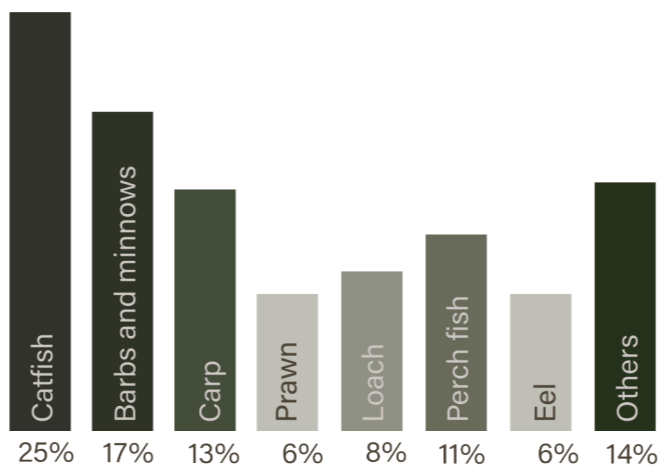


Pond system during dry season (November to May)





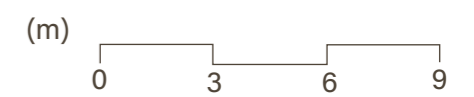
Pond system during monsoon (June to October)



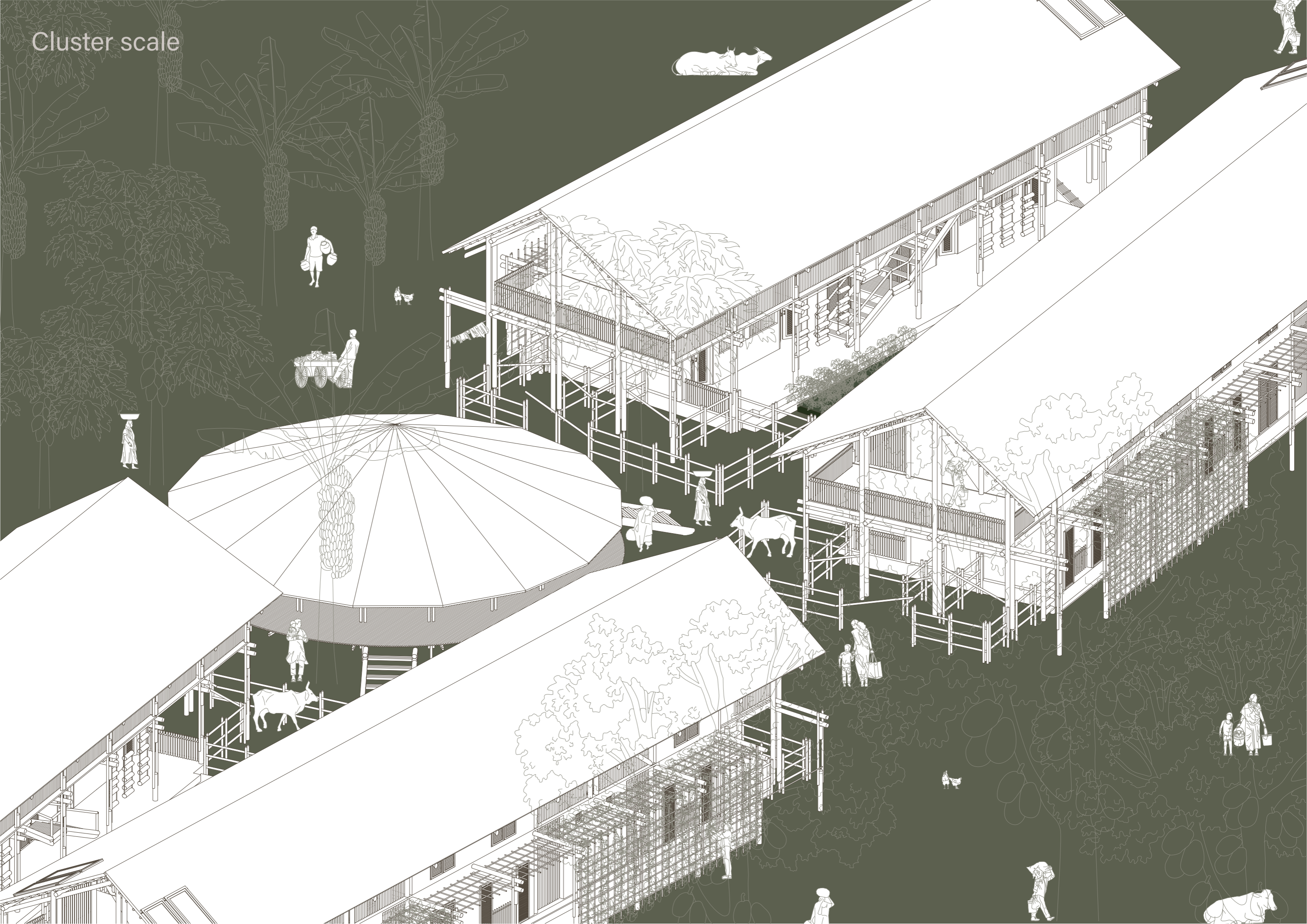
Type of fish

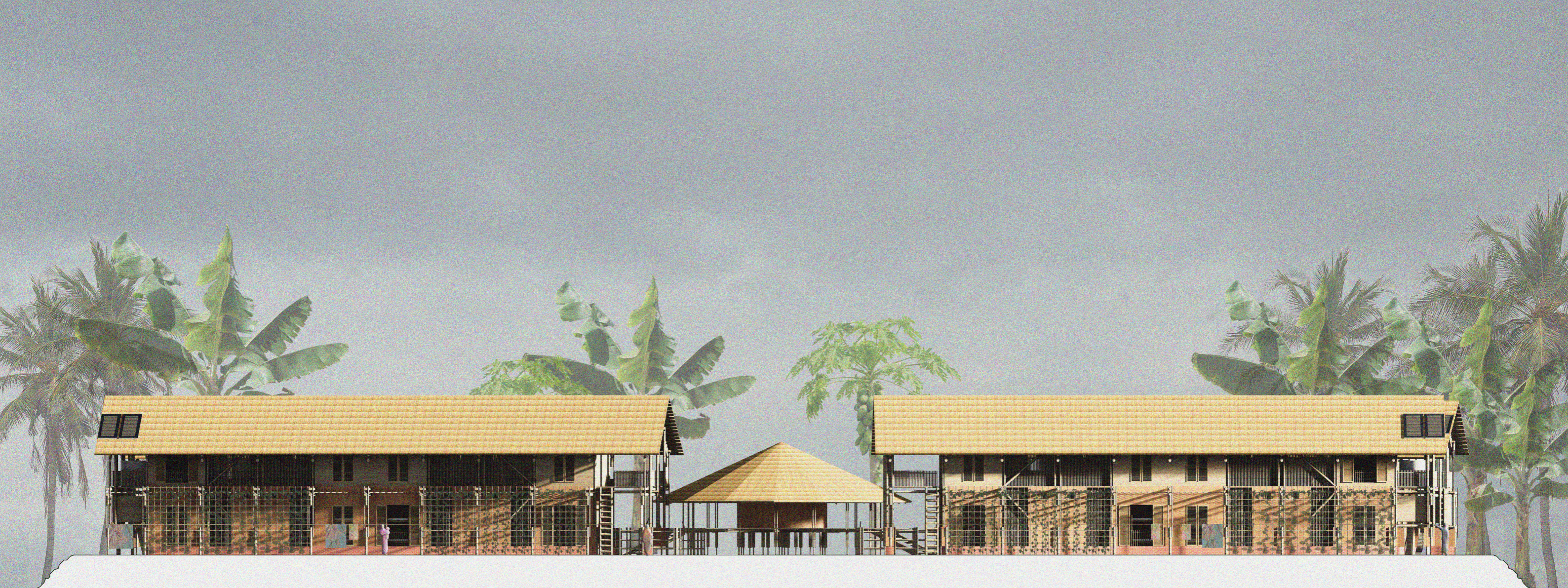


Urban section

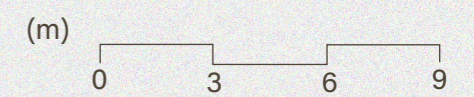


Cluster scale

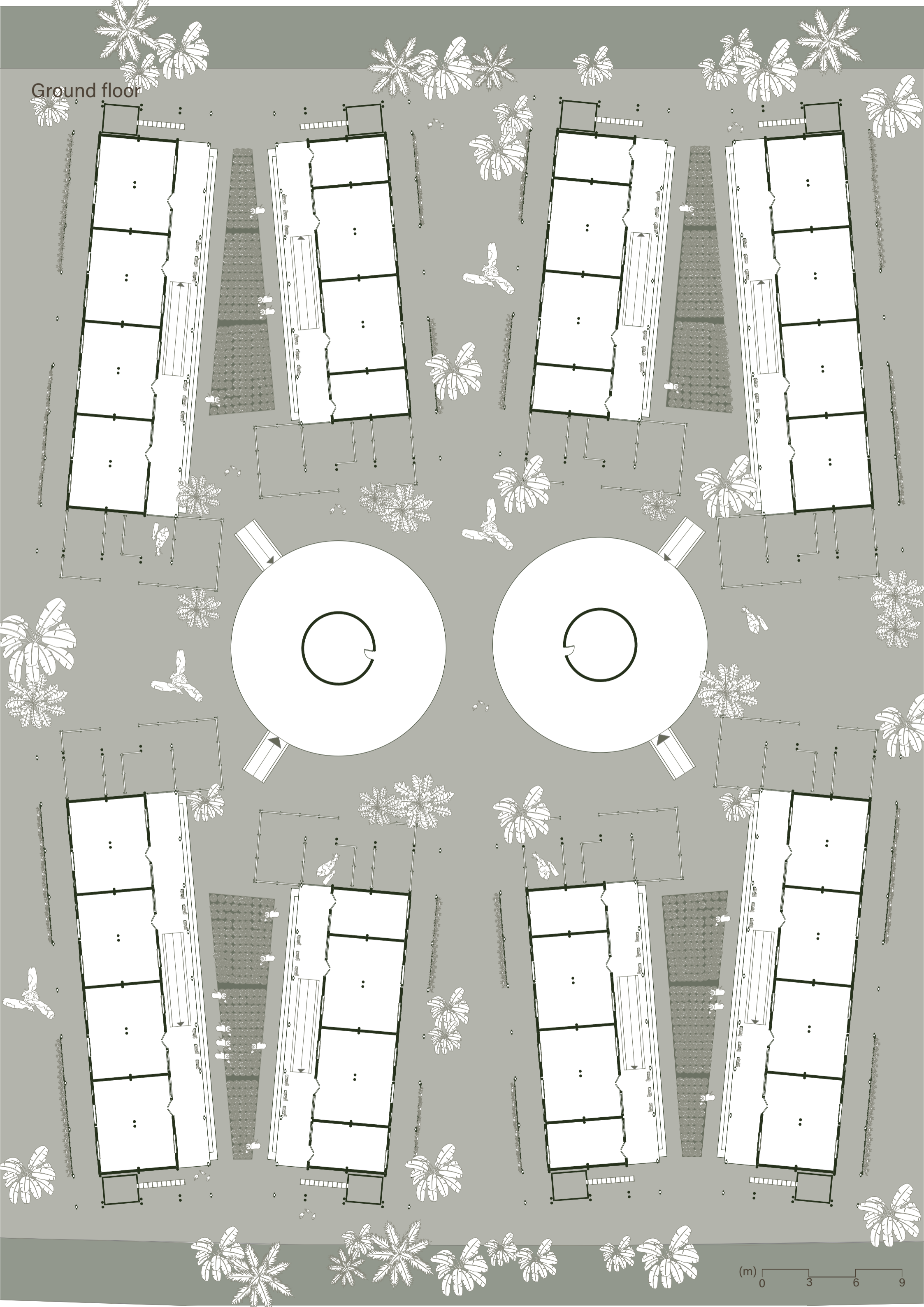




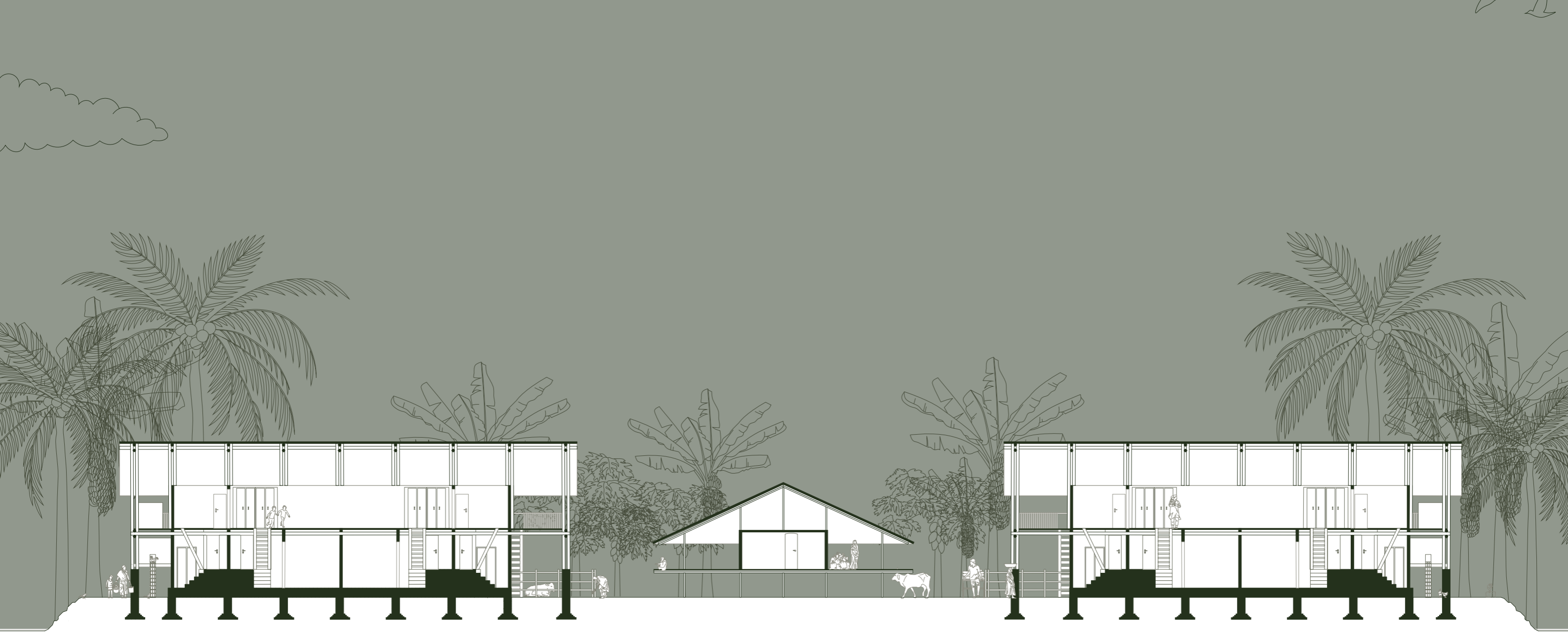
Back facade



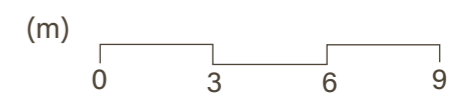
Ground floor



(m) 0 3 6 9

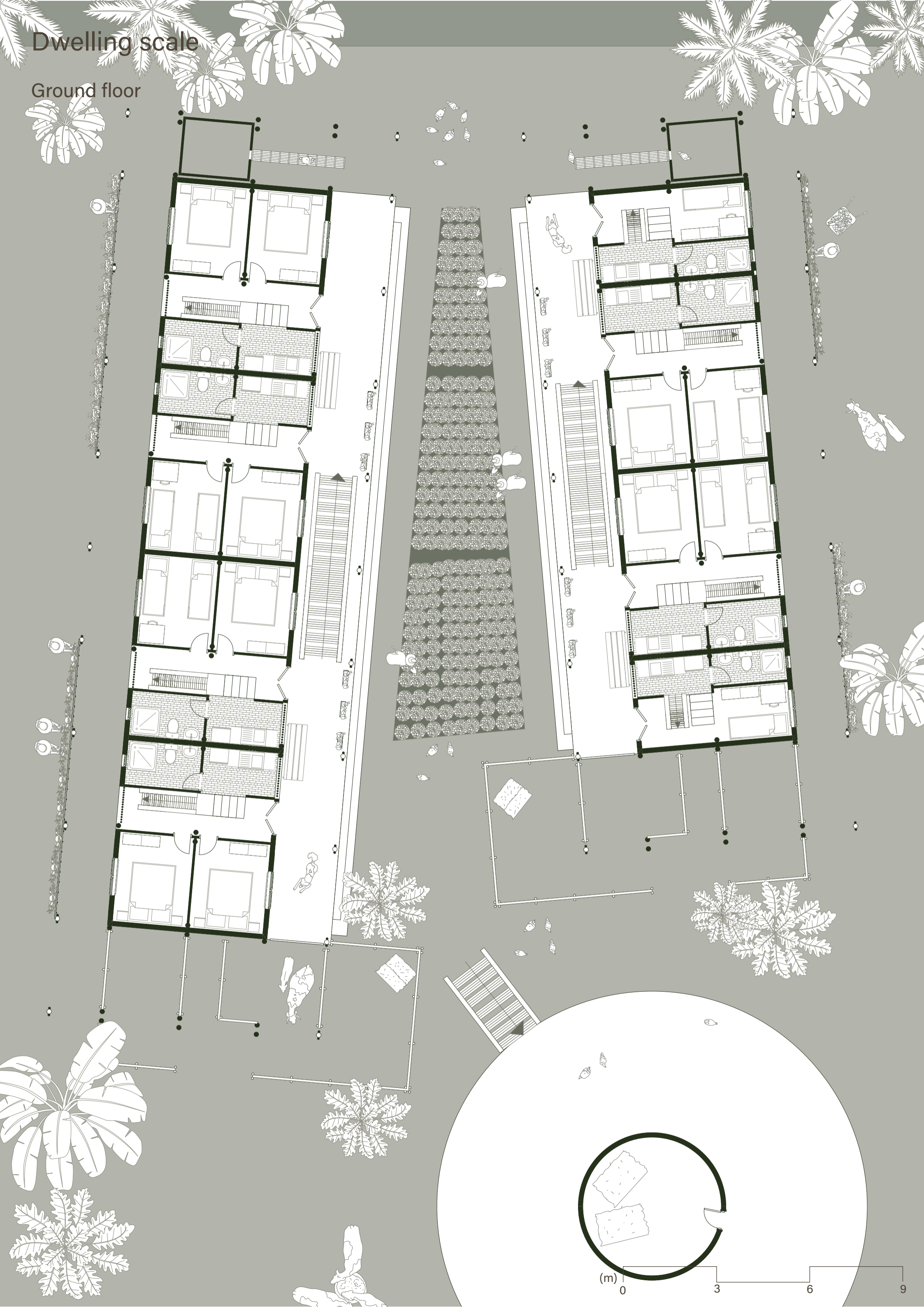


Longitudinal section



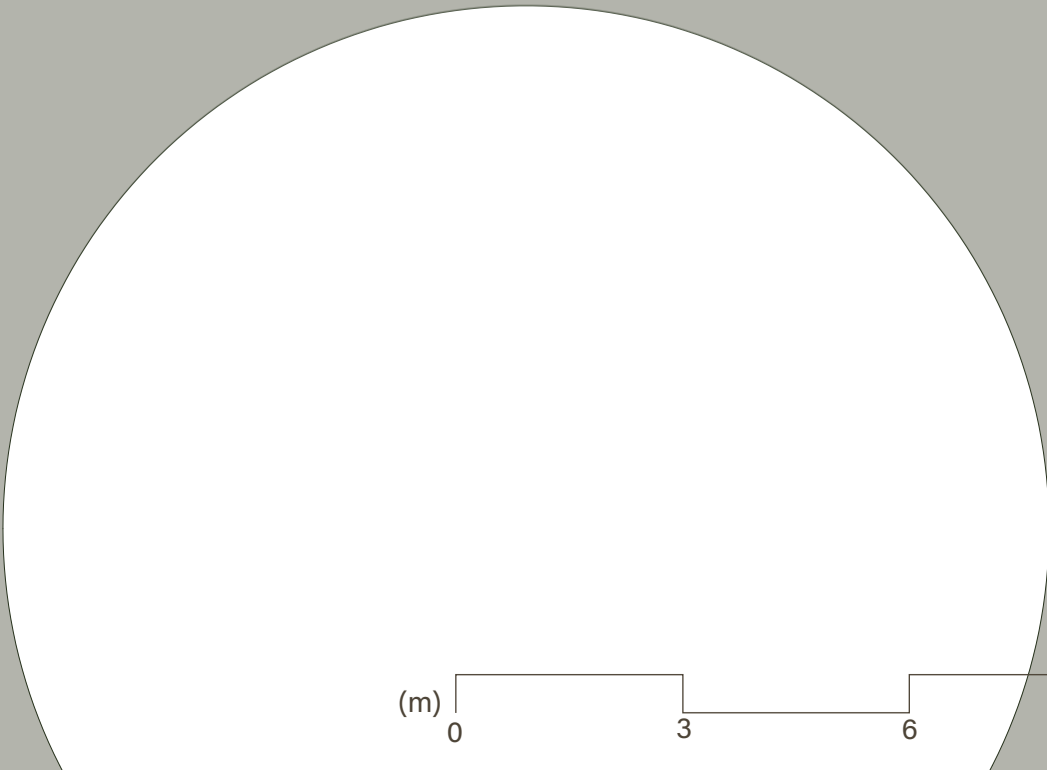
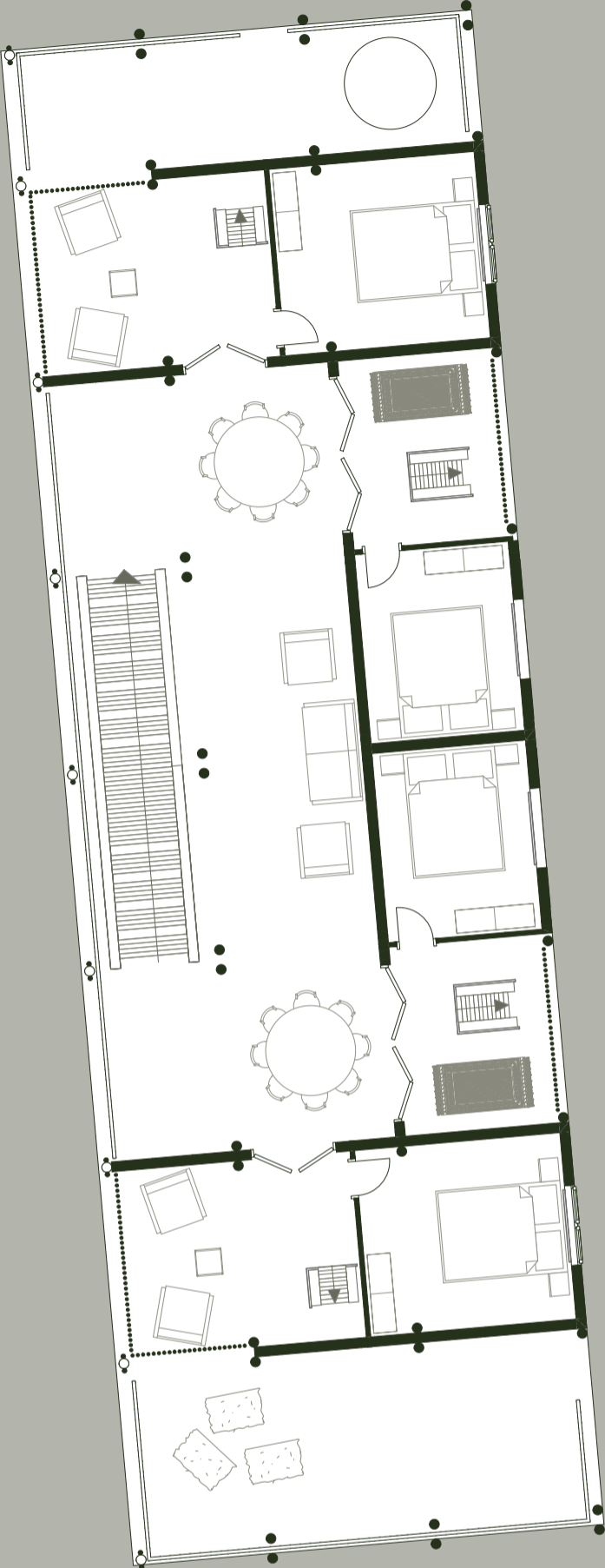
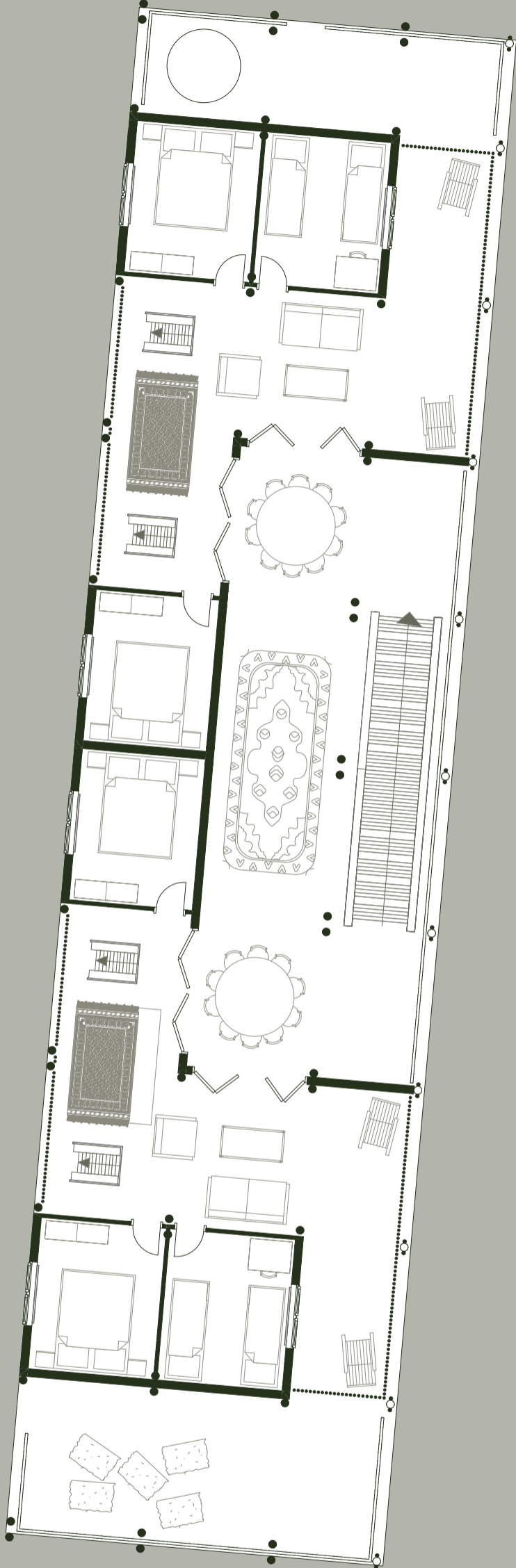
# Dwelling scale

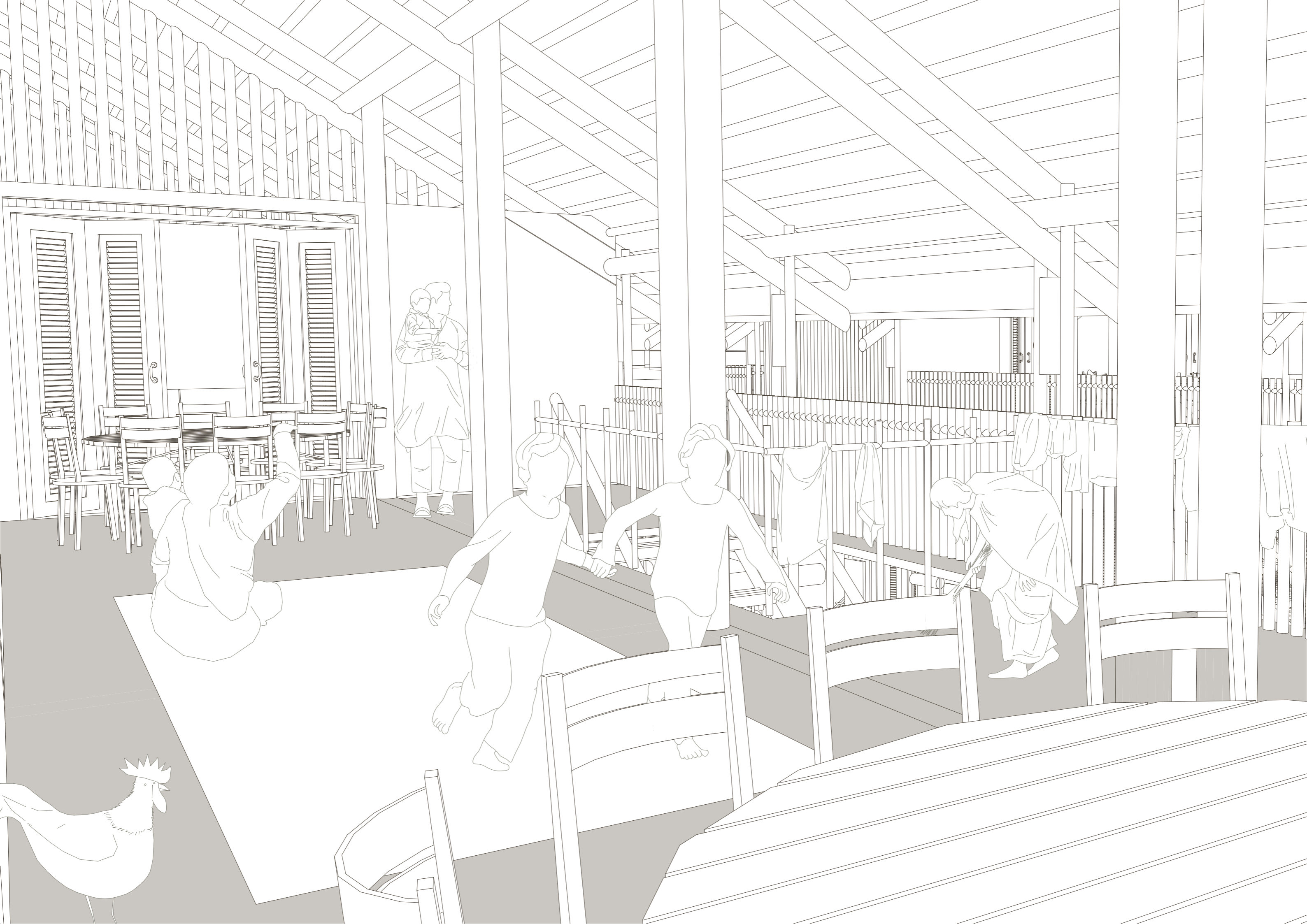
Ground floor





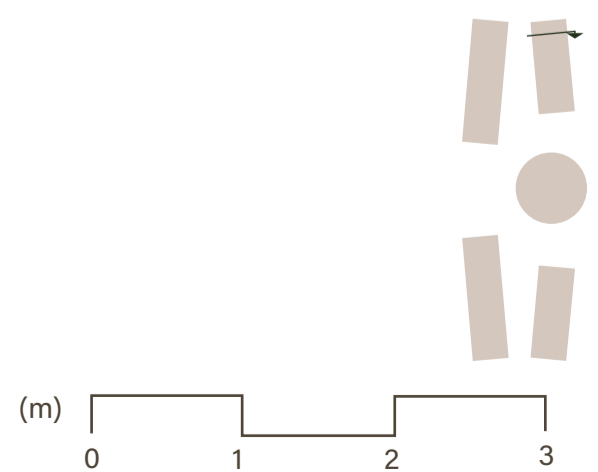
First floor





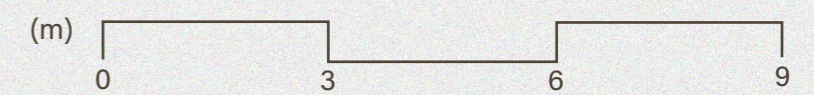


Transversal section



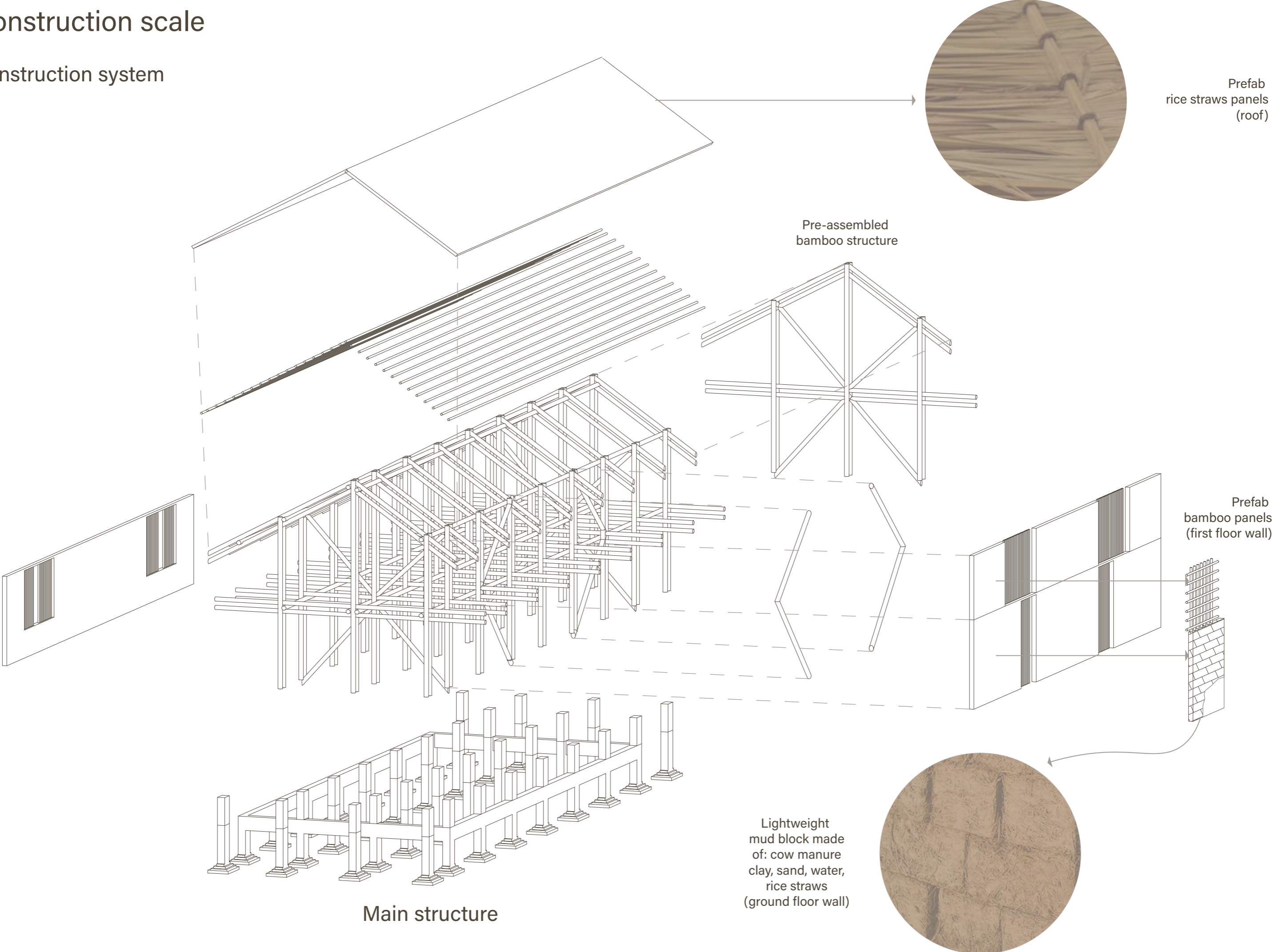


Front facade



# Construction scale

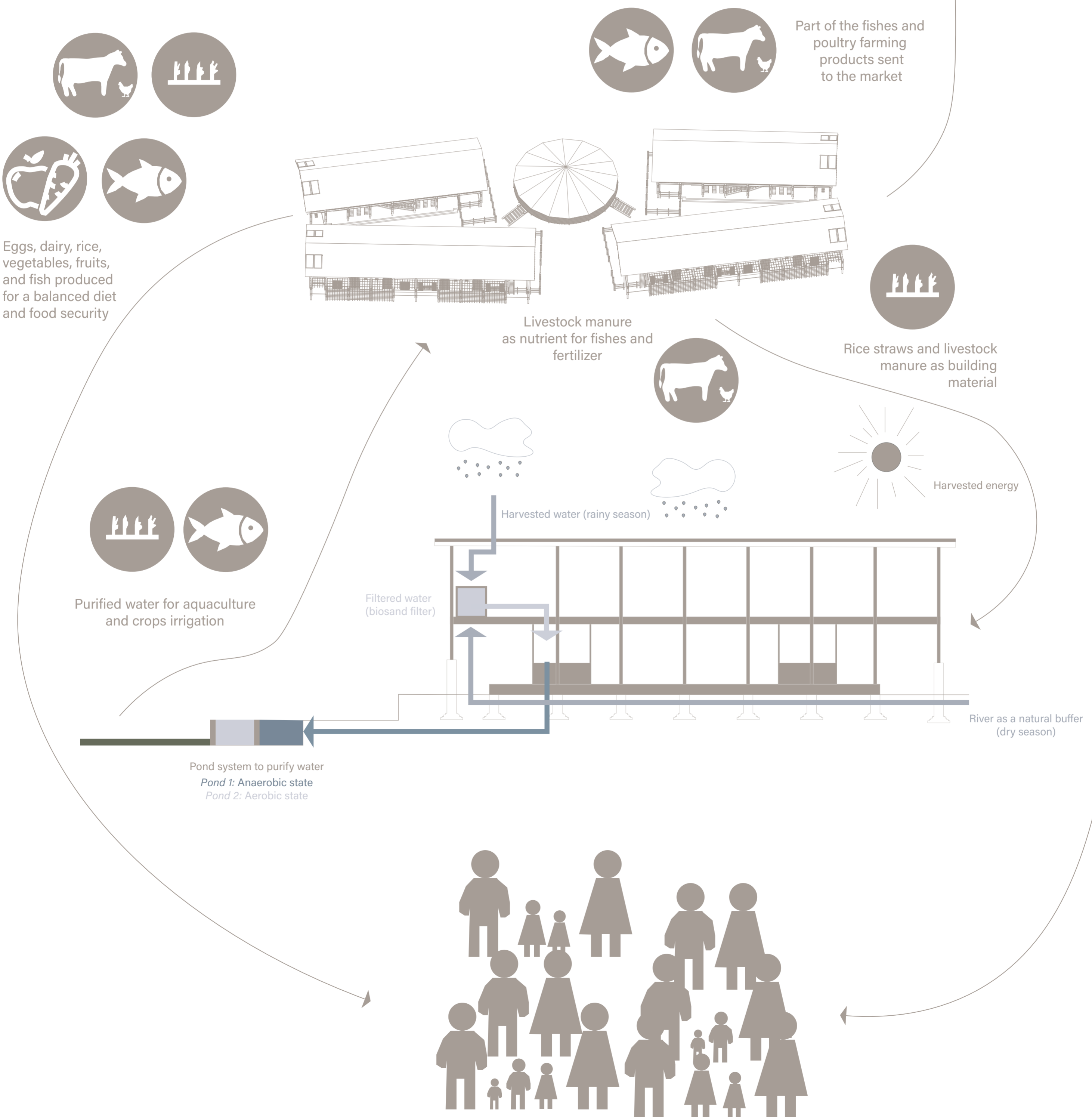
## Construction system

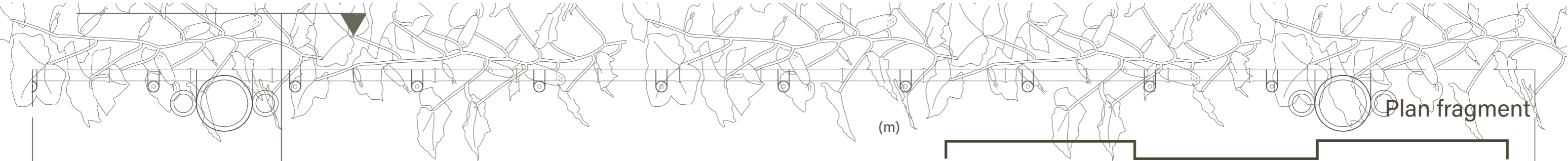


Energy and resources management

Food for the people

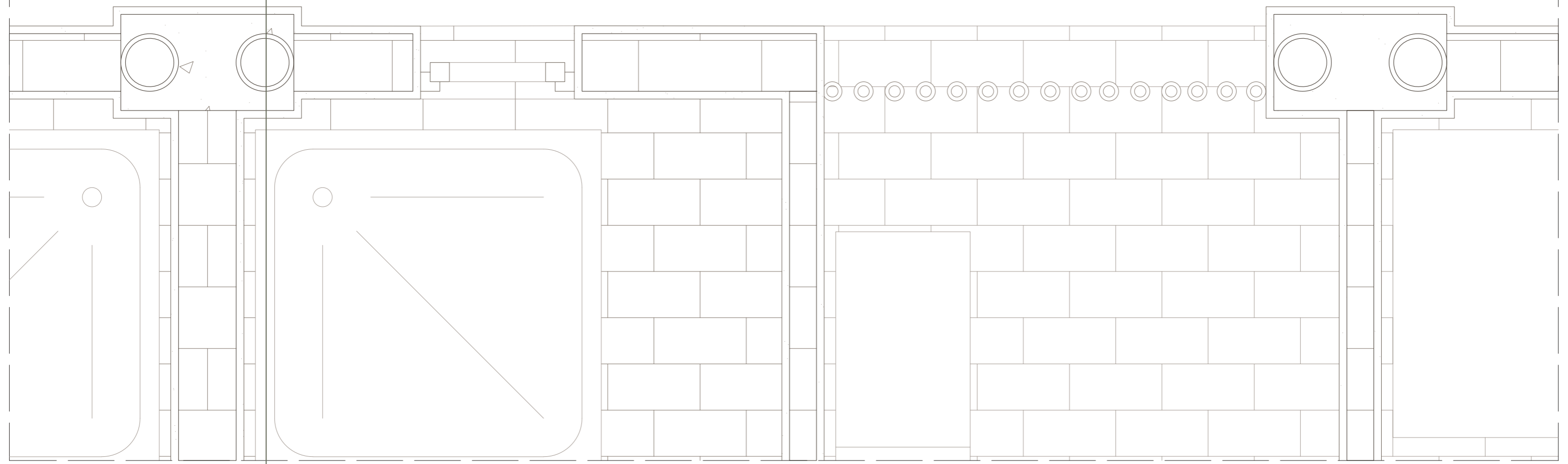
Net income and ability to buy more food at the market



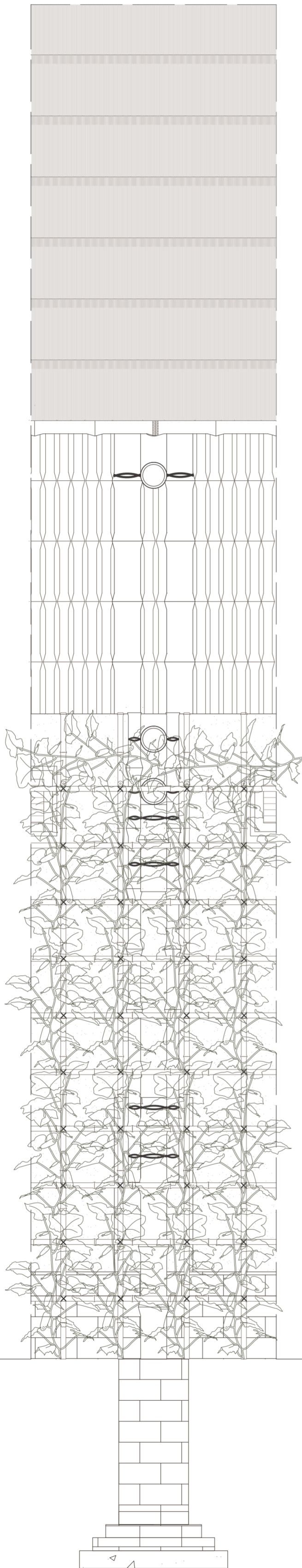


Plan fragment

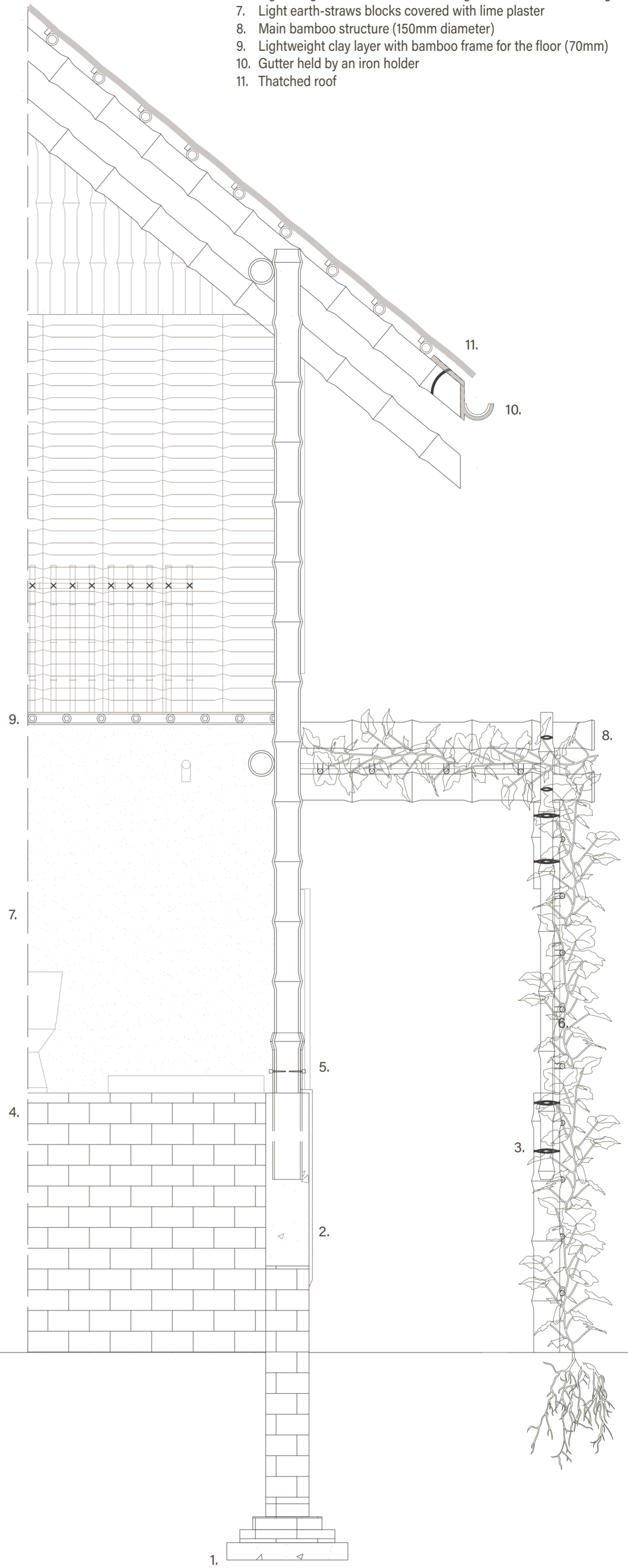
(m)



Facade and section fragment



1. Stepped brick wall foundation laying on lime-mortar bed
2. Cement and mortar column to allow bamboo to connect
3. Zinc coated wire for wire connection
4. Brick ground floor
5. Steel tube embedded in cement and mortar column
6. Light weight bamboo frame to allow gourds and cucumber to grow
7. Light earth-straws blocks covered with lime plaster
8. Main bamboo structure (150mm diameter)
9. Lightweight clay layer with bamboo frame for the floor (70mm)
10. Gutter held by an iron holder
11. Thatched roof



(m) 0 0.5 1 1.5

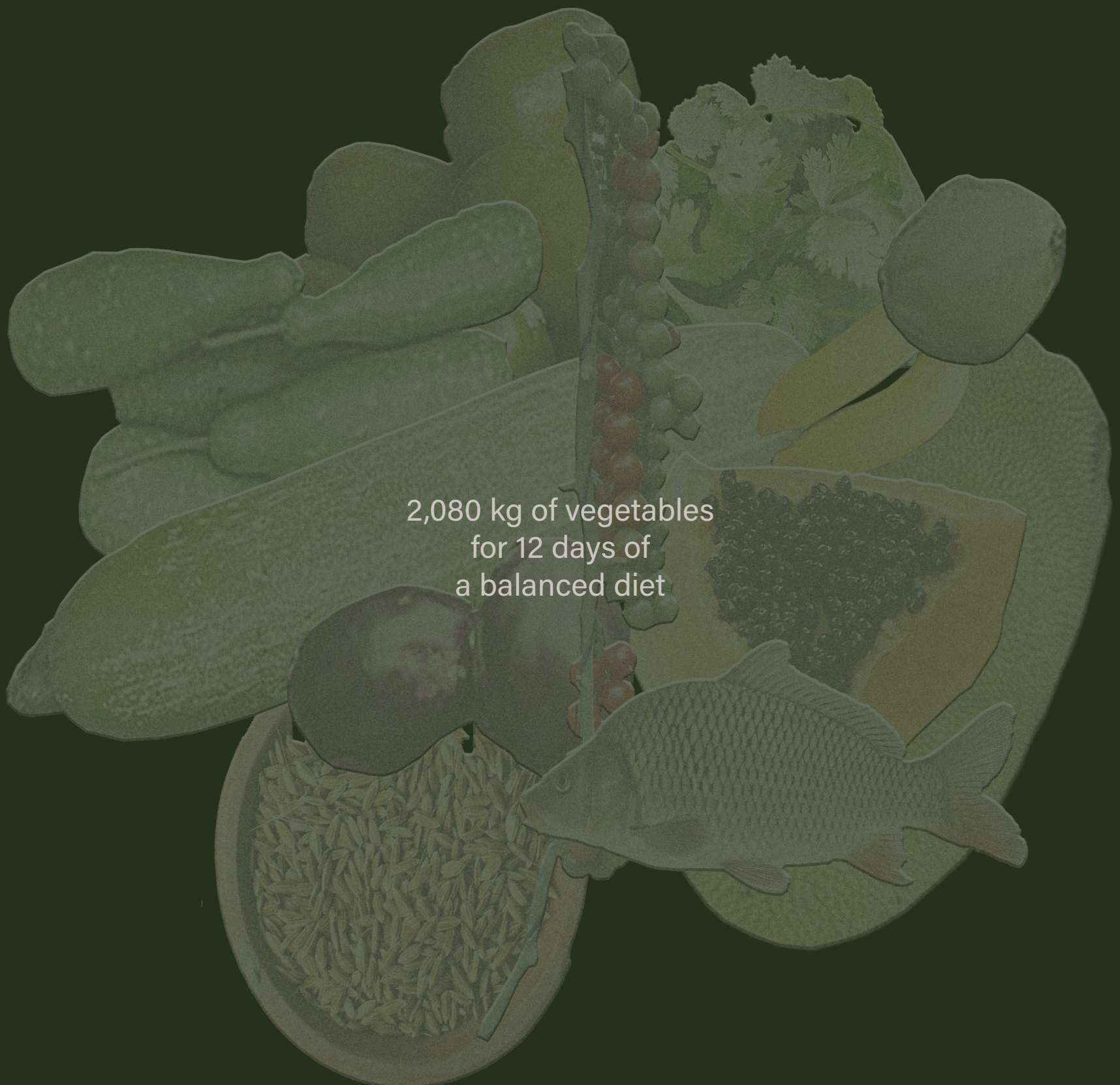




176 kg of fish



2,562 kg of rice  
for 1week  
of flash floods

A collection of various vegetables and fruits including eggplants, tomatoes, leafy greens, and a fish. The items are arranged in a circular pattern, with a fish at the bottom center. The text is overlaid on the center of the collection.

2,080 kg of vegetables  
for 12 days of  
a balanced diet



17,747 kg of fruits  
for 6 weeks of flash floods and  
14 weeks more



*Thank you*