TRANSITION

a sustainable blueprint for
Bolawaras urban evolution

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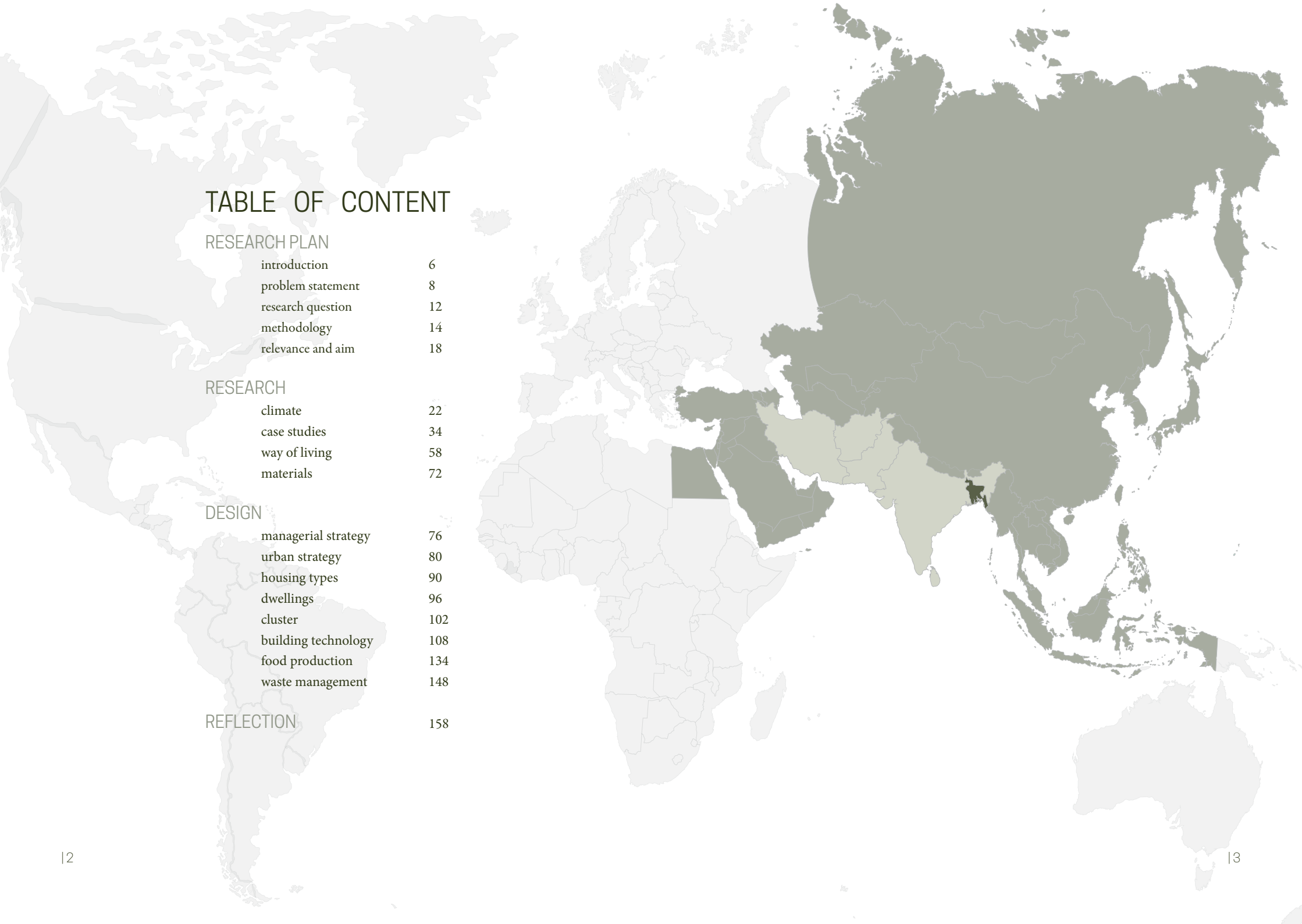


RESEARCH PLAN

INTRODUCTION

Bangladesh will due to its location and characteristics be one of the most affected countries by climate change in the upcoming years. It's characterized by its predominantly flat landscape and is crossed by the ever changing Ganges Delta, the largest river delta in the world.[1] Especially during the monsoon season, the circumstances of the river delta pose great risks and threats, as in particularly bad years up to 75% of the country can be flooded. Those floods are putting thousands of people at risk every year. Leaving them homeless and destroying their whole homestead and fundaments for their families existence. Nevertheless, due to the Ganges Delta the country is also home to some of the most fertile soil, ideal for agriculture and farming and providing an immense area for a large range of flora and fauna in diverse ecosystems. The delta provides a breeding ground for a rich biodiversity and is of high „ecological, socio-cultural and commercial importance".[2]

Within the last decades, biodiversity has been declining rapidly in Bangladesh and all over the world and is endangering the natural balance in our environment. In particular, climate change and the resulting changes such as flooding, droughts or extreme heat are responsible for the extinction of millions of plants and organisms that our systems need for internal balance. Due to evolution, however, it is not only our environment that created a well functioning system, but also our bodies. Our bodies need plants and organisms to survive and, especially during childhood, we need to be exposed to organisms in order to develop and build a healthy immune system. This is not only about the biodiversity of plants, but also about much smaller organisms, such as microbes, bacteria and other microorganisms, whose interactions and structures are summarized under the term of micro biodiversity.[3]

In Addition, the increasing growth of cities and the fact that more and more people are leaving rural areas to move to metropolitan areas is challenging cities like Sylhet.[4] In order to keep up, the demand for densification measures and new residential projects is higher than ever before. The city is growing further and further into the periphery and inner-city open spaces, such as green areas, ponds and water basins, are being replaced by housing developments at the expense of nature and biodiversity.

In order to reflect precisely on this conflict between the richness of ecosystems in rural areas and the ever-growing structure of cities in constant conflict with the growing challenges of climate change, my research plan and my design will focus on the town of Bolawara and its surroundings characterized by the the Surma river.

[1] Brammer, Hugh „Bangladesh's Diverse and Complex Physical Geography: Implications for agricultural Development"

[2] „Ganges Delta"

[3] Siddiquee, Saeed Ahmed; Hoque, Md. Ehsanul „Wetland Conservation in Context of Climate Induced Changes: Bangladesh Perspective"

[4] Marselle, R. Melissa; Lindley, J. Sarah; Cook, A. Penny; Bonn, Aletta „Biodiversity and Health in the Urban Environment"

PROBLEM STATEMENT

Nature is increasingly disappearing from growing cities such as Sylhet in order to create new living space for the growing population and the high level of immigration in the cities. The trigger for this is uncontrolled urban densification measures that are causing an extreme loss in biodiversity and microbiodiversity. The loss of this local diversity in flora and fauna causes extremely poor air and water conditions, but also many other changes that lead to diseases, allergies and poor living conditions for the people.

Green areas are being destroyed and natural water basins that once formed and determined the built environment of Sylhet are being filled in to create new dwellings. In addition to poor living and environmental conditions, this also leads to extreme infrastructural challenges during the monsoon and rainy seasons, which are getting worse from year to year due to the climatic changes caused by climate change. Due to the disappearance of natural green areas and water basins, there is a lack of seepage areas and drainage systems that originally allowed water to leave the city. The influences and destructive power of flooding and rainfall are therefore intensified by the human interventions of increasing urbanization. The result is a vicious cycle in which humans and nature work against each other and interventions are not considering long term effects. The interventions work against the prevailing natural events instead of adapting to the changing conditions and ideally even using them to the advantage of the inhabitants.
In rural areas, on the other hand, there are various other reasons for the increasing loss of biodiversity and other difficulties that local people are facing. The proximity to the Surma River has caused flooding in the region around Bolawara for decades, which is becoming more severe from year to year and has more drastic consequences. In particularly bad years, residents have to leave their homes and seek refuge in nearby schools or with relatives.

However, the floods also have an immense impact on agriculture and the annual harvest, which is particularly important for Bangladeshis, as more than 70% of the country is used for growing crops and 50% of the population is working in agriculture.[5] The productive months are getting shorter and shorter and more agricultural land is needed to achieve the same amount of yield. The steadily growing population is also contributing to the expansion of arable land, causing more and more naturally grown ecosystems to disappear and be replaced. Bangladesh now consists of only 6%-8% natural structures and forests and the area is being reduced every year.[6] This has an immense impact on biodiversity in rural areas and the loss of flora and fauna.

Despite the steady increase in arable land, changes in climatic conditions and population growth still lead to not sufficient harvests to provide people with enough food. By now more than 25% of Bangladeshs population is therefore considered food insecure.[7] Nutrient-rich foods, such as vegetables and fruit, are in particular difficult to protect from the floods and Despite the steady increase in arable land, changes in climatic conditions and population growth still lead to not sufficient harvests to provide people with enough food. By now more than 25% of Bangladeshs population is therefore considered food insecure.[8] Nutrient-rich foods, such as vegetables and fruit, are in particular difficult to protect from the floods and fish catches for vital proteins are also declining due to droughts and flash floods. People are increasingly turning to rice, which means that a large proportion of the population, especially children, are lacking nutrients, resulting in weakened immune systems and illnesses. In Bolawara, this development is particularly profound, as people have no chance to store food due to the annual floods and are either dependent on relatives or need the support of NGOs during the monsoon season.

[5] Anik, Salon Istiak; Khan, Mohammed Abu Sayed Arfin „Climate change adaptation though local knowledge in the north eastern region of Bangladesh“

[6] “Bangladesh FAO Regional Office for Asia and the Pacific | Food and Agriculture Organization of the United Nations.” 2023.

[7] Akhter, Alamgir, Sohel, Rana, Ahmed „The role of women in traditional farming systems as practiced in home gardens: a case study in Sylhet Sadar Upazila, Bangladesh“

[8] Bryce, Emma „An ingenious System of farming on floating hyacinth mats offer climate resilience“

To escape the floods, strategies such as raised beds for climbing vegetables are getting more popular. But the yields of the raised structures are relatively low in relation to the area required and the construction is costly. Therefore they often belong to large farmers who own a large area of arable land. This commercialized agriculture often does not help the villages and local communities when it comes to a stable availability of food leaving them without usable land.

Another strategy of the local family is to develop homestead gardens. Families create small garden structures for their own use and grow food, spices and building materials in their backyards or between individual dwellings. The homegrown bamboo even makes up almost 90% of the locally used building material. As agriculture continues to grow, these gardens are crucial when it comes to preserving biodiversity, as they provide an ideal habitat for small ecosystems and their flora and fauna through the various plants and products.[10] However, difficulties for private cultivation often include flooding and the lack of cultivation areas between the densely populated villages, which is why new and innovative strategies for the implementation of gardens in rural structures are of great importance.

Overall, it can be said that both in Sylhet and in the rural periphery such as Bolawara, the loss of biodiversity is causing major problems for the environment and its inhabitants. These are largely determined and intensified by the built environment and the changed climatic conditions. By analyzing the development of Sylhet in recent decades, a significant growth towards the periphery is visible and with the immense increase in people moving from the countryside to the city, it can be assumed that Sylhet and Bolowara will continue to converge and eventually merge. Rural structures such as Bolowara are becoming increasingly urbanized and the existing challenges are being compounded by urban challenges such as increasing density. The area available for agriculture, but also for homestead gardens, is becoming more difficult and the preservation of nature and biodiversity is being tested intensively.

The aim is to learn from the mistakes observed in Sylhet and to develop new strategies for the transition of Bolawara from a rural to urban area. Architecture needs to be the tool to support the coexistence of humans and nature in order to enrich the growth of Sylhet instead of merely extending the problems of the city to a larger scale.

RESEARCH QUESTION

The loss of biodiversity within the ever growing cities and the massive changes in the ecosystem resemble a vicious cycle that we must break free from. Therefore humans, nature and architecture must go hand in hand and complement and supplement each other when it comes to a rural to urban transition. The basic needs of people must be satisfied through alternative agriculture, the sufficient possibility of effective homestead gardens and at the same time contribute to an urban development of infrastructure and housing.

Architecture is the means to unite the issues and bridge the gap between humans and nature in a peripheral environment. It is the tool to adapt to environmental changes, to counteract climate change and to implement a sustainable resource management. Architecture and alternative agriculture needs to be leveraged as tools to address pressing environmental challenges and foster a more balanced relationship between human activities and the natural world to ensure and preserve the future of the ecosystem and the population in a rural to urban transition.

„How can architectural and agricultural strategies foster the coexistence between humans and nature in the context of a rural to urban transition?“

How have settlement patterns in Sylhet and Bolawara evolved over the past decades?

In order to forecast as accurately as possible how theses cities will develop in the coming years and to what extent the settlement structures will merge, an analysis of the past settlement patterns is crucial. The focus should on identifying areas with a high level of densification and which factors, such as proximity to the river or existing infrastructure, have affected and determined the settlement behavior.

What local and vernacular housing types and structures can be found in Bolawara?

In order to be able to respond ideally to the needs of the locals, collecting a catalogue of the prevailing architecture and structures will create a basis for my design. The local buildings will provide information about occupations, daily live structures and adaptation measures. It is particularly important for the development of new structures to understand the local and vernacular housing in order to be able to continue or expand the built environment appropriately.

What exemplary projects in Southeast Asia exemplify the integration of dwelling and agricultural structures?

For many decades and everywhere in the world, the problem of lack of land for agriculture and green spaces has been prevalent, especially in rapidly growing cities such as Sylhet. Designs that have already been implemented or developed in the past in South East Asia can shed light on both successful and failed measures and provide a basis for my future design period.

METHODOLOGY

For my design, I would like to create a hybrid of different methods with a multidisciplinary approach, combining environmental conditions, vernacular architecture, agriculture systems and local analytics to address the complex challenges of a rural to urban transition. The methodology aims to create a comprehensive understanding of the challenges and opportunities in the rural to urban transition, laying the groundwork for innovative and sustainable solutions that integrate architecture, agriculture, and community well-being.

The two and a half weeks field trip is my most important resource for substantiating the theory and combining it with my personal experiences. All the experiences, impressions and emotions that I gathered during this time form the basis for my personal basic understanding of the current situation. I will process the notes and sketches I made on site in order to be able to reliably draw on my impressions and emotions during the process of our design.

The videos taken on site will be particularly helpful for this purpose, as they will refresh details and simplify my analysis during the design process. As the recordings were made by all different group members, the videos are diverse and contain various details and focuses. As a result, moments were also captured that may have slipped my personal attention or only become more significant during the design process.

MAPPING

In order to be able to assess the development and growth of Sylhet and to anticipate it for the coming years, an intensive analysis of the growth of the last few decades is one of the most important resources. For this purpose, I would like to use historical plans as well as satellite images as a guideline. Furthermore, the historical materials provide information about the intensity and pattern of urban densification and the extent to which green spaces and naturally grown structures have been built on. I hope to be able to analyze how quickly the rural periphery grows and is absorbed into the city through the expansion of Sylhet.

However, since my design will focus on the development of Bolowara in the coming years, the analysis of the Surma river and its movement within the different seasons is also relevant and provides information about the natural conditions and forces.

In general, the maps and satellite images will play a very important role as our experience on site was limited to the conditions prevailing during the field trip due to the great distance to our site area. The satellite images as well as the photos and timelines will close the gaps in my knowledge about the seasons, the climatically induced changes in the environment and nature and the expansion of Sylhet

LITERATURE REWIEV

To gain a genreal knowledge about architectural and agricultural strategies implemented in urban strategies and about the impact of climate change on urban and rural ecosystems existing literature and case studies on Bangladesh will be especially helpful and will add to my own observation on site. Case studies will help to depict the peoples view on a growing density, agriculture and their perception on a rural to urban transition. In particular, projects that have already been implemented will provide information on successful and accepted methods and form a basis

METHODOLOGY

for a catalog of strategies that can be used in the development of the forthcoming urbanization of Bolawara.

ADAPTATION STRATEGIES

Local people have been influenced by the movement of water their entire lives and have learned to adapt to the prevailing conditions and changes in nature. What strategies have people developed especially in terms of agriculture? Where do humans and nature already work in harmony and where do they work against each other? A detailed analysis of the prevailing strategies and everyday difficulties will help to understand which elements can be preserved within a rural to urban transition and in which situation new solutions have to be developed.

DAILY ROUTINE PROFILES

Village structures arise from a mix of age groups, genders, professions, backgrounds, et cetera. In order to understand the prevailing conditions and to be able to design as accurately as possible, I would like to create profiles that provide information about people's daily routines and how they are influenced by life in village structures in the periphery of Sylhet and the prevailing natural conditions compared to living patterns in the city of Sylhet. Hereby the means and importance of agriculture and homegardeining is a major focus to analyze the peoples food supply conditions and farming habits.

ECOSYSTEM RESSOURCES

The analysis of the local resources and the prevailing ecosystem provides a further basis for understanding how man, nature and architecture can work hand in hand. What changes occur in nature during the different seasons, what conditions are man-made and where is nature limited in its natural state or even suppressed? In particular, the examination of ecosystem within the city and within the peripheral context is the focus and defines which adaptations need to be looked into.
Essential to building this knowledge base is an examination and cataloging of both natural materials and plant varieties that can aid in natural flood adaptation and reinforcing existing structures within a rural to urban transition.

„How can architectural and agricultural strategies mitigate biodiversity loss while fostering the coexistence between humans and nature in the context of a rural to urban transition?“

question	How have settlement patterns in Sylhet and Bolawara evolved over the past decades?	What local and vernacular housing types and structures can be found in Bolawara?	What exemplary projects in Southeast Asia exemplify the integration of dwelling and agricultural structures?
method	mapping	literature | site visit	literature | case studies
material	pictures | maps | sattelites	pictures | videos | case studies	plans | designs | concepts
material outcome	sattlement patterns settlement movement factors for settlement	catalogue of existing structures daily life routines ecosystem resource catalogue	catalogue of existing methods successfull | failed strategies
research outcome	prediction for future and relevance for Sylhets periphery and Bolawara	habits of the people vernacular housing types existing adaptation strategies	database for strategies that has already been implemented

Bolawara is transitioning rather than transforming
design that allows to maintain habits, integrate nature, enable agriculture while still densifying the city and giving Sylhet room to grow

RELEVANCE AND AIM

The increasing disappearance of nature in growing cities like Sylhet due to uncontrolled urban densification poses critical challenges, leading to biodiversity loss, poor living conditions, and infrastructural issues. In rural areas, such as Bolawara, the proximity to the Surma River exacerbates challenges, including flooding and agricultural difficulties. The aim is to address the complex interplay between urbanization, biodiversity, and climatic changes, learning from Sylhet's mistakes and developing strategies for Bolawara's transition from rural to urban. The preservation of nature and biodiversity is crucial in this endeavor, and architecture is seen as a tool to support coexistence, enrich growth, and avoid replicating urban problems on a larger scale.

The design approach will focus on the utilizing indigenous resources and harnessing local forces, aligning with the aim of cultivating resilient architectural and agricultural solutions in a peripheral context. The incorporation of natural resources, such as solar energy, water resources, air circulation, greenery, and locally-sourced construction materials, contributes to the environmental sustainability of architectural designs. This approach enhances resilience in the face of adverse conditions, fostering self-sufficiency in villages and reducing dependence on complex infrastructure, particularly in communities with limited financial resources. The design strategies aim to empower individuals in flood-prone regions to lead self-sustaining lives while actively contributing to the preservation and of local biodiversity within a growing urban context.

RESEARCH

DIVISION AND DISTRICT

When Bangladesh gained its independence in 1971, the country initially consisted of four administrative divisions: Chittagong, Dhaka, Khulna, and Rajshahi. In 1993, the Barisal Division was established by separating it from the Khulna Division, thereby augmenting the total to five divisions. Subsequently, in 1995, the Sylhet Division was carved out from the Chittagong Division, resulting in a total of six divisions. In 2010, the Rangpur Division emerged as a separate entity from the Rajshahi Division, expanding the count to seven divisions. Finally, in 2015, the Mymensingh Division was delineated from the Dhaka Division, culminating in the current eight- division administrative structure.[10]
Each division is designated after its principal city, which serves as the administrative capital for its respective jurisdiction. Furthermore, every division is further subdivided into districts, which, in turn, are partitioned into Upazilas (this is similar to a province or a municipality).[11]

DHAKA

Encompassing the nation's capital and largest city, Dhaka[12], this division spans an area of 20,509 km2 and houses a population of approximately 45.6 million Bangladeshis.[13]

CHITTAGONG

Ranking as the largest among the eight divisions in Bangladesh[14], the Chittagong Division covers a total area of 33,915 km2 and accommodates a population of approximately 34.1 million.[15]

RAJSHAHI

Recognized for its cheap labor force and well-developed infrastructure,[16] the Rajshahi Division comprises an area spanning 18,155 km2 and a population of approximately 20.7 million.[17]

SYLHET

Distinguished by its robust economy, replete with tea plantations and citrus orchards, the Sylhet Division has a substantial portion of its people working abroad, notably in the United Kingdom.[18] It encompasses an area of 12,635 km2 and is inhabited by a population of approximately 11.4 million.[19]

KHULNA

Noteworthy for hosting the Mongla seaport, the second-largest in Bangladesh, and the renowned Sundarbans, the world's largest mangrove forest,[20] the Khulna Division spans 22,270 km2 and houses a population of approximately 17.8 million.[21]

BARISAL

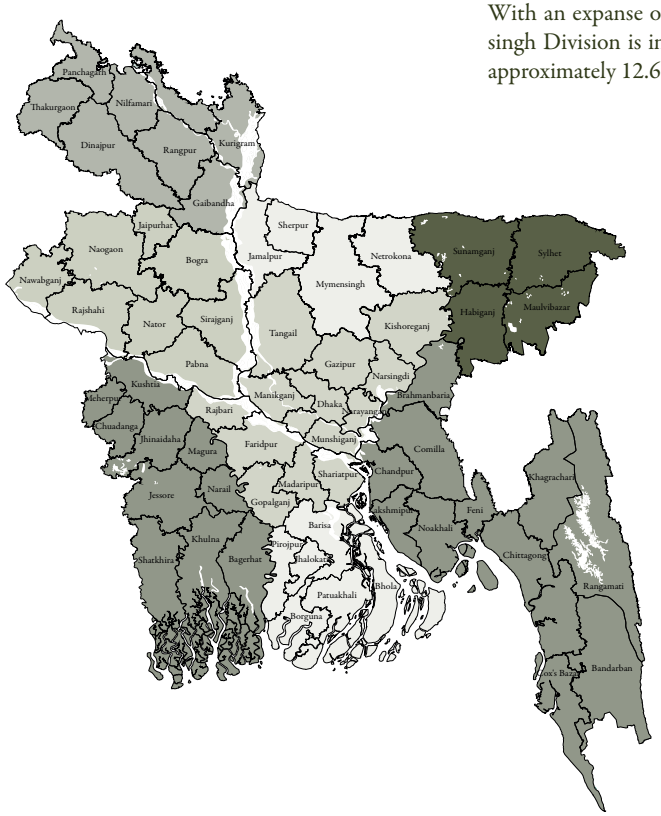
Encompassing a land area of 13,225 km2, the Barisal Division is home to a population of approximately 9.3 million.[22]

RANGPUR

Covering a land area of 16,185 km2, the Rangpur Division accommodates a population of approximately 18 million.[23]

MYMENSINGH

With an expanse of 10,670 km2, the Mymensingh Division is inhabited by a population of approximately 12.6 million.[24]



[10] "Divisions Of Bangladesh." n.d. Academic Accelerator.

[11] "Divisions of Bangladesh." n.d.

[12] Ibid.

[13] "Bangladesh: Districts and Cities - Population Statistics, Maps, Charts, Weather and Web Information." n.d.

[14] Divisions of bangladesh

[15] Bangladesh Population Statistics

[16] Divisions of Bangladesh

[17] Bangladesh Population Statistics

[18] Divisions of Bangladesh

[19] Bangladesh Population Statistics

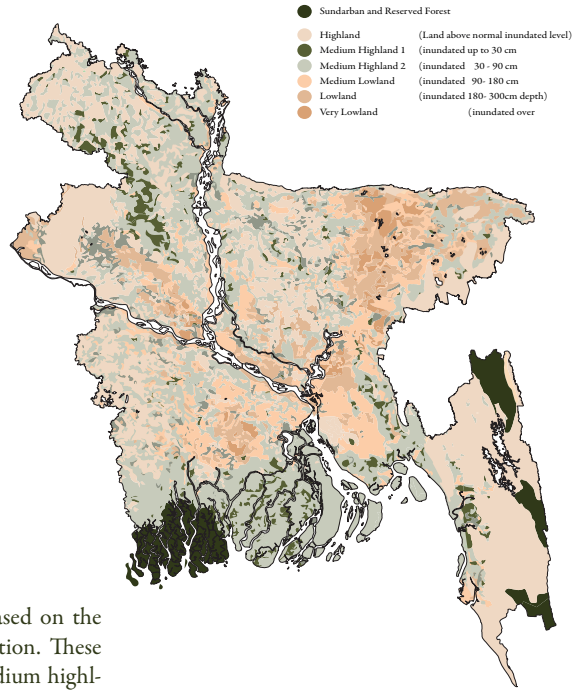
[20] Divisions of Bangladesh

[21] Bangladesh Population Statistics

[22] Divisions of Bangladesh

[23] Ibid.

GEOGRAPHY AND SOIL



Bangladesh has classified its land based on the depth and duration of land inundation. These are identified as highland (HL), medium highland (MHL), medium lowland (MLL), lowland (LL), and very lowland (VLL).[24]

The highland is above the normal flooding level
MEDIUM HIGHLAND - floods to 90 cm
MEDIUM LOWLAND - 90 - 180 cm deep
LOWLAND - 180 - 300 cm deep
VERY LOW - flooded deeper than 300 cm.[25]

Because of the dynamic Ganges and Brahmaputra rivers, the land categories also change through time. Even though the physical, biological, and environmental characteristics remain largely unchanged. These diverse land types encourage farmers to grow different crops, adapted to different soil types and flooding conditions. This causes cropping techniques to differ between locations within the land types.[26]

HIGHLAND (HL) - used for aus (rice), jute, rabi crops (pulses, oilseeds, and wheat), and vegetables or spices.
MEDIUM HIGHLAND (MHL) - when flooded less than 30 cm deep used for aman (rice), aus (rice) plantations, and rabi crops.
MEDIUM LOW LAND (MLL) - Aus (rice), deep water Aman (rice), dry land rabi, Jute, Boro (rice), wheat, potatoes, and other vegetables
LOWLAND (LL) - HYV boro paddy (rice)[27]

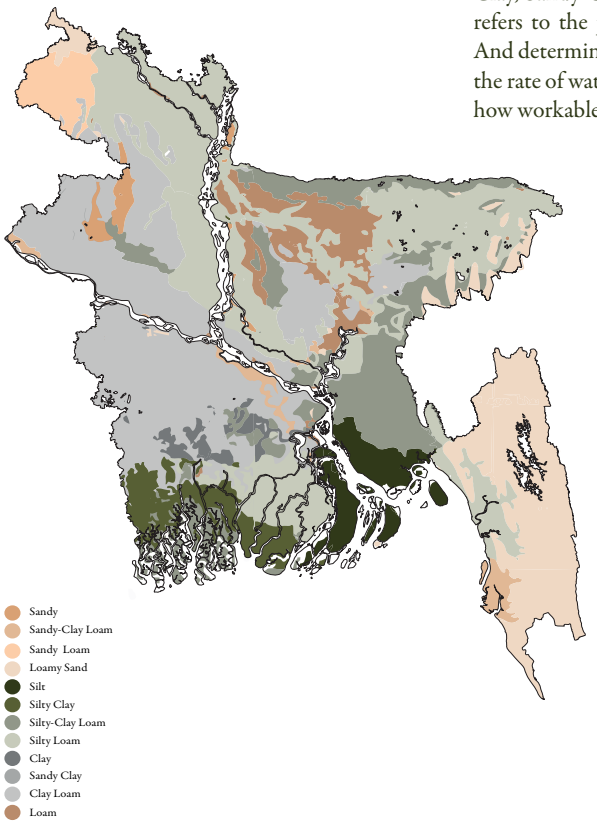
[24] "Table 1 . Classification of Land Types in Bangladesh Based on Inundation." n.d. ResearchGate.

[25] Classification land types, ResearchGate

[26] Md. Jasim Uddin, et al. Land Inundation and Agricultural Soils of Bangladesh

Bangladesh is classified as an Alluvial plain, this means it is a largely flat landform created by deposition of sediments over a long period by one or more rivers coming from highland regions.[28] The alluvial deposits (material deposited by rivers) and silt come from the Himalayas carried downstream by rivers. This causes soils to be extremely fertile.[29]

These deposits formed 80% of the soils of Bangladesh. The remaining 20% of soils are formed in the Teriary (developed by the ocean floor) and Quaternary (formed by rock alteration) sediments of hills (12%) and uplifted Pleistocene terrace (8%).[30]
In a study about soils in Bangladesh, 12 soil textures were found in Bangladesh; Sandy, Sandy-Clay Loam, Sandy Loam, Loamy Sand, Silt, Silty Clay, Silty-Clay Loam, Silty Loam, Clay, Sandy Clay, Sandy Clay, Clay Loam, and Loam.[31] This refers to the proportion of sand, silt, and clay. And determines the amount of water it can hold, the rate of water movement through the soil, and how workable the soil is.[32]



[27] Benjamin Elisha Sawe. "What Is an Alluvial Plain?" WorldAtlas, November. 2017.

[28] Jeffrey Hays, Land and geography of bangladesh

[29] "Bangladesh Soil - Banglapedia." n.d.

[30] Shofiqul Islam, Ryuichi Shinjo. "The Dauki Fault at the Shillong Plateau-Bengal Basin Boundary in Northeastern India: 2D Finite Element Modeling." Journal of Eart

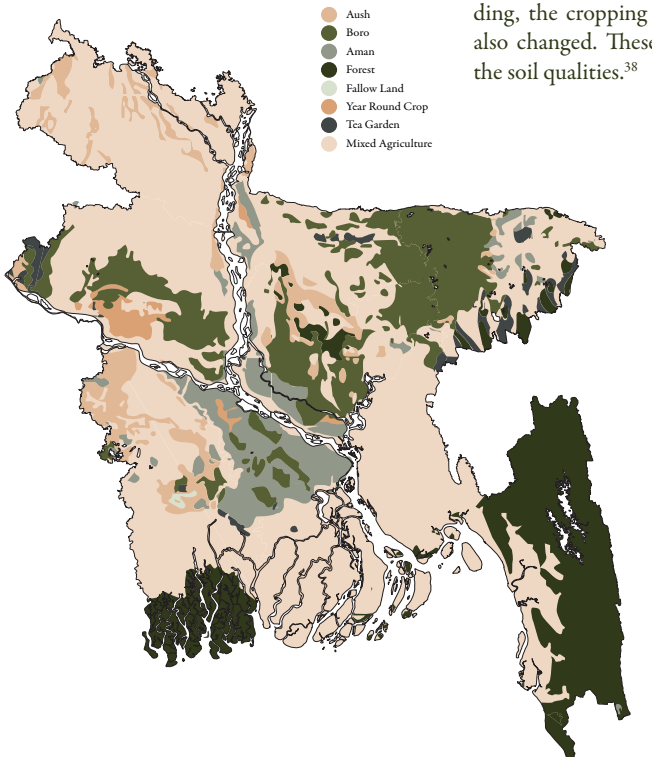
[31] Science 23 (6): 854–63. 2012.

[32] Queensland. "Soil Texture." Environment, Land and Water | Queensland Government. September 24, 2013.

RICE AND FARMING

70% of the country's land is used for agriculture. This consists of 3 types of rice cultivation; Aus, Boro, and Aman paddies. Other agriculture consists of year-round crops, tea gardens, and Mixed agriculture. 59% of Bangladesh's land is arable, which means used for temporary crops. Only 6,5% of the land is used for permanent crops.[33] The country also has some fallow land, which is a technique of not sowing the arable land during one or more growing seasons.[34]

4,6% of Bangladesh is covered by pasture land, which is land used for grazing livestock.[35] The remaining land consists of 11% forest and woods. 18% consists of swamps, marshes, and mountains.[36] The land use is determined by its physiography, climate, and land type related to flooding.[37] The depth of flooding is key in the determination of land use, this determines which crops can be cultivated. More in-depth information about crops and land types is described in the subchapter 'Land types'. Due to the increasing population, the land use has experienced major changes. For example, agriculture has expanded a lot. Due to the depth changes in flooding, the cropping patterns and intensity have also changed. These changes will likely change the soil qualities.[38]



[33] Jeffrey Hays. n.d. "Land and Geography of Bangladesh."

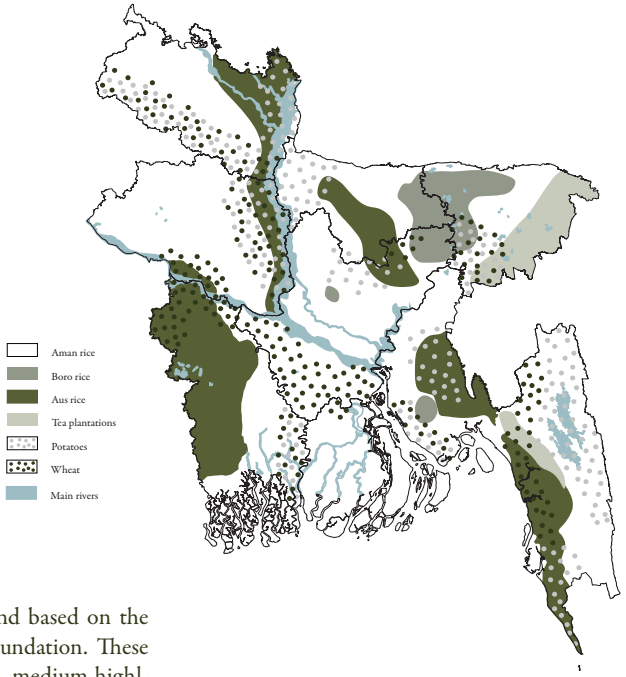
[34] Fervalle - Fabricante de Fertilizantes. "What Is Fallow Land?" Fervalle (blog). October 20, 2022

[35] "Pasture Land — All about Watersheds." n.d.

[36] Jeffrey Hays, Land and geography of bangladesh

[37] "Landuse - Banglapedia." n.d.

[38] Md. Jasim Uddin, et al. "Land Inundation and Cropping Intensity Influences on Organic Carbon in the Agricultural Soils of Bangladesh." CATENA 178 (July): 11–19. 2019.



[39] "Table 1 . Classification of Land Types in Bangladesh Based on Inundation." n.d. ResearchGate.

[40] Classification land types, ResearchGate

[41] Md. Jasim Uddin, et al. Land Inundation and Agricultural Soils of Bangladesh

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RAINFALL

Bangladesh, positioned at the intersection of the Indo-Himalayan and Indo-Chinese subregions, has a sub-tropical humid climate characterized by significant seasonal variations in rainfall, moderately warm temperatures, and high humidity, influenced by the circulation patterns of the pre-monsoon, monsoon and post-monsoon periods.[42] The country is already witnessing the repercussions of heavy rainfall, and severe weather events. The occurrence of floods, cyclones, and tidal surges serves as evidence of the increasing frequency and severity of extreme events in the nation.[43]

In this chapter, the primary climate characteristics of Bangladesh will be discussed. The insights provided in this chapter will serve as an introductory foundation for comprehending the subsequent chapter on climate change, which explores extreme climate events resulting from Bangladesh's climatic conditions. Bangladesh experiences a diverse range of seasons, with a transition occurring approximately every two months.[44] These seasonal changes are categorized according to the prevailing weather conditions in specific regions, leading to Bangladesh being referred to as 'The land of Six Seasons'; summer, rainy season, autumn, late autumn, winter, and spring.[45] Summer is the first season in Bangladesh, as April is the first month of the new year according to the Bengali Calendar.[46]

From a climatic perspective, Bangladesh can be identified as having four well-defined seasons; a dry winter season spanning from December to February, a warm pre-monsoon summer season occurring from February to June, a wet monsoon season extending from June to October, and a post-monsoon autumn season that continues from October to December.[47] Over 71% of the yearly rainfall occurs in the monsoon period.
The fluctuations in the monsoon's arrival, departure, and the amount of rainfall it brings have significant effects on water resources, energy production, agriculture, the economy, ecosystems, and fisheries in Bangladesh. During the winter season, temperatures decrease, leading to a shift in the climate to a cool and dry one.[48]

[42] Shamsuddin Shahid, "Recent Trends in the Climate of Bangladesh," Climate Research 42, no. 3 (July 20, 2010): 185–93.

[43] D.L. Mallick, "Growing Environmental and Climate Refugees in Bangladesh: Urgent actions are required," Tokyo Conference on Climate Change - Adaptation Measures for Sustainable Low Carbon Cities, (October, 2008)

[44] "Notes On Seasons in Bangladesh," Unacademy, April 18, 2022

[45] Kabir Uddin and Mir A. Matin, "Potential Flood Hazard Zonation and Flood Shelter Suitability Mapping for Disaster Risk Mitigation in Bangladesh Using Geospatial Technology," Progress in Disaster Science 11 (October 1, 2021): 100185.

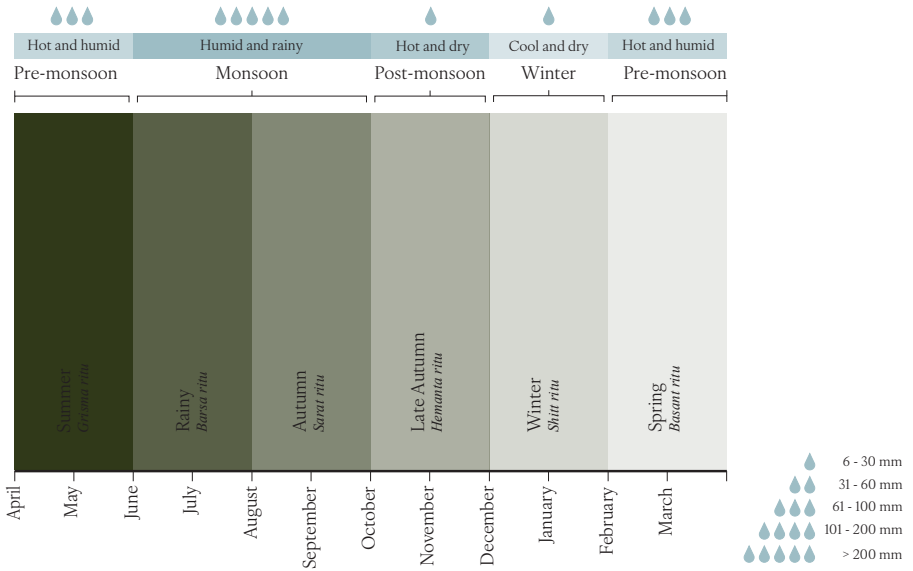
[46] "Notes On Seasons in Bangladesh."

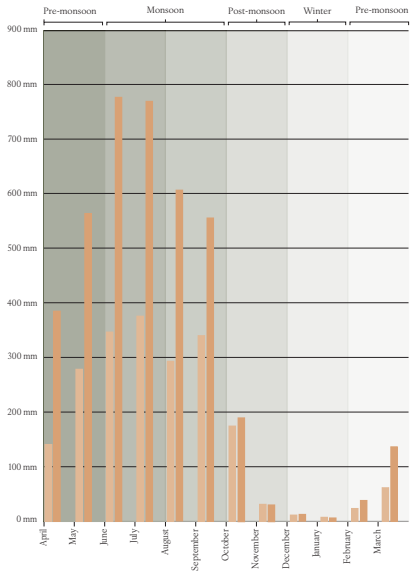
[47] Shahid, "Recent Trends in the Climate of Bangladesh."

[48] Mossammat Ayesha Khatun, Bazlur Rashid, and Hans Olav Hygen, "Climate of Bangladesh" (Norwegian Meteorological Institute, May 31, 2016)

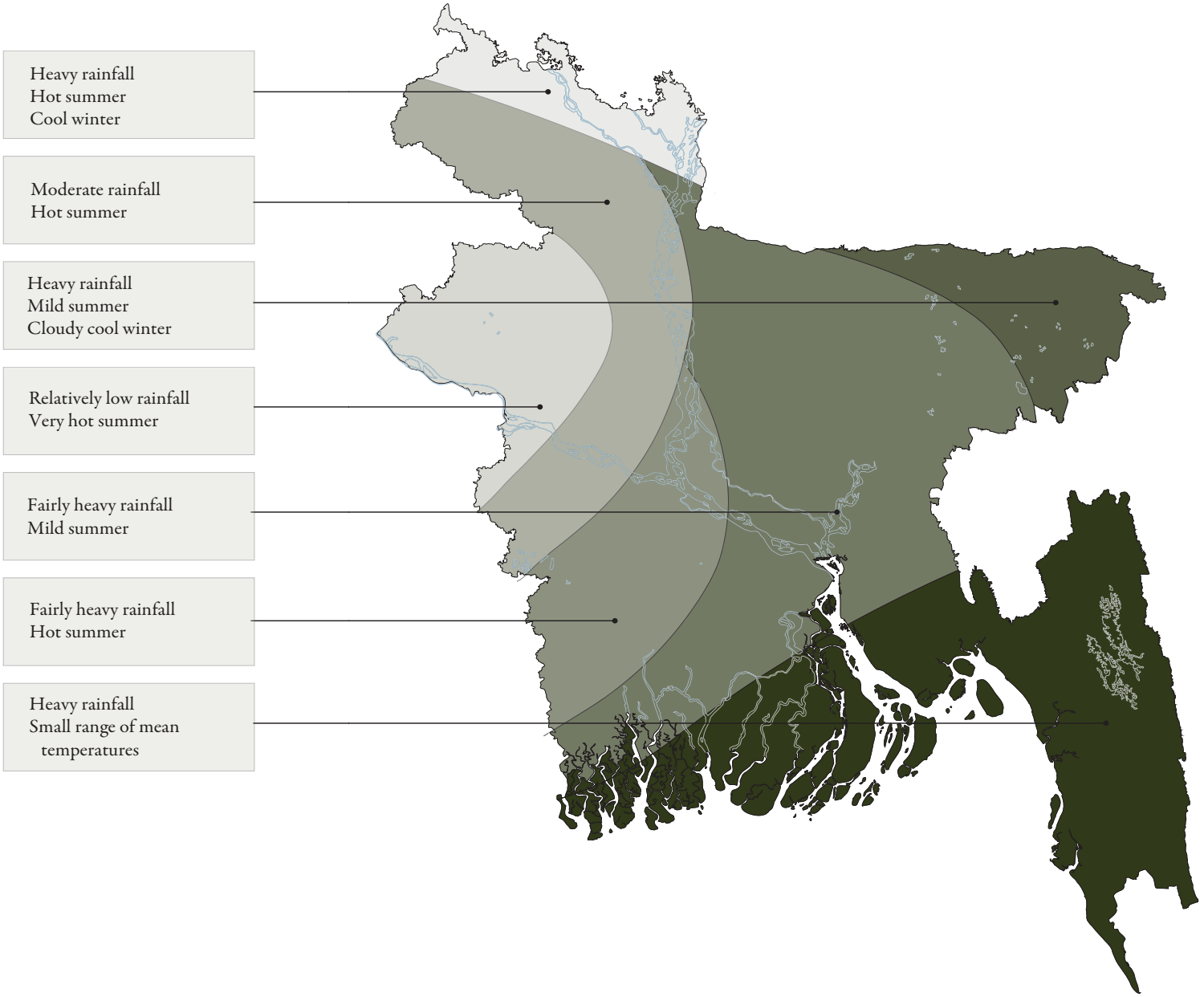
[49] Shahid, "Recent Trends in the Climate of Bangladesh."

[50] Khatun, Rashid, and Hygen, "Climate of Bangladesh."





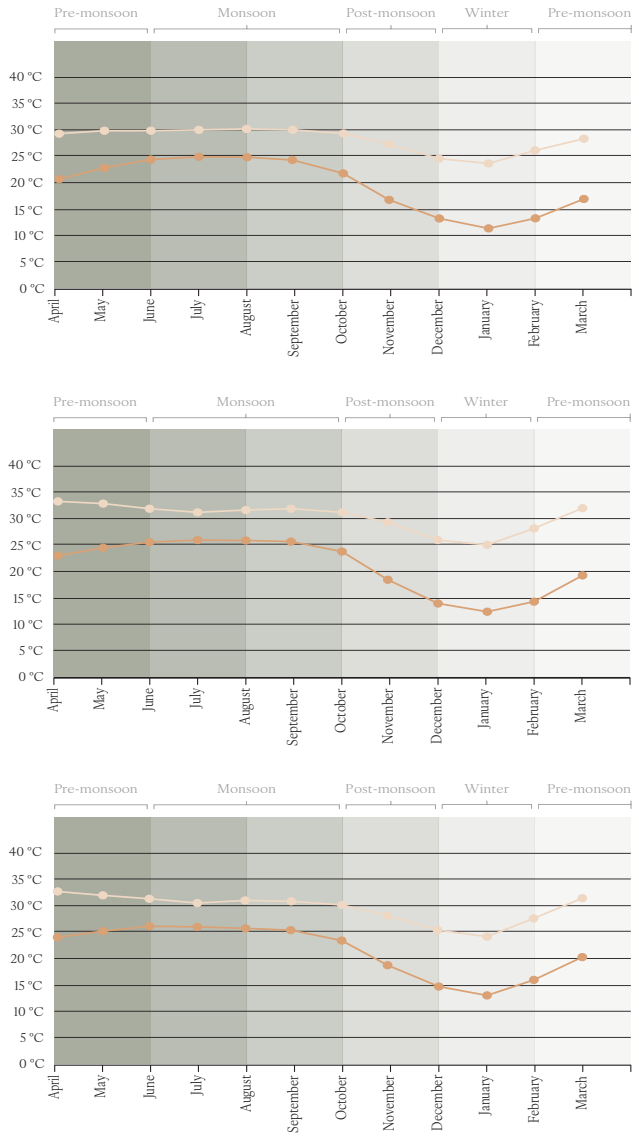
During the monsoon, weak tropical depressions are brought from the Bay of Bengal into Bangladesh by the wet monsoon winds, which causes most of the rainfall occurring during this season.[49] The fact that over 71% of the yearly rainfall occurs in the monsoon period is visible in Fig. [26] The monthly precipitation in Sylhet significantly exceeds that of Dhaka, yet they exhibit a similar pattern, with the monsoon season being the wettest period. Dhaka experiences its highest monthly rainfall at 375 mm in July, while Sylhet records its peak monthly rainfall of 776 mm in June (Fig. 26). These statistics are derived from the monthly normal rainfall data compiled by various stations of the Bangladesh Meteorological Department, covering the period from 1981 to 2010.[50]



Bangladesh's climate seasons exhibit regional variations. The coastal southeast, including Chittagong and the area north to Comilla, experiences relatively stable temperatures and heavy rainfall, exceeding 2500 mm annually, with notable dewfall in winter. The northeastern part, where Sylhet is located, is marked by high humidity, heavy rainfall, and a cloudy, cool winter. In the northern region, there are extremes, with a very wet rainy season (around 3000 mm per year) and a relatively dry summer, along with temperature fluctuations between 10 degrees and 30 degrees throughout the year. Moving to the western region, lower rainfall and fewer extremes are observed compared to the north. The western part of the country is the driest of all regions of Bangladesh.[51]

[51] Haroun Rashid, Geography of Bangladesh (Boulder: Westview, 1977)

TEMPERATURE



In Bangladesh, the temperatures vary from 12.3 °C to 28.1°C in winter and from 22.8 °C to 33.4 °C in summer, with January being the coldest month and May being the warmest.[52]

The pre-monsoon period is characterized by hot temperatures, with a maximum of 33.4 °C. After that, the monsoon period will follow with high temperatures as well as heavy rainfall. During this season, the temperatures in the western regions of Bangladesh are higher in contrast to those in the eastern districts. While this season is marked by elevated temperatures, cooler days are also observed during intense rain showers.[53]

The post-monsoon season is a transitional period defined by a reduction in rainfall and a gradual decrease in nighttime minimum temperatures.[54]

Winter is relatively cooler and drier compared to all seasons. Since temperatures vary throughout the different regions in the country, the minimum and maximum temperatures in Dhaka and Sylhet are compared.[55]

In Sylhet, located in the northeast of the country, the average temperature is lower than the average temperature in Dhaka, located in the center of the country.[56] In winter, the temperature in Sylhet will drop to a minimum of 11.3 °C, whereas the minimum temperature in Dhaka is 12.8 °C. In summer, the maximum temperature will rise to 30.3 °C in Sylhet and 32.7 °C in Dhaka.[57]

To conclude, the average temperatures are a bit higher in Dhaka than in Sylhet. This could be explained by the geographic and topographic differences of these locations. Whereas Sylhet is located near hill areas, influenced by cooling effects, Dhaka is situated in a relatively flat and low-lying area in the middle of the country.

In Fig. 17 and Fig. 18, the minimum and maximum temperatures in Sylhet and Dhaka are summarized.

[52] "World Bank Climate Change Knowledge Portal," n.d.

[53] "Development and Climate .Change in Bangladesh: Focus On Coastal Flooding and The Sundarbans" (Organisation for Economic Co-operation and Development, 2003)

[54] Haroun Rashid, Geography of Bangladesh (Boulder: Westview, 1977)

[55] Agrawala et al., "Development and Climate Change in Bangladesh: Focus On Coastal Flooding and The Sundarbans."

[56] "Sylhet Climate: Temperature Sylhet & Weather By Month," n.d.

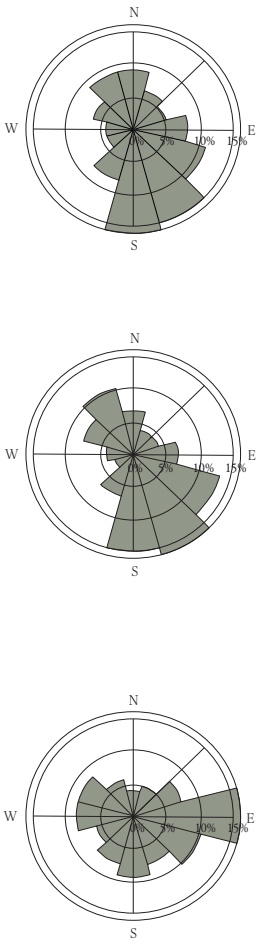
[57] Temperature Dhaka & Weather By Month," n.d.

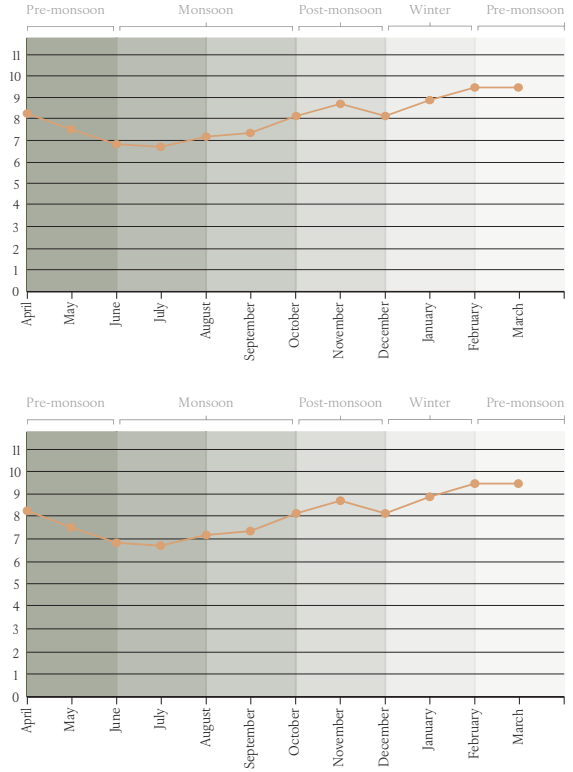
WIND

During the monsoon season, spanning from March to September, a robust south/southwesterly wind originates from the Indian Ocean and traverses its course into the Asian continent, specifically through the coastal areas of Bangladesh. This seasonal phenomenon brings about a monthly average wind speed ranging from 3 meters per second (m/s) to 6 m/s.[58]
It is important to note that wind patterns exhibit regional variations within Bangladesh. For instance, in the capital city of Dhaka, the dominant wind direction maintains a southwest orientation consistently throughout the year, as indicated in Fig. 20. Conversely, in the city of Sylhet, the primary wind direction predominantly points east, also highlighted in Fig. 21.[59]
Fig. 19 displays the typical wind rose chart for Bangladesh, illustrating that, on average, the predominant wind direction across the entire nation is south/southeast.

Not only does the wind direction exhibit variability across different regions of the country but there are also disparities in wind speeds among these areas. In particular, Dhaka experiences higher wind speeds compared to Sylhet, with its maximum wind speeds occurring during the monsoon season, peaking at 8.7 m/s in July.[60]
Conversely, wind speeds in Sylhet tend to be lower overall, but they too reach their highest values during the monsoon season, with a maximum wind speed of 6.1 m/s recorded in July.[61]
Following the monsoon season, there is a decrease in wind speeds in both areas. In Dhaka, the minimum wind speed during this period is recorded at 4.1 m/s in November, while in Sylhet, the minimum wind speeds occur in November and December, reaching as low as 3.2 m/s.[62]

Fig. 22 provides a summary of the monthly wind speeds for both Dhaka and Sylhet, utilizing data collected from weather observations over the past decade.





[58] A.N.M. Mominul Islam Mukut, Quamrul Islam, and Masoom Alam, "Analysis of Wind Characteristics in Coastal Areas of Bangladesh," Journal of the Institution of Engineers Bangladesh, January 1, 1970.

[59] "Global Wind Atlas," n.d.

[60] Infoplaza, "Klimaat kaart wind Bangladesh | Weerplaza. nl," Weerplaza, n.d.

[61] Ibid.

[62] Ibid.

[63] "Dhaka Climate: Temperature Dhaka & Weather By Month."

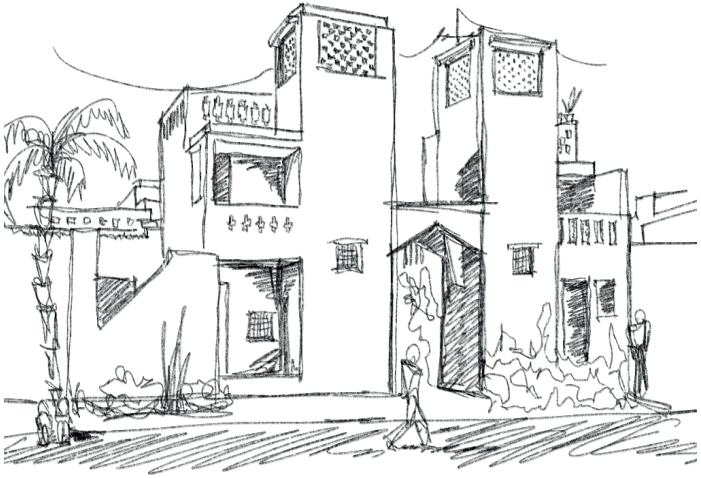
[64] "Sylhet Climate: Temperature Sylhet & Weather By Month."

Sunlight hours vary across different regions of Bangladesh. For instance, Dhaka enjoys more daily sunshine hours compared to Sylhet. As shown in Fig. 23, the peak average sun hours in Dhaka occur in February and March, with 9.4 hours of sunshine, while the lowest average is 6.7 hours in July.[63]
In contrast, Sylhet experiences its maximum average sun hours in February, with 9.3 hours of sunlight, and its minimum in June, with only 5.7 hours (Fig. 24).[64]

These average sun hour patterns closely correspond to the rainfall patterns during the monsoon season, with Dhaka receiving its highest rainfall in July, while Sylhet's peak rainfall occurs in June.

CASE STUDIES

ARANYA LOW COST HOUSING

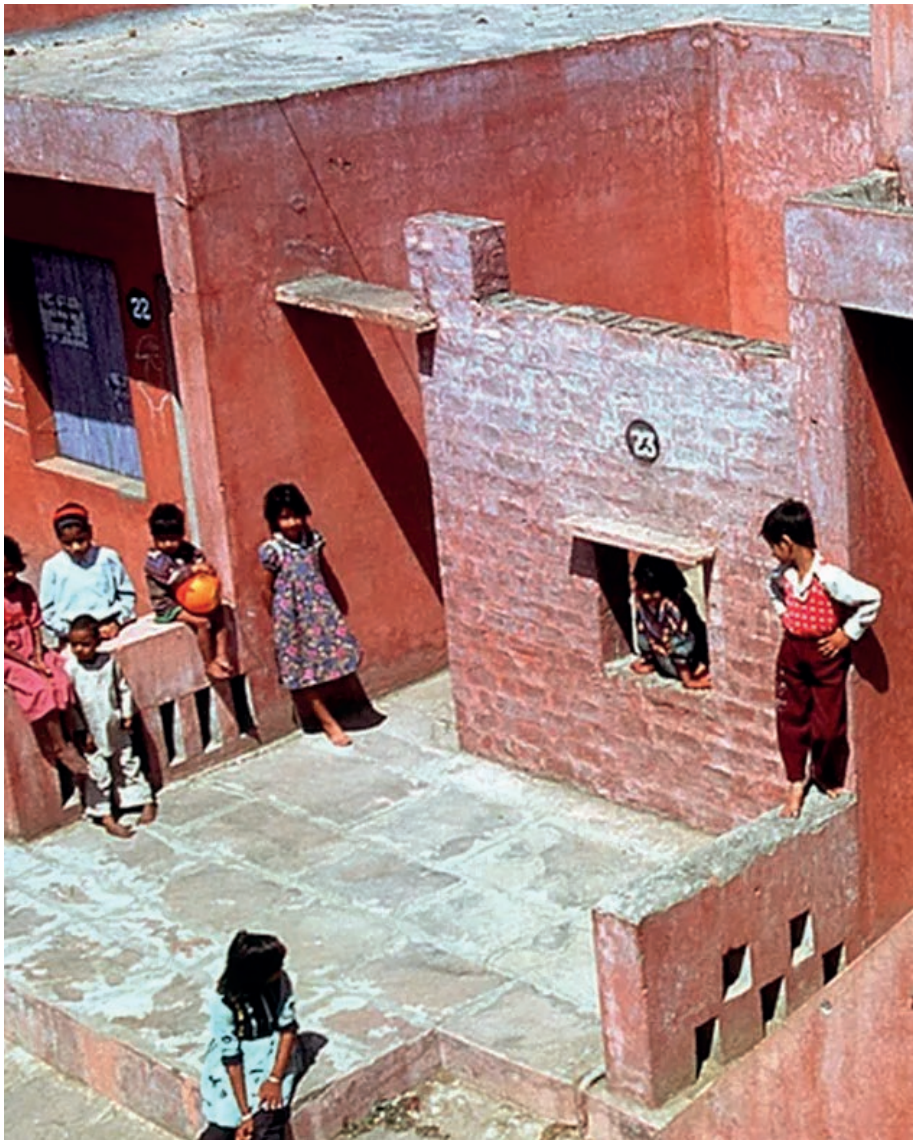


ARCHITECT	B.V. Doshi
LOCATION	Indore, MP
PROJECT SIZE	85 h 6500 apart.
PROJECT POPULATION	65.000

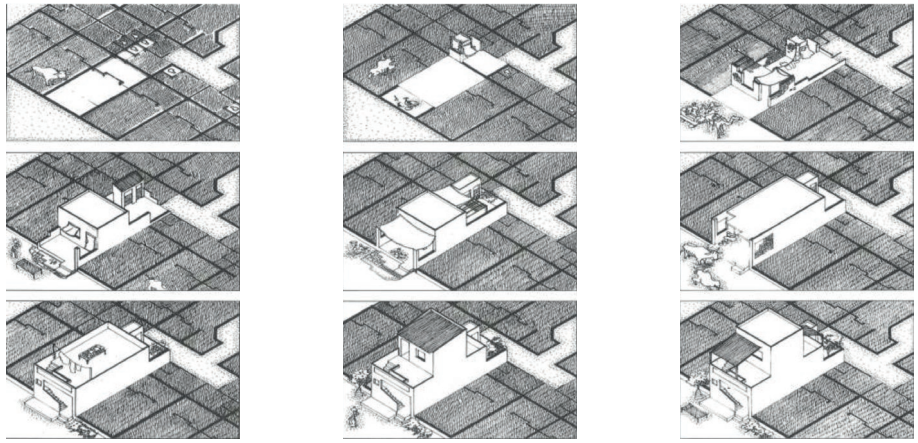
During the 1980s around 51.000 families were homeless or living in informal settlements. To address the topic the Indore Development Authorities developed a scheme with ready built housing solutions. The idea was not developed as the building phase would have taken a long time and the houses were not affordable for low income groups.

Doshis suggestion was focusing on a design that includes all income classes and also all classes of society. For him it was especially important to focus on families and the atmosphere created in the neighborhood, leaving people enough room for personalization of the shared space but also their private houses.

The planning contains a ton centered in which the main facilities are combined. All areas are accessible from this centre and interlinked



by Vastushilpa Foundation

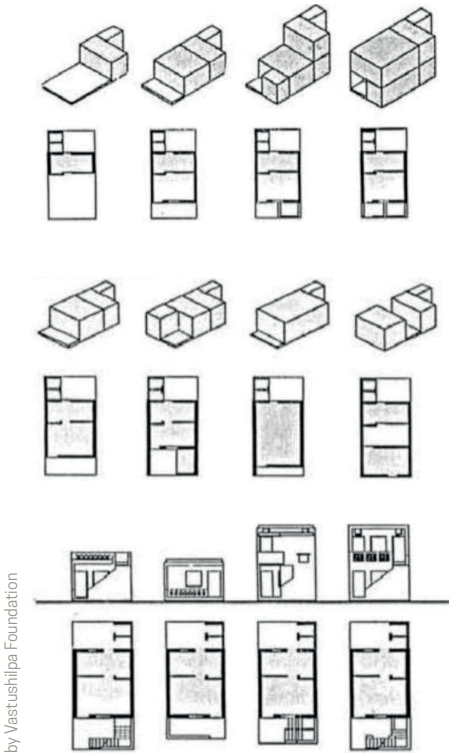


by Vastushilpa Foundation

open spaces combine housing and amenities. Further amenities are distributed evenly within the open and green spaces, keeping them accessible for pedestrian and the town centre. A road network hierarchy ensures easy accessibility without overcrowded streets leading to calm and children friendly neighborhoods in which pedestrians and vehicles are segregated. Vehicles are drawn outwards to the main roads and pedestrian are drawn inwards to the towns centre and amenities.

Furthermore are the dwellings sharing walls to minimize wall surfaces that are exposed to the sun.

The plan contains plots with service cores and a planned infrastructure that are defining the crucial part of the planning. The people can then, according to their budget and to their needs, choose how much and how they wanna built on their plots.



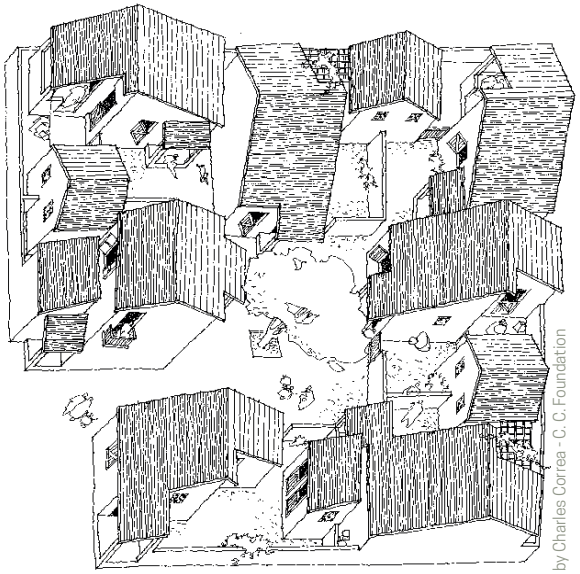
by Vastushilpa Foundation

[65] Doshi, B. (2019). Balkrishna Doshi: Architecture for the People.Thames & Hudson.

[66] Manon Mollard (2019). Revisit: Aranya low-cost housing, Indore, Balkrishna Doshi

[67] [online]. (2019). available at: https://www.architectural-review.com/buildings/revisit-aranya-low-cost-housing-indore-balkrishna-doshi

BELAPUR HOUSING

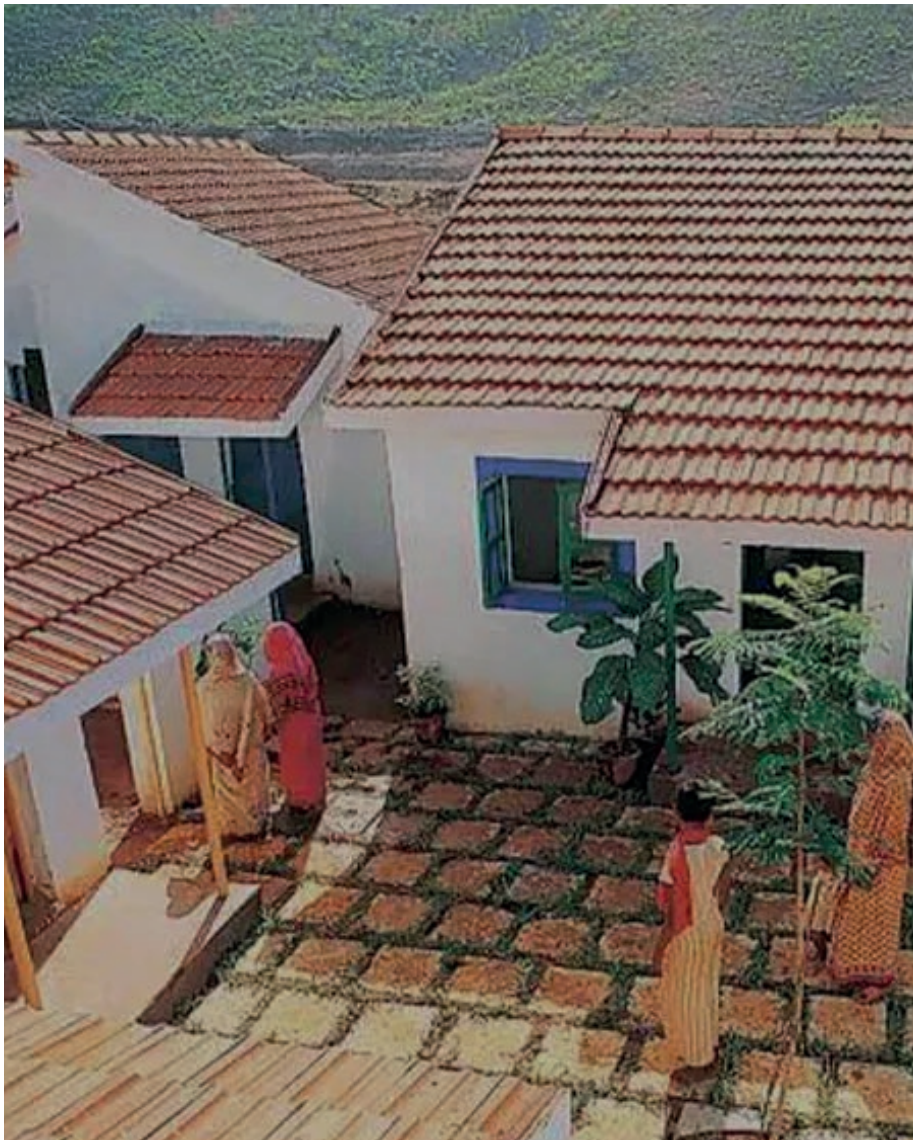


by Charles Correa - C. C. Foundation

ARCHITECT	Charles Correa
LOCATION	Navi Mumbai, India
PROJECT SIZE	5,4 h
PROJECT POPULATION	500 families

Charles Correa's Belapur Housing Project exemplifies innovative, sustainable urban design aimed at fostering community and affordability. The project is celebrated for its incremental development approach, which allows residents to expand their homes over time. Correa's design integrates traditional Indian architectural elements such as courtyards and verandahs to create naturally ventilated, climate-responsive spaces. Emphasizing communal living, the layout includes shared spaces that encourage social interaction, reflecting Correa's vision of a self-sufficient, inclusive neighborhood and provides high-quality, affordable housing.[68]

[68] [online]. (2022). available at: https://charlescorreafoundation.org/2022/03/13/incremental-housing/



by architectopedia

KEY PRINCIPLES AND GOALS

Incremental Development

The project was designed to grow and adapt over time, allowing residents to expand and modify their homes as their needs and financial situations evolved. This approach encouraged a sense of ownership and participation among the inhabitants.

Community and Shared Spaces

Central to the design is the integration of shared community spaces that foster social interaction and a sense of community. Courtyards, playgrounds, and communal facilities are strategically placed to enhance communal life.

Climatic Responsiveness

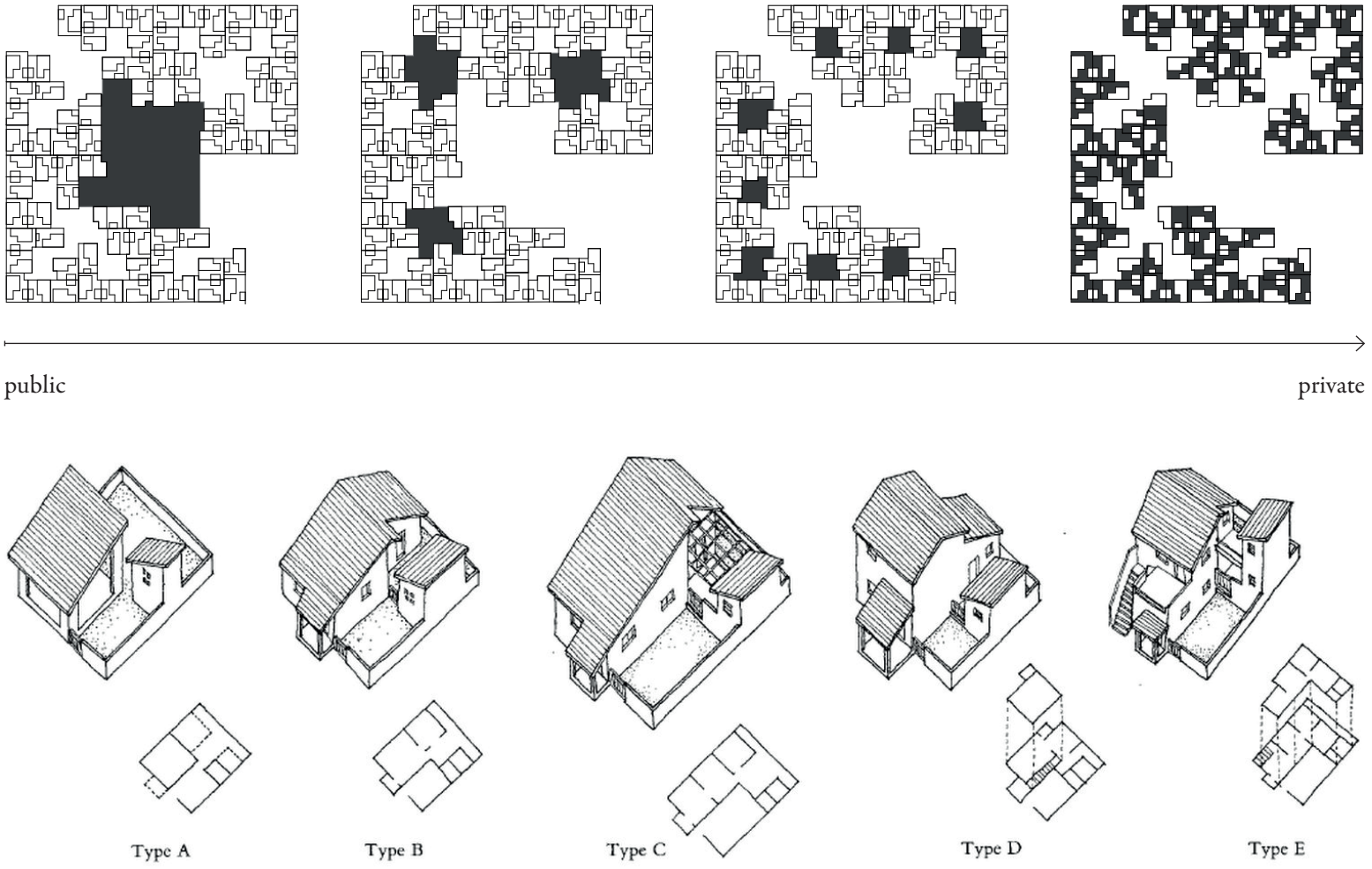
Correa's design takes into account the local climate, using traditional Indian architectural elements such as courtyards, verandahs, and terraces to create naturally ventilated and shaded spaces, reducing the need for artificial cooling.

Affordability and Accessibility

By focusing on cost-effective building techniques and materials, the project aimed to provide affordable housing solutions for lower-income groups without compromising on quality or aesthetic value.

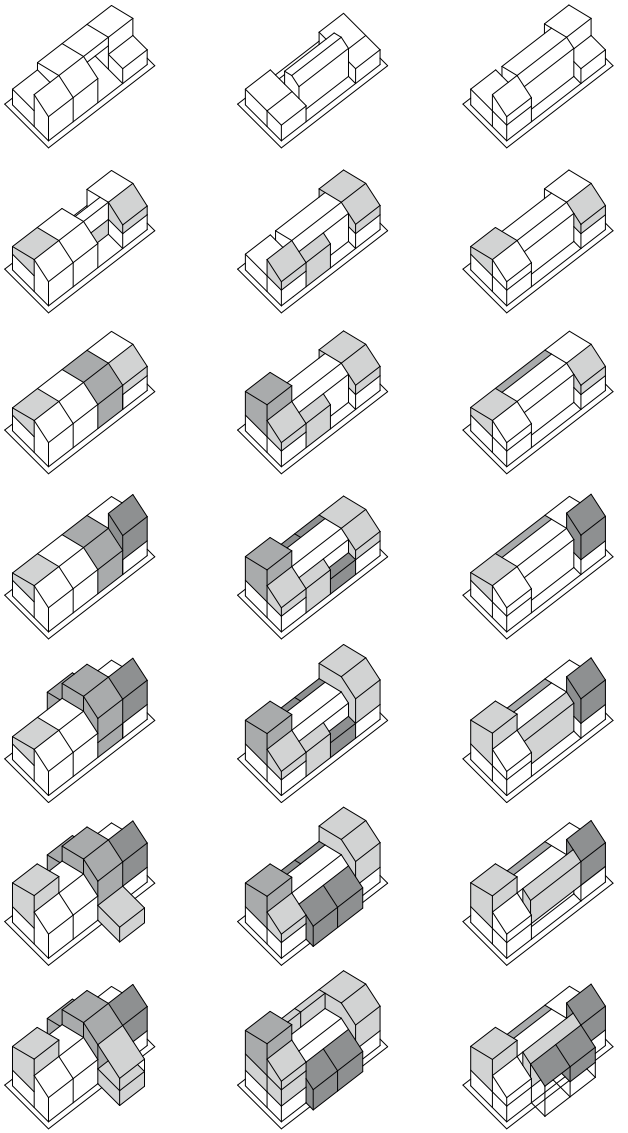
Cultural Context and Local Identity

The architecture reflects and respects the local culture and lifestyle, incorporating traditional Indian elements and local materials to create a sense of place and identity for the residents.



by Charles Correa associates

by Iwan Baan and Jaime Navarro

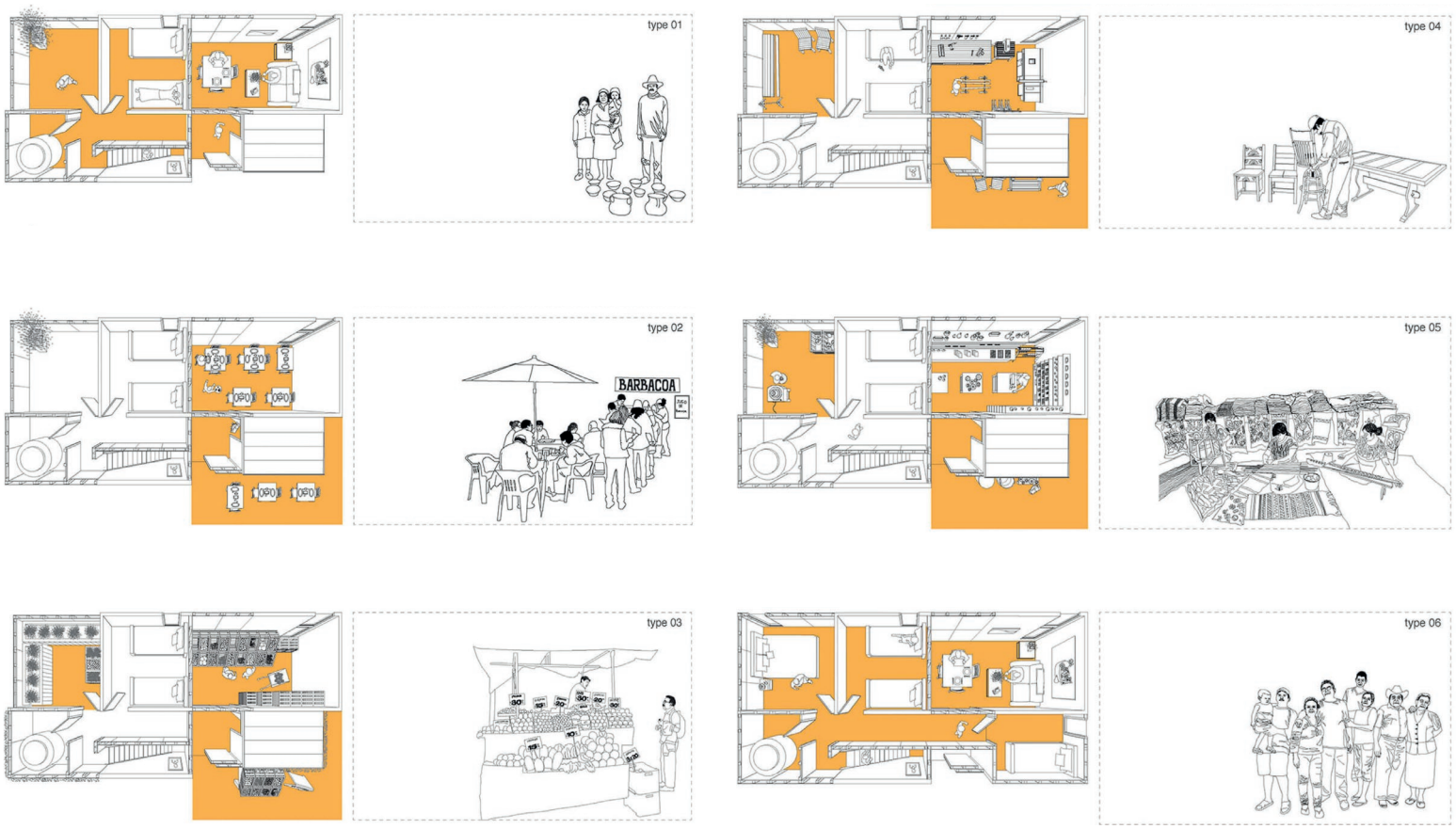


ARCHITECT Tatiana Bilbao

LOCATION Mexico

Tatiana Bilbao's „Housing+" project is also known as her $8,000 House and aims to address the affordable housing crisis in Mexico by providing a flexible and expandable housing prototype. Each basic unit of the house covers approximately 43 square meters and includes two bedrooms, one bathroom, a kitchen, and a living/dining area with a ceiling height of five meters. The design allows for future expansions, accommodating up to five additional bedrooms as families grow and their needs change. This modular approach is intended to be affordable, with construction costs ranging from $8,000 to $14,000 depending on materials and location.

The project emphasizes sustainable and adaptable architecture, using a combination of durable concrete blocks for the core structure and lighter, cheaper materials like wood pallets for expansions. This approach not only keeps initial costs low but also enables families to gradually enhance their homes as resources become available.[69]



by Tatiana Bilbao

[69] [online]. available at: https://tatianabilbao.com/projects/housing

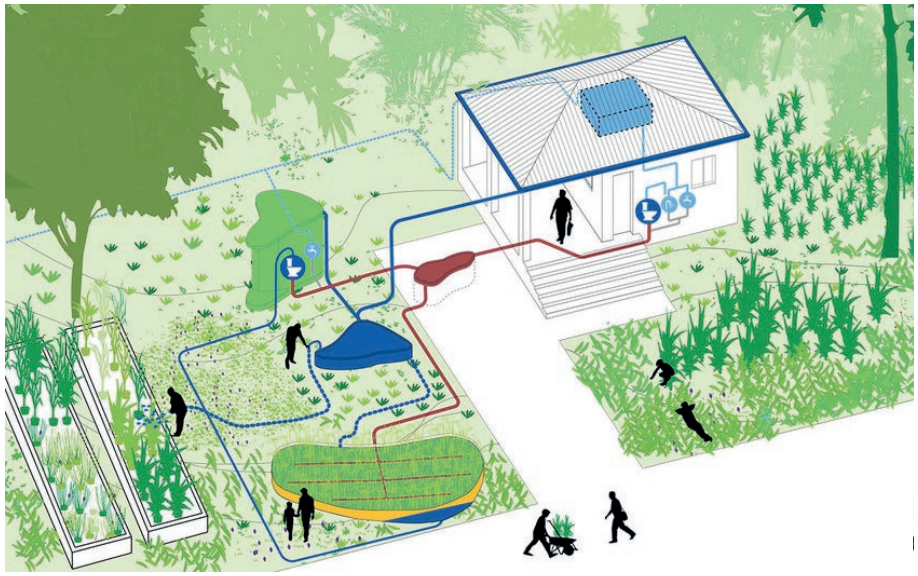
AGUA CARIOCA

LOCATION	Rio de Janeiro, Brazil Guanabara Bay
ARCHITECTS	OOZE
PILOT YEAR	2016
PILOT LOCATION	Sitio Roberto Burle Marx
SUPPORT	Stimuleringsfond NL

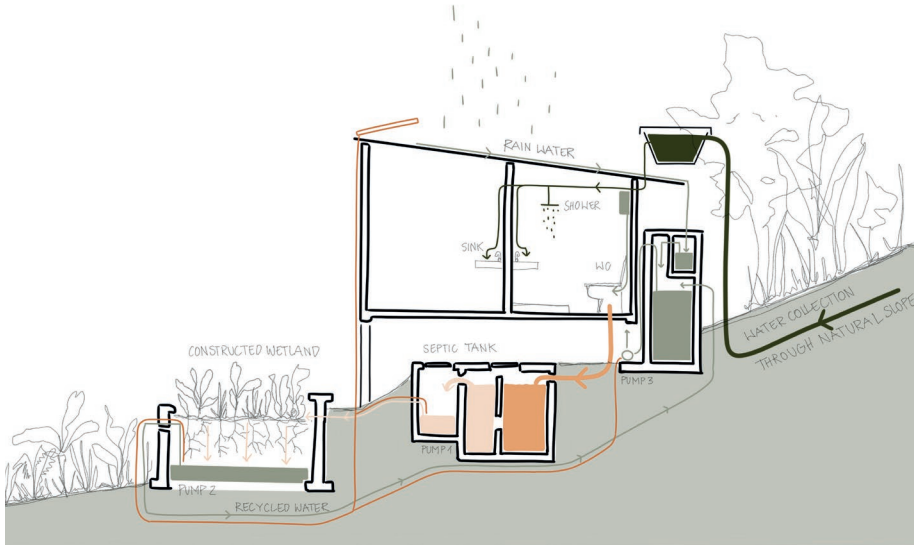
The Água Carioca project aims to provide a sustainable and decentralized water management system specifically tailored for the informal settlements of Rio de Janeiro. The project focuses on natural water treatment, including rainwater harvesting, septic tanks, and constructed wetlands, to manage and recycle wastewater directly where it is produced. This approach addresses critical issues such as sanitation, water scarcity, and environmental degradation, while promoting community involvement in water management.

The pilot project at Sitio Roberto Burle Marx was initiated in April 2016 and serves as a practical demonstration of the Água Carioca system. Located at the historical site of the renowned Brazilian landscape this pilot integrates rainwater collection, a septic system and constructed wetlands to recycle water. This installation not only showcases the feasibility and benefits of decentralized water treatment but also aims to educate the public and influence broader acceptance of sustainable water management practices.
The pilot project has garnered significant attention and support, highlighting its potential for scalability and adaptation in other urban areas facing similar challenges.[70]

[70] [online]. (2017). available at: https://www.aguacarioca.org/#/pilot/



by Agua Carioca

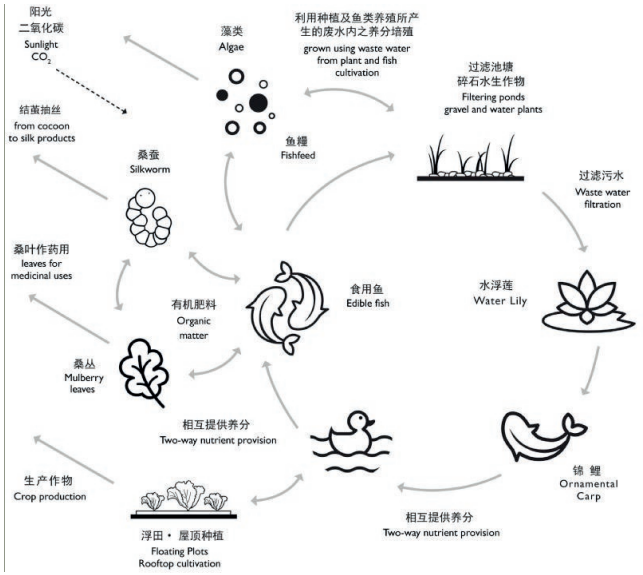


FLOATING FIELDS

ARCHITECT	Thomas Chung
LOCATION	Da Cheng Flour Factory Shekou, Shenzhen, China
YEAR	2016
PROJECT SIZE	1,1 hectar
BUDGET	~ 750.000 dollar

The „Floating Fields“ project by Thomas Chung was developed for the 2015 Shenzhen-Hong Kong Bi-City Biennale of Urbanism\Architecture and showcases an innovative urban agriculture initiative designed to transform a former industrial site into a productive and ecological public space. The project is located at the former Da Cheng Flour Factory in Shekou, Shenzhen and integrates natural and technical systems to create a sustainable, multi-functional landscape.

by Thomas Chung



by Thomas Chung

[71] [online]. (2016). available at: https://divisare.com/projects/312982-thomas-chung-floating-fields-shenzhen-china?utm_campaign=journal&utm_content=image-project-id-312982&utm_medium=email&utm_source=journal-id-59

„Floating Fields“ employs a combination of aquaponics and traditional agricultural practices to restore the site‘s ecosystem while providing recreational spaces for the public. The design features a series of interconnected ponds and wetland areas that support fish farming, algae cultivation, and various crops. This closed-loop system purifies water and recycles nutrients, mimicking the traditional Mulberry-Dyke-Fish-Pond system found in the Pearl River Delta. The project also includes floating farms, made out of bamboo for plant cultivation, enhancing the site’s agricultural productivity.

The technical systems involves a self-sustaining water cycle that includes filtration ponds, aquaponics, and algae cultivation. These elements work together to clean water, support fish and plant life, and produce food, demonstrating a model for sustainable urban living. Additionally, the adaptive reuse of the former factory buildings into multi-use spaces for learning and community engagement helps to reconnect the public with the site while promoting ecological awareness.

The project exemplifies a vision for low-carbon, resilient urbanism by combining ecological restoration with community-focused design, transforming a degraded industrial area into a vibrant, productive landscape.[71]

by Thomas Chung

EL HUERTO FLOTANTE

ARCHITECT	Juan Carlos Bamba Natura Futura Arquitectura
LOCATION	Samborondon, Ecuador
YEAR	2023
PROJECT SIZE	18m²

The „Floating and Palafitic Tropical Greenhouse“ project is designed to address the food production challenges of flood-prone communities in Samborondón. It aims to provide a sustainable and resilient solution for agriculture in regions affected by seasonal flooding. The project features a floating and stilted structure that allows for continuous cultivation of crops even during flooding season.

GOALS AND DESIGN

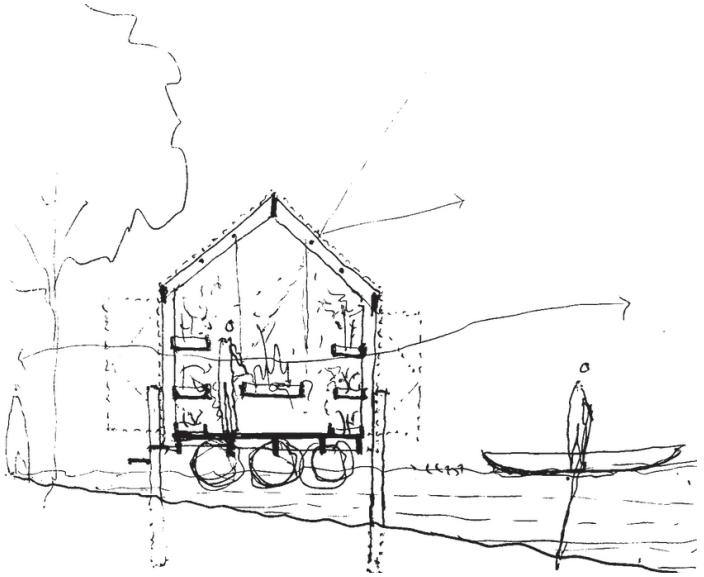
Food Production

The floating garden enables planting and harvesting during the flooding season (January to May), ensuring food security for the local families.

Sustainable-Resilient Communities

The project revalues local and innovative techniques to create autonomous, resilient, and self-sustainable living conditions.

by Natura Futura



by Natura Futura

Collaborative Management

Developed in collaboration with the World Food Program (WFP) and local studios, the project promotes the use of Nature-Based Solutions (NBS) for climate risk mitigation.

Technical Aspects

Structure: Composed of modular porches built with local wood, connected by tubular metal elements, supporting a floating platform of 18 square meters (6x3m) made buoyant by PET tanks.

Anchoring System: The platform is anchored by a mobile system of four piles, allowing it to remain stable at ground level during dry seasons and float during floods.

Cultivation: Utilizes hanging and shelf pots to maximize space and optimize growing conditions for vegetables and greens, facilitated by a light greenhouse membrane for proper ventilation, humidity, and temperature control.

Energy: Equipped with solar panels for nighttime lighting, enhancing its sustainability.

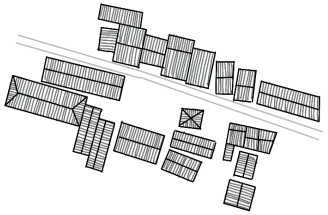
Impact

The project serves as a prototype for future replicability, aiming to improve the resilience and habitability of flood-prone communities through sustainable design and collaborative efforts. It highlights the potential of integrating traditional and innovative techniques to combat the effects of climate change, fostering self-sufficiency and improved living conditions for affected populations.

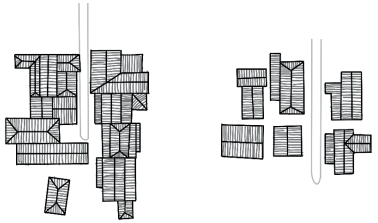
by Natura Futura

WAY OF LIVING

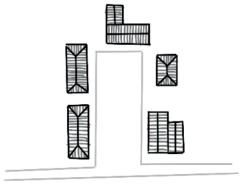
SETTLEMENT TYPES



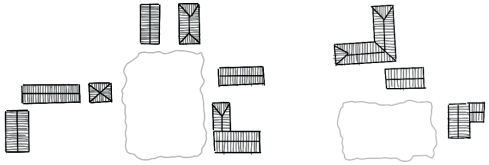
STREET



DEAD END



COURTYARD



POND

CREATING PRIVACY

PALM LEAVES

PLASTIC SHEETS

TEXTILES

STORING

CI - SHEETS
poorly collected CI sheets that are being recycled from other uses

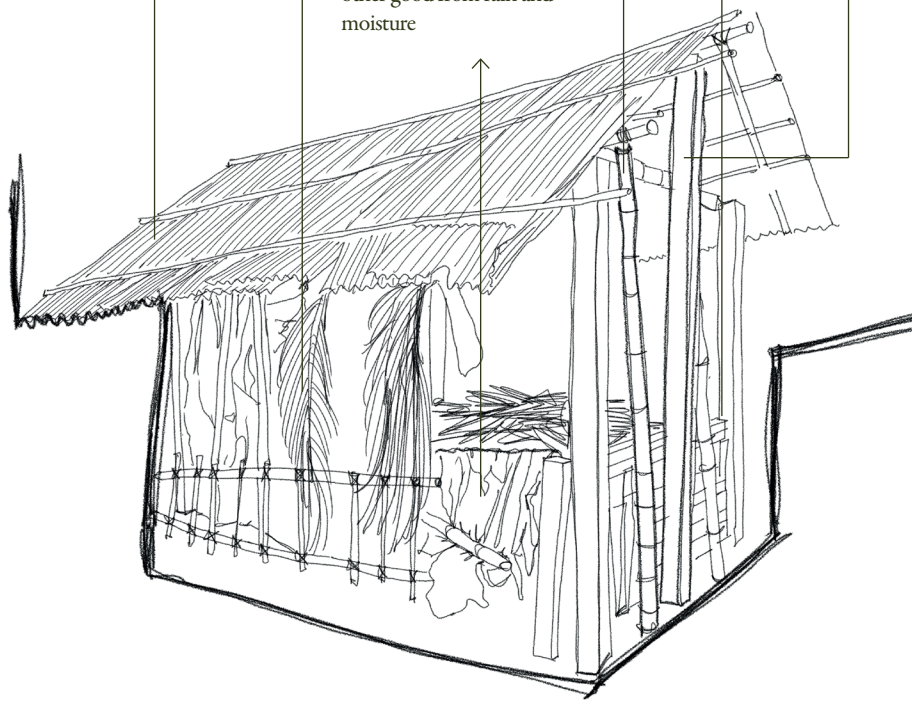
BAMBOO
to stabalize the structure and suppert the roof. also often used fot the main structure of the storage huts

CONCRETE SLAB
collected and reused from other sites and projects to support the structure

PALM LEAVES
collected onn site to create screens and wall protections

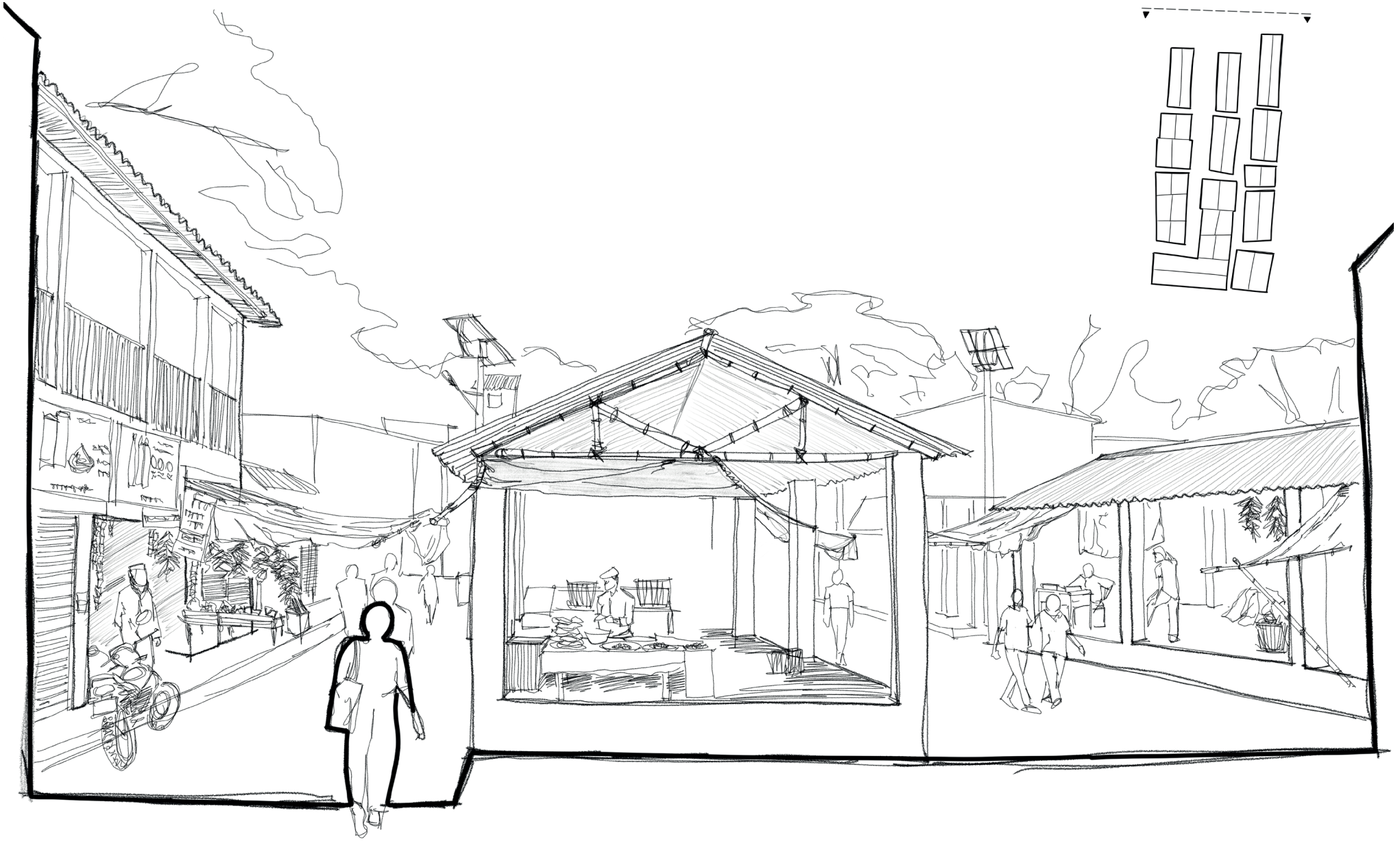
PLASTIC SHEETS
especially used on the height of the plint and the ground to protect straw and other good from rain and moisture

WOOD PLANKS
creating walls and forming a hollow



INCOME GENERATION

By analysing the excisting structures and the peoples ways of living in Bolawara and uts sur-rounndinngs, you can see four main incnome generation sources, which are workshops and shops, in which either local products are sold or even produced. You have farmers on small scale and big scale agricultural land, but also the home owners or farmers who are cultivating their homestead gardens. Last group of income generation are the ones selling their products on markets or streets.



LOCALS

WHO ARE WE DESIGNING FOR?

FARMERS

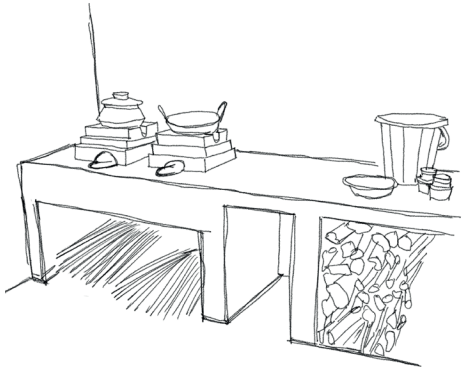
CHILDREN

WHAT ARE THEIR NEEDS AND AMBITIONS?

SMALL BUSINESS OWNERS

WOMEN

COOKING

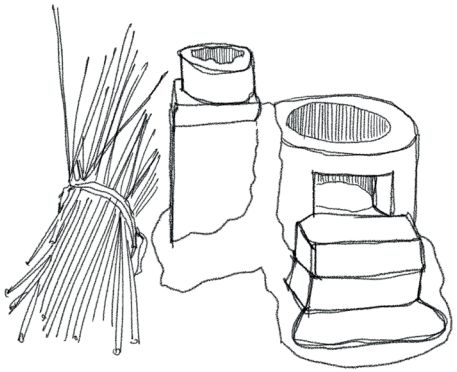


INSIDE

a more advanced cooking and fire place in one of the houses in a rural village. the area is made out of brick and cement and the stove elements are moulded within the working space. storage for wood and clay is uncluded underneath the construction.

OUTSIDE

traditional stove made out of recycled bricks, clay and mud. most of those stoves and cooking activities in rural areas happen within the open and shared courtyards outside. to open the fire, wood but also dried cow dung is used.



PREPARING AND COOKING

especially within communities we could observe cooking as a communal activity in which the courtyard is used as a big cooking and preperation area. all family and communities, men, women and children are involved within the process and different dishes are prepared. the process includes buying or harvesting the ingredients, drying spices, peppers or herbs, cutting and cooking. as fire material coal, wood and cow dung were used and stored within the courtyard.

COMPACT CITY DESIGN

ADVANTAGES

increased social interaction
lowered carbon emission
greater diversity
improved mental health
reduced crime
greater resiliance
access to amenities
energy and land efficiency

DISADVANTAGES

lack of diversity
compromise of personal value
limited privacy
social exclusion
gentrification
higher disaster potential

Compact city design enhances social interaction, lowers carbon emissions, and improves access to amenities. Research by Putnam (2002) indicates that low-density suburban residential areas tend to have a lower sense of community. This sense of community, defined as an individual's perception of feeling connected, invested, and sharing common goals with neighbors, can lead to numerous societal benefits, including improved mental health, reduced crime, and greater resilience after disasters. However, potential downsides of compact city design include exclusion, rigid conformity, compromise of personal values, and a lack of diversity.[2]

A neighborhood's sense of community often requires public spaces where people can meet face-to-face. The optimal community size is determined by the functional demands of the socio-ecological environment. For instance, data from the analysis of three different communities—19th century American utopian communes, Hutterite colonies of South Dakota, and Israeli kibbutzim—demonstrate that small-scale agricultural communities established to be self-sufficient within a communal ideology have specific size thresholds. The Hutterites, for example, split their communities once they grow above approximately 150 members, as they have found this to be the limit at which community cohesion can be maintained without the need for formal laws and a police force to enforce discipline (Olsen, 1987). Similarly, Forge (1972) observed that New Guinea horticulturalists consider around 150 members to be a critical threshold for community size, as basic kinship and affinity relationships are insufficient to maintain social cohesion beyond this point.[8]

Density has become closely associated with ecological sustainability, making compact neighborhood design a key component of sustainable urbanism. Benefits of higher density include more land for biodiversity and human access to nature. New urbanist ideals advocate for concentrated density around transit nodes rather than high density across the board. According to Ewing, compact development should include medium to high density with strong centers, mixed land uses, and contiguity with existing development. This higher density helps reduce automobile use and promotes the sharing of knowledge and resources.

For instance, in India (Dave, 2011), low density is defined as up to 200 units per hectare, medium density as 201-400 units per hectare, and high density as 401-600 units per hectare. Studies have shown a connection between quality of life and neighborhood social connections, suggesting that a sense of community is more attached to people than to the place itself. Compact city design not only fosters social interaction and environmental sustainability but also enhances the overall quality of life through improved neighborhood social connections.[7]

AGRICULTURE

RAISED BEDS

Woven Bamboo structures are lifted from the ground to protect growing fruits and vegetables from the raising water. The plants are rooted in the soil but use the bamboo structure to climb up resulting in a roof out of leafs, roots and fruits. Pumpkins, cucumber, eggplant and other climbing plants are most suitable for this cultivation as their natural behavior is contributing to the climbing structures.

SUITABLE CROPS

pumpkin, gourd, cucumber, eggplant, beans

SUITABLE CONDITIONS

protection from erosion needed

NEEDED SOURCES

bamboo, strings, seedlings

PADDY CULTIVATION

Paddy is a form of wet cultivation for rice in which lower leveled fields are flooded. The water is mainly naturally occurring due to rivers or the heavy rainfall during the monsoon season. Boundaries of the fields are made out of earth and between 10-15 centimeter high do keep the water steady. To prevent seeping, the subsoil of the feels are impermeable. Most of the times the cultivation is similar to how it was done already 2.000 years ago, by using hoe and spade and the help of animals like water Buffalos or horses that traditionally carry an ox-drawn plough with metal share. The water level should always stay between 3-5 cm during the crop growth period and irrigation should stop 10 to 15 days prior to the harvest. Largest crop production in the country with 48% of production volume and 75% of land use.

SUITABLE CROPS

rice, taro

SUITABLE CONDITIONS

sandy loams to clay soil, preferably with a pH between 5.5 and 6.5; temperatures between 21°C - 38°C (can withstand higher temperatures with a risk of less yield)

NEEDED RESSOURCES

steady water, large areas of arable land, equipment for harvest, seedlings

RISKS

climate changes makes climatic conditions more extreme and leads to longer drought periods - less rainfall and less groundwater

HORTICULTURE

OLERICULTURE production of vegetables

POMOLOGY production of fruits and nuts

FLORICULTURE
production of flowering and ornamental plants

Horticulture describes the cultivation of fruits, vegetables, nuts, sees, herbs, sprouts, mushrooms, flowers, seaweed and ornamental trees and flowers. Focusing on smaller plots compared to large scale agriculture like paddy. Vegetable and fruit cultivation becomes more important for rice farmers as paddy cultivation is due to climate induced drought flash floods and shrinking groundwater, getting more challenging and a lot of farmers have already switched from rice to vegetables. There are three main production seasons for vegetables, two in summer, Kharif 1 and Kharif 2 and the third one in winter, Rabi. Summer production is more profitabel but also more challenging due to heavy rainfall and increased decease threats. On the production rate in winter is higher but therefore the prices are also lower.

SUITABLE CROPS
fruits, vegetables, nuts, sees, herbs, sprouts, mushrooms, flowers, seaweed, ornamental trees, ornamental flowers

RISKS
climate change risks like droughts or flash floods, urbanization leads to less arable land

But the shift from traditional agriculture to more horticulture in for example homestead gardens is not only important for individual farmers but also for the rural poor and their livelihood. Especially in the last 40-50 years one could see the shift effecting and improving food security and the quality of life for poor families. The homestead gardens are usually producing 8 major elements of daily life like fruits/food, timber, firewood, spices, fodder, medicine, fencing and miscellaneous. Therefore most of the homestead gardens are not only providing the families with food and nutritions but also with other daily needed goods like construction material. With this variety of plants and crops growing, homestead gardens are also providing a great habitat for smaller insects, birds and other animals, helping not only the families but also the surrounding ecosystem. Insects and birds play a great role as pollinators keeping the plants blooming and growing and at the same time helping with the natural regeneration of plants. Making the gardens and their inhabitants, especially in agricultural regions, to one of the biggest diversity conservation factors.
Furthermore are the trees, bushes and plant routes functioning as a great protection from rising water and water induced soil erosion during the monsoon season, protecting built structures and infrastructure.

~31%

of children under 5 years are stunted

~15%

insufficiet habitual food consumption

~32%

moderate or severe food insecurity

CASE STUDY

„Characteristics of Distinct Dietary Patterns in Rural Bangladesh: Nutrient Adequacy and Vulnerability to Shocks“
Zakari Ali, Pauline F. D. Scheelbeek, Kazi Istiaque Sanin, Timothy S. Thomas, Tahmeed Ahmed, Andrew M. Prentice and Rosemary Green

800 farming households of seven agroecological zones collected in the same season between December 2010 and February 2011 - Women were interviewed to estimate the food items and the amount their family has consumed during a period of 14 days.

The study and interviews show that around 75% of urban and 92% of the rural populations are consuming less than the by the WHO recommended 400g of five servings of fruits and vegetables a day and are therefore considered food insecure. Especially when it comes so a sufficient supply in nutrients the missing vitamins are effecting the overall health of the population and in particular the health and the natural growth of children and young adults. By analyzing the given numbers from the case studies one can see that nutrient insecurities are mostly independent from gender but housewives seemed to be a little bit more effected. In addition it was visible that the higher the eduction of the head of the family the lower the nutrition deficit within the individual members was.[2]

	WHO Recommendation	Rice and Low Diversity (*n* = 263)	Wheat and High Diversity (*n* = 262)	Pulses and Vegetables (*n* = 259)	Meat and Fish (*n* = 16)	Total (*n* = 800)
Total energy (kcal/capita/day) mean (95% CI)		2812.86 (27310.8–2893.3)	3054.7 (2956.6–3152.8)	2918.7 (2839.1–2998.3)	3225.1 (2750.9–3699.3)	2933.5 (2883.5–2983.5)
Macro-nutrient (mean % of total energy)						
Carbohydrate	55–75	**78.9**	70.6	**76.1**	**75.2**	**75.2**
Fat	15–30	**9.1**	16.2	**11.4**	**12.5**	**12.2**
Protein	10–15	**9.0**	11.0	**9.7**	10.1	**9.9**
Fruit and vegetables (mean in grams)	400	**218.9**	**380.7**	**284.4**	**248.6**	**293.7**
Met WHO recommendation (%)						
Carbohydrate		100.0	97.7	100.0	100.0	99.2
Fat		3.0	48.1	8.5	25.0	20.0
Protein		10.0	37.0	29.0	37.5	25.4
Fruit and vegetables		3.4	36.6	15.4	12.5	18.4

CASE STUDY

„Low Daily Intake of Fruits and Vegetables in Rural and Urban Bangladesh: Influence of Socioeconomic and Demographic Factors, Social Food Beliefs and Behavioural Practices“
by Sadia Mustafa, Emdad Haque, and Soham Baksi

501 households - 200 urban and 301 rural households from randomly chosen villages in the area of Upazilas, Sylhet Divisions and urban of the city of Dhaka south

The study revealed that around 85% of the low income participants were to belief that rice is more important than vegetables in a daily diet whereas only 44% of the high income group agreed with this statement. A similar outcome, with 59% of low income groups and 11% of high income groups agreeing, had the statement that „vegetables are only food for the poor“, whereas meat and fish are more to believed food for the rich and the upper classes. The study drastically shows the perception of food and certain goods besides the availability and affordability of the product itself. In addition it substantiates the fact that lower income families consume less fruits and vegetables in their everyday diet.[3]

Attitudes	Statements	Response	%	HH Monthly Income			*p*-Value
				Low	Medium	High	
Food belief	‘Rice is more important than vegetables in everyday meals’	Disagree	25.6	13.8	31.4	54.4	0.0000 *
		Neutral	0.6	0.7	0.0	1.1	
		Agree	73.8	85.5	68.6	44.6	
	‘Meat is more important than vegetables in daily meals’	Disagree	64.0	58.9	73.5	68.5	0.0959
		Neutral	1.3	1.5	1.0	1.1	
		Agree	34.8	39.6	25.5	30.4	
Food status	‘Vegetables are food for the poor’	Disagree	57.6	39.3	78.4	89.1	0.0000 *
		Neutral	1.1	1.8	0.0	0.0	
		Agree	41.4	58.9	21.6	10.9	
	‘Fish and meat are food for the rich’	Disagree	51.8	32.7	75.5	82.6	0.0000 *
		Neutral	1.7	2.2	2.0	0.0	
		Agree	46.5	65.1	22.5	17.4	

Subjective belief	‘My family members eat enough vegetables’	Agree	32.2	24.0	38.2	50.0	0.0000 *
		Neutral	6.0	9.1	2.9	0.0	
		Disagree	61.8	66.9	58.8	50.0	
	‘My family members eat enough fruits’	Agree	26.6	19.3	29.4	45.6	0.0000 *
		Neutral	6.4	9.1	3.9	1.1	
		Disagree	67.0	71.6	66.7	53.3	
Environmental practice	‘Formalin on fruits are a more important reason than higher price for why fruits are eaten less’	Disagree	30.9	33.1	22.5	33.7	0.0003 *
		Neutral	6.8	10.5	2.9	0.0	
		Agree	62.3	56.4	74.5	66.3	
	‘Pesticides on vegetables are a more important driver of eating less vegetables even if the price is low’	Disagree	54.2	47.3	57.8	70.6	0.0012 *
		Neutral	7.9	10.5	5.9	2.2	
		Agree	38.0	42.2	36.3	27.2	
Economic practice	‘If income rises more meat is bought than vegetables’	Disagree	38.6	21.8	51.0	75.0	0.0000 *
		Neutral	3.6	4.7	2.9	1.1	
		Agree	57.8	73.5	46.1	23.9	
	‘If income rises more rice is bought than vegetables’	Disagree	50.8	34.9	66.7	80.4	0.0000 *
		Neutral	5.3	6.5	5.9	1.1	
		Agree	43.9	58.6	27.5	18.5	

PRODUCTION

Crop | vegetable | fruit	Area (in acres) 1 acre = 4046,86 sqm	Yield (per acre in kg)	Yield (per ha in kg)
Rice AUS | AMAN | BORO	28.455.000	1220	3015
Wheat	30.374.000	1294	3187
Garlic	177.000	2631	6.501
Tumeric	70.000	2117	5.231
Ginger	24.000	3379	8.350
Coriander	7.000	743	1.836
Onion	426.000	4231	10.455
Rabi Brinjal	82.000	4348	10.744
Rabi Pumpkin	42.000	4586	11.332
Cauliflower	50.000	5701	14.087
Cabbage	46.000	7020	17.347
Tomato	70.000	5562	13.744
Radish	64.000	4786	11.826
Beans	52.000	3793	9.373
Carrot	5.000	2434	6.015
Pumpkin Kharif	28.000	4072	10.062
Brinjal Kharif	47.000	3605	8.908
Patal | pointed gourd	24.000	3504	8.659
Okra | Ladys Finger	29.000	1891	4.671
Jhinga | ridge gourd	25.000	2024	5.001
Green banana	28.000	5599	13.835
Arum	55.000	4169	10.302
Cucumber	25.000	2975	7.351
Puisak | spinache	26.000	3192	7.888
Danta	27.000	2824	6.988
Kachhu shak	2.000	5494	13.576
Owl Kachhu	25.000	4322	10.680
Mukhi Kachhu	13.000	4390	10.848
Maan Kachhu	5.000	3530	8.723
Pat Shak	52.000	2793	6.902
Banana	121.000	6903	17.058
Pineapple	37.000	5909	14.601
Melon | Bangi	9.000	4555	11.256
Water Melon	27.000	6878	16.996
Mango	235.000	78	193
Jack Fruit	25.000	121	299
Papaya	8.000	25	62
Litchi	44.000	56	138
Guava	97.000	24	59
Orange	45.000	20	49
Strawberry	15.000	3600	8.896
Lime and Lemon	159.000	15	37

RICE PRODUCTION

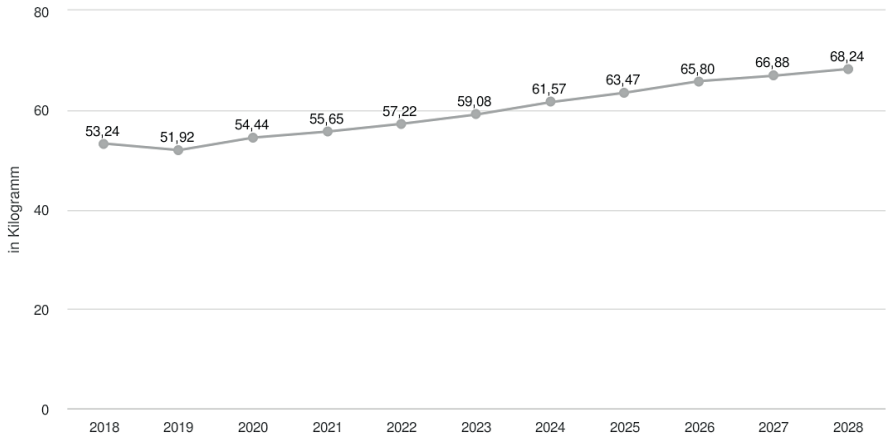
THE IMPORTANCE OF RICE

Rice holds profound significance in Bangladesh, both as a staple food and a cornerstone of the nation's economy. For the people of Bangladesh, rice is more than just a dietary staple; it is deeply woven into the cultural and social fabric of daily life. It is the primary source of nutrition for the majority of the population, featuring prominently in nearly every meal, and is integral to traditional dishes and culinary practices. The importance of rice extends beyond its nutritional value, symbolizing sustenance, tradition, and family unity.

Culturally, rice is central to many Bangladeshi customs and festivities. It is often used in religious ceremonies, weddings, and community gatherings, reflecting its symbolic status as a life-sustaining element. The preparation and sharing of rice dishes foster communal bonds and reinforce social ties, making it a vital component of Bangladeshi identity.

Economically, rice is a crucial sector, significantly impacting the national economy. Bangladesh is one of the largest rice producers, with vast tracts of arable land culticating rice. The agricultural sector employs a large portion of the population, and rice farming is a primary source of income for millions of households. This sector's productivity and sustainability are essential for the country's food security and economic stability.

AVARAGE RICE CONSUMPTION PER PERSON PER YEAR

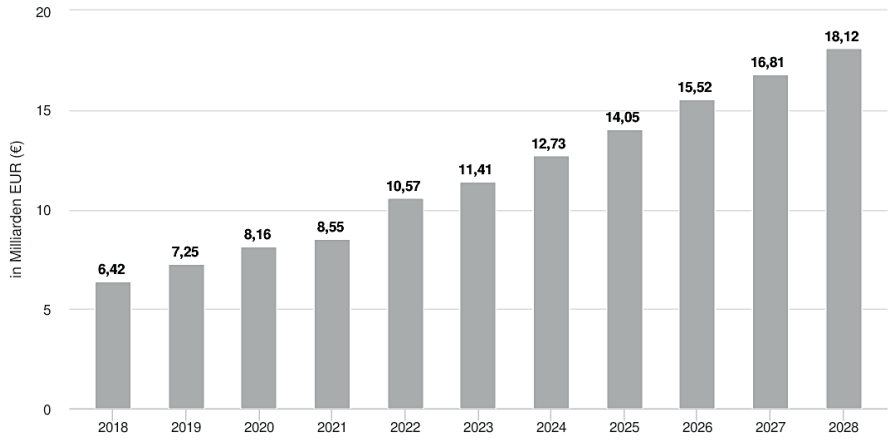


RICE PRODUCTION

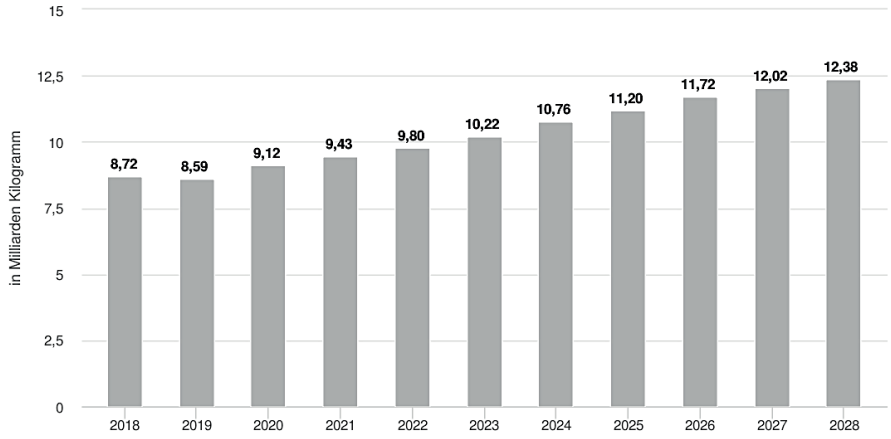
Rice production contributes substantially to the Gross Domestic Product (GDP) of Bangladesh. The government has implemented various policies and initiatives to support rice farmers, improve yield, and ensure food security. Advances in agricultural techniques, irrigation systems, and the introduction of high-yield rice varieties have boosted production, helping the country achieve self-sufficiency in rice. However, challenges such as climate change, natural disasters, and fluctuating market prices continue to pose threats to rice production and the livelihoods of farmers. The perception of rice in Bangladesh is multifaceted. It is viewed not only as a daily necessity but also as a symbol of prosperity and resilience. For many, a bountiful rice harvest represents economic stability and food security, while a poor harvest can signify hardship and uncertainty. The government's efforts to maintain rice reserves and stabilize prices are crucial in managing the socio-economic impact of rice production fluctuations.

In conclusion, rice is of immense significance in Bangladesh, permeating the cultural, social, and economic spheres of life. It sustains the population nutritionally, reinforces cultural traditions, and underpins the national economy. The perception of rice extends beyond its role as a food product, embodying notions of community, prosperity, and resilience. As Bangladesh continues to navigate the challenges of rice production, the importance of this staple crop remains as vital as ever to the nation's well-being and economic health.

YEARLY REVENUE



PRODUCTION VOLUME



DESIGN

COMMUNITY LAND TRUST

Community Land Trusts (CLTs) are non-profit organizations designed to provide permanently affordable housing and to ensure community stewardship of land. CLTs achieve this by acquiring and holding land in trust for the benefit of the community while leasing homes and other buildings on the land to residents.

OWNERSHIP AND STRUCTURE

The CLT owns the land, separating land ownership from building ownership. Homes or buildings on the land are sold to individuals, but the land is leased to the homeowners through long-term, renewable leases (often 99 years). This ensures that the land remains under community control and is used for the community's benefit.

AFFORDABILITY

To maintain affordability, CLTs establish resale restrictions. When homeowners decide to sell their property, the CLT has a pre-established formula to determine the resale price, ensuring that homes remain affordable for future low- to moderate-income buyers.

COMMUNITY INVOLVEMENT

CLTs are governed by a board of directors made up of three groups: residents who lease land from the CLT, community members who do not lease land but have an interest in the trust, and public representatives who support the CLT's mission. This structure ensures that a broad range of interests are represented and that decisions benefit the entire community.

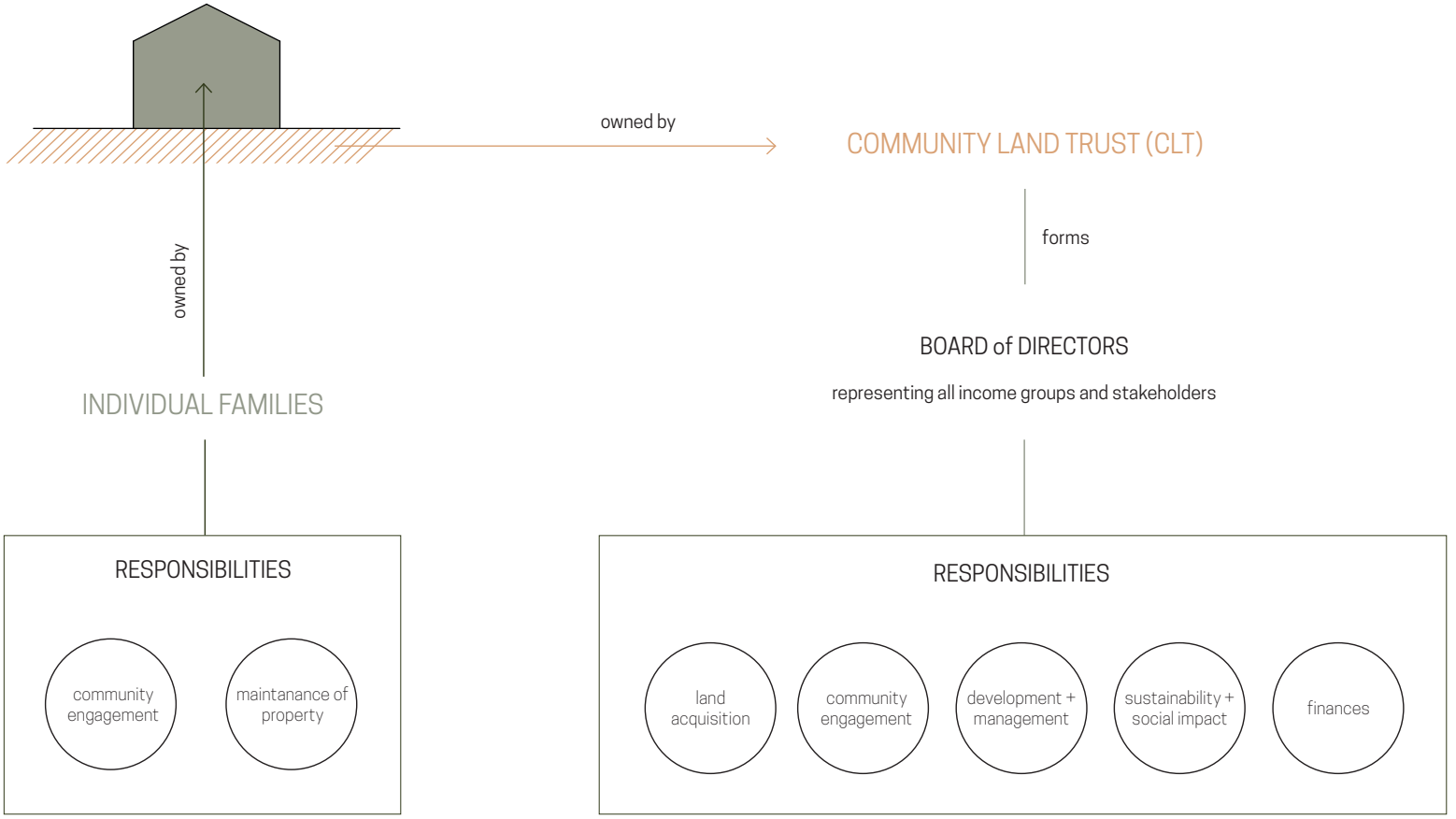
SUSTAINABILITY AND SUPPORT

CLTs often provide support services to their residents, such as homebuyer education, financial counseling, and assistance with home maintenance. This support helps residents maintain their properties and financial stability, contributing to the sustainability of the community.

COMMUNITY DEVELOPMENT

Beyond housing, CLTs can also be involved in other community development activities, such as creating community gardens, commercial spaces, and parks, all aimed at enhancing the quality of life for residents.

By maintaining ownership of the land and focusing on long-term affordability, CLTs provide a sustainable model for addressing housing needs and fostering community resilience and empowerment



MANAGERIAL GOALS

STAKEHOLDERS

CLT organization is at the core, managing land and ensuring adherence to affordability and sustainability principles

CLT Board of directors guides the strategic direction with input from residents and community members ensuring their needs are met

Local government providing funding, infrastructure support, policy guidance for affordable housing, urban agriculture and waste management

Local farmers contribute knowledge and participate in skill sharing programs

Residents participate in decision making via the CLT membership

Financial institution provide necessary funding ensuring financial viability, offering micro loans and financial products to support small business and homeownership within the development

NGOs provide technical expertise in urban agriculture, waste management and community development strategies

Educational Institutions offering training programs in sustainable practices, entrepreneurship and food production

Local businesses and entrepreneurs activate commercial spaces, driving economic activity

Environmental and agricultural experts ensure the success of food production and waste management system

Service providers maintain essential services, contribute to the overall livability of the community

COMMUNITY

forming communities through architecture and space

community engagemnt through CLTs

MIXED INCOME HOUSING

housing types representing different income groups

mixed communities with high potential

ECONOMIC OPPORTUNITIES

commercial spaces for shops and workshops

community spaces for business development and training programs for residents

local market to sell goods and produces

FOOD SECURITY

courtyards and systems to facilitate food production

collaboration with local farmers for knowledge exchange

INCREMENTALITY

low income housing with the possibility to expand incrementally as family or income grows

forstering personalisation and identification with community

RESOURCE RECOVERY

composting system to convert waste into fertilizers for community gardens and for income generation

waste management and education

HIERARCHY OF SPACE

The urban plan introduces a hierarchy of spaces to foster community interaction while maintaining varying levels of privacy. At the most private level are the courtyards, dedicated to a community of families. These intimate spaces provide a safe environment for family life, encouraging neighborly relationships.

The next level of space comprises the public and wide connection streets throughout the masterplan. These streets, lined with shops and business spaces on the ground floor, offer space for market tents, enhancing the street life and supporting local businesses.

At the most public level is the central market and gathering space. This area serves as the heart of the neighborhood, surrounded by shops and community spaces. It is designed to host a variety of community activities such as celebrations and events, fostering a strong sense of togetherness.

All these spaces are interconnected, offering opportunities for interaction and community building. The design ensures a clear hierarchy of privacy, from private family courtyards to bustling public markets, creating a balanced and inclusive urban environment.

HOUSING TYPES

The concept offers a range of housing types that cater to different income groups, family configurations, and lifestyles. It encompasses low-income to upper-middle-income households, ensuring an inclusive community.

Low-income and middle-income housing are strategically clustered around communal courtyards, fostering a sense of community while maintaining connectivity to public spaces. The low-income housing includes opportunities for gardening and agriculture, promoting self-sufficiency and increased food security. In contrast, the middle-income housing comprises apartment buildings equipped with higher quality amenities, offering a more comfortable living experience.

Parking facilities for middle-income residents are conveniently located and easily accessible from the main streets. Additionally, the masterplan ensures efficient connectivity to the city center of Sylhet via the main connection street, enhancing accessibility and integration with the broader urban fabric.

FLOW OF NATURE

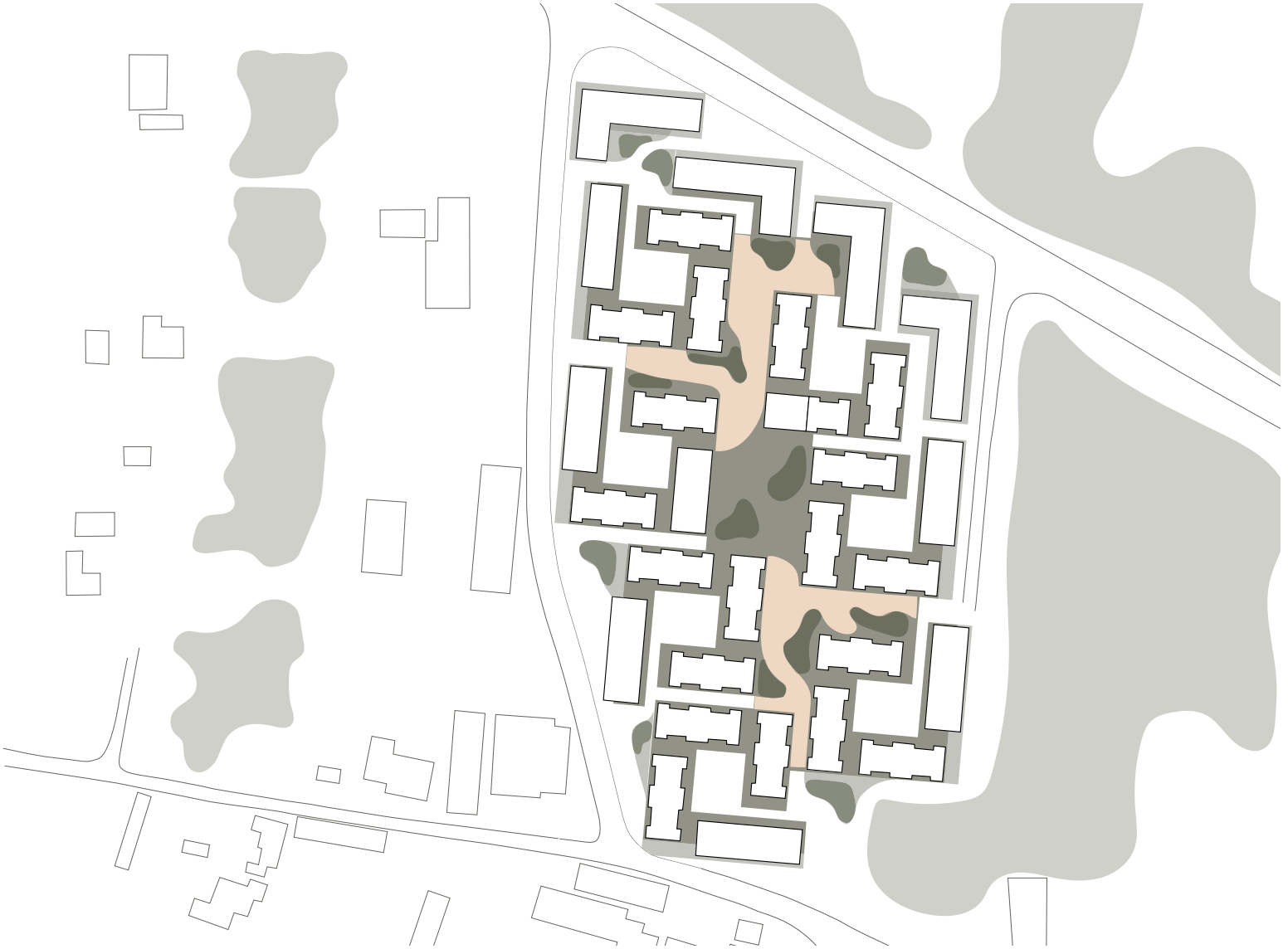
This masterplan concept emphasizes the preservation and integration of the area's natural landscape to maintain biodiversity and natural balance. The region, characterized by agricultural land, naturally grown swamps, and forests, is designed to seamlessly blend these elements with new urban developments. The plan invites nature to flow into the newly developed areas, creating a cohesive connection between existing natural features and man-made structures.

The vision is to ensure that humans and nature coexist harmoniously without compromising each other. To achieve this, the urban plan incorporates water basins, ponds, green spaces, and planting areas as defining features of the public space. These natural elements are intended to enhance the aesthetic appeal of the neighborhood and raise awareness among inhabitants about the importance and beauty of nature. This approach fosters a sustainable and balanced environment where urban living and natural ecosystems thrive together.

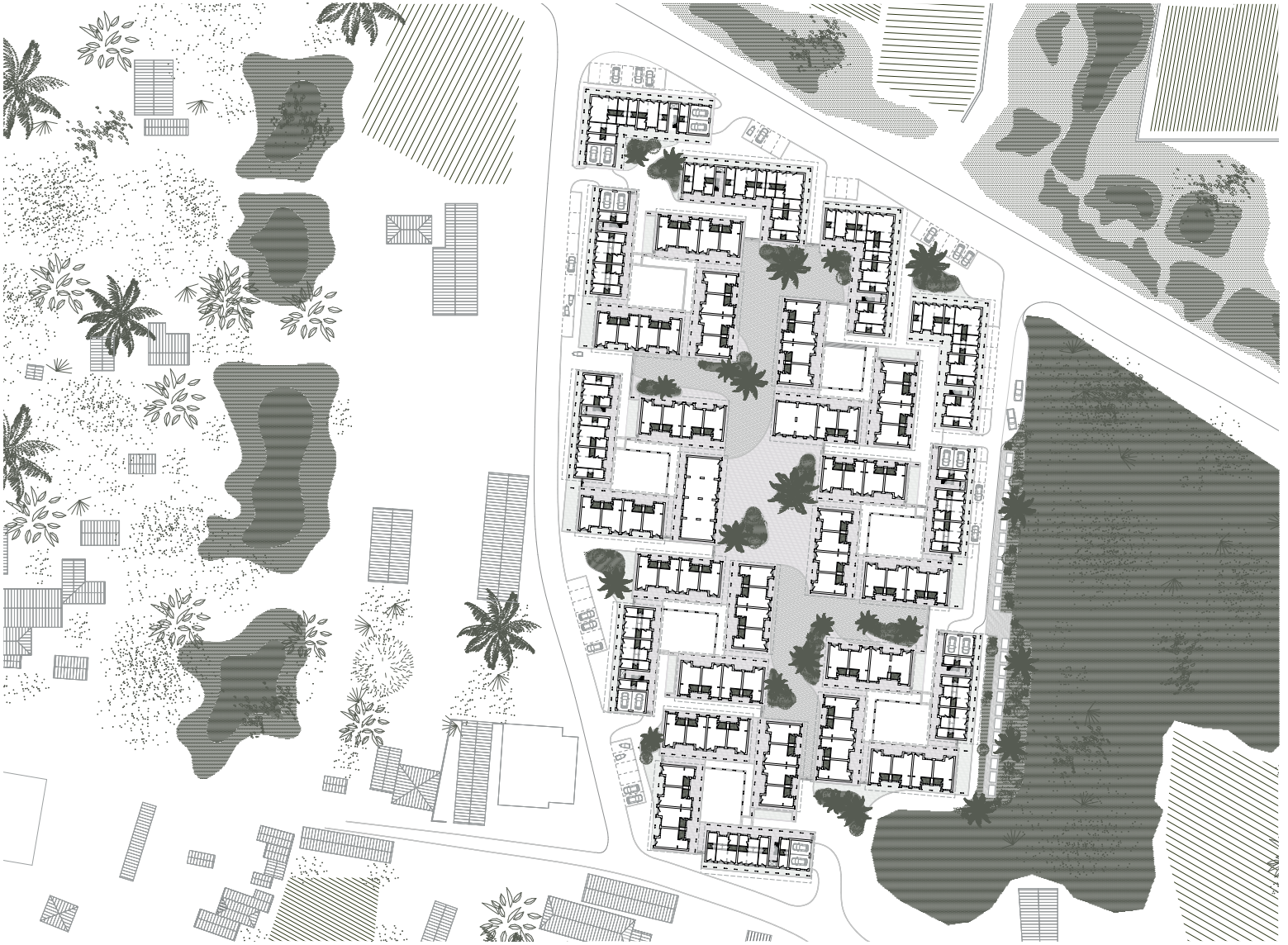
LANDSCAPE

The landscaping of this masterplan includes various elements at different elevations, designed to protect the area from flooding by directing water to lower courtyards. These height differences not only manage water effectively but also create diverse spatial experiences. Elevated connection streets with shops and the market space are designated as CNG and car-free zones, enhancing safety for families and children while reducing noise and pollution.

Key gathering areas and outdoor shop spaces feature brick flooring to ensure stability and cleanliness, while walking passages are paved with natural sandy materials to promote water seepage.



MASTERPLAN

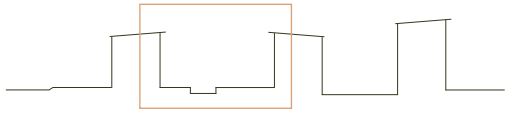


The primary objective of this urban plan is to create a vibrant neighborhood that creates a sense of community. The design integrates various community areas such as a central market, cluster courtyards, and connection streets lined with shops. This neighborhood will balance density and open spaces, ensuring a harmonious coexistence between urban living, nature and rural qualities.

By blending urban density with generous open spaces and integrating elements of rural living, this neighborhood will offer an inclusive and sustainable living environment. The design aims to foster a strong community spirit while accommodating growth and preserving the nature and agriculture.

SITE SECTION

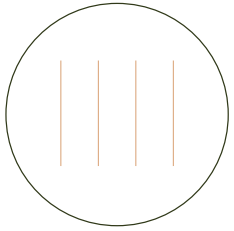
MARKET SQUARE



DESIGN

STRONG CORE - LIGHT SKIN

GRID SIZE



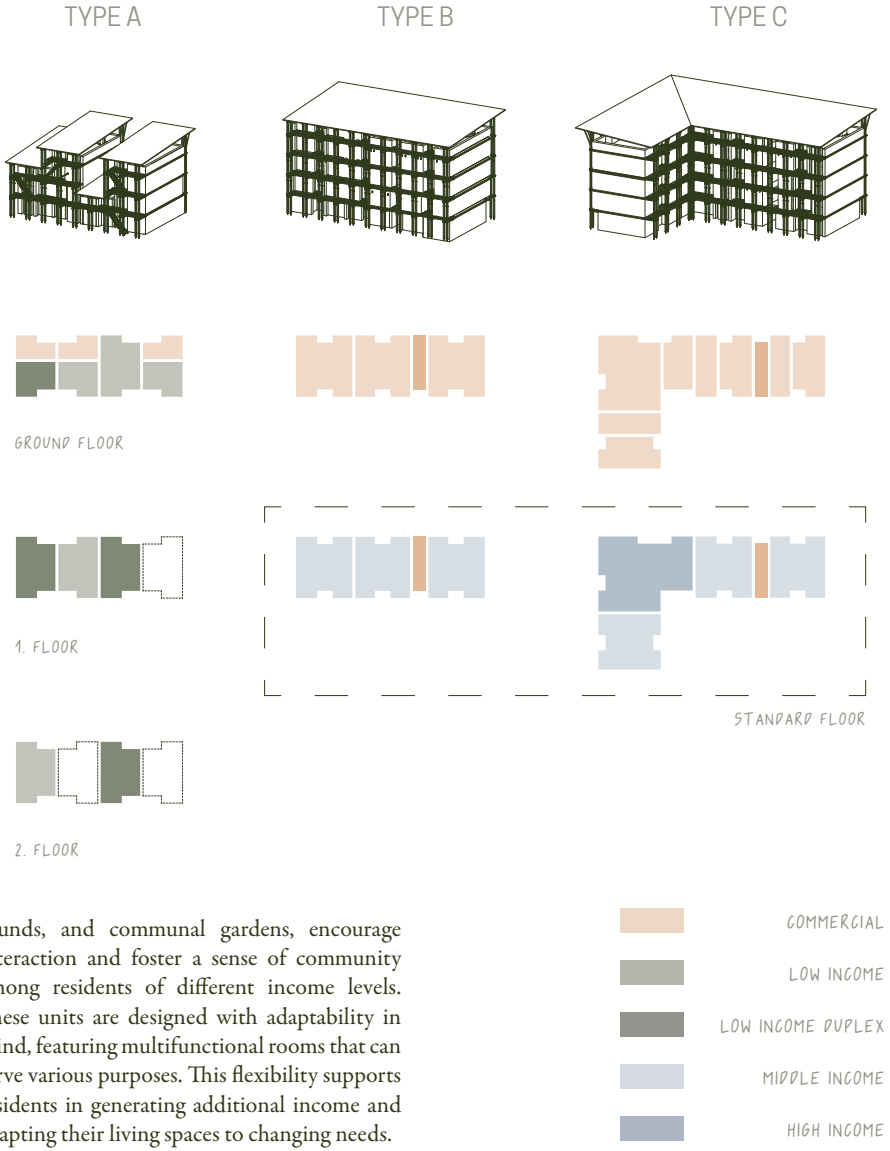
MIXED INCOME

INCOME GENERATION

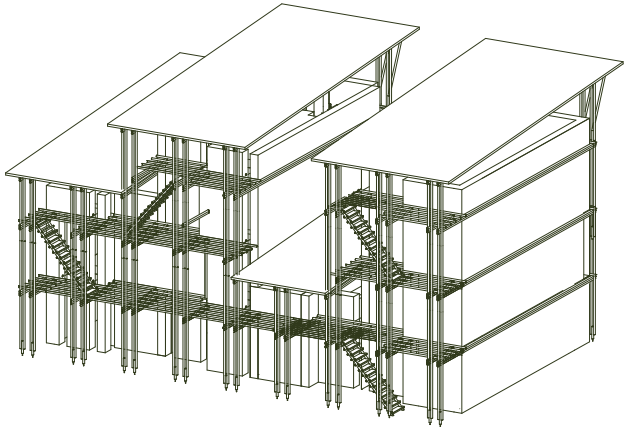
The proposed architectural project emphasizes an innovative and adaptable approach to urban housing by integrating three key design principles: construction out of a strong core surrounded by a light and adjustable skin, a coherent grid size maintained throughout the design, and income generation possibilities incorporated within the housing units. This concept caters to diverse income groups, featuring three different housing types, including low to middle-income housing. The low-income units are designed to be incrementally expandable and customizable to meet the evolving needs of families.

The entire development adheres to a standardized grid system, promoting uniformity and coherence across the project. This grid facilitates efficient space utilization, ease of construction, and systematic expansion. The grid size ensures compatibility between different housing types and shared spaces, fostering a harmonious community environment. This consistency also simplifies maintenance and future development phases.

Each housing unit incorporates design elements that support income generation for residents. This includes designated spaces for home-based businesses, rental rooms, or small commercial enterprises. The inclusion of flexible workspaces and storefronts within residential areas encourages entrepreneurship and provides additional income streams, thereby enhancing the economic stability of the community.
Mixed-income housing units are strategically distributed throughout the development to promote social integration and diversity. Shared community spaces, such as parks, playgrounds, and communal gardens, encourage interaction and foster a sense of community among residents of different income levels. These units are designed with adaptability in mind, featuring multifunctional rooms that can serve various purposes. This flexibility supports residents in generating additional income and adapting their living spaces to changing needs.

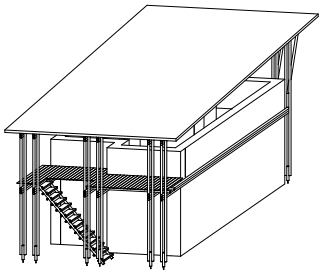


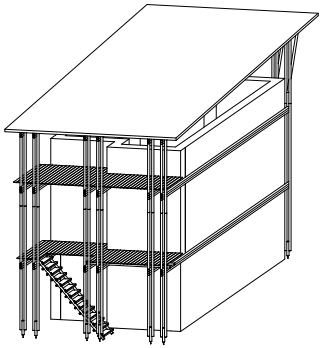
TYPE A

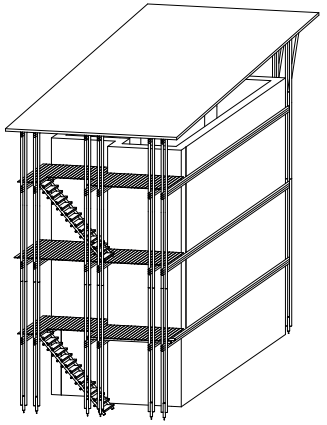


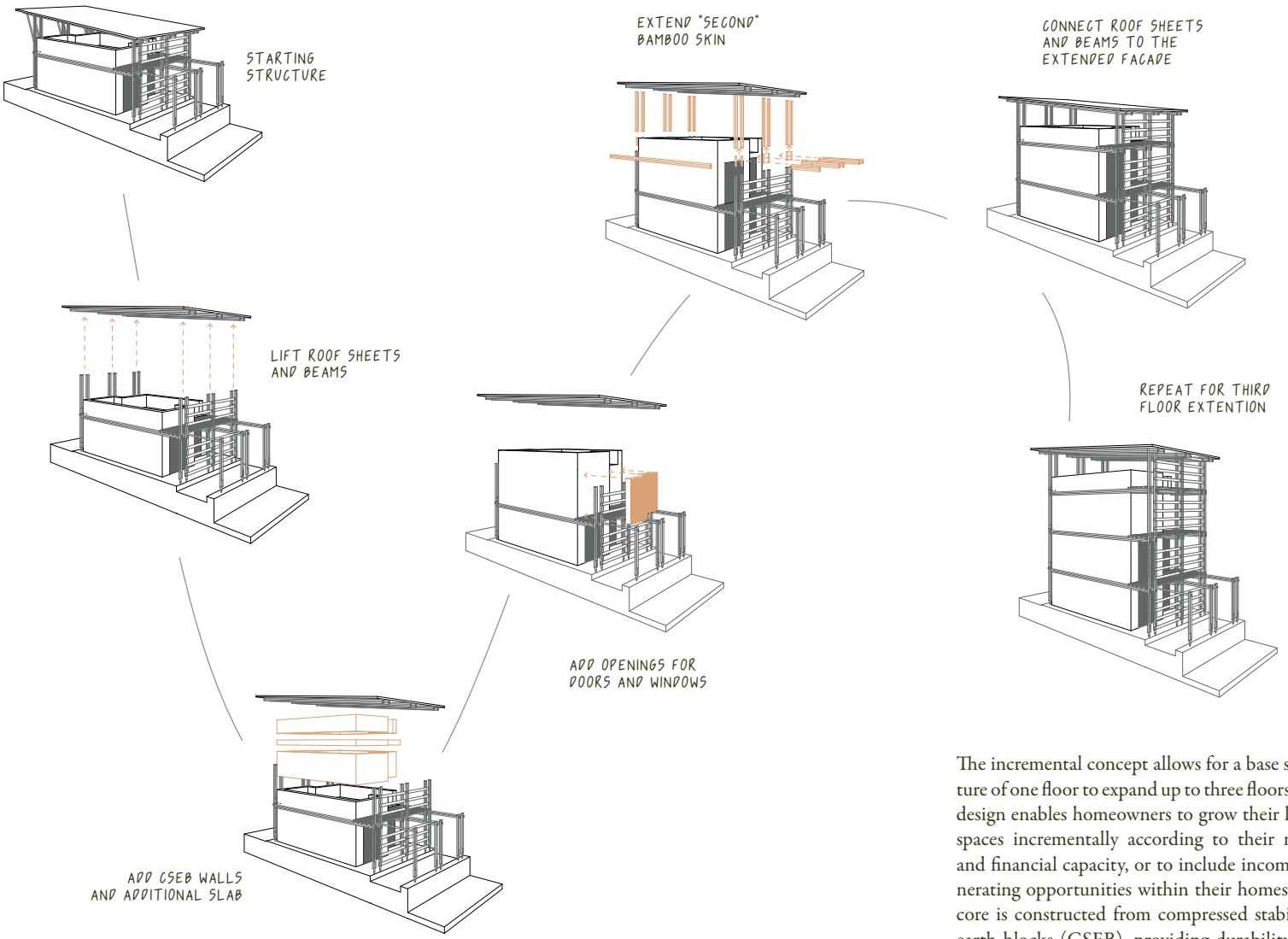
INCREMENTALITY

The project features three distinct housing types. The low-income housing is designed for scalability, starting with a basic, affordable core structure that can be expanded over time. Residents can add additional rooms, floors, or amenities as their financial situation improves. The light and adjustable skin allows for easy modifications and expansions without disrupting the core structure. Families can personalize their homes based on their needs and preferences, promoting a sense of ownership and long-term investment. The design includes predefined modules for various functions that can be easily integrated into the existing structure. Affordable, modular construction materials ensure that expansions are cost-effective and accessible to low-income families.





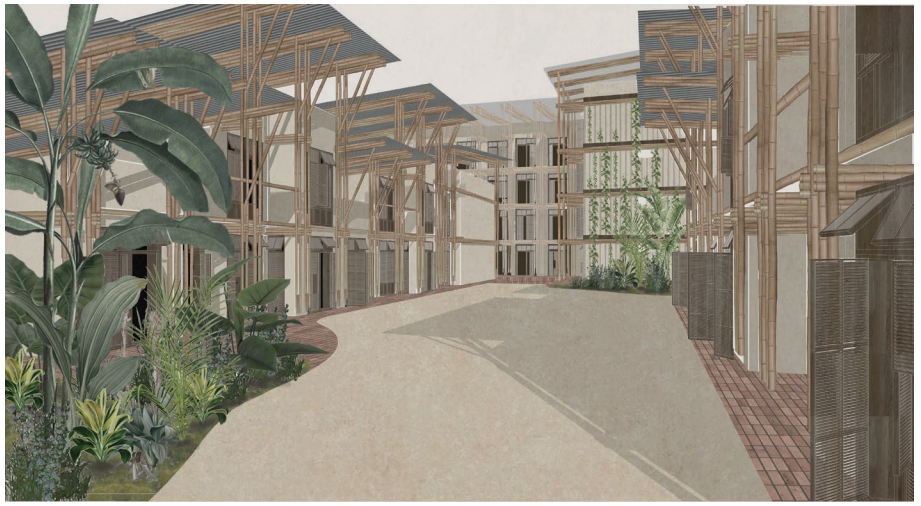


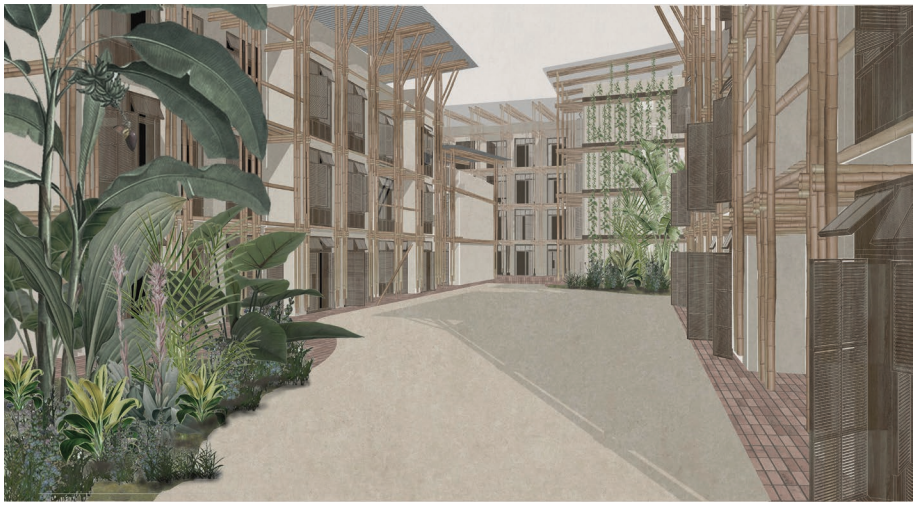


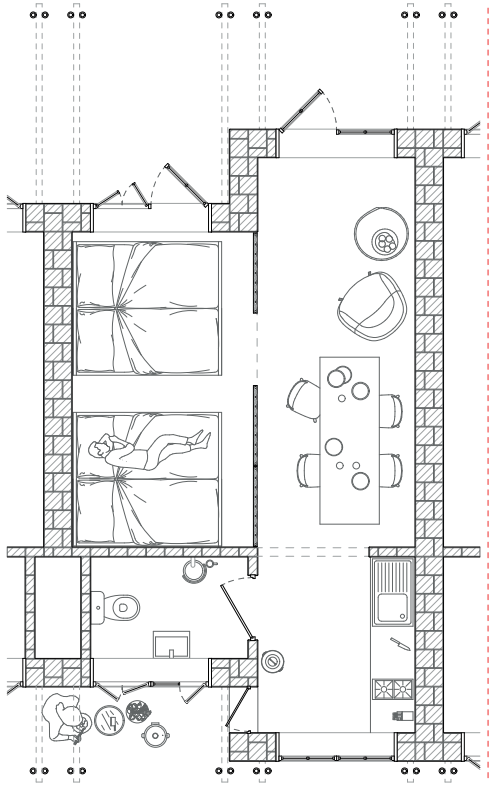
The incremental concept allows for a base structure of one floor to expand up to three floors. The design enables homeowners to grow their living spaces incrementally according to their needs and financial capacity, or to include income-generating opportunities within their homes. The core is constructed from compressed stabilized earth blocks (CSEB), providing durability and insulation and new walls can be easily added. The lightweight outer shell of the house is made from bamboo, a versatile and sustainable material. This bamboo shell can be extended by attaching new and longer pieces to the existing structure.
The system is designed to be modular, allowing additional sections to be added without the need for demolition or waste.
This approach ensures that as the house expands, no materials are discarded, making the growth process both cost-effective and environmentally friendly. The simple building techniques employed, particularly the use of temporary bamboo connections, enable homeowners to either extend their homes themselves or hire affordable local labor. This flexibility ensures that extensions can be carried out efficiently and economically.

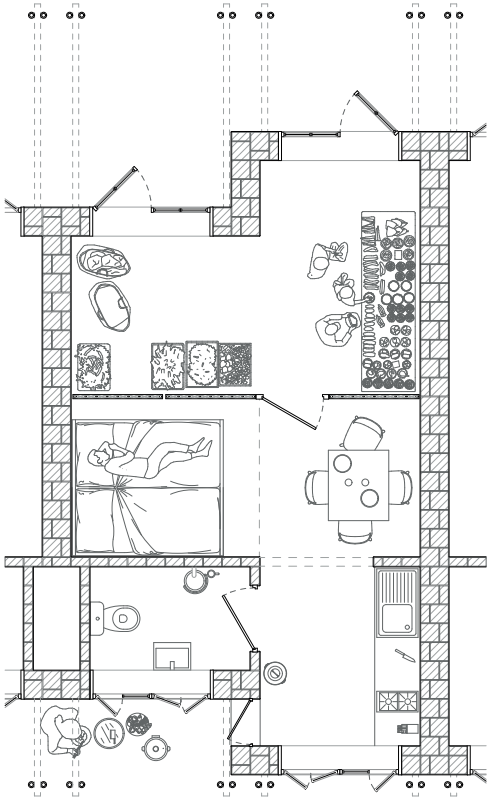
The construction materials used in the Vertical Incremental House are locally sourced, easily accessible, and affordable. The use of compressed stabilized earth blocks and bamboo not only supports local economies but also reduces the environmental impact associated with transporting building materials over long distances. These materials are well-suited to a variety of climates and provide excellent thermal performance, contributing to the overall comfort and energy efficiency of the home.

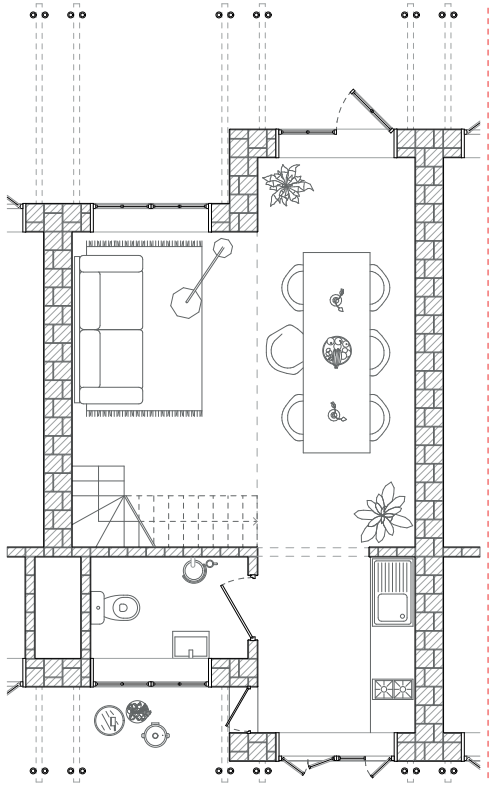
In addition to accommodating growing families, the design includes provisions for income generation. Homeowners can incorporate rental units, small businesses, or workspaces within their homes, providing additional revenue streams and enhancing economic stability. This flexibility is particularly beneficial in urban areas where space is at a premium and the cost of living is high.

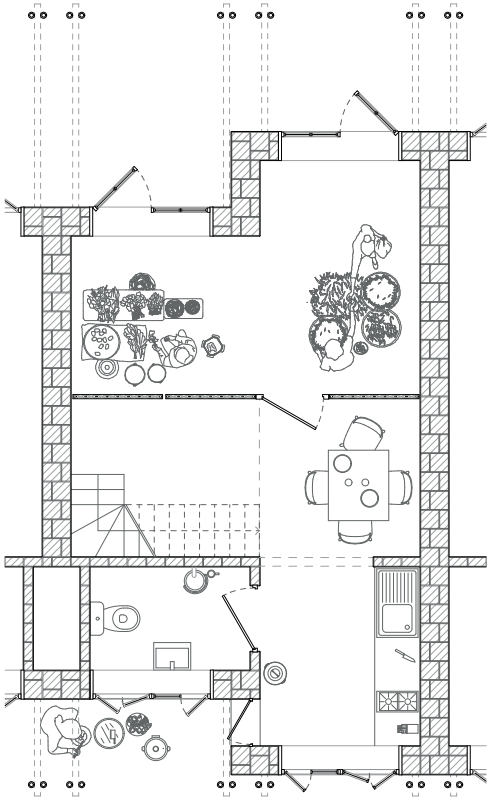


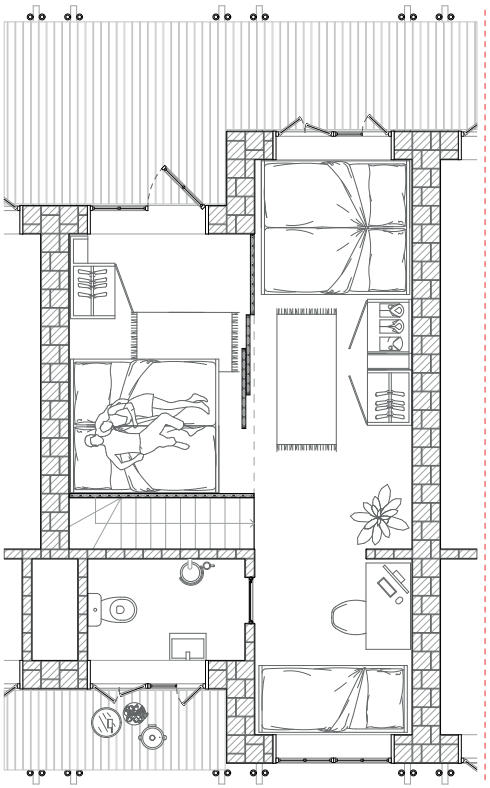




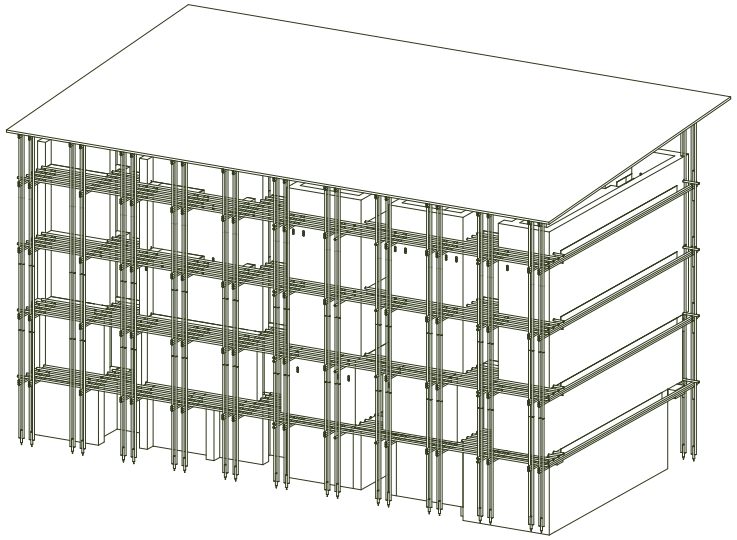








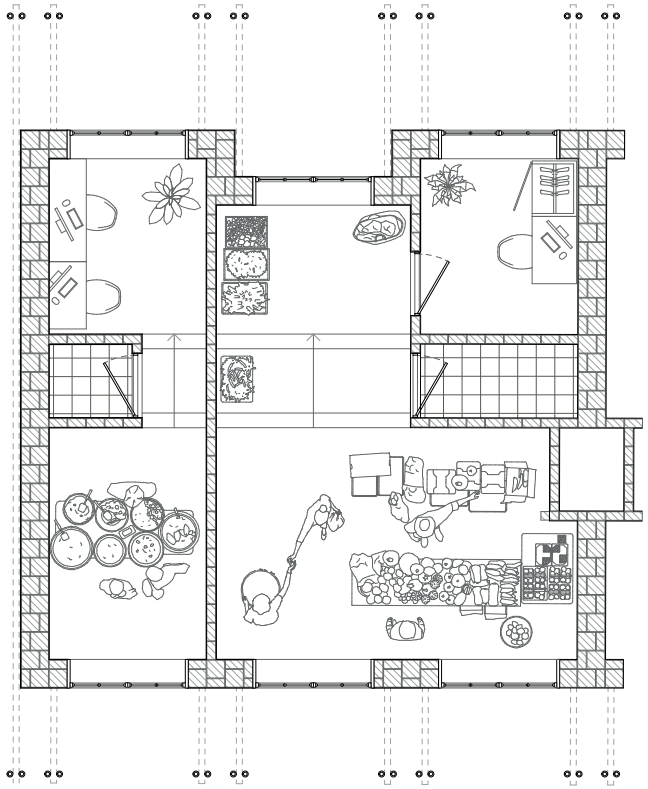
TYPE B

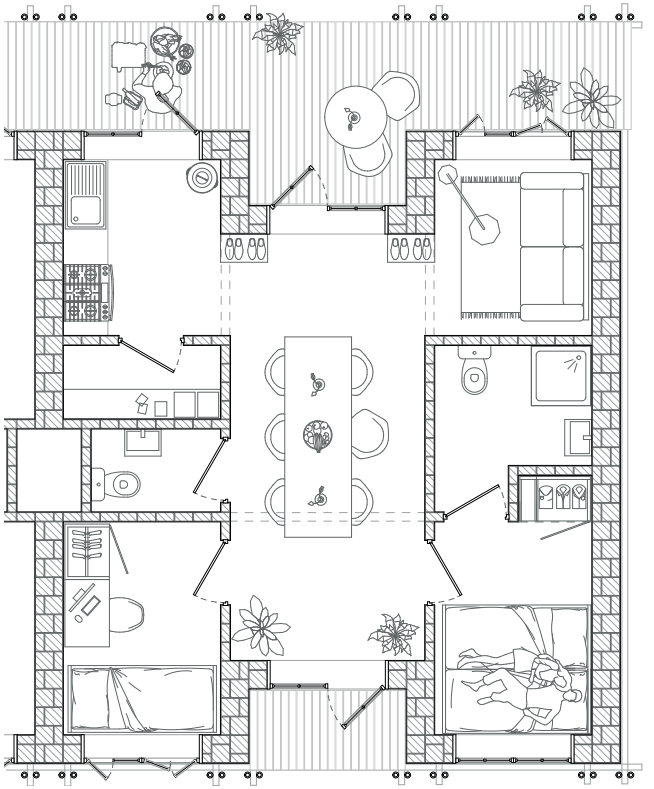


The proposed housing type is a four-story building that seamlessly integrates commercial and residential spaces while fostering community engagement and sustainability. The ground floor is dedicated to commercial use, featuring shops of two different sizes to accommodate a variety of businesses. This design supports local entrepreneurship and provides convenient access to goods and services for residents and the surrounding neighborhood.

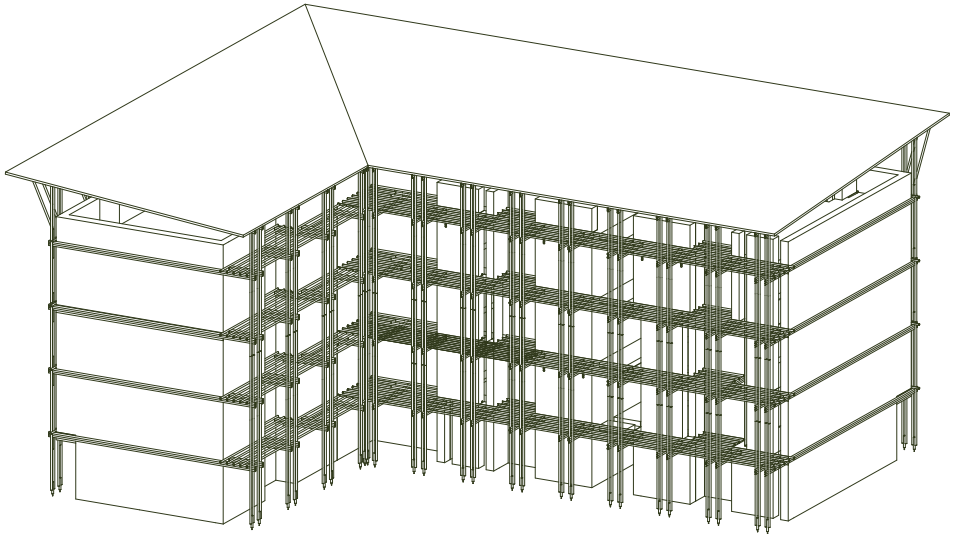
From the first to the third floor, the building houses middle-income apartments, with three apartments on each floor. These apartments are designed with an open floor plan that promotes cross ventilation, ensuring ample natural light and fresh air throughout the living spaces. This not only enhances the comfort of the residents but also reduces the reliance on artificial lighting and mechanical ventilation, contributing to energy efficiency.
The apartments themselves are designed with flexibility in mind. The open floor plan allows rooms to be easily adapted to suit the needs of the residents, whether as bedrooms, living rooms, or home offices. This adaptability ensures that the living spaces can evolve with the changing needs of the families who reside in them.

A standout feature of this housing type is the communal rooftop, which serves as a hub for both communal activities and everyday tasks. Residents can gather on the rooftop for social events, gardening, or recreational activities, fostering a sense of community and belonging. Additionally, the rooftop provides practical amenities for everyday activities, such as designated areas for storing food and drying clothes. This shared space not only enhances the functionality of the building but also promotes sustainable living practices by utilizing natural sunlight and ventilation for food preservation and laundry.

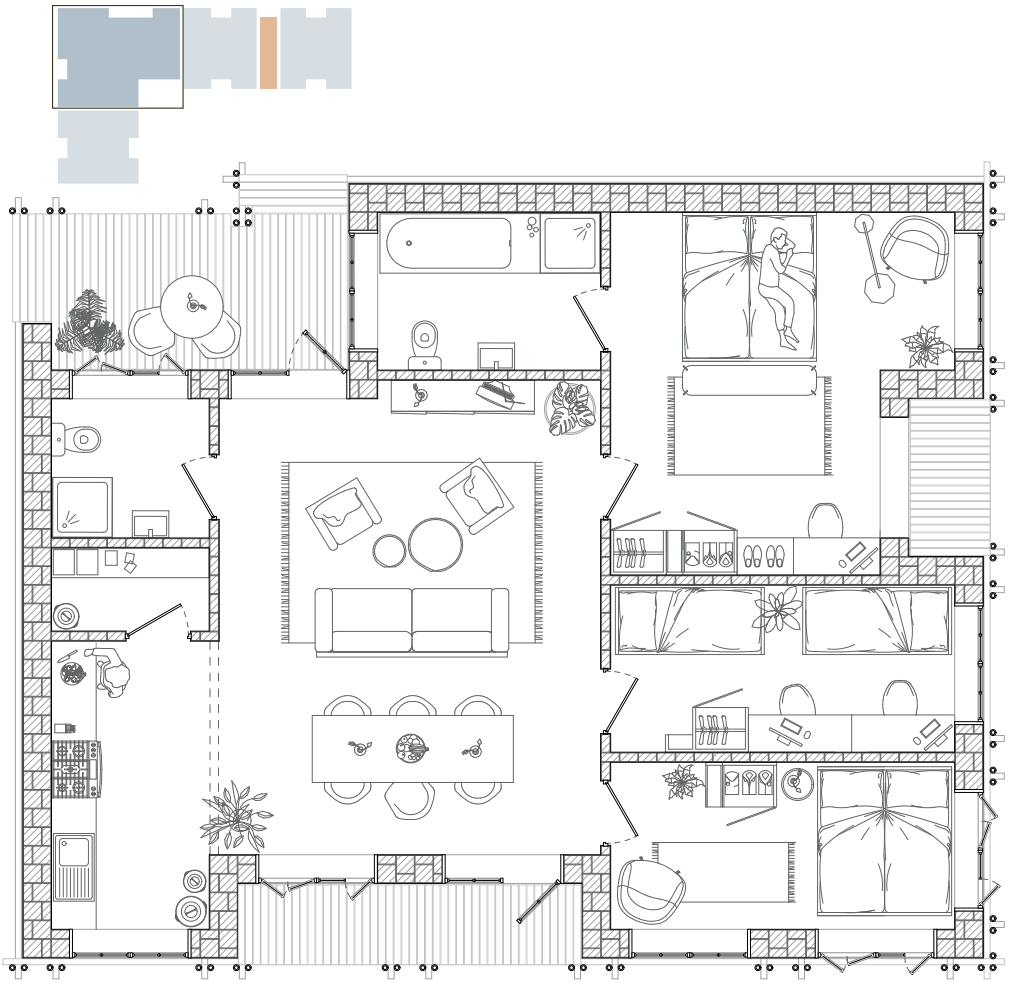




TYPE C



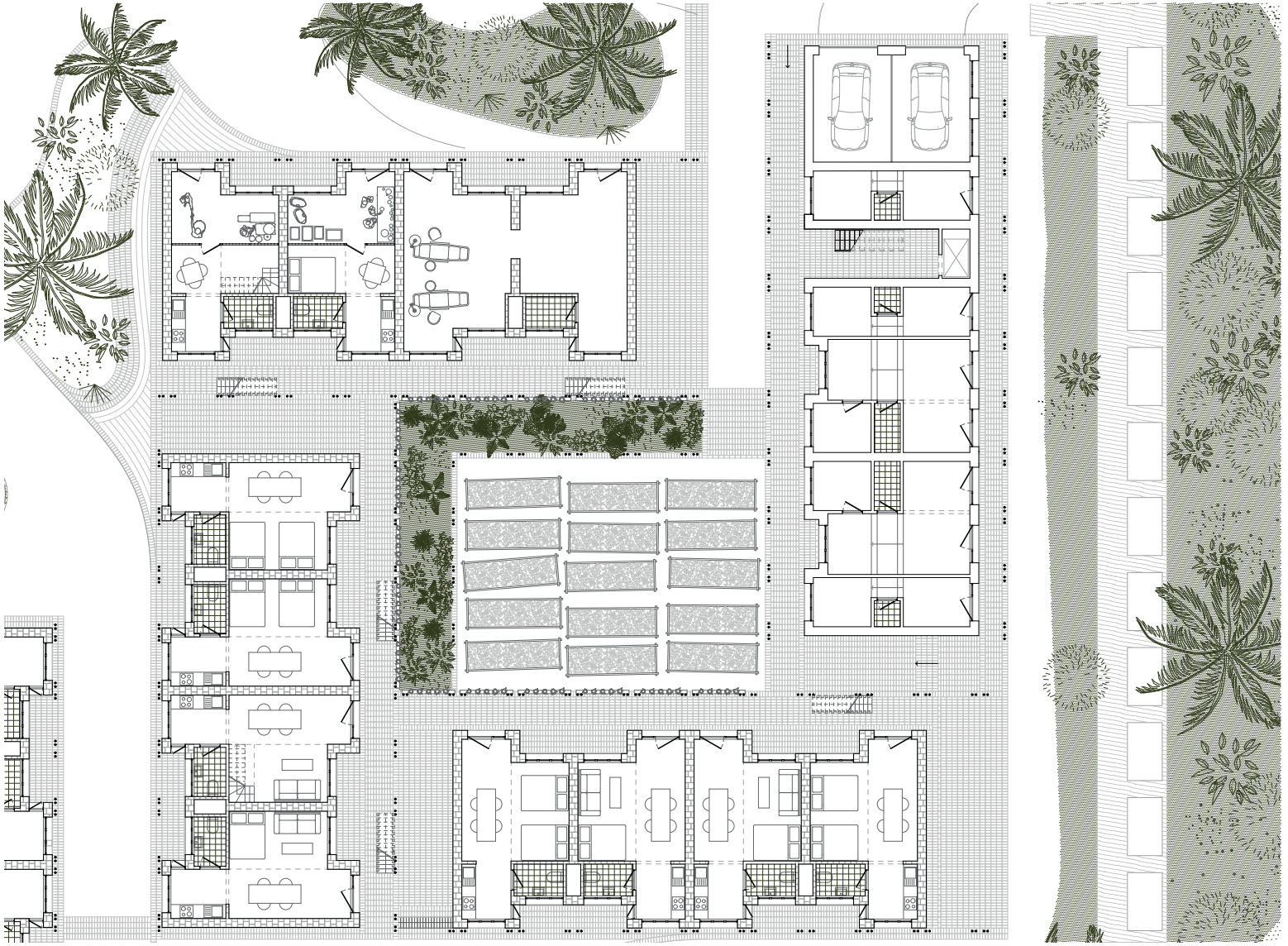
Housing Type C introduces an additional, slightly larger corner apartment on each residential floor. This apartment benefits from increased natural light and ventilation, while maintaining the same flexible floor plan that allows for adaptable living spaces. The building continues to support a vibrant community through its integration of commercial spaces, accessible design, and communal rooftop, creating a harmonious and sustainable living environment for all residents.

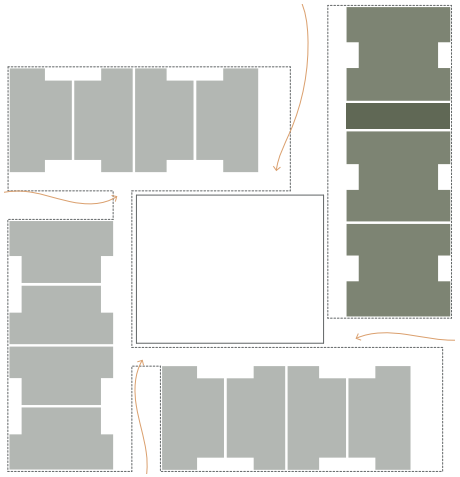


Each cluster in this plan consists of four buildings, three of which are low-income housing (Type A) designed for incremental growth, and one middle-income apartment building (Type B) offering workshops and business spaces on the ground floor. The low-income housing features flexible ground-floor spaces, allowing families to include a shop or workshop within their homes. All businesses are accessible from outside the courtyard, maintaining privacy for residents.

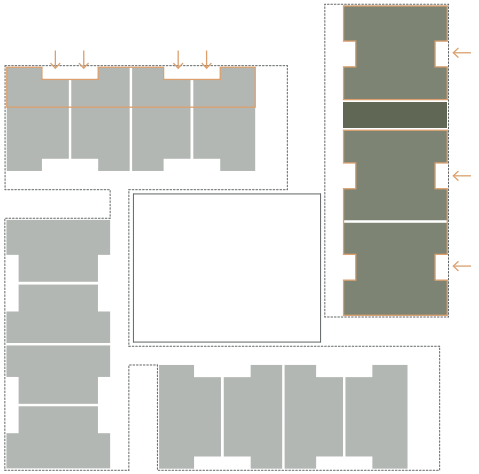
The courtyard, encircled by pathways and open spaces, serves both individual families and communal gatherings. Primarily dedicated to gardening and agriculture, it provides low-income families with essential vegetables and fruits, addressing food and nutrition needs. Positioned at a lower elevation, the courtyard collects water during the monsoon season, supporting a floating agriculture system. Additionally, each cluster includes a dedicated space for keeping livestock, which is protected and conveniently located close to the families.

The plan also incorporates individual recycling stations for both household waste and food production waste, promoting sustainability and efficient waste management. A secondary bamboo facade acts as a climbing structure and supports vertical farming, enhancing sustainability and providing additional food sources.

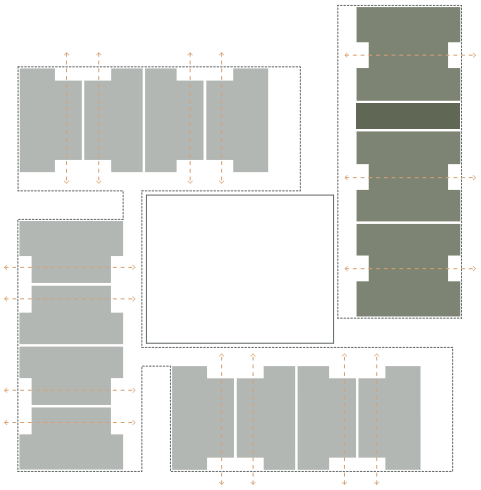




ACCESSABILITY



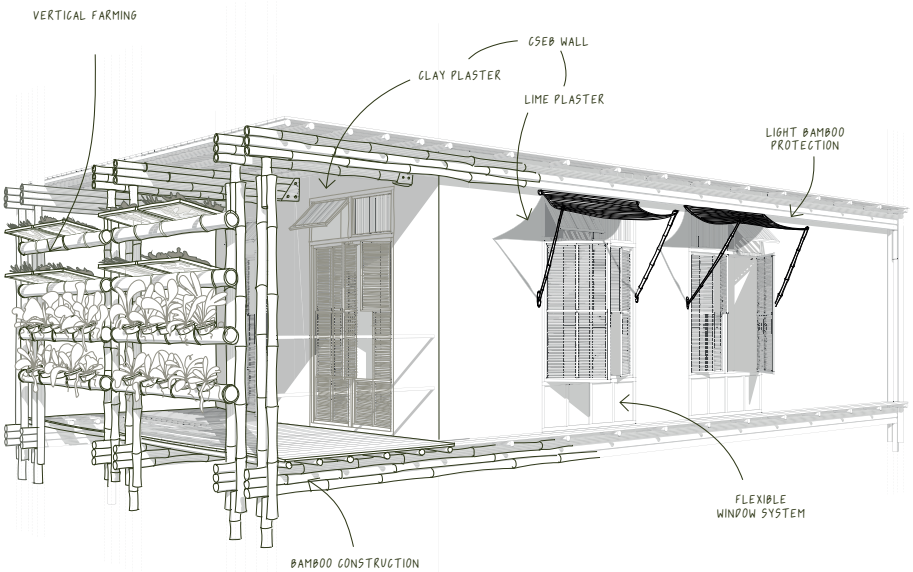
COMMERCIAL SPACES

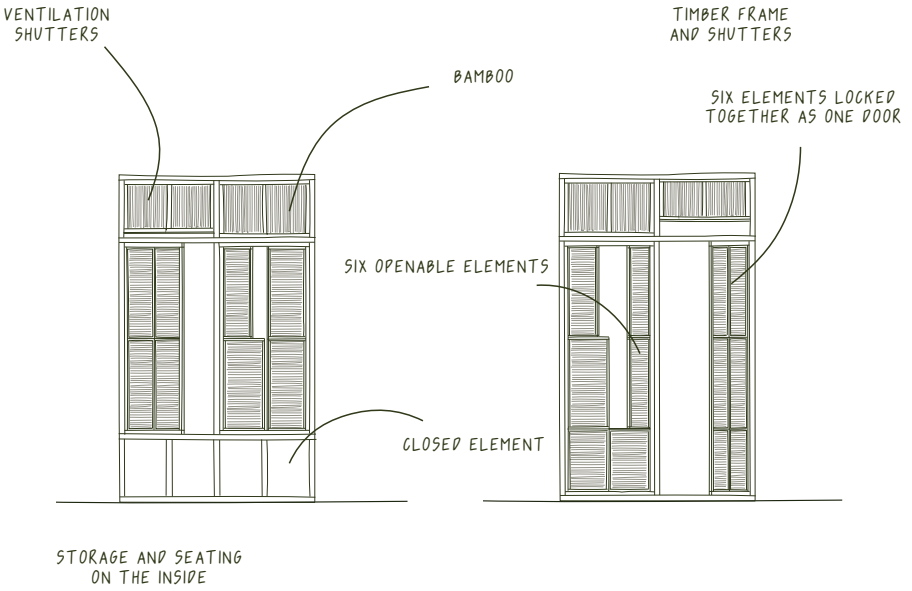


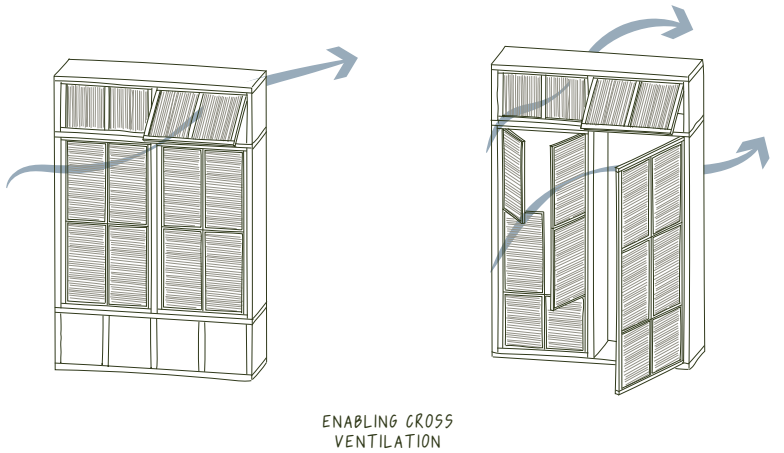
INSIDE - OUTSIDE

SHARED ROUTING

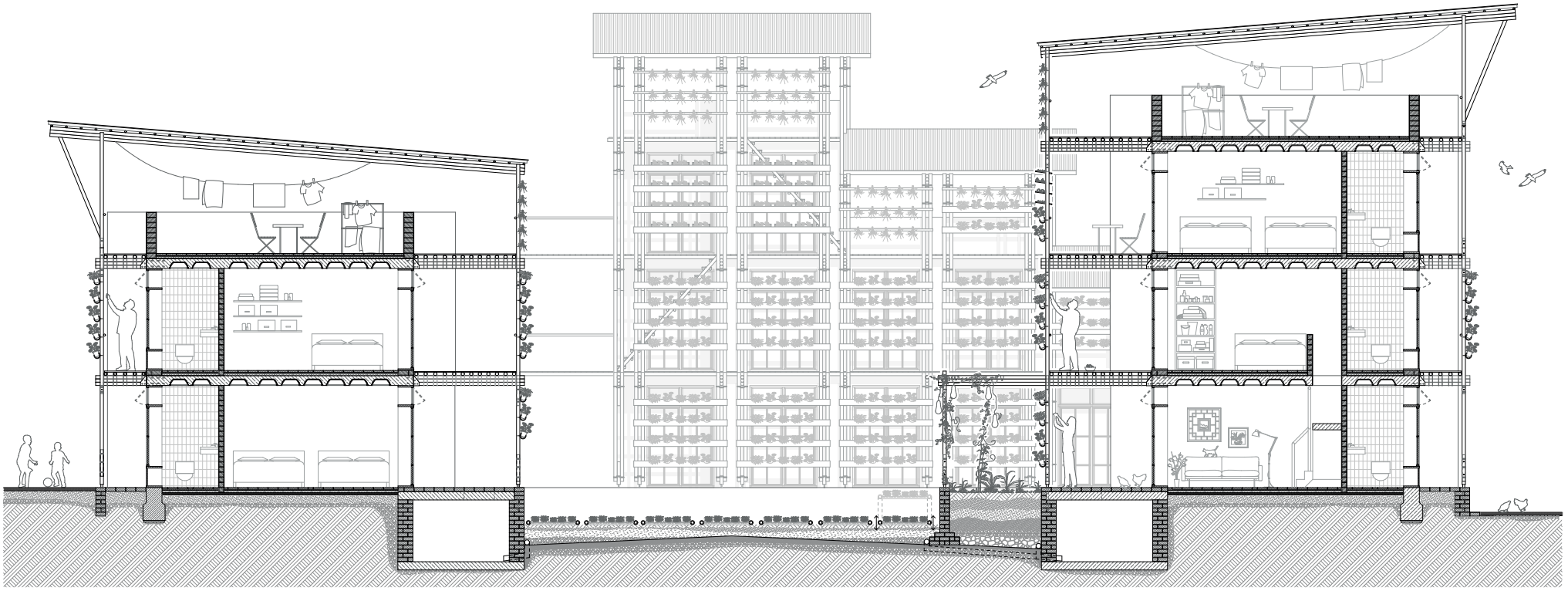
BUILDING TECHNOLOGY


VERTICAL FARMING
CSEB WALL
CLAY PLASTER
LIME PLASTER
LIGHT BAMBOO PROTECTION
FLEXIBLE WINDOW SYSTEM
BAMBOO CONSTRUCTION


VENTILATION SHUTTERS
BAMBOO
TIMBER FRAME AND SHUTTERS
SIX ELEMENTS LOCKED TOGETHER AS ONE DOOR
SIX OPENABLE ELEMENTS
CLOSED ELEMENT
STORAGE AND SEATING ON THE INSIDE

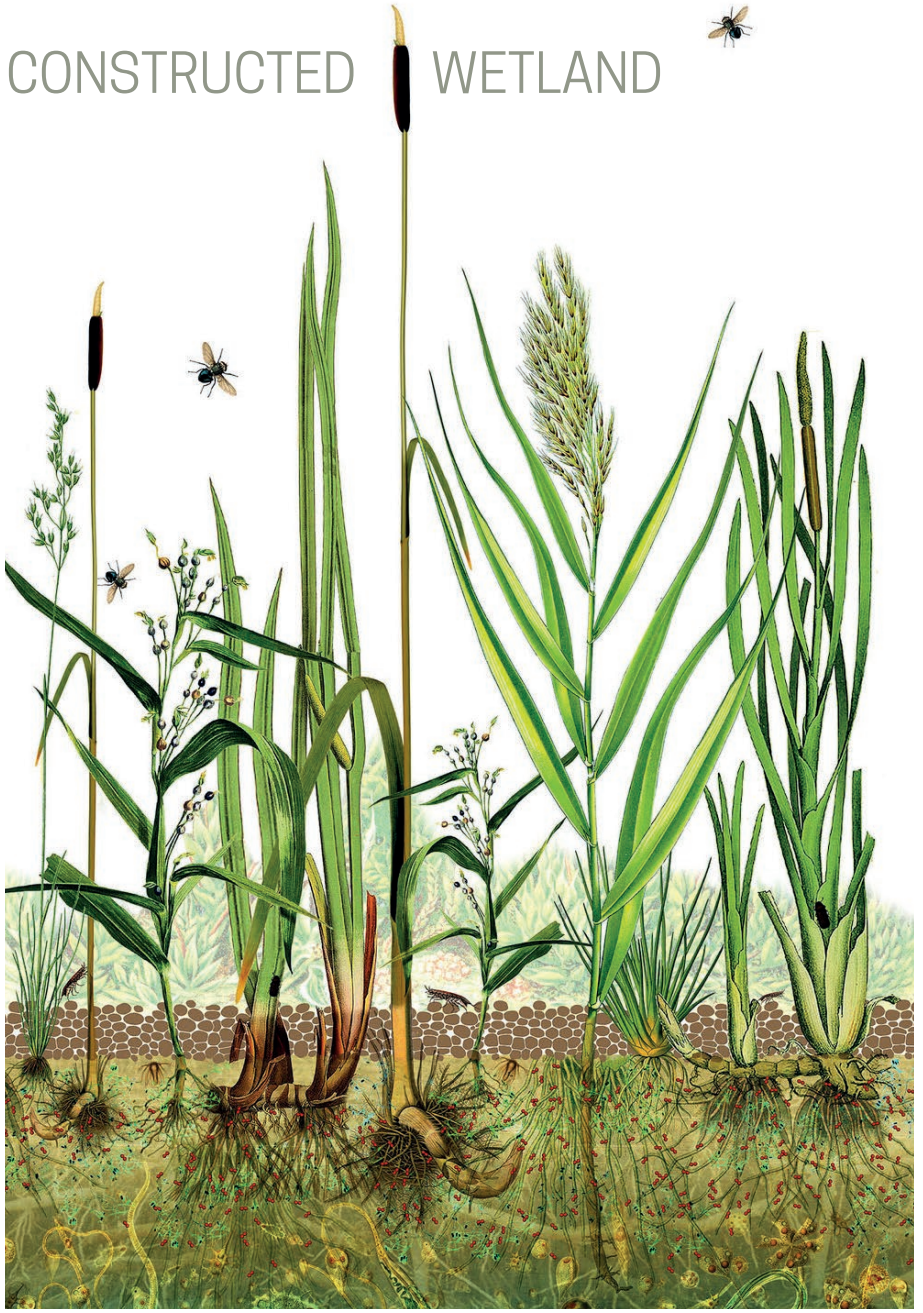

ENABLING CROSS VENTILATION

DETAIL CLUSTER



WATER MANAGEMENT

CONSTRUCTED WETLAND

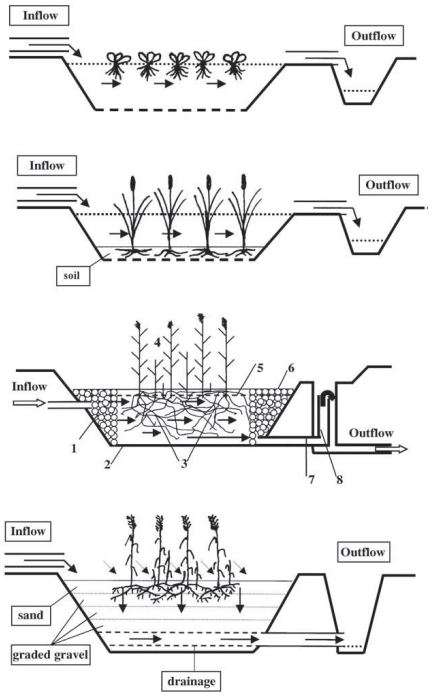


Constructed wetlands are engineered systems designed to mimic the natural processes of wetland ecosystems for the treatment of greywater. These systems use a combination of vegetation, soil, and microbial activity to filter and purify the water.

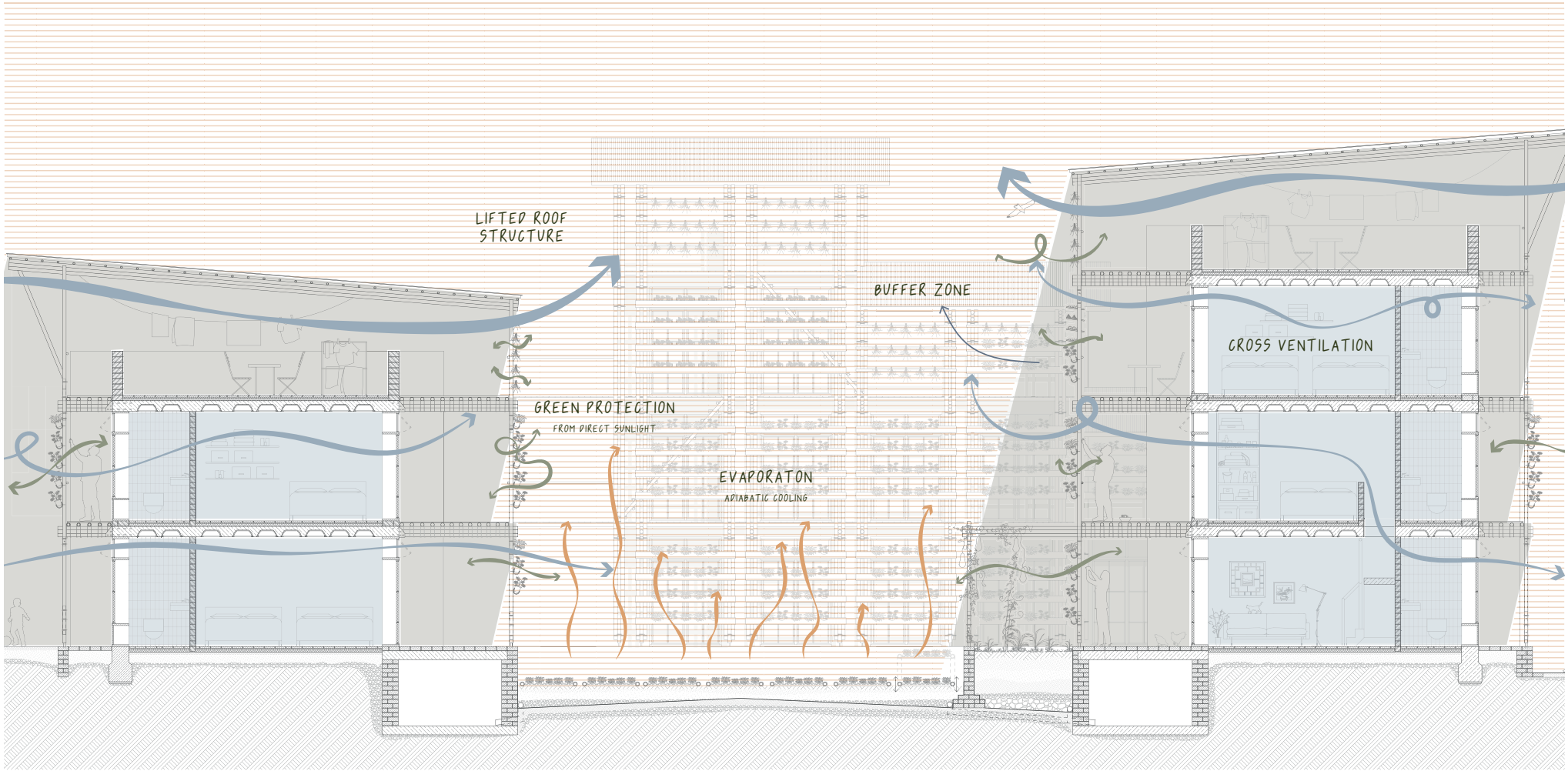
The primary function of constructed wetlands involves several processes. Filtration and sedimentation occur as larger particles settle out of the water as it flows through the system, thereby reducing turbidity and solid load. Biological degradation is facilitated by microorganisms in the wetland substrate, which break down organic matter in the greywater, significantly reducing biochemical oxygen demand (BOD) and chemical oxygen demand (COD).

Plants in the wetland play a crucial role in nutrient removal, absorbing nitrogen and phosphorus found in greywater. This process helps prevent eutrophication when the treated water is lead into natural water bodies. Additionally, the root systems and soil in constructed wetlands can bind heavy metals and other toxins, preventing them from entering the natural water cycle.

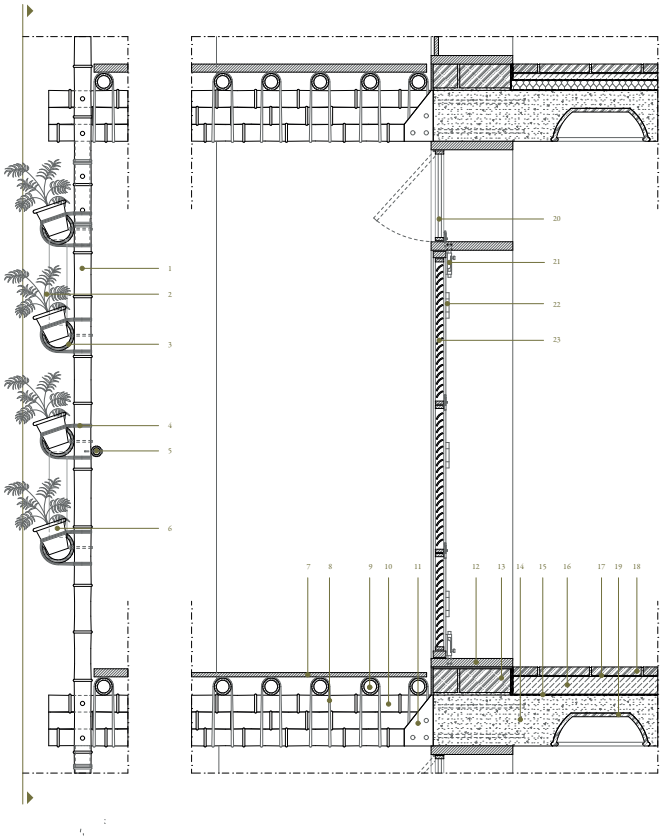
The treated greywater can be reused for non-drinking water likee toilet flushing, and landscape maintenance. Constructed wetlands offer a sustainable and cost-effective solution for greywater treatment, particularly in areas without access to centralized wastewater treatment facilities. They enhance water quality, promote biodiversity, and can be integrated into urban landscapes, contributing to environmental sustainability and resilience.



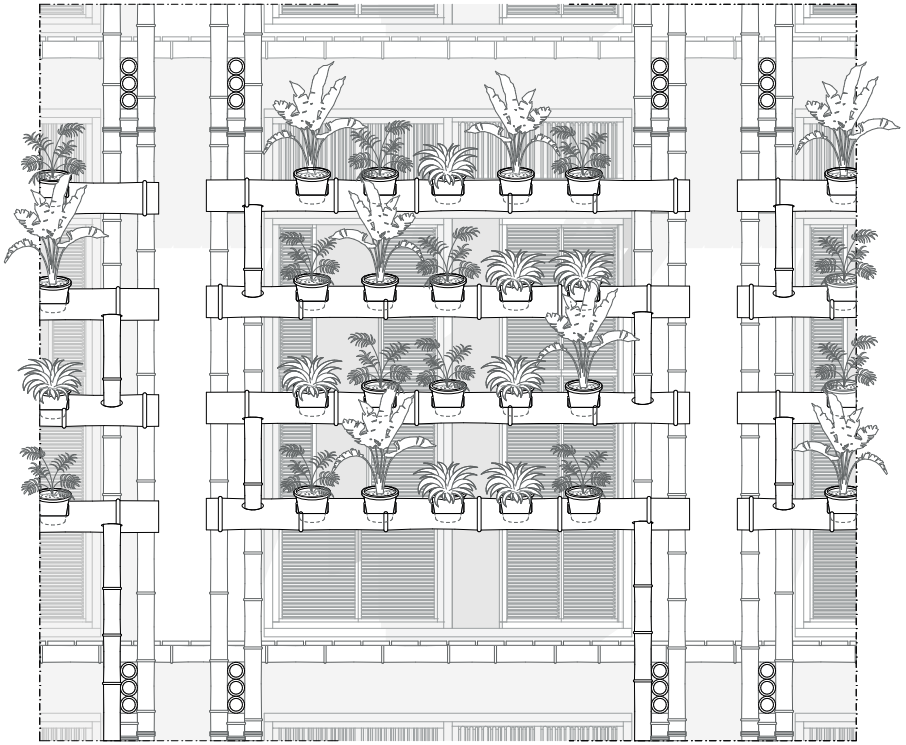
CLIMATE MANAGEMENT

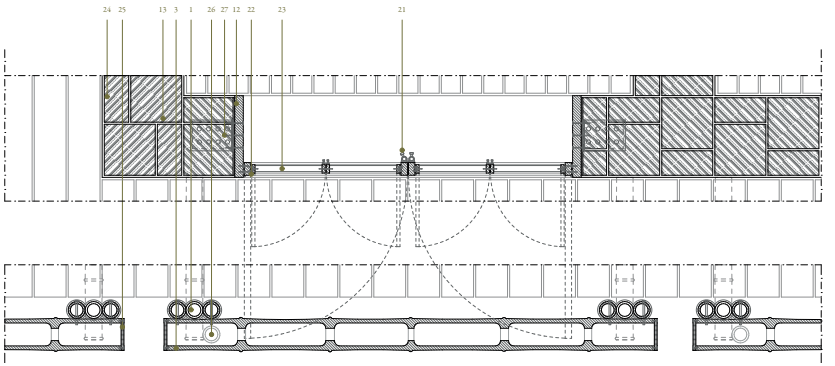


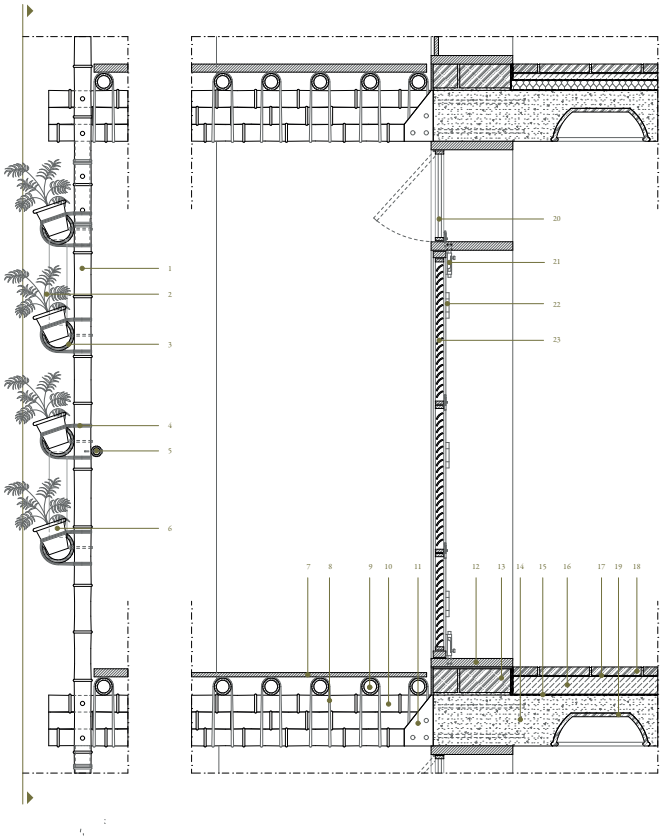
DETAIL FACADE



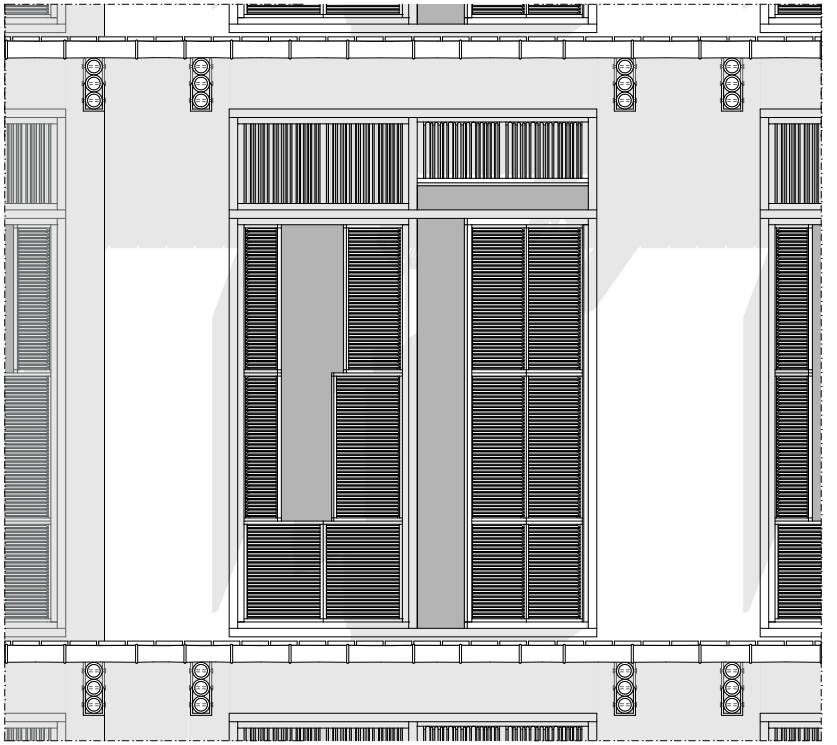
1. bamboo construction	3 x ø 8 cm	14. concrete filler slab	24 cm
2. seedling for vegetables | fruits | herbs		15. PE foil	
3. horizontal bamboo - epoxy coating	ø 15 cm	16. compressed clay	9 cm
4. rope for additional joint support		17. clay mortar	
5. bamboo railing	ø 3 cm	18. CSEB floor tiles	9 cm x 24
6. clay planting pot		19. clay pots as filler elements	ø 45 cm
7. bamboo planks	4 cm x 15 cm x 246 | 146 cm	20. ventilation shutter	
8. jute rope connection		vertical bamboo sticks in timber construction	
9. horizontal bamboo underconstruction	ø 8 cm	21. shutter lock	
10. bamboo beam	3 x ø 8 cm = 24 cm x 8 cm	22. hinge	
connection between 3 bamboo poles		23. bamboo planks in timber frame	
11. metal U connection		24. clay plaster | exposed facades: lime plaster	
12. timber frame	4 cm	25. timber plate	
13. CSEB	9 cm x 24 cm x 24 cm	26. bamboo water pipe - epoxy coating	ø 8 cm
compressed stabalized earth block	9 cm x 24 cm x 11,2 cm	27. metal L plate	

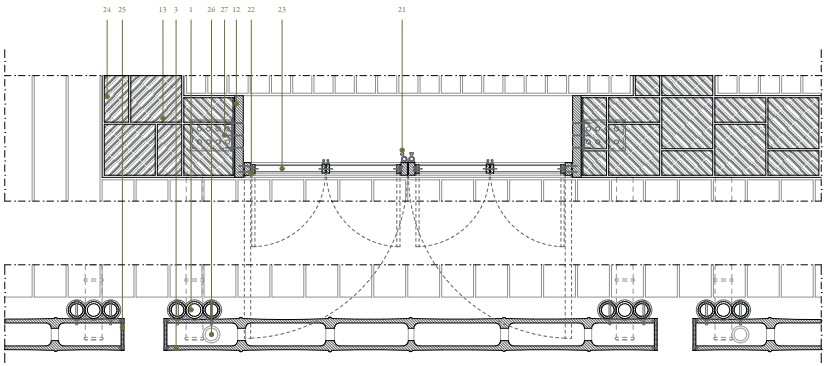


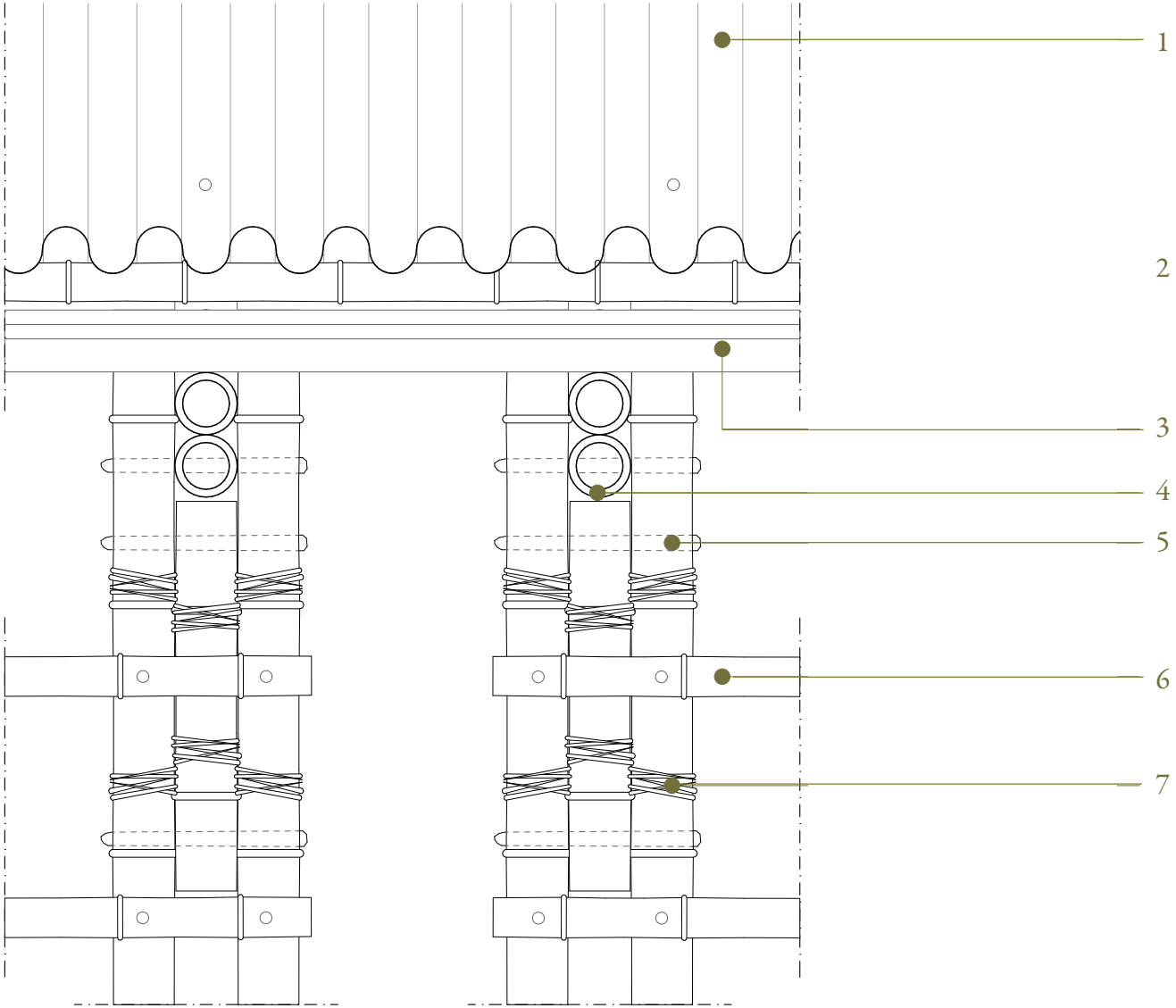




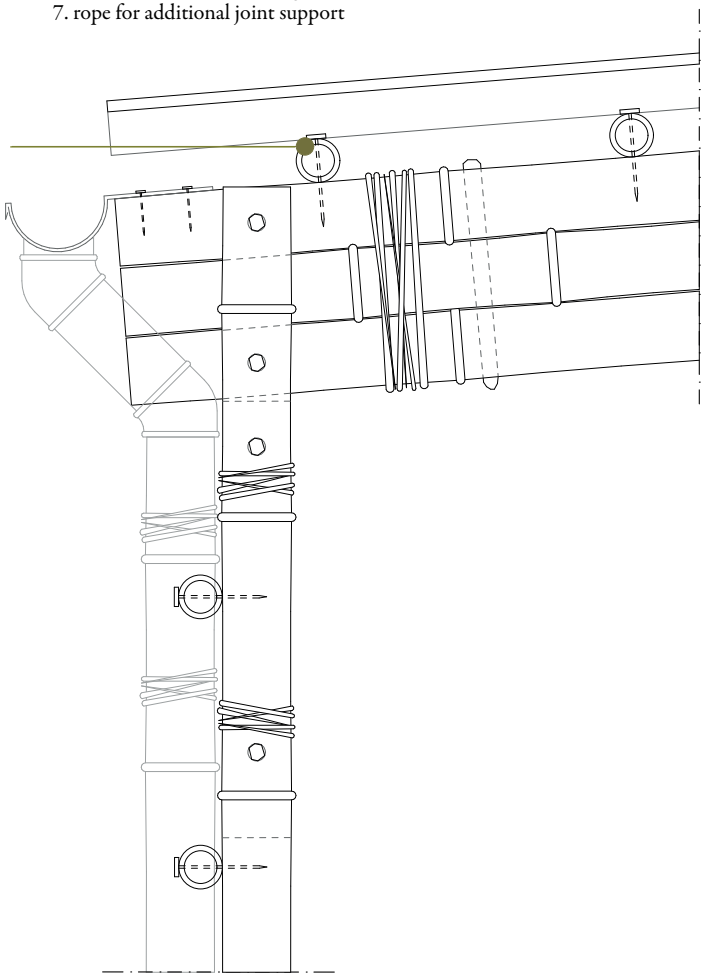
1. bamboo construction	3 x ø 8 cm
2. seedling for vegetables | fruits | herbs	
3. horizontal bamboo - epoxy coating	ø 15 cm
4. rope for additional joint support	
5. bamboo railing	ø 3 cm
6. clay planting pot	
7. bamboo planks	4 cm x 15 cm x 246 | 146 cm
8. jute rope connection	
9. horizontal bamboo underconstruction	ø 8 cm
10. bamboo beam	3 x ø 8 cm = 24 cm x 8 cm
connection between 3 bamboo poles	
11. metal U connection	
12. timber frame	4 cm
13. CSEB	9 cm x 24 cm x 24 cm
compressed stabalized earth block	9 cm x 24 cm x 11,2 cm
14. concrete filler slab	24 cm
15. PE foil	
16. compressed clay	9 cm
17. clay mortar	
18. CSEB floor tiles	9 cm x 24
19. clay pots as filler elements	ø 45 cm
20. ventilation shutter	
vertical bamboo sticks in timber construction	
21. shutter lock	
22. hinge	
23. bamboo planks in timber frame	
24. clay plaster | exposed facades: lime plaster	
25. timber plate	
26. bamboo water pipe - epoxy coating	ø 8 cm
27. metal L plate	

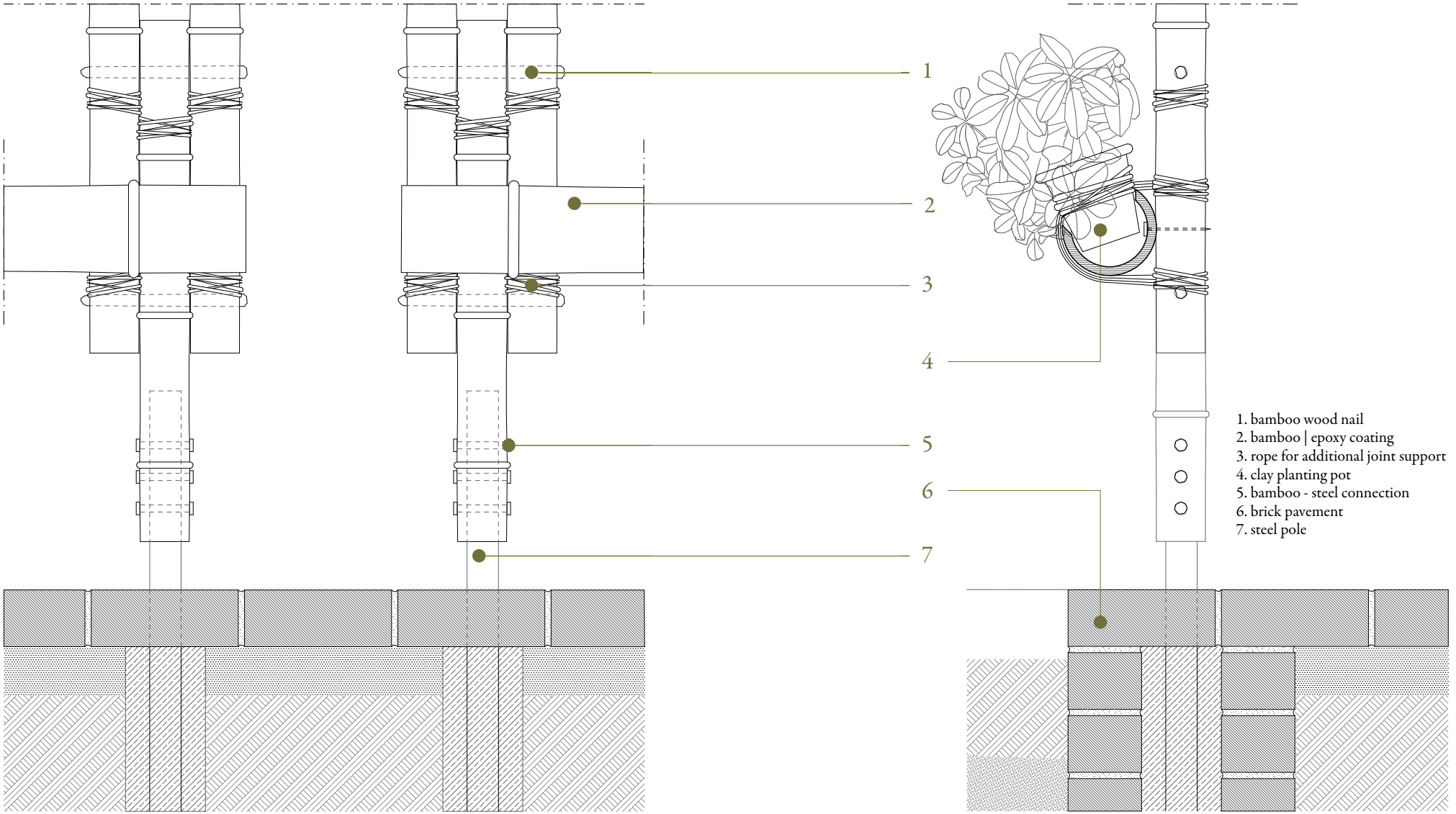




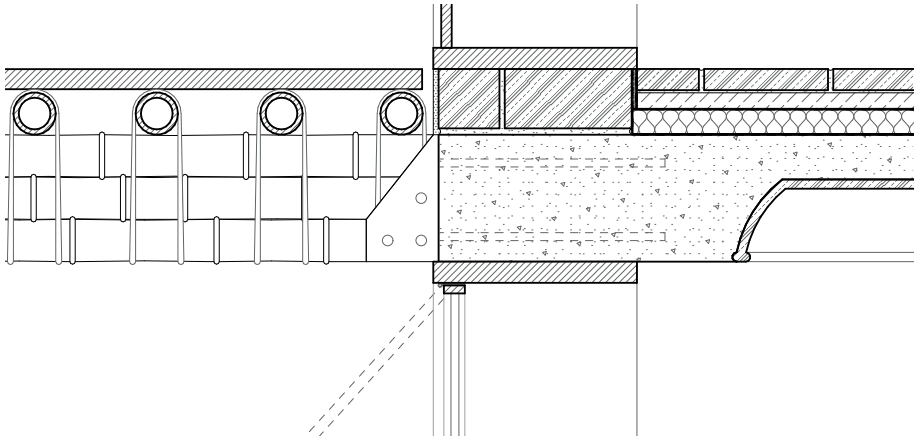


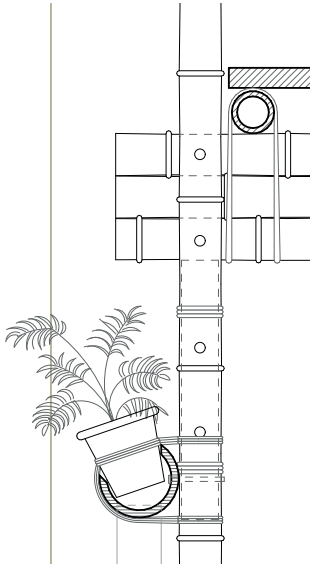
1. corrigated iron sheet 3 x ø 8 cm
2. bamboo ø 5 cm
3. rain gutter
4. bamboo beam - 3 connnected bamboo poles 3 x ø 8 cm = 24 cm x 8 cm
5. bamboo wood nail
6. horizontal bamboo (drying support) ø 6 cm
7. rope for additional joint support

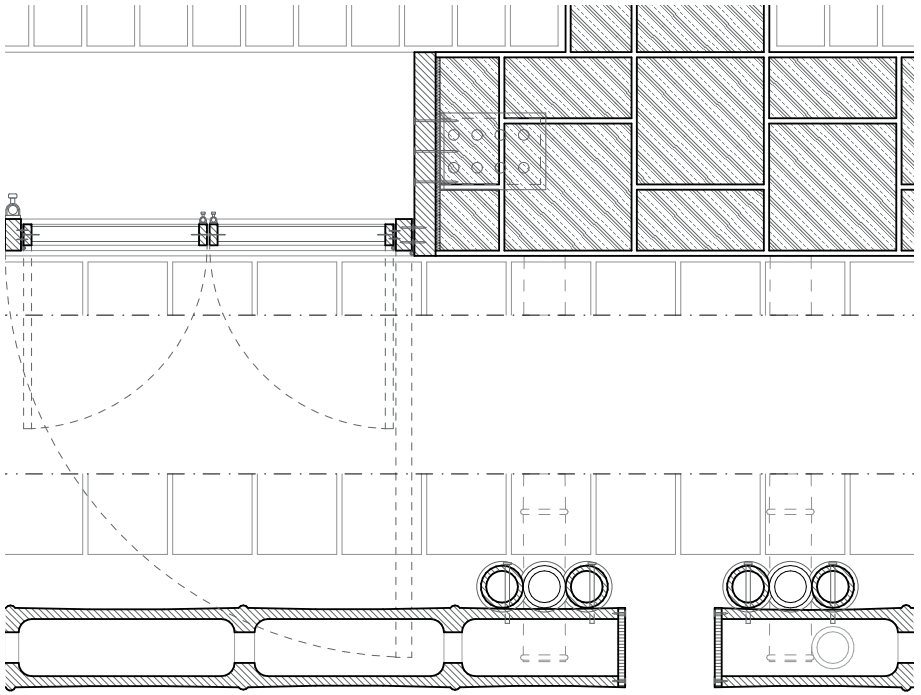




1. bamboo wood nail
2. bamboo | epoxy coating
3. rope for additional joint support
4. clay planting pot
5. bamboo - steel connection
6. brick pavement
7. steel pole



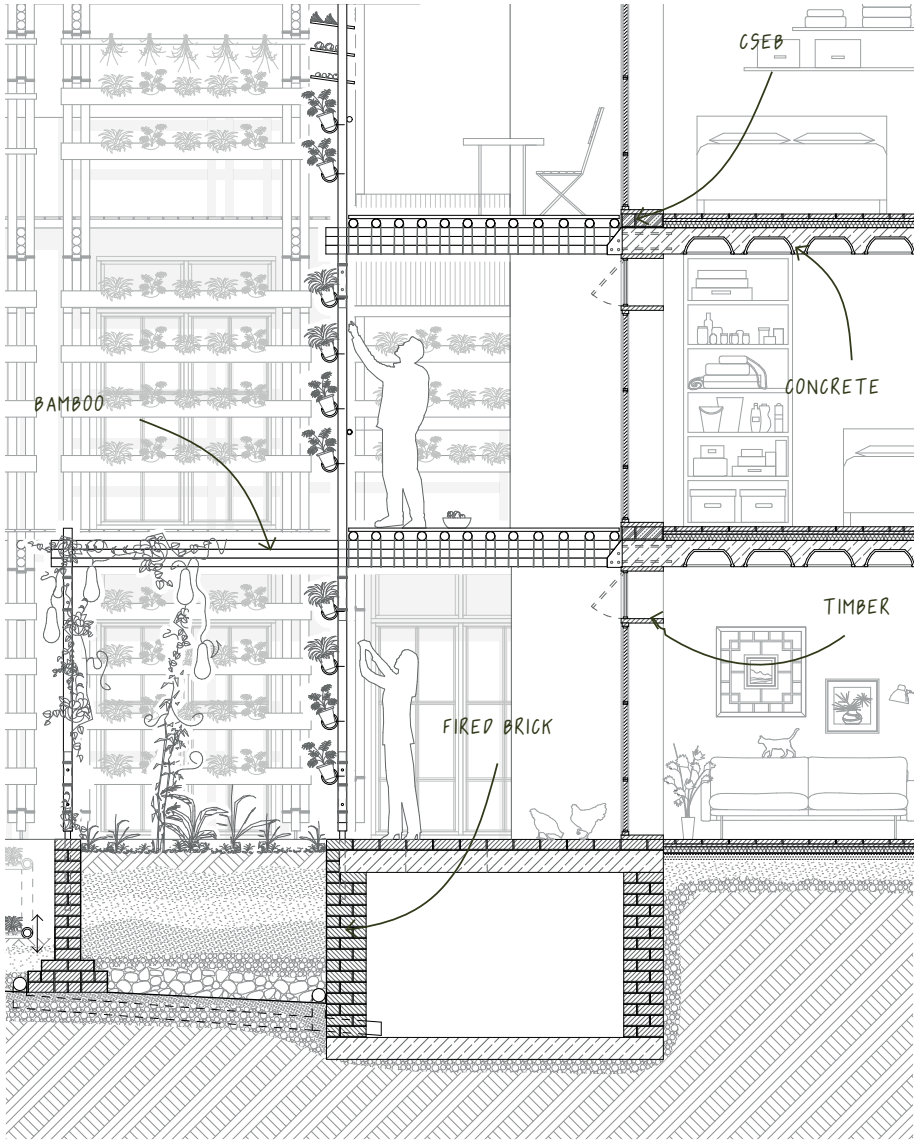




MATERIALIZATION

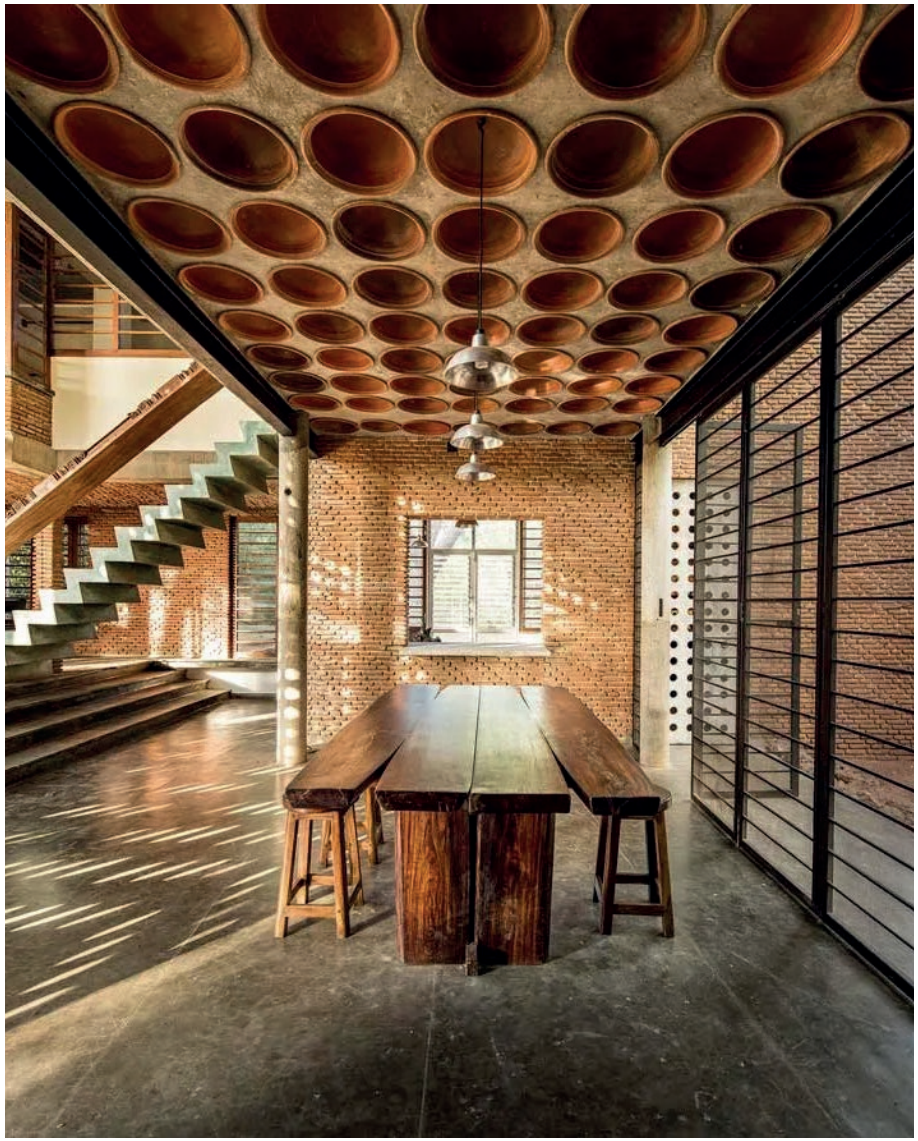
The material concept for this masterplan emphasizes the use of natural and locally produced materials, minimizing the reliance on concrete to essential areas such as slabs and parts of the foundation. This approach ensures security and stability, particularly for incremental houses, while enhancing durability and extending the lifespan of the buildings.

By prioritizing natural and locally sourced materials, the plan not only makes construction more accessible and affordable for residents but also stimulates the local economy. Familiarity with these materials empowers the community, enabling residents to maintain and extend their homes independently. This sustainable material strategy promotes self-sufficiency, economic growth, and a deeper connection between the community and their built environment.



MATERIALS

FILLER SLAB



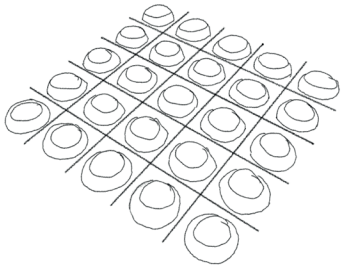
~20%

less concrete

~30%

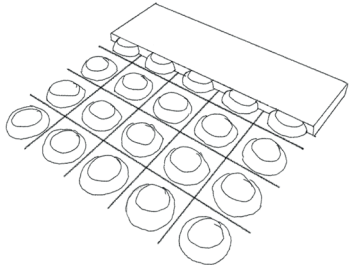
less steel reinforcement

The classic western method of saving material in concrete floor construction is the coffered floor. The more traditional equivalent to this are „filler slabs“, in which the lower half of the concrete is partially replaced by a lightweight and inexpensive filler material, thereby reducing the consumption of concrete without reducing the load-bearing capacity of the slab. A popular and local material for this is clay in the form of clay shells, which are placed in the formwork and poured over with the concrete. This not only reduces the amount of concrete and replaces it with local materials, but also creates new design qualities within the ceiling construction. In addition, the use of locally produced products supports and strengthens the local economy. Furthermore, the local people are familiar with the product and the material clay and the construction is easy to implement for local workers.[8]



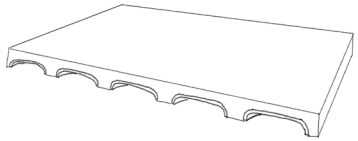
create shutter + place reinforcement grid depending on size of filler material

(example grids: 35 x 50 or 45 x 45)



filler material (clay) needs to be soaked before pouring concrete, so that it doesn't absorb water from the concrete

cement |concrete can then be casted as traditional slab



ADOBE EARTHBAGS

ADOBE CONSTRUCTION

Adobe construction is a traditional building technique that uses a blend of soil (containing clay), water, and organic materials like straw, to create a mixture and prevent cracking that is formed into bricks. Those bricks are traditionally dried in the sun, then afterwards used to construct walls and structures. The dried adobe bricks are laid using a mortar made from a similar mix of earth and water and the walls massively constructed to ensure stability and to regulate indoor temperatures. The finished walls are then usually finished with a plaster made from mud or lime, which protects the bricks from erosion while still allowing the walls to „breathe“ and manage moisture.

ADVANTAGES

Adobe construction is environmentally friendly, utilizing locally available materials with minimal processing. The thick walls provide insulation, reducing the need for artificial heating and cooling. Adobe buildings are also known for their aesthetic appeal and durability.

DISADVANTAGES

Adobe is susceptible to water damage and erosion, requiring regular maintenance and proper protection from rain and flooding. The construction process can be labor-intensive and time-consuming compared to modern building methods, but the processes are comparably easy and allow even unskilled laborers to become part of the construction process.

EARTH BAG

ADVANTAGES

- high mass walls that can facilitate as a good source of cooling or heating
- due to availability quite cheap option of building - store both heat and cool
- are restimstand in cases of earthquakes of flash floods
- no cement or brick needed for construction or production
- no specific skills are needed for construction
- flood proof as bags hold the structure in place and prevent walls from being washed away
- soundproof, no extra insulation needed
- less sifting - the bags are somehow providing a certain structure and encasement - not every earth mixture has to be exactly the same for the construction to function

DISADANTAGES

- labour intense
- site depended
- high clay content needed inn soil
- 40-50 pounds individual bags - a certain hight gets labour intense and super heavy
- bard wire needed to prevent the bags from slipping - not „fun“ to work with
- more plastic - but locked into a building for hundreds of years

ST JEROME‘S CENTRE

ARCHITECT	Orkidstudio
LOCATION	Nakuru, Kenia
YEAR	2014

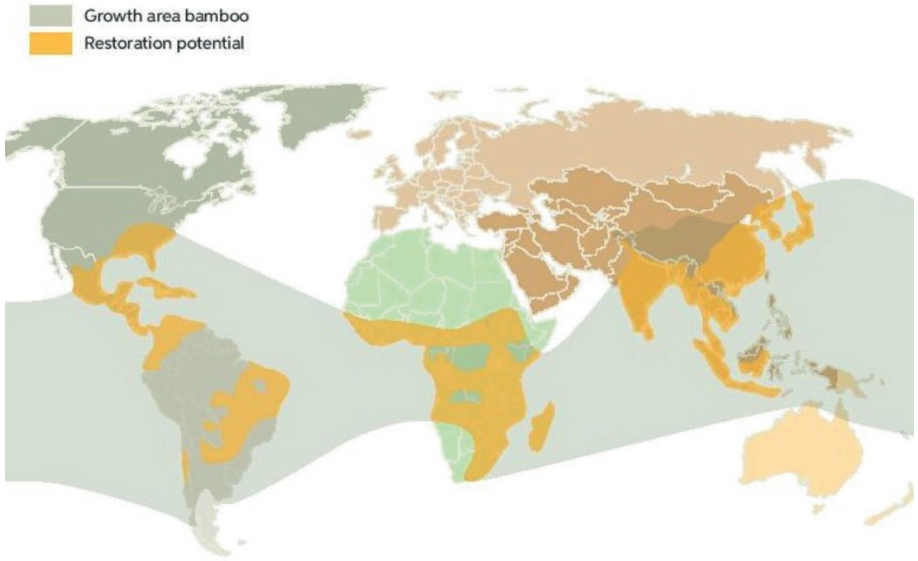
Orkidstudio is a humanitarian design organization that has completed a new home for disadvantaged and abandoned children in a small Kikuyu community on the outskirts of Nakuru, Kenya. This project is also known as the St Jerome’s Centre and departs from the typical orphanage design by limiting each room to just four children, offering ample space and natural light. It also includes various social spaces like open communal areas and quiet nooks for studying, reading and relaxing.

Built with the help of a diverse local group and a small team of architecture students, the construction used earthbags made from locally sourced soil with 20% clay content. The earth is packed into grain bags, that are stacked on one another to form durable massive walls. This method regulates temperature by absorbing heat during the day and releasing it at night. The project involved up to seventy people daily and was completed in only eight weeks of construction time. The process also included women who worked alongside men for equal pay, setting a precedent for employment equality in the area. The success of the project has led to further commissions for earthbag homes, promoting the transfer of skills within the community.

Additionally, the home features timber cladding made from pillar cores, a by-product of veneer processing, and includes a rainwater harvesting system with an integrated community tap, providing clean running water. The project exemplifies Orkidstudio‘s belief that design and construction can drive social change and empower communities through skill-sharing and collaboration.

BAMBOO

Bamboo stams are due to their cellulose fibers that function as a sort of reinforcement within each individual stam, a durable and strong building material. The average growing time for bamboo as a building material is between 4 and 5 years, as only after this time the fibre cells are fully matured. In addition to its strong fibres, the hollow structure of the stems adds to the durability and makes the bamboo one of the strongest ad efficient natural structures. The road and hollow shape is therefore highly sufficient and can absorb a great mechanical moment, that is even 1.9 times higher than a rectangular solid cross section of wood. Furtherrmore, the hollow shape is creating a great relation between weight per volume and the strength and stiffness of the material. Due to its large starch content, the bamboo as tobe protected from the ground, moisture and the sun, to make it less vulnerable against insects, termites and fungi that lower its durability. Especially when the bamboo is locally grown and produced, its one of the most sustainable building materials that can be used with an average footprint of 0.19kg CO2 eq/kg. A lot of different products and productions have been coming up during the last centuries to make bamboo use as efficient as possible and to use various different parts of the bamboo stems to produce different products. The utilization rate has risen to up to 85% percent creating a market for bamboo products all over the world.



~40%

cellulose fibres

~10%

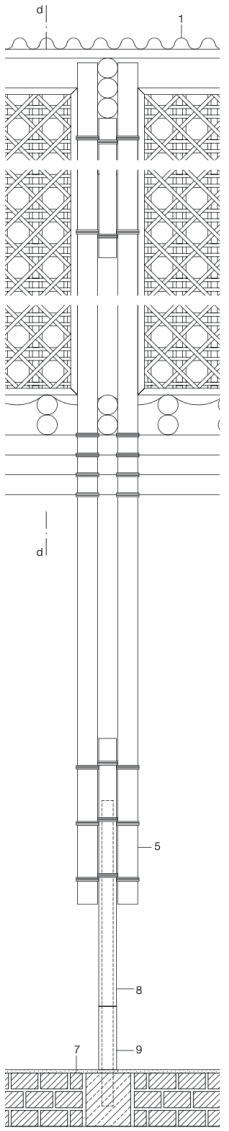
vascular bundles

~50%

parenchyma tissue

VOCATIONAL SCHOOL

The vocational school project in Rudrapur, Bangladesh is an exemplary model of sustainable and community-focused architecture. The school aims to provide practical and technical education to local students, utilizing traditional building techniques and materials like bamboo and earth. Heringer's design philosophy emphasizes the use of local materials and labor, integrating traditional methods with contemporary design to create a structure that is both functional and culturally relevant. The school is constructed primarily from mud and bamboo; rammed earth forms the massive walls, offering natural insulation and a comfortable indoor climate, while bamboo is used for the framework and roof, creating a second and lighter layer around the building.
Sustainability is a key priority in this project, achieved by minimizing environmental impact through the use of locally sourced, renewable materials. This approach not only reduces construction costs but also supports the local economy and preserves traditional craftsmanship. The construction process actively involved local workers and villagers, fostering a sense of ownership within the community.
The vocational school provides students with hands-on training in various trades, preparing them for employment and empowering them with practical skills and the building itself serves as an educational tool, showcasing sustainable construction techniques. The project has received international acclaim for its innovative approach to sustainable architecture and its positive impact on the community, illustrating the potential of combining modern design with traditional practices.

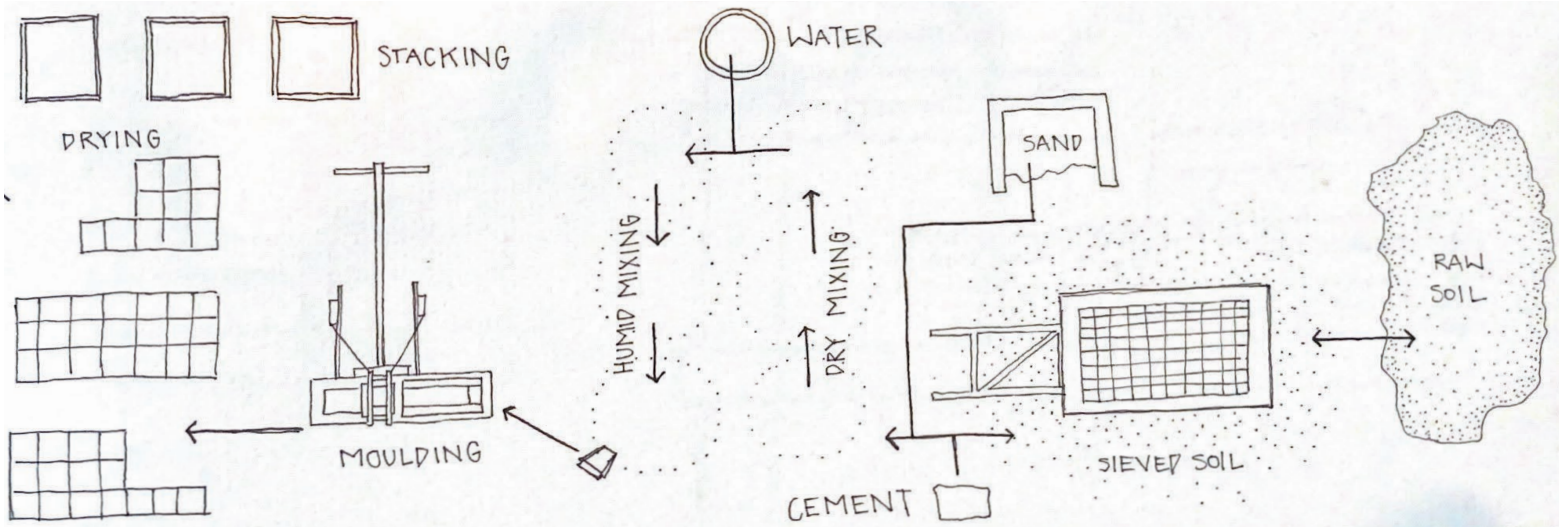


ARCHITECT	Anna Heringer
LOCATION	Rudrapur, Bangladesh
YEAR	2012

CSEB

Similar to traditional sun dried bricks, but compressed with a simple machine. The compression of the soil makes it really durable and strong and when mixed with a little bit of stabilizer the brick can even resemble the durability of local burnt bricks. Downside can be the vulnerability to moisture but this can be solved with some easy to follow design principles. If treated accordingly, the blocks can be used for load bearing walls and easily for thee story high buildings. Many producers of the compressing machines are claiming that every grown person can easily produce 500 bricks a day with this method, which makes the process and production efficient and easy to use on site (if those numbers are realistic, needs to be analysed and taken into account when planning with CSEBs)

Clay as a building material is becoming increasingly attractive, as clay is still available in sufficient quantities. In addition, at the end of the life cycle of an unfired clay material, the product can easily be reintroduced into the material cycle. The old stone is ground up, remixed with water and then pressed and dried. A new stone is created and can be used again as before. Even in rainy regions, such as Germany, it is permissible to use the stones for building heights of up to 13 meters.[5]



RAMMED EARTH

Rammed earth walls are a sustainable building technique that involves compacting a mixture of soil, sand, clay, and sometimes stabilizers like cement into molds to create solid, durable walls. This method, an evolution of traditional rammed earth construction, results in walls that are not only environmentally friendly but also possess excellent thermal mass, helping to regulate indoor temperatures. The process begins with the preparation of locally sourced soil, which is mixed with sand and clay, and sometimes small amounts of cement or lime for added stability. The mixture is then poured into molds or formwork and compacted in layers using manual or mechanical tampers. Once the layers are compacted, the walls are left to cure and harden, creating a solid, monolithic structure.

Rammed earth walls offer several advantages, including sustainability due to the use of local and natural materials, high thermal mass for energy efficiency, and aesthetic appeal with their natural, earthy appearance. They are also durable and fire-resistant, making them suitable for various climates and settings. This technique supports eco-friendly construction practices and can be adapted to modern architectural designs, promoting both environmental and social benefits in building projects.

STABALIZERS

Cement averagely 4-5% needed to be an effective stabalzier (in some occasions you can use less, but extensive research and try outs are needed to secure effectiveness with the soil components. In addition cement is a very recent and contemporary stabilizer as it as only been invented in the last century. It is a highly used product due to its effectiveness, but needs a lot of energy during the production process making not sustainable. Also the vavalability and the costs should be a factor in looking into more traditional and natural stabalizsers

Lime functions really well in combination with mud and can be found in shells and limestone all over the world, making it easily accessible and cheap. The ingredients resemble cement but are thousands of years old and don't need an excessive amount of energy in the production process. The needed quantity of lime again depends not he quality and the ingredients of the used soil, but are usually between 2-6% (usually 3% are sufficient).

lime and cement can be used in combination if you want to speed up the process, as lime is setting slowly which is then sped up by the added cement. Hereby and adequate mixture can be 1% of cement and 2% of lime.

TRADITIONAL STABALIZERS

Cow dung contains a lot of fibrous material and can be used in all sorts o mud work

Straw has no chemical advantages but helps to minimize cracking and makes the damp blocks manageable, especially used for solid with a high percentage of clay - also other fibers and be used

Urine the contained urea is functioning as a binder or glue with the soil mixture

Gum arabic binder and water proofer - all gums and resins can be used

Sugar and molasses crude waste jaggery is used as a binder as it is often high inn fibrous materials

Oil can be useful to water proof surfaces of mud walls. All oils are suitable for waterproofing but especially local coconut oil has been effective. This technique is not only handy for mus walls but can also be used in cement and concrete

Plant juices a lot of plants contain sticky sap that can function as a binder but also to waterproof the soil mixture. As the saps a often resinous the hardly mix with water and are harder to use within simple mud mixtures.

If you have a good mixture of soil, stabilizers are usually not needed at all. For soil that contains too much clay, sand can help to make the mixture more powerful and the other way around. Especially in rural areas, where you don't have any machines to analyze the soil components, simple testing and experimenting with the available soil will make the trick to produce stable and effect earth blocks.

FOOD PRODUCTION

FLOATING FARM

Floating farms, made out of bamboo wood and water hyacinths, are especially popular in the southern parts of Bangladesh. Bamboo wood is used as a frame and substructure and the water hyacinths are harvested, spread on the structure and hemmed to then be left to rest for a few weeks. This creates a fertile breeding ground in which seeds can be planted. The water hyacinths substrate is relatively rich in nutrients compared to regular soil and can withstand the constant moisture on the floating farms. The structures then provide space for versatile crops, vegetables, such as cucumber, eggplant or tomatoes, as well as herbs and fruits. Also the water underneath the gardens become more fertile which makes fish cultivation easier. The gardens can be extended as required and provide growing space for about 10 years before they need to be renewed. Generally the farms are increasing farmers income in food security by creating a system on how to use water to their advantage, but the structures of the floating farms are also very fragile and are often damaged or even destroyed by wave activity and increasingly severe flash floods.

SUITABLE CROP

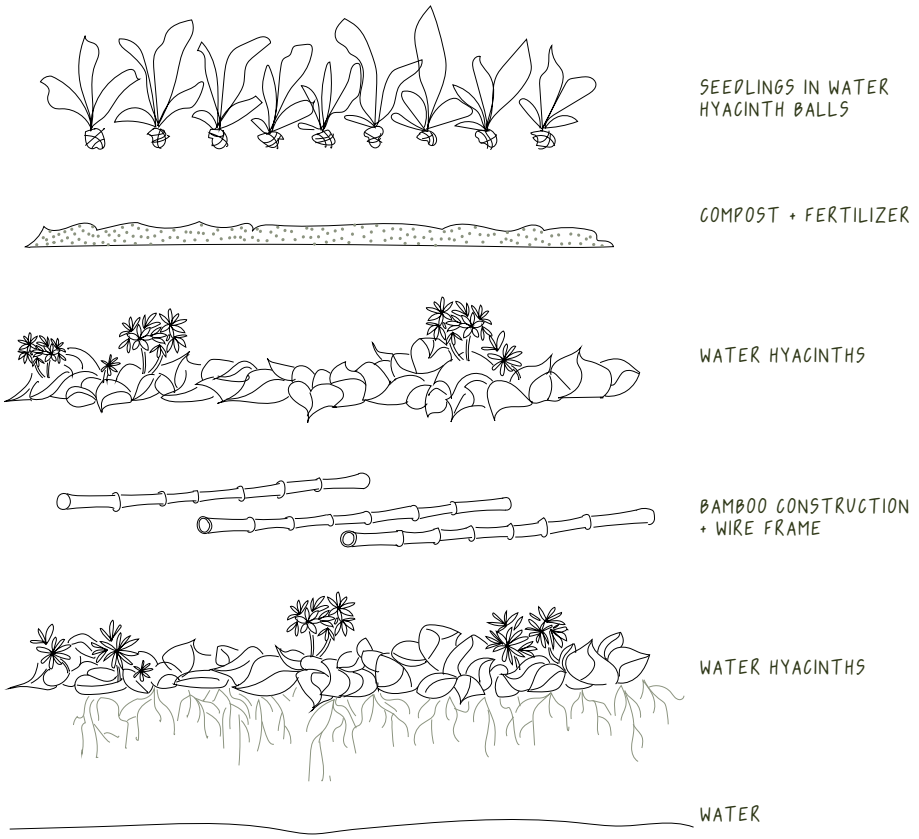
tomatoes, cucumber, spinach, eggplant, potatoes, spices, herbs

SUITABLE CONDITIONS

steady water, no wave activities, moderate water movement

NEEDED RESSOURCES

bamboo, strings, water hyacinths, cow dung, seedlings



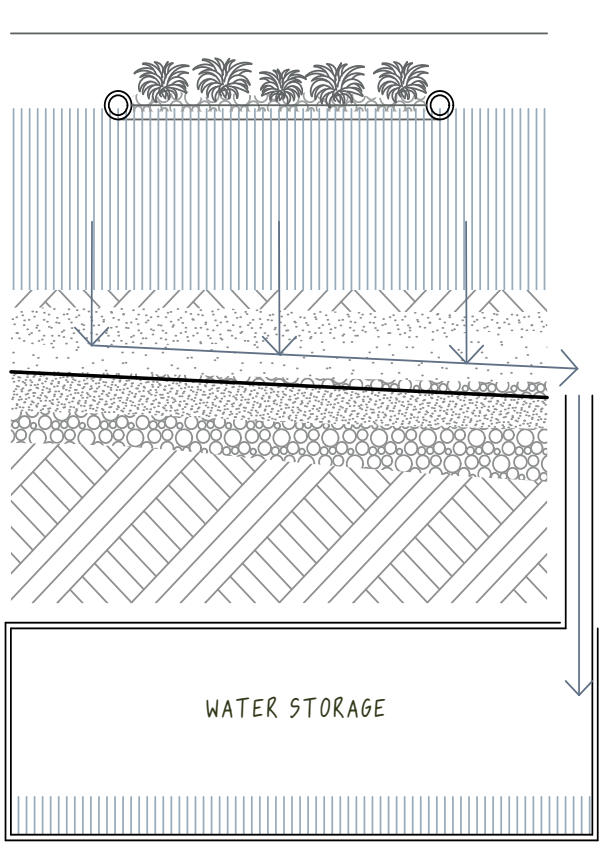
WATER HYACINTH

The water hyacinth is an invasive species originated in the Amazon's basin in south america that is responsible for the destruction of various ecosystems since 1900. Due to its rapid growth its clogging water ways like rivers and natural drainage areas causing and intensifying floods. It is a huge danger to the indigenous flora and fauna as it blocks sunlight from lower levels and uses a huge amount of oxygen from the water that plants and fish need to survive.

Islam, M. A.; Khandoker, M. S. A.; Chowdhury, S. „Constraints of floating farming in HVaor area of Bangladesh"; table 2

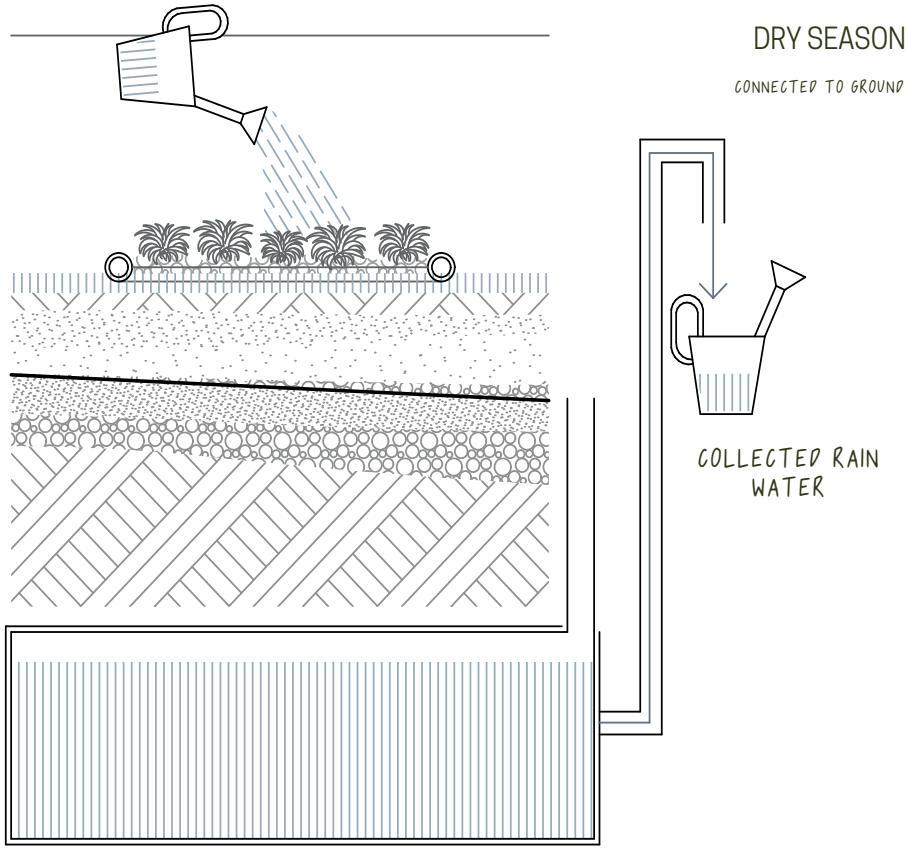
MONSOON SEASON

FLOATING ON WATER



DRY SEASON

CONNECTED TO GROUND



VERTICAL FARMING

Horticulture describes the cultivation of fruits, vegetables, nuts, sees, herbs, sprouts, mushrooms, flowers, seaweed and ornamental trees and flowers in soil. Focusing on smaller plots compared to large scale agriculture like paddy. Vegetable and fruit cultivation becomes more important for rice farmers as paddy cultivation is due to climate induced drought flash floods and shrinking groundwater, getting more challenging and a lot of farmers have already switched from rice to vegetables. There are three main production seasons for vegetables, two in summer, Kharif 1 and Kharif 2 and the third one in winter, Rabi. Summer production is more profitabel but also more challenging due to heavy rainfall and increased decease threats. On the production rate in winter is higher but therefore the prices are also lower.

OLERICULTURE production of vegetables

POMOGOLY production of fruits and nuts

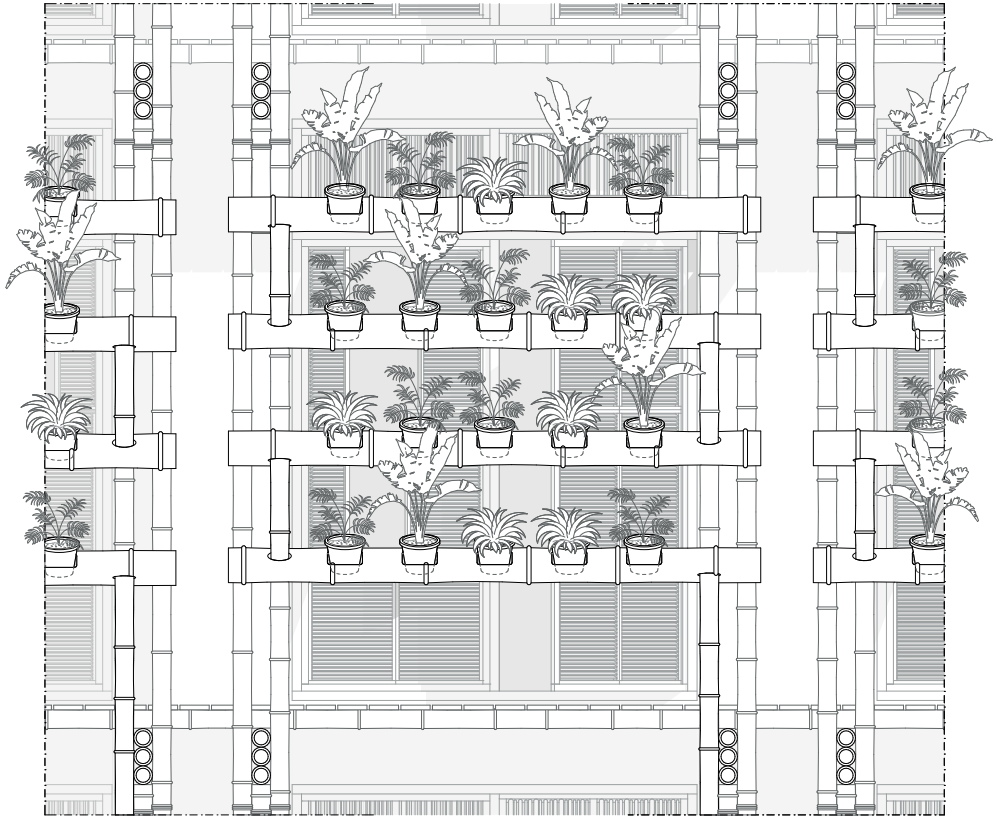
FLORICULTURE production of flowering and ornamental plants

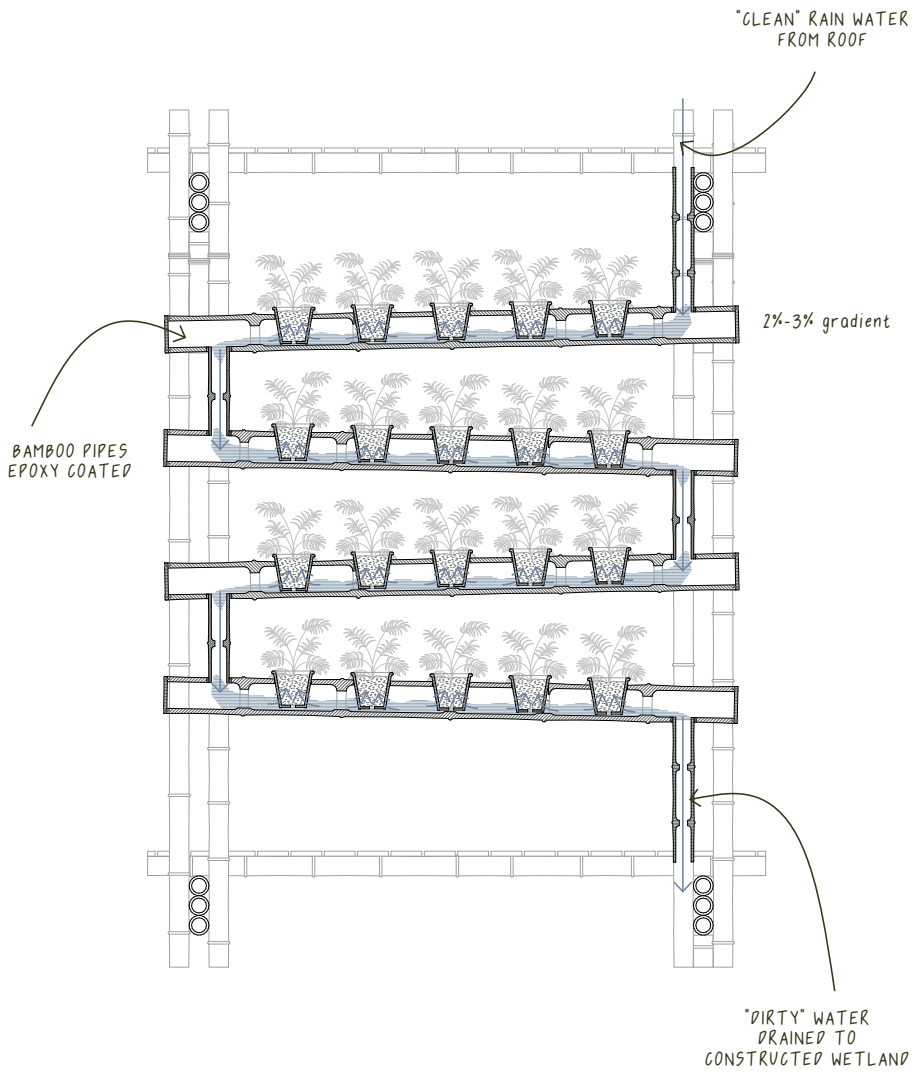
SUITABLE CROPS

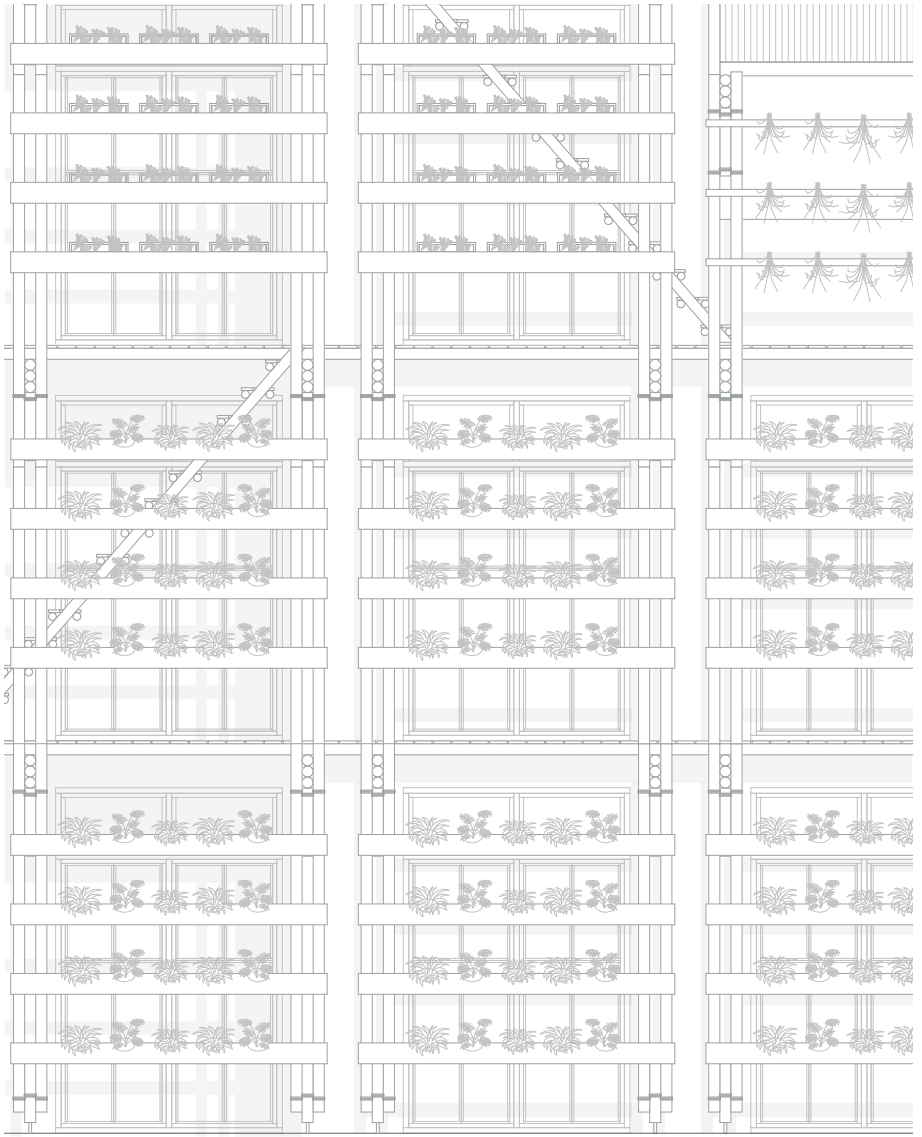
fruits, vegetables, nuts, sees, herbs, sprouts, mushrooms, flowers, seaweed, ornamental flowers

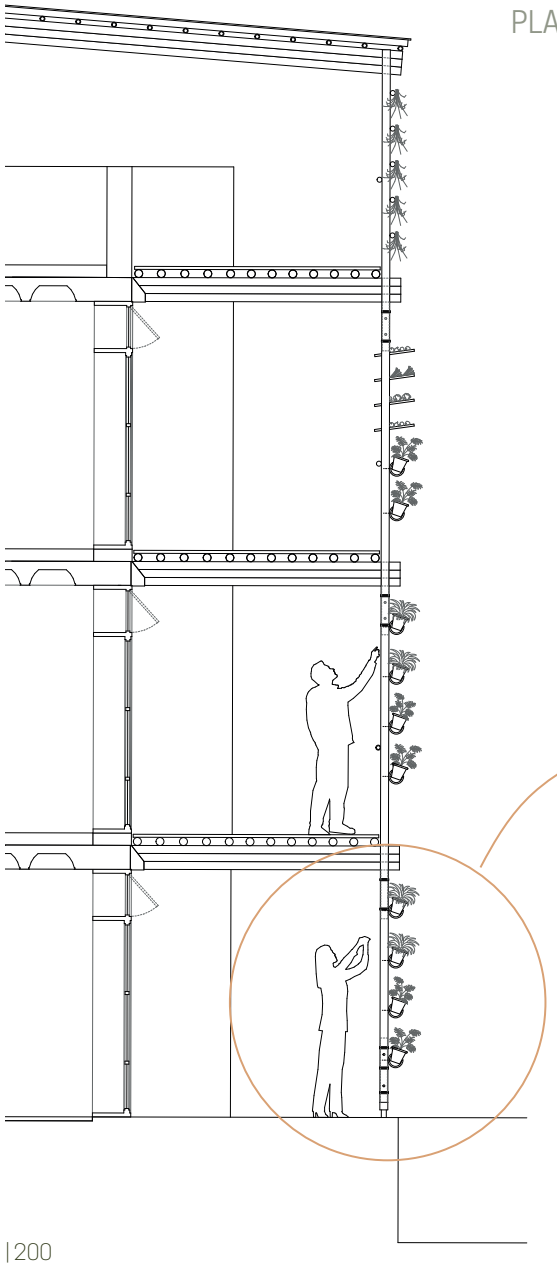
RISKS

climate change risks like droughts or flash floods, urbanization leads to less arable land

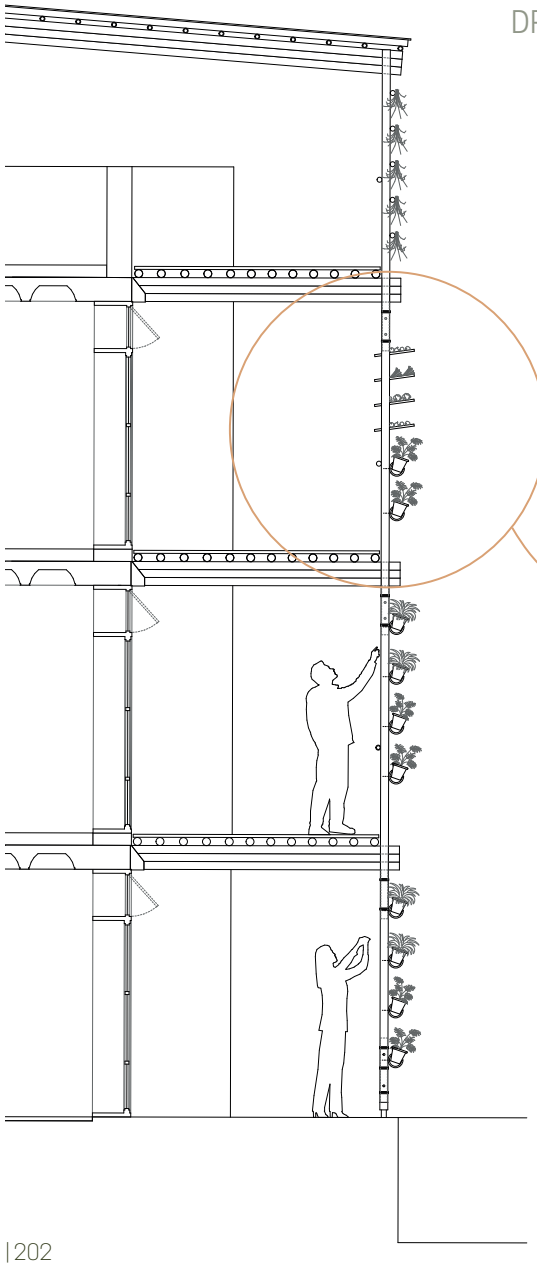



"CLEAN" RAIN WATER
FROM ROOF
2%-3% gradient
BAMBOO PIPES
EPOXY COATED
"DIRTY" WATER
DRAINED TO
CONSTRUCTED WETLAND

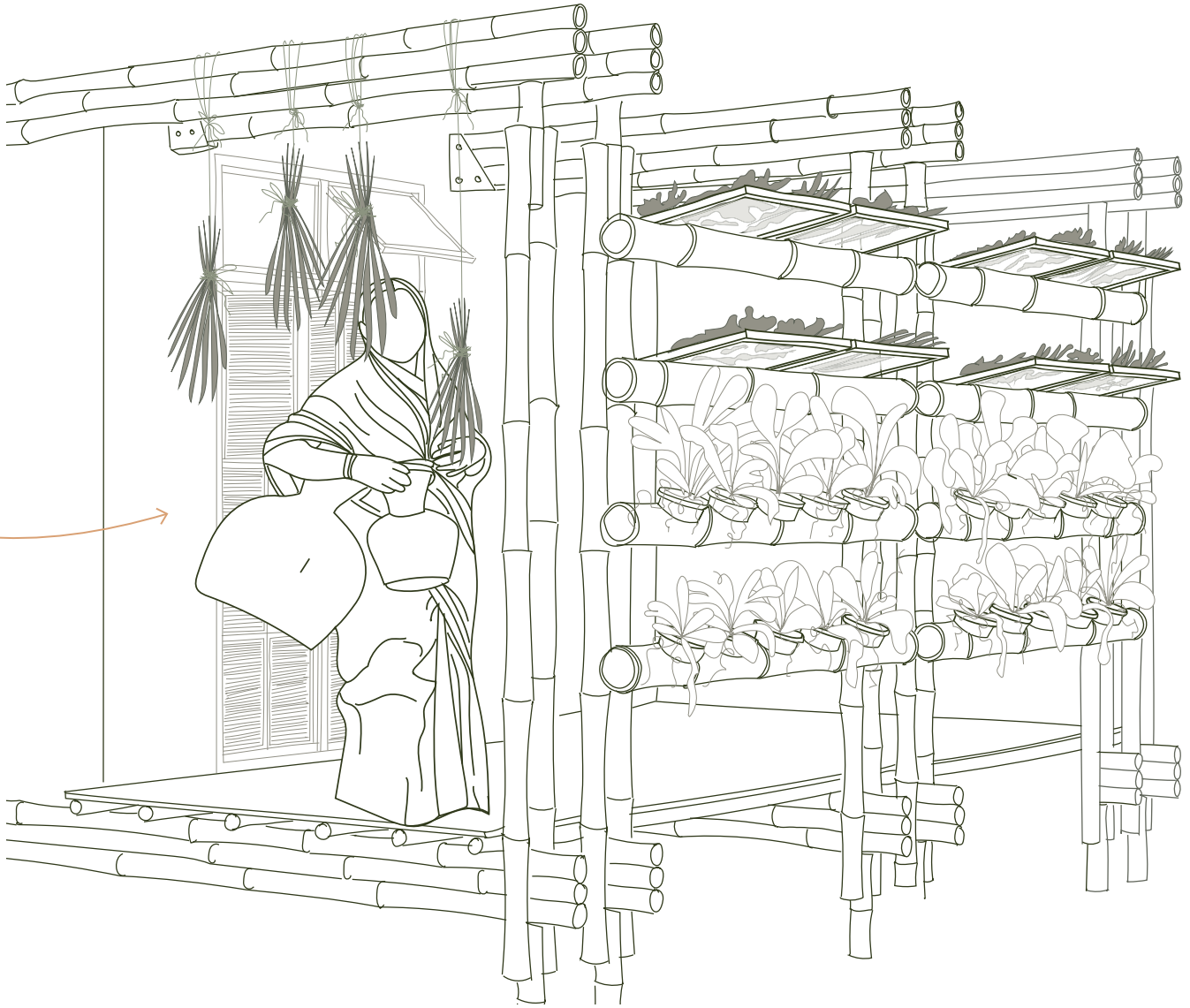




PLANTING | HARVESTING



DRYING



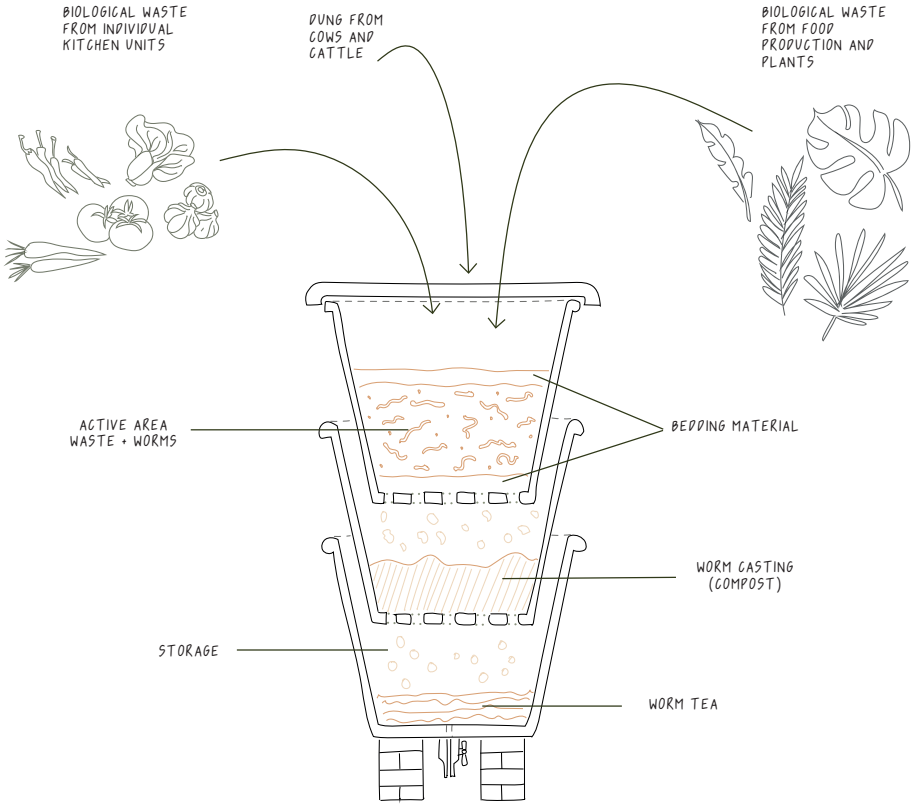
WASTE MANAGEMENT

COMPOSTING | CLUSTER

To address waste issues common in urbanizing areas, this masterplan introduces a comprehensive waste management and recycling concept to transform waste into a valuable resource. Recognizing waste as a significant challenge, the plan incorporates a two-scale recycling approach to ensure sustainability and efficiency.

At the cluster scale, the recycling system includes the collection of biological waste from households, food production within courtyards, and dung from livestock. This organic waste is gathered in dedicated areas within each cluster, enabling effective composting and recycling processes. By managing waste locally, the plan not only reduces the environmental impact but also creates compost that can be used to enhance soil quality for agriculture within the community. This holistic approach to waste management supports a smooth transition from rural to urban living while promoting environmental sustainability and resource efficiency.

Recycling stations are located in each cluster and in dedicated areas for the apartment buildings. This makes the recycling areas reachable for everyone and making the recycling process as easy as possible for the inhabitants, motivating people to take part in the system.



This recycling process employs tiger worms, also known as redworms. Preferred for their surface-dwelling nature and rapid population growth, these worms can double in number every month, significantly boosting the composting process. The worm castings produced are highly beneficial for soil, containing five times more nitrogen and eleven times more potassium than ordinary soil, thereby enhancing plant growth | fertility.

To optimize worm activity and reproduction, a damp, warm, and aerated environment is crucial. Under ideal conditions, 1,000 worms can multiply to 32,000 in just six months. It's important to manage excess liquid, known as ‚worm tea,' which serves as an excellent garden fertilizer. Proper drainage prevents the accumulation of liquid, which could otherwise create unfavorable conditions and odors, reducing worm productivity.

Vermicomposting bins vary based on the desired compost output. The simplest option is a plastic or clay storage tub with drainage holes. A more advanced method is a stacking tray system, where worms move upward in search of food, ensuring continuous compost production. This method involves adding bedding and food scraps to the bottom tray; once composted, worms migrate to the top tray containing fresh bedding through holes in the tray's bottom.[44]

[44] Holly McElroy, Vermicomposting and the importance of the tiger-worms, 2020

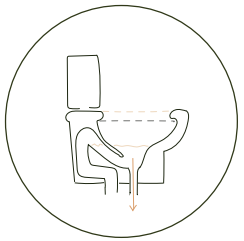
COMPOSTING | SITE

The second recycling station operates in three distinct areas, incorporating various waste streams to optimize resource recovery.

The first step focuses on collecting paper waste and finished products from the initial recycling station, integrating them into the urban recycling process. The second step handles liquids from household toilets, which are rich in nitrogen and potassium, essential for composting processes. The third step processes waste from plants and other organic materials, ensuring the necessary fiber content for effective composting.

The process requires a balance of two parts fiber to one part liquid to maintain optimal moisture levels. Given the potential shortfall in available fibers from the urban area, local farmers are encouraged to bring their agricultural waste to the recycling station, providing additional fibers.

TOILET LIQUIDS



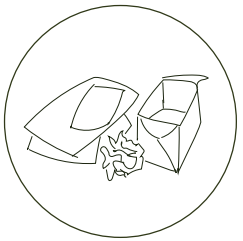
LIQUIDS SEPERATED IN SEPTIC TANK

NITROGEN

POTASSIUM

PHOSPHORUS

PAPER WASTE



PAPER + CARTON

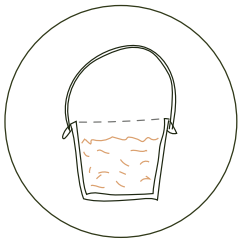
FIBRES

PLANTS | FIBRES

PLANTS + WASTE FROM RICE PRODUCTION

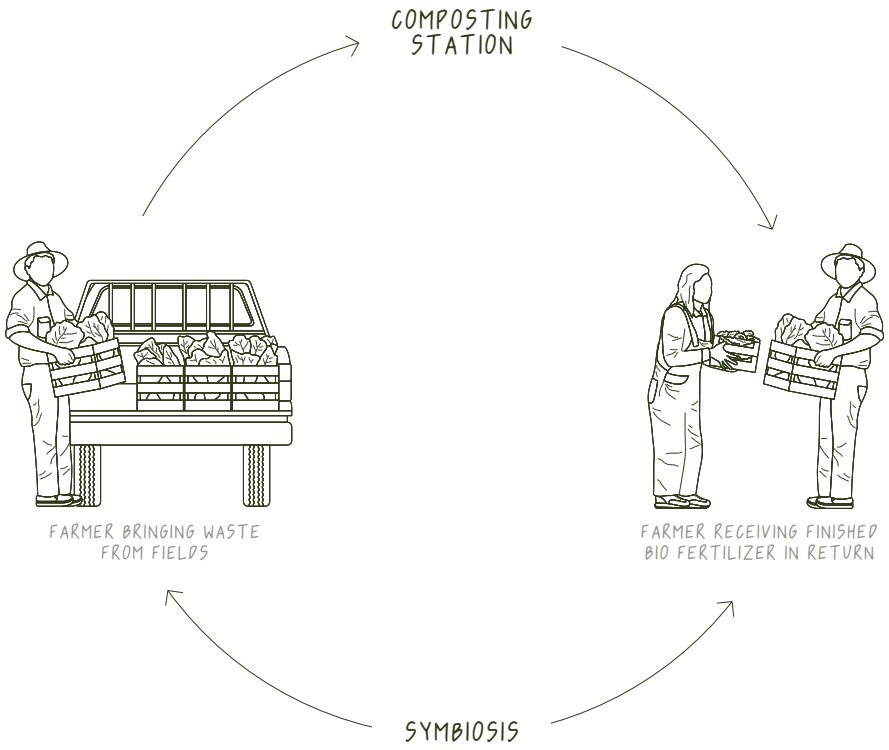
FIBRES

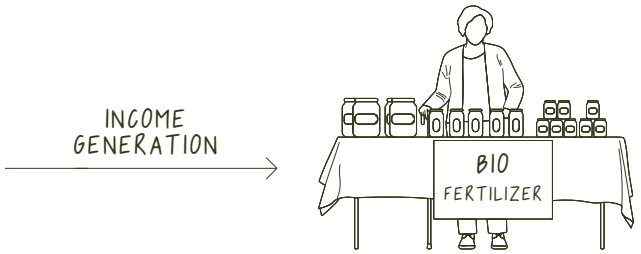
COMPOST



FINISHED COMPOST FROM CLUSTER STATION

FIBRES





This income generation strategy revolves around a symbiotic relationship between urban recycling stations and surrounding farmers. The composting and recycling stations depend on additional fibers supplied by farmers from the neighboring areas. Farmers bring their biological waste, such as leaves and hay, to the stations and receive high-quality, organic fertilizers in return.

This exchange provides farmers with superior fertilizers for their fields, enhancing their food production and promoting sustainable agricultural practices. Simultaneously, it supports the recycling stations‘ operation, ensuring effective waste management and resource utilization. This cycle fosters mutual benefits, as the urban area reduces waste and the farmers gain valuable compost.

Any excess fertilizer produced that is not distributed to farmers or used locally can be sold, generating a new source of income for the community. This strategy creates a sustainable, profitable system where both urban and rural participants benefit from the shared resources and collaborative efforts.

REFLECTION

MOTIVATION

In recent decades the issue of sustainability has become the focus of our society and affects us all due to the increasingly rapid consequences of global warming. As a mediator between people and the environment and also due to its great responsibility towards our available resources, architecture plays a major role in reducing global warming. But as architects, our task is not only to minimize the impact and provide for the future, but also to improve existing grievances and contribute to our built environment and the quality of life.

Bangladesh is one of the most densely populated countries in the world and is particularly affected by climate change due to its location and environmental conditions. These influences are particularly noticeable in the living conditions of local people, as flooding, pollution and a lack of financial resources, lead to an unsafe and inadequate housing environment. The topicality and urgency of the issue of improving housing conditions in the Global South was one of the reasons for me to choose the Global Housing Studio and to use my research and my Master's thesis to understand the current challenges and to develop new concepts and methods in which architecture acts as a mediator between human and nature. With the support of my tutors Rohan Varma, Marina Tabassum and Rocio Conesa Sanchez, I have embarked on this challenging journey of research and design to address the prevailing circumstances and adequately tame and improve them.

RESEARCH

One of the most important elements of my research and the development of a research question were the almost three weeks we spent with the studio on site. The impressions and experiences I had on this trip were substantially and had a significant impact on me personally, but also academically, and laid the foundation for the last months of research, experimentation and design. Already on site, I discovered fascination for the role of nature in our built environment and the extent to which we can sustainably shape the unavoidable growth of cities in order to give nature a place in densely populated cities.

Bangladesh has an incredible and vivid biodiversity, which contributes significantly to the preservation of the ecosystem and the quality of life but is also challenged by the prevailing and shaping delta environment. My research has focused on the current conditions in the periphery of Sylhet and how the positive aspects of rural life can be integrated and preserved in the growth of the city. Prevailing rural challenges are combined with the challenges and potentials of the city and merged into a harmonious coexistence. This analysis of two extremes (urban and rural), but also of already developed systems, was extremely demanding at times, but at the same time also revealed many possibilities and design ideas that enabled me to develop the project „Transition" in its entirety.

My research was based on a multidisciplinary approach in which I used various different methods like, sketching, reading, analyzing video and photo material that were taken during our trip, but also talking to the people and listening to their goals and aims for their built environment. Looking back, the most influential aspects of my research were my own observations and experiences and the conversance with locals, which I was subsequently able to consolidate and solidify with the help of the sources and examples available to us at Bouwkunde.

PROCESS

At the beginning of the project and especially at the beginning of the research, I focused particularly on the haor region and dealt with floodplains and the seasonal monsoon period. Water and flooding were the central theme and my main focus especially before the field trip. On site, however, I quickly realized that I was particularly interested in the local nature and how people interact with their natural environment, especially in the context of a rural to urban transition. The flora and fauna that I found gradually came more and more into focus and, the immense displacement of nature by agricultural land and urban structures became unambiguous. Although agricultural land and rice fields in particular were omnipresent, many local people were starving and suffering from extreme vitamin and nutrient deficiencies. This paradox became the guiding principle of my research and led me to various topics and challenges in rural but also in urban areas. During the research phase, I then delved deeper and deeper into agricultural processes, especially rice cultivation. But shortly after starting my design process, I realized that the implementation in terms of land use but also in solving the nutrient deficiency, won't be effective and solution orientated.

This was only one of several realizations during my research and shows how much my research has influenced my design decisions. But not only has the research effected my designs, but also has the design immensely effected my research and especially my interests. The process was therefore a constant give and take between design and research and was often paralyzing but also greatly enriching my process and my final products.

The organization of the graduation program at TU Delft is to first focus on research, after which you then start the design process with the newly gained knowledge from your research. Although the two phases flowed smoothly into each other and weren't strictly separated in my project, I would have liked my research, the field work and the design process to go even more hand in hand and to be developed simultaneously from the beginning on. Due to my limited knowledge of the Global South at the beginning of the year, I had little to no use for the research that I did at the start of the studio. For me personally the connection to the place and also to my future design was simply missing to set my priorities in my research straight. Ultimately, this meant that the missing research had to be made up for during the design process, which resulted in an extreme amount of work and pressure that I would have loved to put more into my design.

AIM

The focus of my project is on the development of an incremental housing system in which all income groups, food production but also nature go hand in hand and form an almost self sustaining union. In particular, the integration of the individual in the development of an architecture and a community is placed in order to strengthen each individual and at the same time create a sense of community. This not only promotes the quality of life and individuality of the residents, but a community also creates a sense of belonging, which results in respect and care for the surrounding environment. By creating various opportunities for self sustained living, food production but also strengthening the connection to the city, „Transition" offers space for various ways of living, different income groups and people with different backgrounds and aims. This allows the community to become rich in culture, opportunities and have a broad exchange of knowledge and believes.
In my understanding, architecture should always have a mediating function and bring people and nature together and therefore ensure a liveable and self-determined environment in which everyone benefits from each other.

APPLICABILITY

Due to the ever-increasing effects of climate change, the constantly growing world population, but also the ever-widening gap between rich and poor, is Bangladesh unfortunately not an isolated case with its challenges and difficulties. The focus on developing low-income housing that enables everyone to have a roof over their

heads and build a home for themselves and their families is therefore a major issue that need to be addressed and should be one of the core objectives of every architect. The principles of using local and resource efficient materials can be applied to any location in the world and are one of the starting points for sustainable growth on our planet. „Transition" focuses on the creation of communities within a place through architecture, increasing a sense of belonging and ownership. More ownership leads to a greater interest in optimization, but also to more mindfulness of each other, the place itself and its development. My design includes many processes, such as water and waste management, which require help from the residents, but at the same time also address global problems that can be found everywhere and offer solutions on a small scale. Recycling, but also the conscious use of water and resources, is of great importance not only in Bangladesh, and can be tackled with local systems and self-sustained living solutions.
Furthermore, the integration of food production systems for efficient small scale gardening supports the food security of the residents and promotes a more balanced diet through an additional supply of nutrients. Expensive products, such as fruits and vegetables, can be grown in the communities under their own responsibility and even support the families' income if there is a surplus. There are also places for income generation as well as schools and community areas where knowledge and experiences can be exchanged. This constant exchange of knowledge, but also the opportunity to open own businesses, enables income and more financial security.
My addressed topics therefore strike at the he

art of the Global Housing Studio's beliefs and address global topics like self sustained living, resource optimized building, incremntailty and food security. It deals with lower income groups and the impending challenges of the global south and applies the knowledge I have gained in the last semesters of my Masters and applies it in a diverse and global context. Architecture acts as a mediator between man and nature, between individual and community and between rural and urban.

LOOKING BACK

When I look back on the process and development of my thesis project, I am deeply grateful for the experiences and knowledge I was able to gain during this time. The impressions I was able to gather during our trip not only shaped my project, but also had an impressive impact on me and grounded me in many ways. The design process was very challenging at times, as I was used to drawing on my own knowledge, experience and preferences regarding architecture and my surroundings from previous projects. Dealing with the environment and living conditions of the Global South did not allow me to fall back on those personal experiences and challenged me to change my perspective in many respects in order to adequately approach and accept the design assignment. However, this change of perspective opened many doors for me and visibly broadened my horizons not only for my university work but also for future projects and my personal perception of our built environment.