Hybrid Landscapes:
Nature, Architectural Form, and Cultural Programming for Resiliency in the Mekong Delta

by

Melissa Nguyen

Submitted in partial fulfilment of the requirements
for the degree of Master of Architecture

at

Dalhousie University
Halifax, Nova Scotia
June 2020

Contents

Abstract

The Vietnamese Mekong Delta is a region characterized by the entwined natural and human landscapes that are perpetually being redefined. From the colonial periods to post-war nation-building, homogeneous modernization ideologies has led to a commodification of the delta and disjunction between the people and natural resources that sustain them.

This thesis hybridizes architecture and programming to revive the nature-as-culture identity, reconciling war-torn and exploited mangrove landscapes with the locals that depend on them. Situated in Năm Căn, a rural coastal town, proposed education and community buildings will house new cultural programs. Education classes will foster a sustainable, high-value shrimp economy for small-scale farmers. Workshops will promote cultural exchange through mangrove-based programs for local skills development, traditional craft tutorials for tourists, and coastal protection. These programs are facilitated by place-specific architectural strategies that reconnect people to their environment, and to one another, in a dynamic social space at the river's edge.

Acknowledgements

I would like to thank Catherine Venart and Susan Fitzgerald for your dedication, guidance, and encouragement to continually push this thesis.

A special thank you to my uncle, Phuoc, for sharing your photos and knowledge of the site, Valerie Chang for coming through in my hour of need, and all of my friends and colleagues at Dalhousie University.

To my Mom, my Dad, Christine, and Rachel, for your support and care throughout my architectural education and beyond. None of this would mean anything without you.

Finally, I would like to thank my family, my friends, and the people I have met in Vietnam for showing me the beauty and strength of the Vietnamese community. Your love for the country and its traditions has inspired my own, and provided me with the drive to pursue this thesis project.

Xin cảm ơn, tất cả.

Chapter 1: Introduction

Culture and Landscape Identities

The interconnectedness of natural systems and human systems is at the heart of the Mekong Delta. The intertwinement of settlements, land, and water have long been apparent in areas where water becomes not just the backdrop of a landscape but as an ordering power that dictates and sustains life and livelihood. The metabolic component of water and land often reveal a place's history through land-scapes and land-forms (Gandy 2014, 218-219), their dialogue then playing an instrumental role in the formation and growth of towns and cities (Tvedt and Oestigaard 2014, 1). Infrastructure and technology are also closely tied to the formation of settlements in water-dominated environments, harnessing nature's resources for human use (Gandy 2014, 2-4). The word *landscape*, first appearing in the English language via the Dutch *landschap*, is a concept attributed to land appropriated for drainage and cultivation (Gandy 2014, 3). In the Vietnamese language, similar connections between nature and people are revealed through etymology. *Đất nước* is the Vietnamese word for "country", where *đất* means, "soil", and *nước* means, "water". The embedded scales of individual, community, and country are revealed here to be mediated through traditional ties to nature. The dragon in Vietnamese mythology is a sacred animal representing the main element of water. The Vietnamese symbol of Yang, of the Chinese Yin and Yang, represent the universe, life, existence, and growth. The Mekong River, as it flows through the flat topography of the delta, carves the land, branching out first into two main distributaries, the Mekong River and the Hậu River, and then

A photographic collage of Vietnamese ties to the water and land of the country. The earliest settlements were from the northern delta, Red River Delta, and slowly migrated to the southern delta, the Mekong Delta beginning in the 11th century. (base map from Google Maps 2015)

into nine channels before reaching the sea at nine estuaries. The Vietnamese have aptly named these channels, *Bang Sông Cửu Long*, or, The River of Nine Dragons (Balica et al. 2014, 260; Renaud and Kuenzer 2012, 3). In turn, the water of the rivers have met with the fertile lands to feed the agrarian civilizations that have settled in the Mekong Delta for centuries.

Water, Land, and Hydraulic Civilizations

The spine of these settlements became the rivers and streams that served as natural infrastructure for transportation and commerce and in turn, informed architectural settlement

typologies (De Meulder and Shannon 2019, 296). These are the characteristics of early water-based settlements, indigenous built adaptations to the complex hydro-ecology whereby proper maintenance and care for natural resources were safeguarded to ensure the continuation of culture and livelihoods (Benedikter 2014). The transition from this modality began as a shift to despotic powers seeking dominance over the natural world (Benedikter 2014, 548). Termed by Karl Wittfogel in *Oriental Despotism* (1957), "hydraulic civilizations", the most prominent of which have stemmed from the Asiatic regions of the world, are societies created and maintained through and via a strict form of total political control, as a form of "agrarian despotism" (Benedikter 2014; Wittfogel 1957). The interweaving of society and the land ecology changes with the change of societal economies and infrastructures, as Wittfogel (1957, 11) states: "nature changes profoundly whenever man in response to simple or complex historical causes, profoundly changes his technical equipment, his social organization and his world outlook". The process of human transformation and actualization of the land in turn feeds back through nature's acquisition of new functions and appearances (Wittfogel 1957, 12; Shannon 2009).

Situating Vietnam and the Mekong Delta. (base map from Open Development Mekong 2016)

The Modernity Paradox

"Modernity" and "modernization" are terms that describe the continual transformation of the water/land and human nexus. These terms are often embedded with unilateral intentions and are closely tied to the European experience. The historic events of the Mekong Delta act, to a certain extent, as a reflection of the conditions of change within Vietnam at large. A rather tumultuous past has seen centuries of imposition from the Chinese, the French, Japanese, Soviets,

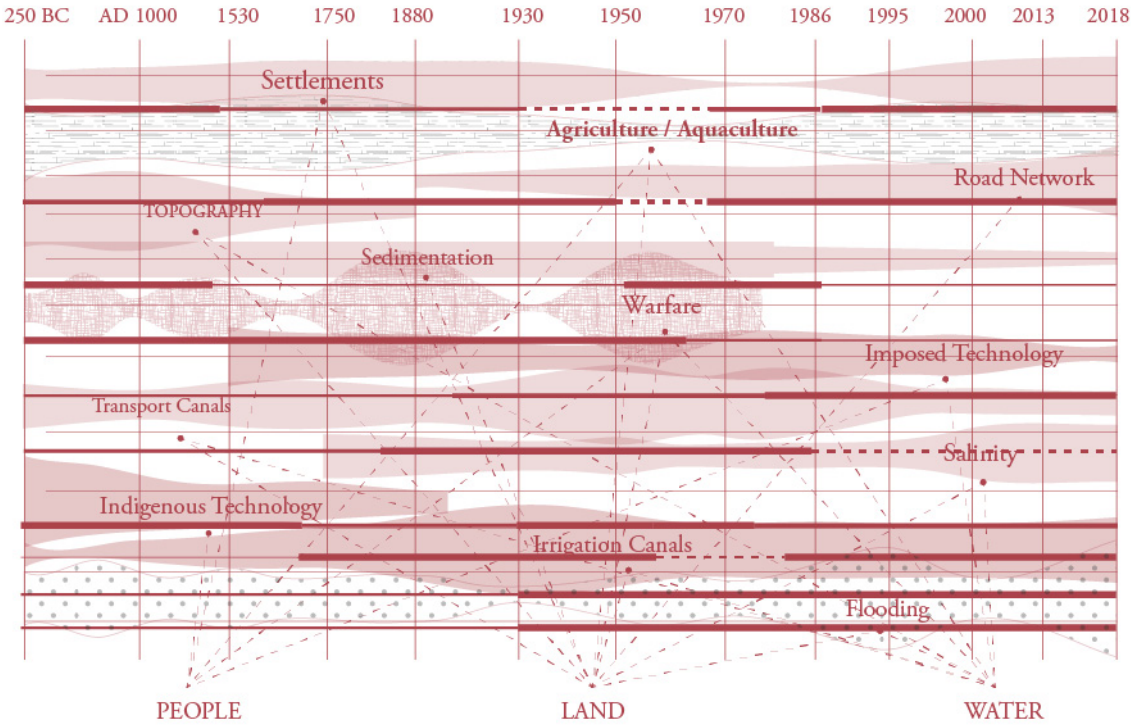


Diagram highlighting key thesis topics, their intensity, and linkages throughout the Mekong Delta. The emergent image is one of complex interconnectivity.

American, and more recently, to globalization following open market reforms. While the region's ability to recover and repair decades of war and destruction has significantly improved millions of lives in the immediate present, this modernity paradox belies the underpinnings of colonial ideologies, industrialization, mechanized land use, and an intensified import/export economy that has shifted from water/land as culture to water/land appropriation. The result of which is revealed in the proliferation of Western imported urban infrastructure, settlement patterns, and building forms (Yeang 1987, 8) that operate independent from the processes of the environment. Architecture and design emerges as the smallest unit of this modernity paradox. Left to the periphery of development and architectural design discourse, homogenization of landscapes (human and nature) and culture becomes the result.

Kenneth Frampton's theory of Critical Regionalism (1953), a critique against the role of modernity, thus emerges as a jumping point to re-evaluate a more suitable design paradigm, situated in the specificities of place. In his explorations the specificities of place adhere to contextual conditions: climate, light, topography, and tectonic form (the craft of construction). Where this thesis begins as an extrapolation is its focus on how architecture can respond to the cultural conditions of place and take advantage of complexity and heterogeneity. To bring to synergy an environmental response with the dynamic (and ever-changing) rituals and narratives of local people in multi-faceted ways.

Thesis Question

The modernity paradox that I have described defines the current paradigm of land-use and urban development in the Mekong Delta, which in many respects is an attempt to "catch-up" to global modernization after decades of imposition, war, and erasure. In light of climate change, however, this race fails to acknowledge the susceptibility of the delta as a functional water and land-scape, and with it, the susceptibility of communities that depend on its resources. A delicate balance between land, water, and human livelihood needs to be maintained if we are to safeguard it for the future. The role of architecture then seeks to mediate the dialogue between nature and culture, to highlight one's responsibility to water, land, and to each other.

How can the reconnection of culture and nature be mediated by a hybrid approach to regional architecture in a modernizing Mekong Delta?

Chapter 2: A Delta in Flux

A History of Landscape Imposition

Landscape as Culture

The hydrology of the Mekong Delta is defined by the trans-boundary Mekong River. The Mekong River Basin encompasses the six countries that the river flows through: China, Myanmar, Laos, Thailand, Cambodia, and Vietnam. The river flows for 4,800 kilometres beginning at an elevation of 5000 metres above sea level (ASL) in China and exiting into the East Sea at it's lowest point, no more than 5 metres ASL, in Vietnam (Balica et al. 2014; Vo 2012, 49). The region experiences a tropical monsoonal climate that fluctuates between extreme wet and dry seasons. The wet season lasts from mid-May to November, with monsoonal months occurring from July to November, and the dry season from December to April. There are two types of flooding that affects the Mekong Delta: freshwater floods from upstream, which are longer floods, with inundation up to 3 metres (Marchand, Pham and Le 2014, 230) lasting from 2-6 months (Vo 2012, 57). The second type of flooding

Collage of local agrarian uses of land and water throughout the Mekong Delta.

A map of the Mekong River Basin and changes in elevation. The Tonlé Sap controls the freshwater floods into the Mekong Delta. (base map from Open Development Mekong 2015; Google Maps 2015; photos from NASA Earth Observatory n.d.; data from Vo 2012, 50)

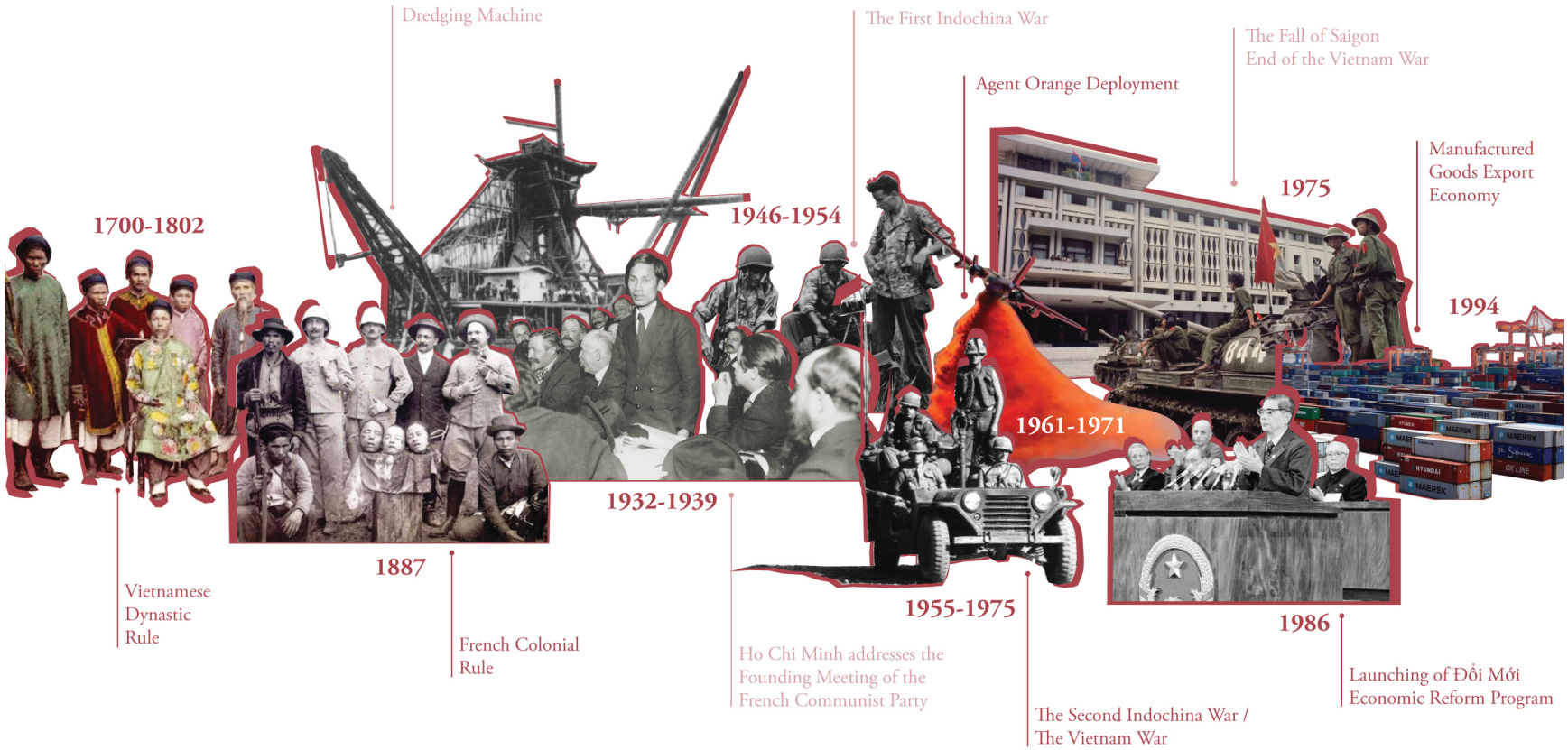
is triggered by tidal regimes in the Gulf of Thailand to the west and the East Sea to the east and south (Balica et al. 2014). The low topography results in heavy flooding during monsoonal months, being regulated by the Tonlé Sap lake in Cambodia, the "beating heart" of the Mekong River that controls its flood pulse down river (Vo 2012, 51). The natural hydrological regime of the Mekong Delta presents a fluctuating system involving precipitation, river discharge

rates, and tidal influences. This complex system also impacts the way the land is shaped and composed.

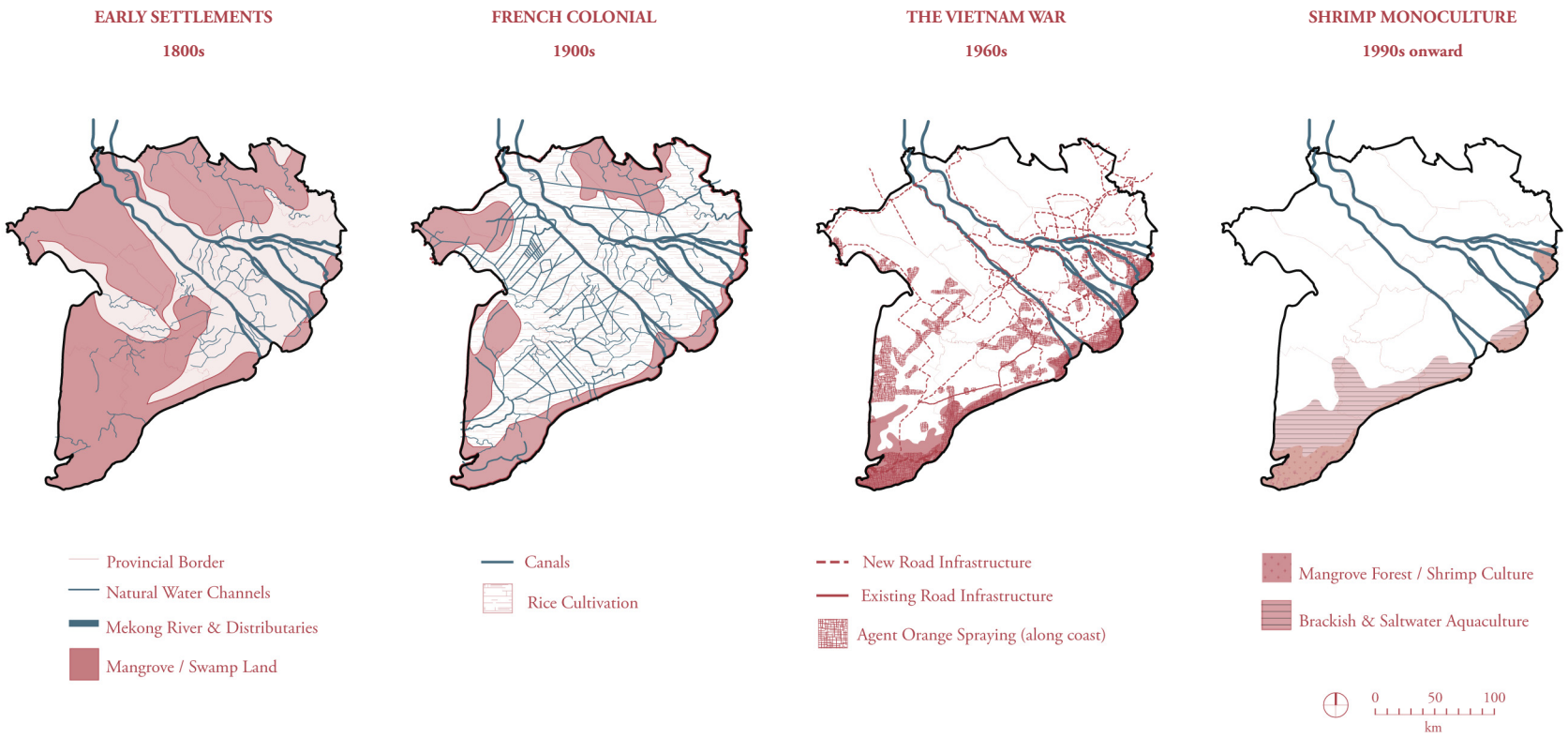
The Mekong Delta was formed through this process of flooding and land propagation (sedimentation) over the past 7,500 years (Liu et al. 2017, 78). The earliest accounts of these lands were covered with thick mangrove forests and swampy grounds with few and far habitable areas. The natural formation of levees along rivers from deposited alluvium created an elevated level (2-3 metres ASL) that people inhabited, building homes atop them. This provided safety from high tides and flooding while still having access to water for transportation and commerce (De Meulder and Shannon 2019; Pham and Pham 2011). On the other side of the house, away from the river, high banks provided easily controlled drainage to create farmlands, utilizing integrated farming systems, and irrigation capabilities (De Meulder and Shannon 2019, 295). The continued cut-and-fill strategies has created a landscape of “micro-topographies”, a typical composition for farmlands (De Meulder and Shannon 2013, 122). Trees were planted atop these elevated grounds, the roots of which would provide the structure to solidify moved earth. The impetus for achieving high crop yields during this time were aimed for local consumption by and for local families, and craft production utilizing local resources provided extra income (Brocheux 1995, 71). The complex hydrologic system of the Mekong Delta became interweaved into the early formations of settlements in the region whereby an “interdependency, yet autonomy, of ‘earth and water’” became a central idea to the culture and pragmatism of everyday Vietnamese life (Shannon 2009). It was through the symbolism of the landscape but also the

transformation of it to culture and productivity that evidently shaped the Vietnamese deltaic society (Shannon 2009, 55).

In the pre-Western colonial period (acknowledging the colonialization of Vietnam by China), the waterways were the main method of transportation, the “amphibious ecology” making it difficult for any kind of road construction. The two major canals of pre-Western colonial times was the Vĩnh Tế canal, stretching from Hà Tiên to Châu Đốc along the Cambodian border, and the Long An Ha canal, from Rạch Giá to Long Xuyên (Brocheux 1995, 11). These transverse routes were mainly used as passageways, rather than for irrigation, connecting routes to the major ports along the coast to inland commerce points (Brocheux 1995, 16). The relationship between settlements and flowing water was that of special reverence and often abided by the traditions of *phong thủy*, or *feng shui*, “the science of wind and water” (Shannon 2009, 55; Vo 2018, 6). The supernatural belief of *chi*, one’s energy source, was a continual and cyclical flow of energy within the universe, within the environment, down to within one’s home. Order and directionality were imperative aspects of maintaining one’s *chi*. Folk belief in *phong thủy* required individuals to pay respects to the spirits of the place and obtain permission to alter nature in anyway (from choosing lands to settle to cutting down a tree for construction material) (Vo 2018, 6). They do so to request protection of their house and those living in it (Vo 2018, 6). The fluxes of water level became intimate knowledge by the locals and aided in travel for interregional commerce: moving towards local commercial “hot spots” (*giáp nước*) during high tide, and returning home when the current reversed for low tide (Biggs 2010, 32).



Timeline of the periods of history this thesis will examine: Dynastic period, French Colonial Rule, American Imposition and the Vietnam War, to contemporary economic reformations. Modernity and modernization has been a central ideology that has permeated each of these time periods. (images from, left to right, Tran 2014; Alpha History, n.d.; Robinson 1907; Bria 2017, Saboureau 1907, 150; WNYC Studios 2017; Hynes 2015; Nguyen 2017; Bao Da Nang 2020; Nguyen 2019)



A series of maps outlining landscape changes with each time period: early settlements and predominant natural forest cover, French colonial canal mechanization, American Lines of Communication Program implemented during the Vietnam War to extend roads into the deepest parts of the Mekong Delta as well as mangrove deforestation missions, and contemporary shrimp monoculture. (base map from Open Development Mekong 2016; Google Maps 2015; data from Marchand, Pham and Le 2014)

French Colonial Period: Water Mechanization

The southern third of present-day Vietnam, referred to then as *Cochinchine*, became a French colony in 1859 (Jamieson 1993). Spearheaded by then governor-general Paul Doumer, the introduction of Western science and technology would forever change the Vietnamese deltaic landscape. Large public works infrastructure like bridges, railroads and ports to facilitate new markets and trade routes boomed in the early colonial years (Jamieson 1993; Buttinger 1958). In the Mekong Delta, large swaths of swamplands and mangroves, considered as wild and untamed lands by the French, were drained and cultivated through numerous canalization projects. Between 1880 and 1937, the total cultivated area rose from an estimated 552,000 hectares to 2,200,000 hectares (Shannon 2009, 56) The goal of expedited land reformation for cultivation was achieved by the implementation of a new French land ownership system. The resultant effect of that goal saw

View of Vietnamese workers digging the Nicolaï canal, or Chợ Gạo canal, in 1875. (Tommy Japan 2014)

the rise of a labour class, comprised of farmers stripped of their land entitlements, and free trade (Brocheux 1995, 51). For the French, they viewed trade liberalism as a form of modernization of the new colony and that opportunities for profits could be obtained by tapping into a lucrative rice export economy. New avenues for commerce in the Mekong Delta stimulated the economy but in turn created a system and people dependent on rice monoculture (Brocheux 1995, 52). Monocultures became the norm throughout the cultivation communities as strict rice production was imposed by French colonists and backed by an emerging class of French-educated Vietnamese whom owned land and rented out to tenant farmers (Callison 1983, 94).

By the 1920s, every sector in the Vietnamese economy had become mechanized for a market economy. Where the Mekong Delta's resources were traditionally injected with hydraulic infrastructure that served agricultural purposes of flood protection and salinity intrusion control, they were now being intensified for exports, a system that stood independent from and counter to the hydrology of the landscape (Shannon 2009). It also completely rerouted not just the natural water flow, but how it functioned. Settled lands once protected from high waters were now experiencing inundation with higher than normal flood levels. Water channels became blocked becoming stagnant and toxic. Poor drainage ensued all the while salt waters from the sea permeated deeper into the inner fertile soils (Shannon 2009). Farmers were experiencing hardships from severe debt (a result of French-directed loan systems as well as usury practices) that resulted in reduced quality of living or even homelessness, low morale, and lost trust in the promised benefits of French modernity (Brocheux 1995).

For many Vietnamese landowners, newly imposed French land tenure systems and enforcement resulted in land dispossession and their proletarianization (Brocheux 1995, 92) which inspired little desire for them to maintain the health of the land, in fact exploiting it for higher monetary gains. Farmers and farmer families saw little food for subsistence, as a fully-fledged rice export market had consumed any and all rice yield. When the Great Depression hit in 1929, Vietnam too, as intertwined in the global economic market as any other nation, felt havoc ripple through the economy (Jamieson 1993). Anti-French sentiments, which had been brewing amongst the labour class became full fledged, sparking the First Indochina War (1946-1954).

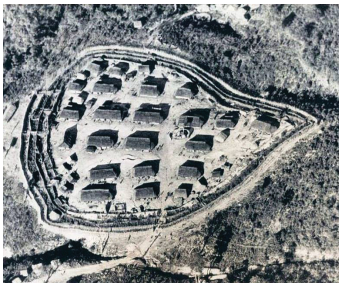
The intertwining of economic and ecological systems became a new paradigm that enveloped many cities and towns throughout the delta. The canalization and shift to cultivated lands led by the French colonists, while predominantly profit-driven, also played another role for the French military: surveillance and dominion. The waterways and canals subsumed a dual and strategic identity, one, as the corridors for “poison of revolt” and rebels, and the other as opportunities for surveillance to maintain rule in the new colony (Brocheux 1995, 16; Tregaskis 1975, 1-2). This mentality of surveillance and control continued into the following war, the Second Indochina War, or better known as, The Vietnam War (1955-1975). Areas of minimal Western-influence and development became synonymous with areas of communist insurgency and with that, opportunities for destruction and new land-water relationships.

The Vietnam War: Modernizing the Frontier

The United States government began pouring funds, commodities, and technical knowledge into Vietnam from the early 1950s, after the end of the Second World War, when France was weakened and lost stronghold of their colonies in Vietnam (Jamieson 1993). Soon after French engineers were replaced by American technicians, working to implement new schemes for environmental and social control (Biggs 2010). The Việt Cộng (VC), or National Liberation Front, was a guerilla group of southern Vietnamese working under the ideologies presented from the now disbanded Việt Minh group, whom detested all French and foreign rule in the country. By the mid-1960s, they had re-occupied large expanses of the Mekong Delta (Biggs 2010). As described by Biggs (2010, 198) in *Quagmire*, the Mekong Delta was a war of "counterinsurgency…defined less by major combat operations than by a host of programs aimed to 'pacify' the population through refugee settlements, psychological operations [and] agricultural mechanization". In short, the main drives for United States military involvement during this time was two-fold: to pacify and to modernize.

Ideas of modernization played an important role in how the U.S. military framed many of their operations, particularly in South Vietnam and the Delta region. Roads became key indicators of modernization and an important military goal. The Lines of Communication (LOC) program that proliferated during 1969 provided the means to greater pacification, widened trade and settlements and increased ease of mobilization of military and police forces to areas of guerilla insurrection (Tregaskis 1975, 409). The program sought to connect the major southern city, Saigon, now Ho Chi Minh City, to the Mekong Delta, with minor roads

connecting the upper delta to the coast (Tregaskis 1975, 411). Meanwhile, less developed areas, villages and towns with little road connectivity but large canal and river-based transportation, became areas to be policed (Tregaskis 1975, 1). The implementation of agrovilles was done with haste in the proceeding two years after its 1959 announcing by then President of South Vietnam, Ngo Dinh Diem (Zasloff 1962). The program as laid out was to create dense settlements in rural areas for social and economic development and new infrastructures for a “happy compromise between hustling, teeming city life and placid rural existence” (Zasloff 1962, 327). This was in fact a secondary aim after increased internal security, control, and pacification of dispersed pastoral villages to prevent assistance (of goods, supply and information) to the VC (Zasloff 1962). The succession of the agroville rural settlement gave way to the strategic hamlet approach during the Vietnam War under the same intentions but failed due to similar accounts, in fact pushing many uprooted and angry farmers to take sides with the VC (De Meulder and Shannon 2019). The U.S. military, unable to manifest a regional development program that stuck under the guise of counterinsurgency in the rural delta, turned to other means (Biggs 2010).



Aerial view of a strategic hamlet. Hamlets are barricaded by wooden punji stakes sharpened at one end (Friedman, n.d.)

Inhabitants building the punji stake barricade for the hamlet. (Friedman, n.d.)

Bombing strategies became the main method of operation, occurring in newly designated, and abundant, “free fire zones” (Green Left 1993). The mass migration of farmers leaving their fertile lands for the cities was a two-fold solution for the U.S. military: one, the VC could no longer depend on farmers for supply, and two, decimated and defoliated forests made it harder for guerillas to hide in, revealing VC positions and bases (Biggs 2010; Green Left 1993). The two-year series of operations beginning in 1969, Operation Sea

A guerrilla in the Mekong Delta paddles through a mangrove forest defoliated by Agent Orange, 1970; photograph by Le Minh Truong. (Page 2002, 114)

Float and Breezy Cove, as well as chemical spraying under Air Force Operations Trail Dust and Ranch Hand, were the most destructive, causing thousands of farmers to flee to cities, leaving their fertile lands to waste (Biggs 2010, 220-223). The presence of VC troops in the southern reaches of the delta, especially in the Cà Mau province where mangroves lined the shore, received some of the heaviest spraying between 1966-1970. A single spraying of Agent Orange in these regions cleared the forests entirely (Hong and Thi San 1993). The destruction of these ecologically, economically, and socially important mangrove areas would have implications for the country and the local inhabitants to come. The signing of the Paris Peace Accord in January of 1973 saw an almost immediate withdrawal of all U.S. military personnel from Vietnam (Jamieson 1993). In efforts

to boost the Vietnamese economy, the government pushed out reformation programs on all fronts, from population relocation, to agriculture and aquaculture intensification as part of land reforms for the progress of a newly unified country (Jamieson 1993, 360).

Đổi Mới: The [Un]sustainability of Market Reform

Re-education camps were implemented in southern Vietnam as well as a scheme for the relocation of millions of people into devastated lands whom were expected to transform them into productive grounds. In the Mekong Delta, the communist party forced the collectivization of agriculture with a few goals in mind: one, extrapolating all means of production and resources, two, to reduce social differentiation and promote uniformity, and three, to prevent any forms of capitalism from emerging (Jamieson 1993, 366-67). The profits of collectivization never materialized due to the disjunction between scales of economy and rapid urban growth, as well as resistance by farmers with the State who claimed the majority of profits from production (Jamieson 1993, 368; O'Rourke 2004). By the 1980s, the country's economy was teetering towards collapse with low agricultural productivity, land degradation, and public uprisings (Jamieson 1993, 371). In many senses, just like the French had done earlier, modernization schemes were implemented via a top-down approach. This re-emerged as the disconnect between local knowledge and remote governance of resource use in-situ:

> …the government experts had created maximum disjuncture between people's culture, their production techniques, and their environment. Traditional local cultures became a menace instead of a valuable resource when applied to unaccustomed tasks in unfamiliar environments. Environmental degradation, low productivity, and social stress have been inevitable. (Jamieson 1993, 365-366)

The initial reformation attempts following the end of the war were unsuccessful and a second attempt was realized in 1986 with the Đổi Mới policy signaling a shift to a socialist-oriented market economy (O'Rourke 2004). The development of a stable agricultural industry and the emergence of new ones had contributed to national income growth, urban development and social stability (Nguyen 2007, 141). But rapid transformation of the Mekong Delta has brought many economic and environmental challenges to the country such as competition for freshwater resources, increase in fertilizer use, improper market pricing (Nguyen 2007, 141), reduction of natural forest area, and land exploitation and degradation (Renaud and Kuenzer 2012). Paving the path for economic restoration was the continued push for monocultures. Rice monocultures remained intensively concentrated to the upper delta that still received abundance of freshwater, and in other areas where saline intrusion had crept in from exposed coastlines, were shifted to other monocultures, most notably shrimp (Joffre et al. 2010, 49). Rice fields however remained the dominant land-use category covering 60-80% of the central to upper areas of the delta where they were not affected by saltwater intrusion, whereas coastal areas only accounted for about 10% of rice cultivation (Joffre et al. 2010, 49). Higher population densities were related to intense agricultural areas with rice-dominant areas reaching average densities of 450 people/km^2, while non-rice dominant areas had about 200 people/km^2 (Joffre et al. 2010, 50).

New economic activities that are being pursued like industrial parks and manufacturing and processing are growing investments that bring with it new typologies that add another layer of change onto the landscape. To

support these new areas, roads, which ramped up initially during the Vietnam War, continue today and have come to replace the river as economic and cultural veins of the Mekong Delta (Pham and Pham 2011, 9). A multi-layer road system (highways, roads, and residential roads) has also reconfigured the spatial patterns of communities (Pham and Pham 2011, 11). Shifting away from the linear typology of settlements, inhabitation is now strung along road infrastructure in larger homes with fixed foundations (as oppose to the adaptable stilt homes built by rivers). These rapid transformations of the delta have similarly brought many economic and environmental challenges. Projected dangers from climate change include rising sea levels which threaten many people's livelihood, storm intensification that destroy homes, to reduced sedimentation and more frequent drought conditions, which are exacerbated by large damming projects in upper countries (Mekong Delta Plan, n.d.). Urbanization and a shift to land-based living create hard surfaces that are unable to adapt to worsening floods with projected sea level rise. Large cities, often laying less than 2 metre ASL, become very susceptible. For farmers, new advances in farming have increased reliance on fertilizer use, marginalizing those that cannot afford it as well as eroding soils.

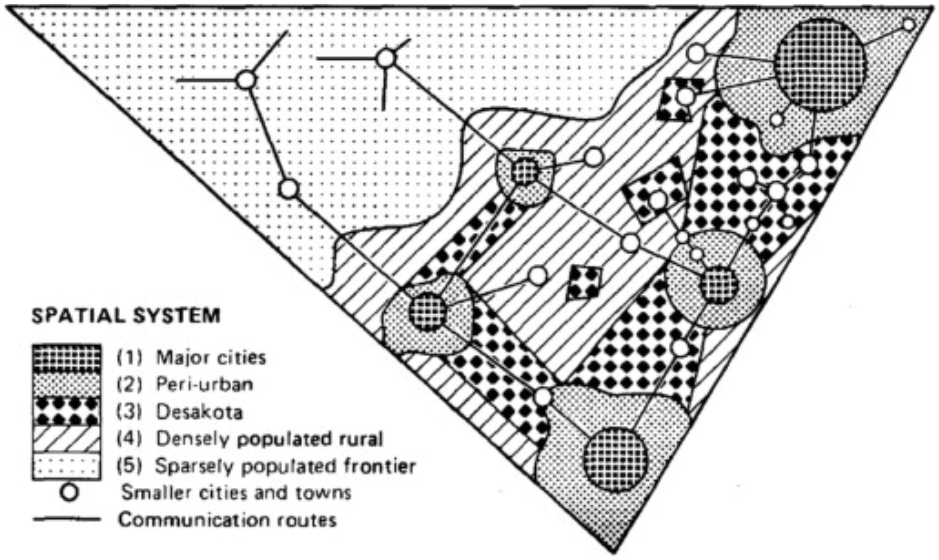
The economic profitability of the delta lacks proper translation into ensuring continued livelihood for local inhabitants (Renaud and Kuenzer 2012). Reconciliation, between modernization attempts and consideration for the seasonal rhythms of water, resource, and cultural flows, is needed if a viable and sustainable Mekong Delta is to continue into the future. A look at the layers of landscape transformation reveals an underlying intention of modernity that was

imposed with each new governing power. The implications of this were felt most harshly by the local inhabitants and the landscapes that make them. In the Mekong Delta, history thus shows that any singular understanding of modernity has led to a process of cultural erasure and environmental appropriation. As continually increasing urbanization and rural town settlements occur in conjunction with changing environmental calamities, new and holistic ways of living within the natural systems highlight the potential for critical reflection and translation into a response at the user level.

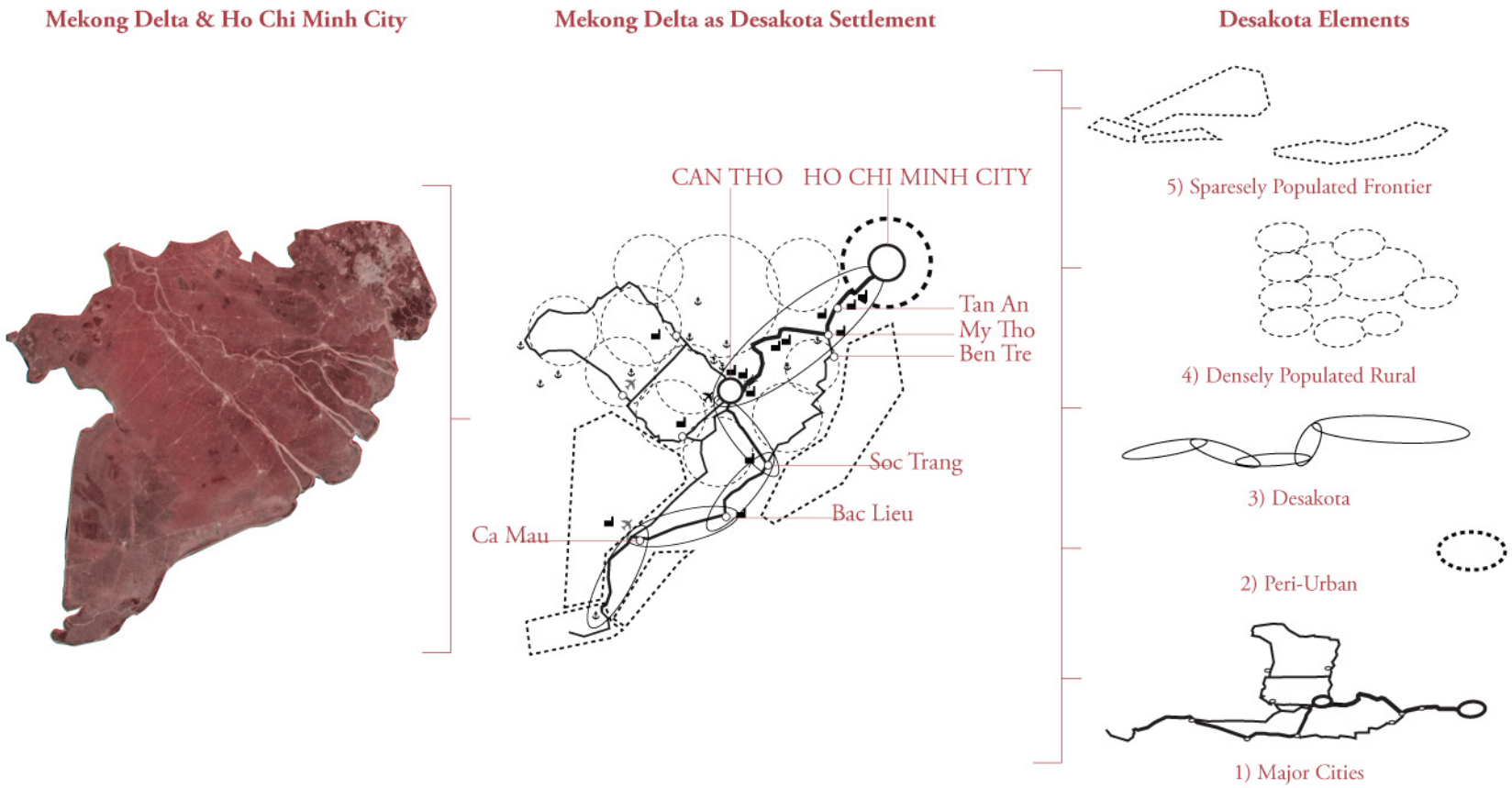
The Mekong Delta Machine

Desakota is a concept of urban morphology developed in the late 1980s by Canadian geographer Terry McGee, that comes from the Indonesian language combining the words *desa*, “village”, and *kota*, “city” (Ginsburg 1991, 38). The theory examines the characteristics and organization of regional economic structures specific to high cultivation areas (particularly that of wet rice cultivation), in South East Asian regions (McGee 1991, 7). The term *kotadesasi,* or *desakotasi*, includes *si* for “process”, describes a condition of change from one urban type to another (Ginsburg 1991, 38). The concept presents patterns of “hybrid in situ urbanism which consists of the overlapping of functionally independent entities into already densely populated agricultural regions”, or, patterns of agriculture existing with industry (De Meulder and Shannon 2019, 298). There are three types of *desakotas*: Type 1 is characterized by declining rural population and activities while seeing increasing urban functions, high incomes and productivity (McGee 1991, 8-9; Kesteloot 2015). An example of this is the shift from rural to intense urbanization as seen in areas of Japan and South Korea. Type 2 *desakotas* are regions seeing population

shifts from agriculture to industrial activities and a growing urbanity. Improved transport infrastructures are also characteristics of this type. Taiwan would be an example of this. While Type 3 are regions with slow growth and a continuation of predominantly pastoral-based livelihoods (McGee 1991, 8-9; Kesteloot 2015). At the time of writing (the end of 1980s) McGee posited that the Mekong Delta was a Type 3 *desakota*, regions characterized by slow economic growth but high population growth, with agriculture the predominant economy (Kesteloot 2015; McGee 1991, 13). The Mekong Delta, since then, has certainly transitioned into a Type 2 *desakota*, from marshland to machine beginning with colonial modernization and economic transformation. The region may well be on the way to becoming a Type 1 *desakota* as the area continues to experience urbanization, new industrial centres, and land-based infrastructural shifts (Kesteloot 2015). A diagrammatic study of the Mekong Delta region as a Type 2 in transition reveals evidence of this process and categorical relationships (rather than hierarchical one) between various settlement patterns (De Meulder and Shannon 2019, 298). The Mekong Delta



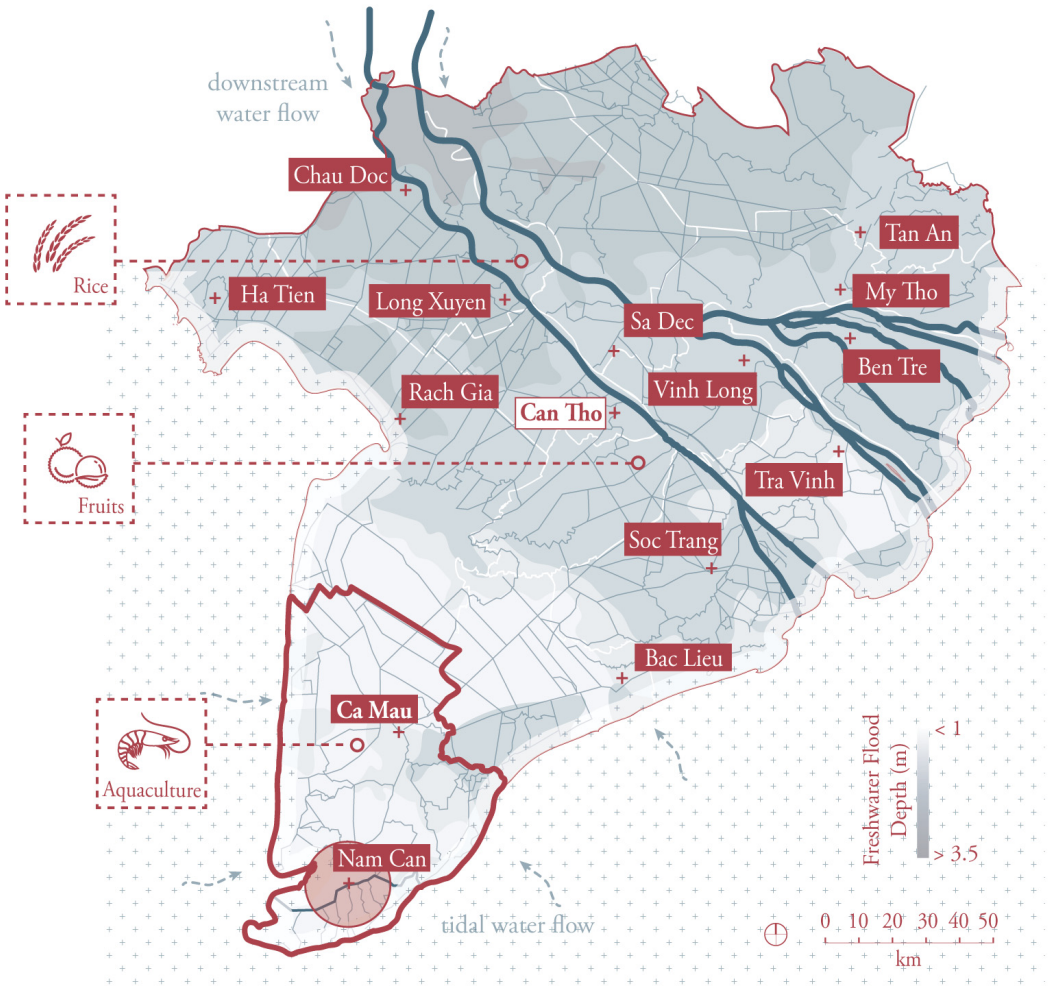
McGee's *desakota* diagram showing the layers of the spatial system. (McGee 1991, 6)



Reinterpreting the Mekong Delta as a *desakota*. An analysis of the region through the lens of the *desakota* layers reveals the concentration of economies (agriculture and industrial / rural hinterlands to urban centres) into varying zones. The layers, rather than being a sustainable mix of economies, begins to reveal itself as homogenous zones with little balance between rural and urban. (base map from Google Maps 2015; data from McGee 1991, 6; Kesteloot 2015)

is primarily connected to the rest of the country via the developing ‘light industry corridor’ from Can Tho, the largest city in the Delta, to Ho Chi Minh City. *Desakota*, an area of intensive mixing of urban and rural activities, similarly extends from this main corridor to the most southern tip of the Mekong Delta, Cà Mau Peninsula. As the region beings another phase of transition towards a Type 1 *desakota*, this thesis questions the sustainability of the current trajectory of economic, environmental, and social development, and whether a new trajectory can entail a more heterogeneous approach.

While for a top-down administration these new modernization efforts have been beneficial, there are also many challenges that come with it. The territorial scale of this development framework is hard to regulate and planning is not enforceable, and, more importantly, an increasing compartmentalization of economic zones abstracts the “synergy between urban and rural, the consumptive and productive landscapes” (De Meulder and Shannon 2019, 299). At the local scale, which is the focus of this thesis, the continual shift from subsistence food production towards export-oriented markets will “entail a passage from autonomy to market dependence for livelihood” (Kesteloot 2015). A market-dependent society tends to “dissolve the sense of community and transforms every person into an individual producer and consumer, forced to compete for profit rather than cooperate” (Kesteloot 2015). The emergence of a nuclear family ideology, replacing the more traditional extended family ideology apparent in Mekong Delta families, fails to maintain the benefits of collective care and responsibility for the management of communal resources/ecosystems such as freshwater, soft/natural infrastructure that facilitate



The relationship between hydrology and land-use systems in the Mekong Delta. Cà Mau province is outlined and Năm Căn, site area, is indicated. (base map from Open Development Mekong 2016; Google Maps 2015; data from Vo 2012, 52)

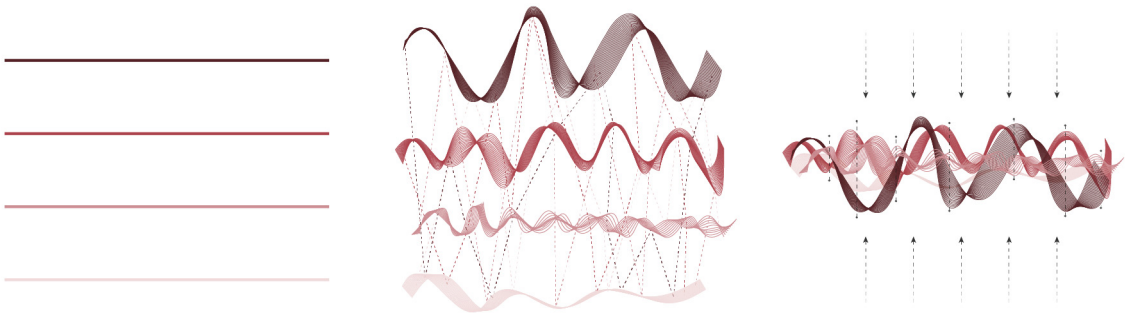
food production, and even larger infrastructure that defend against climate change (Kesteloot 2015).

Thesis Scope

The Mekong Delta Plan, a joint effort by the Socialist Republic of Vietnam and the Kingdom of the Netherlands, was launched in 2013 that outlined a strategy for social and economic development and environmental protection for the present condition to year 2050, and from 2050-2100. In the document, they release four scenarios for potential development plans for the delta region, all of which pivot

around the "urgency and prioritization of the Mekong economy advancement through a diversified industrial development": Corridor Industrialization scenario, Food Production scenario, Agro-Business Industrialization scenario, and the Dual Node Industrialization scenario (Mekong Delta Plan 2013). By and large, the four scenarios are focused on centralized planning, orbiting around Can Tho city and Ho Chi Minh City. The various zones of the Mekong Delta have been partition off based on specific hydrologic and ground conditions, and are linked via large road infrastructure. De Meulder and Shannon (2019) criticize the plan for being a "textbook of ideal abstract planning principles" that apply "rigid, central economic planning dogmas" and largely ignore the uniqueness of each zone in terms of productive landscape, population dynamics, local economies and culture (299-300). In many regards, the colonial vestiges of homogeneous modernization efforts underpin them.

The architectural intervention proposed within the exploration of this thesis begins as a response to economic development plans like the Mekong Delta Plan, and others that have been proposed since the end of the Vietnam War. As an antithesis to the homogenization of cities, towns, environmental processes, economies, local livelihood, and



Exploring a theoretical framework through diagrams. The idea of static (left) and dynamics (center) is about moving from being passive observers of history to active participants. This is echoed in the bottom-up and strength in hybridity (right) approach of my thesis.

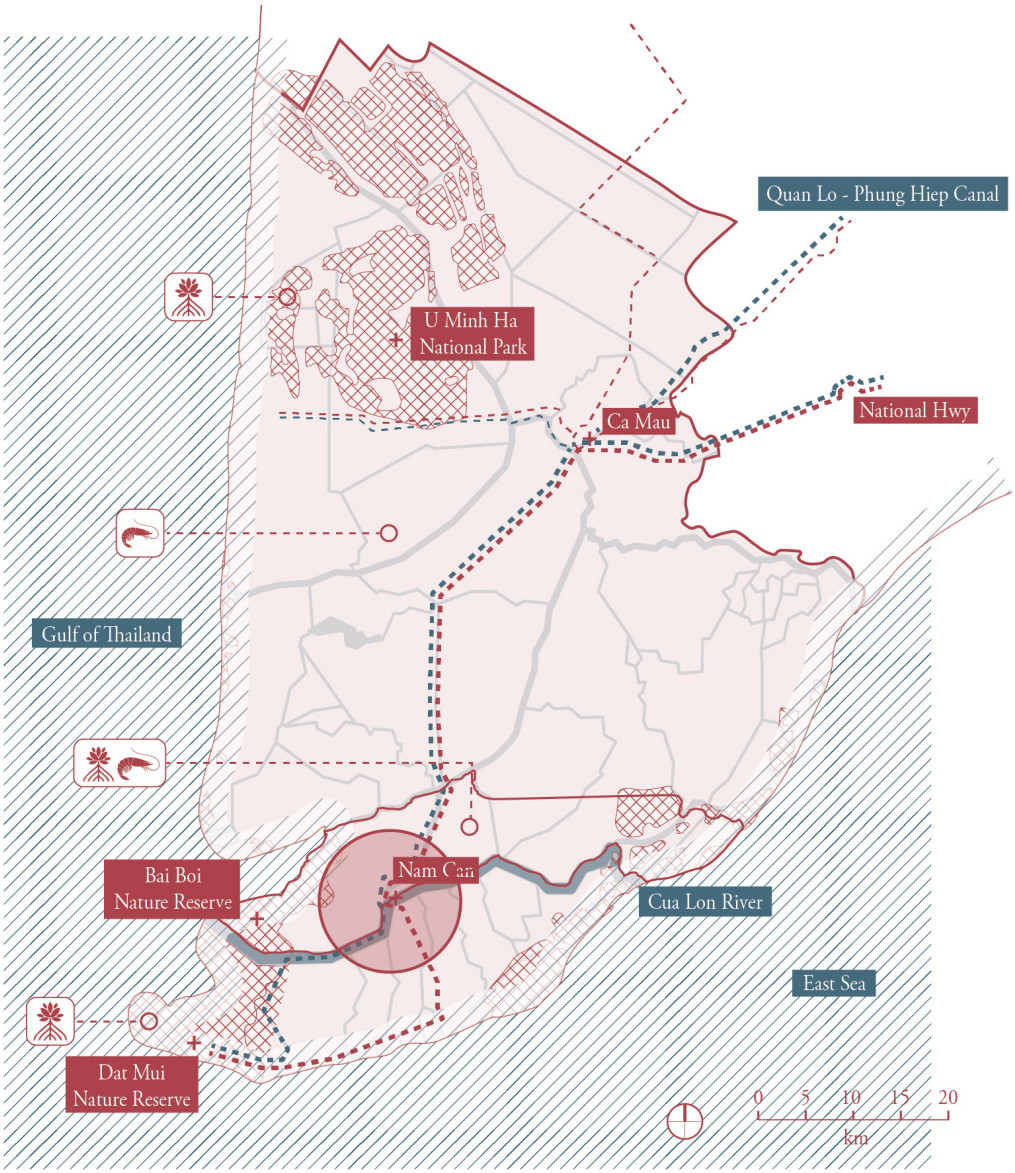
culture, the framework that this thesis proposes is one of hybridity. A hybrid approach reinstates the complexities involved with life and livelihood in the Mekong Delta, and the fluidity required to constantly adapt to changing natural and future climate conditions. The ecological, economic, and social diversity that emerges lends to resilience that begins at the local user level and scales up to the community, town, region, territory, and country. The scope of the architectural intervention begins at the regional scale, focusing on the coastal edge and the mangrove landscapes that define land-water edges, regional economies, patterns of inhabitation, infrastructure, regional architecture, local inhabitants, and their livelihoods. This can be done by acknowledging the cultural *and* economic importance of the Mekong Delta as a productive landscape via a re-emphasis on rural activities through a bottom-up approach to local knowledge, sustainable practices, and user cooperation and exchange. A critical approach to architecture is explored that can facilitate development rooted in new expressions of place-specific forms, reflecting contemporary cultural agency and programmatic exchange that acknowledges cultural dynamism.

Chapter 3: The Coastal Context

The proposed site for this thesis exploration is located in the town of Năm Căn, in the southern-most province of Cà Mau. At this scale, the strategy of an intervention addressing modernization's erasure of culture begins by revealing productive natural systems as the baseline for an architectural intervention. Six agro-ecological regions of the Mekong Delta identify the relationship of productive landscapes to the ecological characteristics that define that region, such as soil configuration, hydrology, and flora/fauna (De Meulder and Shannon 2019).

Productive Landscapes: Soil and Hydrology

The Mekong Delta, a large floodplain (Vo and Nguyen, 2012, 364), has, for over 3000 years, been naturally formed by sand and silt being deposited from the Mekong River (Marchand, Pham and Le 2014, 230). Every year the Mekong River deposits about 160 million tons of sedimentation, expanding land area by 60-100 metres per year (Marchand, Pham and Le 2014, 230). The average elevation of the delta ranges from 1.0 to 1.5 metres ASL in the central areas, and 0.3-0.7 metres ASL at the coastal areas (Vo 2012, 50-51; Hecker et al. 2011). The province of Cà Mau, sitting at 0.3-1.6 metres ASL, is influenced by two tidal regimes stretching along its 170 kilometre coastline. Water flows from the East Sea to the east and south and from the Gulf of Thailand to the west (Vo 2012, 54). While the two tidal regimes conflict with one another, mixed semi-diurnal from the East Sea and semi-diurnal from the Gulf of Thailand, East Sea tides dominate (Hecker et al. 2011, 19). This results in tidal inundation occurring twice daily and tide amplitudes of 0.5 metres at neap tide (when the sun and



A study of Cà Mau province looking at infrastructural connectivity and mangrove landscape. Location of site, in Năm Căn, is indicated. (base map from Open Development Mekong 2016; Google Maps 2015; data from Hecker et al. 2011; Van et al. 2015)

moon are at right angles to one another), and 1.9 metres during spring tides (when the sun adds to the gravitational pull of the earth and moon creating high high-tides and low low-tides) (Hecker et al. 2011). These tidal regimes consist of high amplitudes that flow deep into the Mekong Delta through estuaries and from underground, bringing in salt water that, during the dry season, increases salinity in soils, affecting 45% of the delta (Vo 2012, 62; Hecker et al.

2011, 15). The weak discharge rate of freshwater upstream, which slows to about 2,000 m^3/s, is unable to combat the influx of saline water, resulting in salinity intrusion far inland (Vo 2012, 62). The average salinity is 24.5-26.0 ppt (parts per thousand), falling to 18.0-20.0 ppt after heavy rainfall that washes the salt content out (Hecker et al. 2011, 17). The only other access to freshwater that this area sees is from rainfall and underground aquifers. Soil fertility still relies on sedimentation from upstream river systems however, upstream damming projects, in conjunction with reduced mangrove forest area along the coast, make collection harder. Additionally, wave activity along the coast change the shoreline in a process of erosion and accretion. These simultaneous functions occur in different locations, corresponding to the flow and storm activity of coastal waters. To the east of Cà Mau, the coastline is eroding at a rate of 20 metres per year, while accretion occurs to the west at an extension rate of about 10-20 metres per year (Lusterio 2009, 68).

Soils in the delta fall into five main categories: i) alluvial soils around the Mekong River distributary, ii) acid sulphate soils in deep depressions ranging from low to high severity, iii) saline soils along the coast which are rich in nutrients but limiting for certain plants, iv) grey peat soils, degraded but are valuable as land resources in some place, and v) sand ridge soils, distributed along the eastern coast (Vo and Nguyen 2012, 364). At the coast, alluvia, saline, and acid sulphate soils dominate. Naturally occurring acid sulphate soils comprise 1.6 million hectares (47%) of the Mekong Delta, although is highly sensitive to changing conditions of the river discharge and ground water (Hecker et al. 2011, 33). During dry season, the surface water level lowers by

1 metre, exposing the soil resulting in deep cracks from oxidization (Stoop et al. 2015, 12-13). Similarly, droughts, excavation or dredging for urban development exposes acid sulphate soils to oxidization that can turn to sulfuric acid, accumulating in the soil and then mixing into surface water during rain events (Stoop et al. 2015, 13). The changing soils along the coast due to direct anthropogenic influences as well as saltwater inundation have shifted a dominant rice cultivation culture to a new monoculture of shrimp farming. Within the last few decades, a shift to shrimp monoculture has preceded a rise in furthered mangrove exploitation and deforestation at the coastal edge.

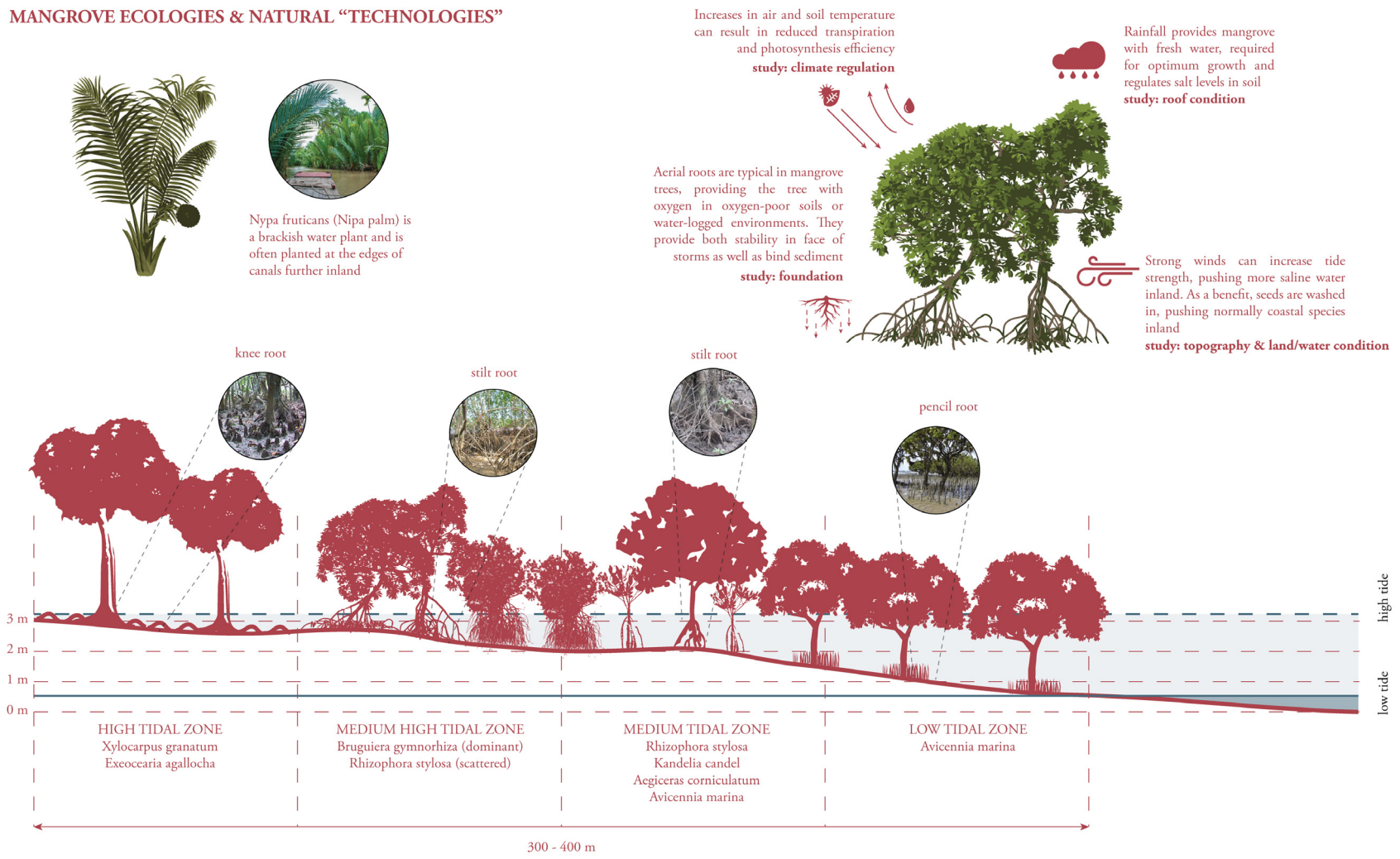
Mangrove Systems

Mangroves are a special form of vegetation that exists at the interface between two environments: land systems and hydrologic systems (Spalding, Blasco and Field 1997, 11). Their ability to adapt to the nature of change at this edge condition is also what makes them tolerant to salt and brackish waters and able to thrive and propagate in often muddy and shifting ground conditions (Spalding, Blasco and Field 1997, 11). Mangroves are well-established ecosystems abundant in coastlines between 32°N and 38°S of the equator (Veettil et al. 2019, 212). They provide numerous benefits to both human and natural environments such as unique wildlife, natural resources for humans and coastal protection from storms and saline water intrusion into cultivated lands and aquaculture farms (Spalding, Blasco and Field 1997). These benefits are referred to as ecosystem services and are categorized into four service types: provisioning (eg. food, water, timber), regulating (eg. services that impact environmental conditions like climate, flooding, water quality), cultural (eg. recreational, tourism,

Diagram linking the importance of mangrove ecosystems to humans through their ecosystem services. (data from Millennium Ecosystem Assessment 2005, vi)

aesthetic, spiritual benefits), and supporting (eg. nutrient cycling or other functions that allow the ecosystems to continue) (Millennium Ecosystem Assessment 2005, vi). The continued strength and effectiveness of mangrove ecosystems are especially important for community livelihoods that depend on their services in one way or another.

During the earliest periods of settlement formations, the mangrove forests covered an estimated area of 400,000 hectares (ha). By the end of the Vietnam War, after years of herbicide and napalm bombing missions, an estimated 56%



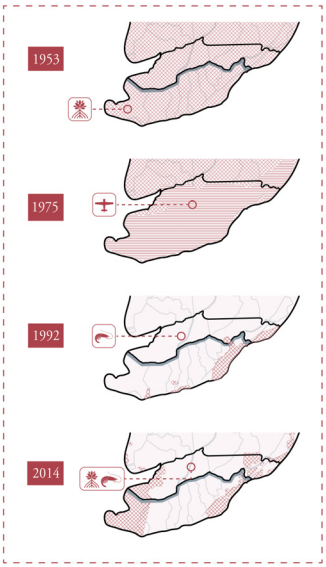
Study of the mangrove systems and their natural 'technologies' at the coastal edge and the changes in mangrove type as they move inland. Mangrove functions are also examined as they may be understood architecturally (via floor, wall, roof) through strategies for climate regulation and protection (data from Tusinski and Verhagen 2014; Hecker et al. 2011)

of mangrove forests were destroyed (Veettil et al. 2019). The increase in wastelands of a once heavily protected Vietnamese coastline make susceptible the communities that lined the coast from storms, severely reduced their economic stability and sustenance for survival, along with tragic health defects that would persist for years to come (Jamieson 1993, 344-345).

Traditional farming methods in these coastal areas relied on rain-fed rice crops during the wet rainy seasons and brackish water aquaculture in the dry season. Within the plans of Đổi Mới reformations, for land use in the coastal delta, the government encouraged the shift to intensified aquaculture, mainly shrimp, as a method of adaptation to market demands for predominantly export-driven profits (Van et al. 2015, 77) and high international prices. The shift was spurred on by foreign aid from the World Bank and the Asian Development Bank for poverty reduction and employment creation (Van et al. 2015, 77). Shrimp aquaculture boomed, growing from 89,605 ha in 1991 to 429,114 ha in 2003 (Joffre et al. 2010, 51). In a relatively short period of time, the coastal economy, from low rice-oriented market, became the largest area of saltwater aquaculture in Vietnam, contributing 83% of total exported shrimp value in the country, equating to a US$319 million industry (Joffre et al. 2010, 51-52).

The impacts of these economic and social changes were directly shown on the landscape. It is estimated that between the period from 1977-1994, mangroves were depleted by 23% as intensive and unsustainable conversion of land to shrimp farming was taking place (Veettil et al. 2019, 213), accounting for the largest occurrence of mangrove destruction second only to Agent Orange deforestation during the war. This resulted in a loss of two-thirds of

remaining mangrove forests by 2000 (Van et al., 2015, 77). Mangrove forested areas, once regarded as dangerous and inhospitable places with few communities venturing to set up settlements within them (Spalding, Blasco and Field 1997, 12), suddenly saw increasing farmer communities in areas cleared for shrimp farms. Mangrove forests along the coast act as barriers to protect against land erosion from typhoons and intense storms, provide resources for biodiversity and also material for people, filter pollutants and maintains water quality for vital nurseries and habitat for a large number of coastal and marine species (Veettil et al. 2019, 219). With aquaculture-based conversions more than 8 million people in Vietnam are at risk from death and destruction during natural disasters (Veettil et al. 2019, 219). Mangrove reforestation programs were numerously implemented following the end of the war. Money from international foreign aid allowed communities around the Mekong Delta, especially in the coastal areas, to replant mangrove areas for growth and future protection and social benefit. While success rates varied during initial stages of the program, due to lack of consideration of species selection within the hydrological and geomorphic setting, higher community involvement and knowledge has continued to be an important component of higher mangrove growth success rates (Veettil et al. 2019, 220). Mangrove areas have similarly been diversified to allow for different functions to co-exist. Strict protection zones, buffer zones comprising of mangrove used for afforestation as well as aquaculture and other cultivation activities, and economic zones are part of a zoning strategy to solve both natural and contemporary problems associated with loss in mangrove areas (Veettil et al. 2019, 221). Today, there are three zones of mangrove protection: U Minh Forest, Mui

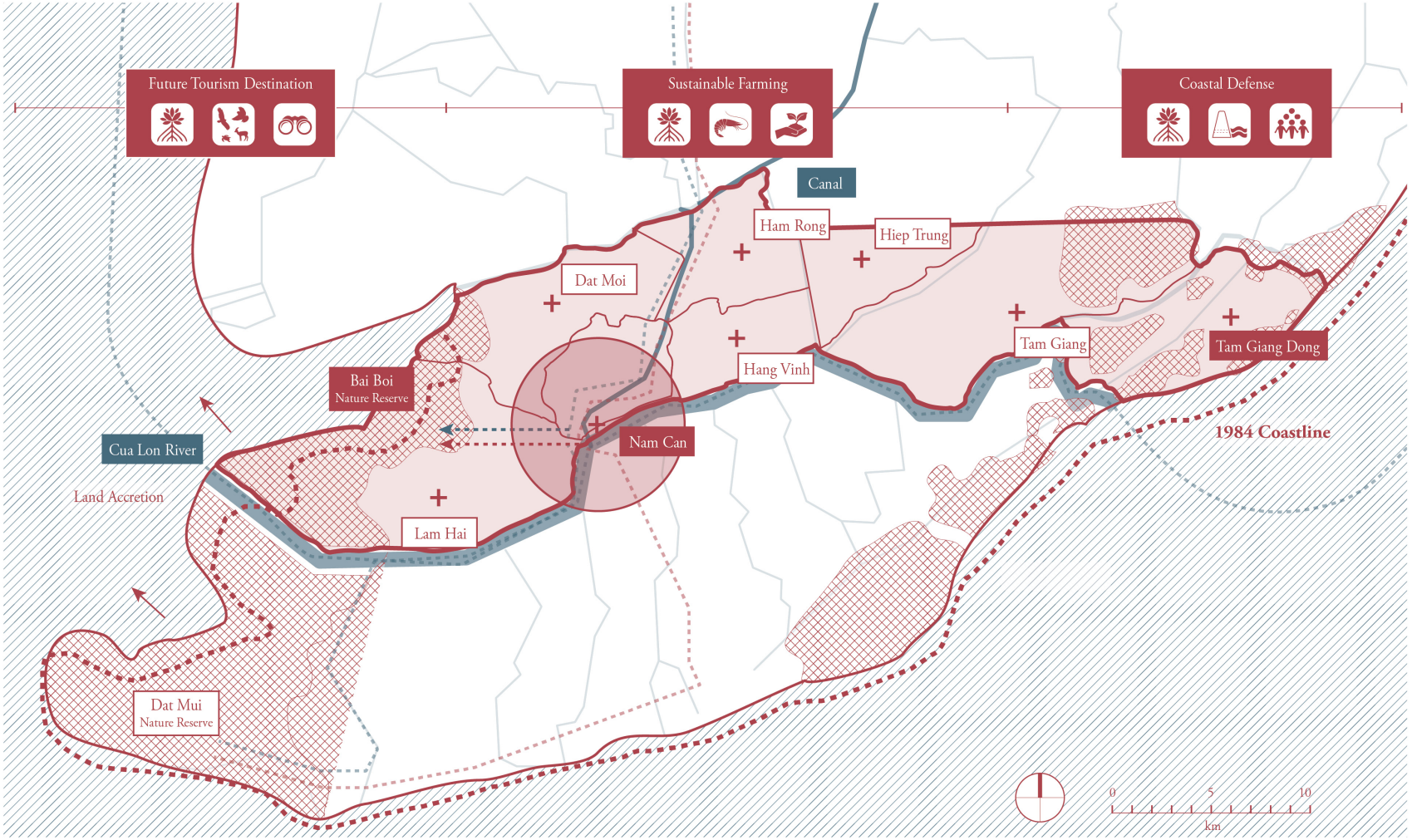


Changes in the mangrove landscape through time at the tip of Cà Mau Province. (base map from Open Development Mekong 2016; Google Maps 2019; data from Van et al. 2015; Hecker et al. 2011)

Cà Mau National Park that is divided into two domains as it straddles two districts: Bai Boi Nature Reserve in Năm Căn District and Dat Mui Nature Reserve in Ngọc Hiển District (Hecker et al. 2011, 20-21). These two natural reserves are rehabilitated shrimp farms. Mangroves were replanted in place of the defunct farms to facilitate other flora and fauna biodiversity. The goal for these protected areas are to revive the high fauna biodiversity that thrive in mangrove areas, especially for birds as migratory sanctuaries, and fish that dwell in the roots of the predominant brackish cajeput mangrove trees. Tourism, recreation, and conservation education and research are also potential opportunities for economic growth in the region (Hecker et al. 2011, 20-22).

Aquaculture Economy

Another effort to reintegrate the mangrove system in Cà Mau, which acts as a buffer protecting the entire region south of the Hậu River, is the integration of mangroves with shrimp farming. There are three general methods of shrimp farming that are employed in the Cà Mau area: traditional or extensive (requiring 3-5 ha of pond area), improved tradition or semi-intensive, and intensive (requiring 1-3 ha) (Joffre et al. 2010, 52). While intensive methods require smaller pond size to achieve similar yields as extensive methods, higher initial costs for the tools and technology involved leave small-scale farmers out. The growth of intensive shrimp farms are the main cultivation method for large-scale operations. Aerators and other chemicals (pesticides, antibiotics, additives) are used to prevent disease outbreaks, however are much more taxing on the environment. The life span of a large industrial shrimp operation typically only lasts 2-5 years before serious pollution or disease corrupts the pond (Hecker et al. 2011, 39). The precariousness of



A district strategy focusing on mangrove forests for sustainable farming, coastal protection, and area for recreation and tourism, provides the framework for the architectural intervention. (base map from Open Development Mekong 2016; Google Maps 2019; data from Van et al. 2015; Hecker et al. 2011)

industrial shrimp farming has pushed local governments to seek alternatives. Mangrove-shrimp integrated aquaculture is a new farming model that have emerged out of Năm Căn District. The local government has rolled out a rule that requires a 60%-40% ratio, that at least 60% of farmland needs to be dedicated for mangrove replanting while 40% is used for shrimp farming (Hecker et al. 2011).

Năm Căn District: Site Introduction

Cà Mau province is subdivided into nine districts, with Cà Mau city being the provincial capital. Năm Căn District, with a population of 100,330 (2018) is an area of dense canalization, bordered to the north by the Bảy Háp River, to the right by the East Sea, to the west by the Cửa Lớn River, and to the west by the Gulf of Thailand. The Cửa Lớn is a major river that runs east-west, the only one in the delta, connecting the two seas and presents a complex interaction of tides and water flow. While the higher turbulent waters of the East Sea dominates, the two seas mix in the Cửa Lớn River, with tidal amplitudes around 3 metres during high flood, and 1.8-2.0 metres during days of little flood (Hecker et al. 2011, 19). Southwest monsoon season lasts from May to November, with July-November consisting of the heaviest rainfall period with average wind velocities from 1.8 to 4.5 m/s (Hecker et al. 2011, 19). A comparison of the 1984 coastline at the tip of the Mekong Delta shows land erosion occurring to the east, and land accretion to the west. While a naturally occurring process, anthropogenic factors such as mangrove destruction at the coast has largely attributed to the problems associated with erosion.

Administratively, Năm Căn district is further divided into seven communes (Hàm Rồng, Đất Mới, Hàng Vịnh,

Hiệp Tùng, Tam Giang, Tam Giang Đông, Lâm Hải) and one commune level town, Năm Căn. Năm Căn district is bookended to the west by the Bai Boi Nature Reserve in Lâm Hải commune and Tam Giang Đông commune to the east. Năm Căn Township is the most urbanized area, sitting at the confluence of the Cửa Lớn River and a north-south canal off the Bảy Háp River, which runs adjacent to the National 1A highway.

District-Scale Opportunities

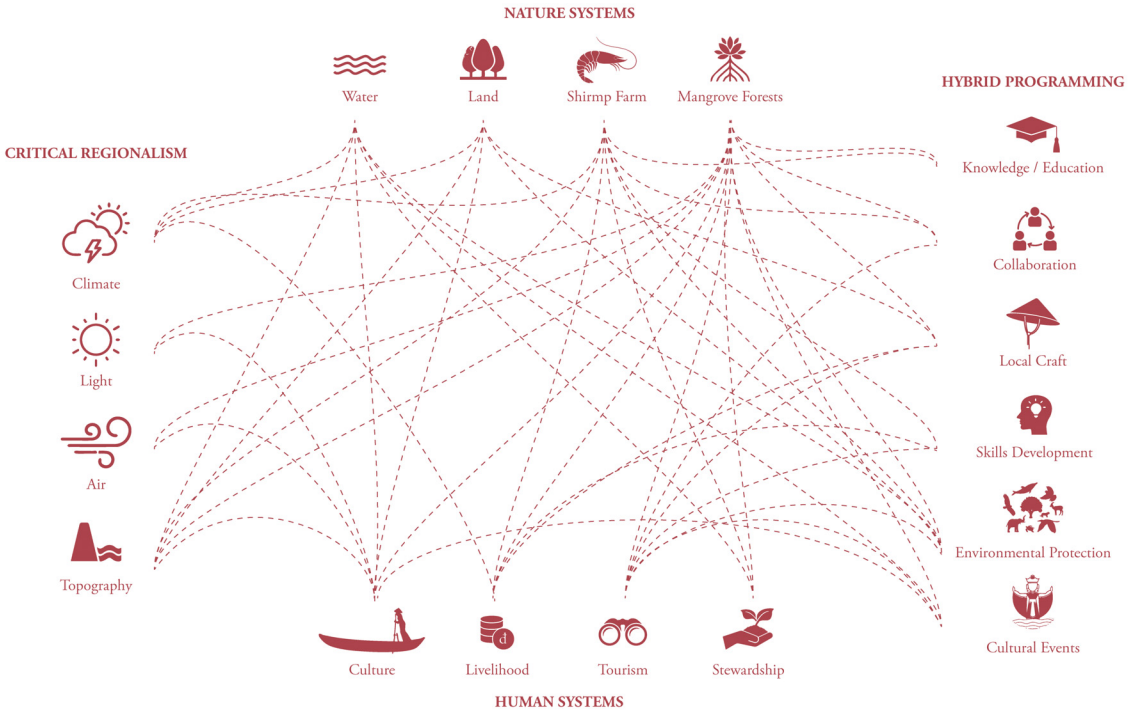
The relationship to natural landscape and functional landscape underlies the characteristic of the district which can be promoted to reveal a strategy for bottom-up ecological, social, and economic reform. As land accretes to the west, the Bai Boi Nature Reserve will be extended, offering the formation of new wetlands and proliferation of mangrove as it propagates to solidify the soil. Recreation and tourism activities can be implemented here. The central district can grow to further support mangrove-shrimp integrated farming. The internationally recognized Aquaculture Stewardship Council (ASC) certification can be pursued by local authorities and shrimp farmers to both add value to production outputs as well as foster environmental stewardship. Continued mangrove replanting programs can be utilized along the eastern edge, to fight against land erosion that is destructive for settlements in the area. Mangrove coastal defense will serve as a soft technological approach, rather than hard infrastructure and costly technical approaches. Opportunities to consult with organizations around the world for soft coastal defense infrastructure and design helps lift the district, region, and country onto the global stage for natural environmental protection and local culture support. The new district strategy reconnects inhabitants and visitors

with the environment, acting to support the regeneration of the destroyed mangrove landscape. It does so by promoting sustainable use of mangrove resources by local inhabitants, adds value to the products and foods grown in mangrove-shrimp farm systems, and enhances local knowledge and stewardship through workshops and classes. It also diversifies income opportunities for inhabitants while allowing them to reconnect to the landscape through tourism to mangrove protected reserves and replanting programs for coastal protection. The thesis will focus on the town of Năm Căn, which geographically already serves as the node that connects district edges to the province, to the delta, and, to the country.

Chapter 4: Program Development

Critical Regionalism and Program

The term “critical regionalism” first appeared in the essay, “The Grid and the Pathway” (1981) by Alexander Tzonis and Liliane Lefaivre, and was picked up by Kenneth Frampton (1983). In many regards, the architectural theories and practices within the framework of critical regionalism has served as an “architecture of resistance” against the placeless ambiguity of contemporary modernist architecture and superficial historicism of post-modernity (Frampton 1983, 16; Eggener 2002, 228). Frampton’s approach to the theory has transformed the role of architecture and the architect, especially during the latter half of the 20th century, to reconsider the merits of design to diplomatically “mediate the impact of universal civilization with elements derived indirectly from the peculiarities of a particular place” (Frampton 1983, 21) that remain applicable today. Frampton emphasizes the architectural components required to confront the placelessness of modern architecture through design considerations for topography, context, climate, light, and craftwork of tectonic form (Frampton 1983, 27-28). These tenets work together to address a need for a balance between the visual architectural form and the experiential or tactile qualities of the space. The thesis, expanded in a later chapter, will utilize these tenets to understand and evaluate contextual design and construction strategies seen in the water-based lifestyles of the coastal Mekong Delta. However it will also propose an additive component to the design strategy in light of critiques against critical regionalism, as the theory does not exist without some contradictions against what it purports. For example, its application



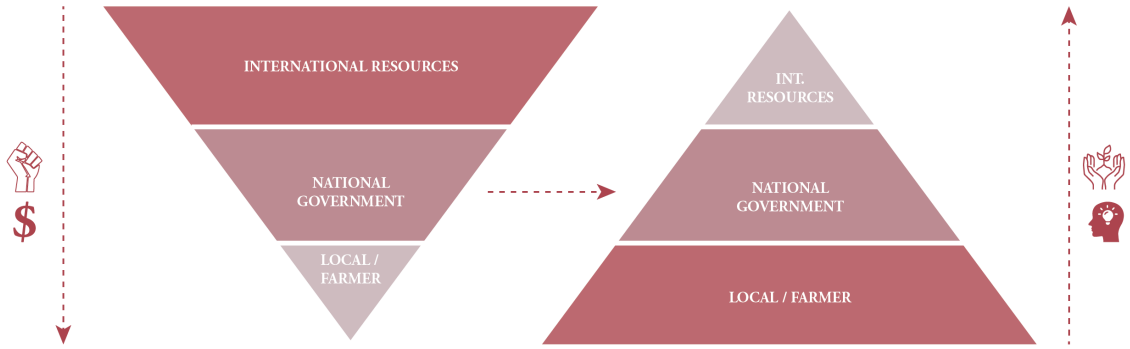
Looking at the linkages between nature and human systems with critical regionalism and hybrid programming.

predominantly appears in developing, post-colonial nations, so-called “architectural peripheries”, that maintains a Euro-centric vision and focus of what architecture ought to look like and be (Avermaete et al. 2019; Eggener 2002, 232; Yeang 1987, 8).

Similarly, the theory has been criticized as viewing “periphery” cultures and traditions as static legacies of the past, which supports the need to reconcile binary viewpoints: “East/West, traditional/modern, core/periphery, self/other, space/place” (Eggener 2002, 234). Eggener (2002) posits that “critical regionalism is, at heart, a post-colonialist concept” (234) and is supported by the writings of Jane Jacobs insofar as she writes: “Just as postcolonialist tendencies have always been produced by colonialism, so colonialist tendencies necessarily inhabit often optimistically designated postcolonial formations” (Eggener 2002, 228). Critical regionalism then served as a “slogan, a catchword,

a formula" for an otherwise complex architectural response to difficult and diverse contextual conditions (Eggener 2002, 235). This is the point in which the thesis proposes an addition to the strategies of critical regionalism to include the role of programmatic elements in architecture to include the complex and dynamic narratives and rituals of local users. In many ways Lewis Mumford's views on culture and identity, which preceded and impacted Tzonis and Lefaivre's essay (Eggener 2002, 228-229), argued that unlike the binary lens that influence imperial views of culture to be either "modern" or "primitive", they are more "mutable and conditional" and "so must be their architectural expression" (Eggener 2002, 228). While design strategies that utilize the place-making strategies of topography, climate, light, and tectonic form will be explored in the architectural intervention, they serve as the means to promote a programmatic strategy that gives agency to local cultures in a contemporary context. Hybrid programmatic loops, that is, synergies between diverse user groups, activities, and programs will serve as a method for doing so.

An exploration in the architectural expression then emerges from the dialogue *and* play between dynamisms of the environmental context and the dynamisms within social

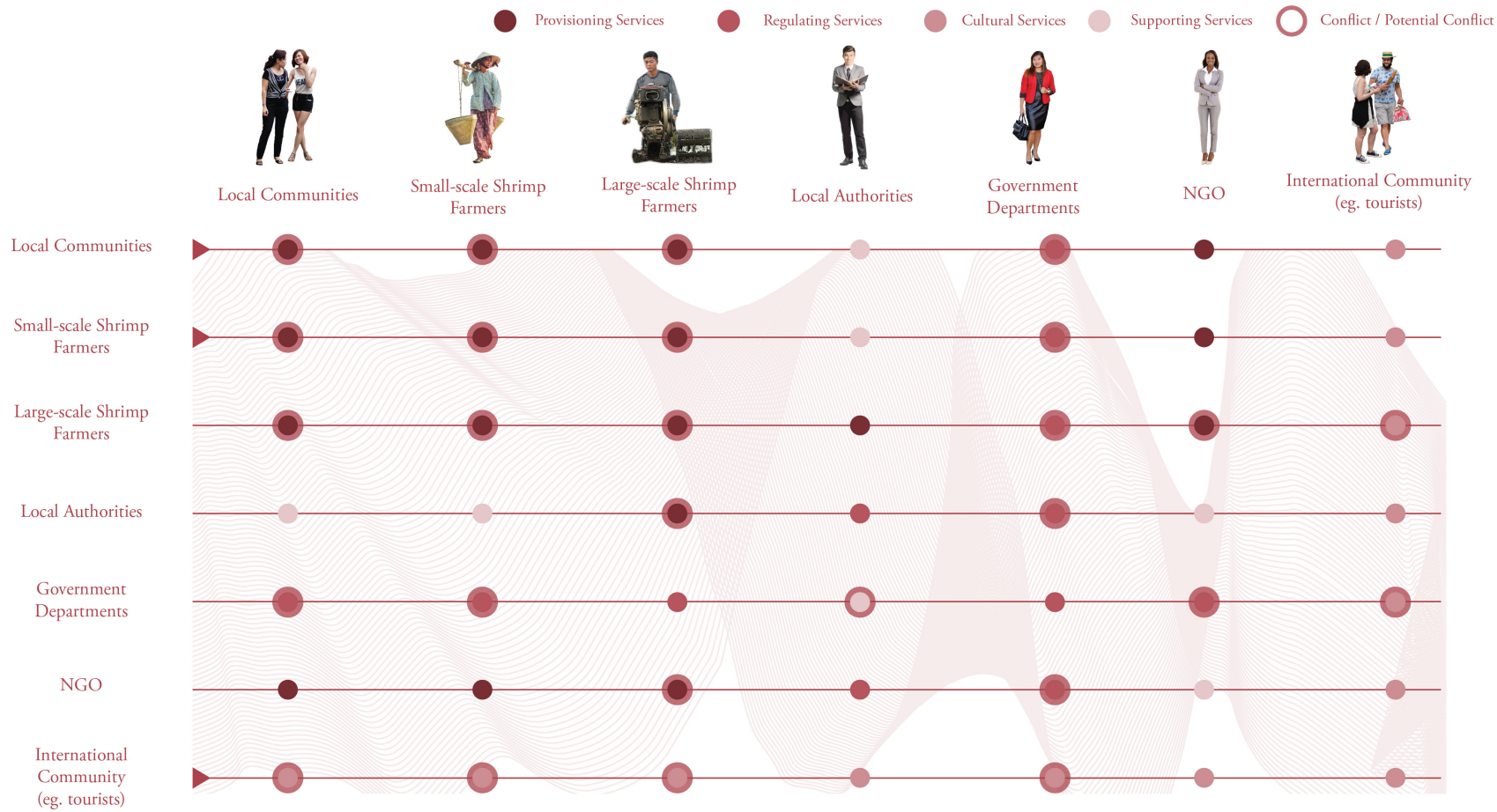


The project is framed as a shift from a top-down to a bottom-up approach focusing on local inhabitants and users.

exchange. So that form and activities are forever in flux but in a snapshot of a moment in time, reflects their reciprocity. A study of the social conditions that frames this thesis follows, while a study of the architecture's response to the environment will be done in a later chapter. The design intervention then explores how they can be woven together.

User Description and Program Opportunities

The Institute for Environmental Security released an assessment for a Poverty Alleviation Program in January 2011 (Hecker et al. 2011) studying the impacts of mangrove systems on key stakeholders from the farmer to international organizations in Cà Mau and Năm Căn District. A "conflict matrix" or stakeholder analysis, describing commonly shared environmental problems between various stakeholders, is one of the outcomes of this assessment. For this thesis, the information was synthesized and extrapolated to understand how the proposed district strategy could be filtered through their study and distilled into programs and activities that could inform the thesis design proposal. I have categorized the problems presented by the Institute for Environmental Security Assessment into the four mangrove ecosystem services: provisioning services, regulating services, cultural services, and supporting services. Rather than allocating priority to the ecosystem services, an assessment was done to draw out which key users would benefit from a bottom-up approach to the shrimp export value chain as well as overall environmental stewardship. Local communities, small-scale shrimp farmers and international community, focusing on tourists, are the three key user groups that could optimize positive feedback into the district system of mangrove biodiversity programs, sustainable farming, and soft mangrove coastal defense.



An analysis of mangrove stakeholders outlines seven user groups and examines their commonly shared concerns regarding mangrove ecosystem services. The matrix also pinpoints key areas for current or potential conflict between users. The bottom-up approach becomes an important method to resolve conflicts at a local scale which can feed back up. The project will focus on the users indicated with an arrow. (data from Hecker et al. 2011, 41-43)

Local Community Members

Local community members in Năm Căn district utilize the mangrove services and resources primarily to maintain their livelihood. Their motivation for mangrove resource protection and stewardship comes from the need to procure fish and shrimp for food, wood for fuel, construction materials for housing, and maintenance of waterways for transportation (Hecker et al. 2011, 23). Local routes through the town are impacted by the types of waterways which is expanded on in a later chapter that looks at town parcels and plot types.

Opportunities to improve the lives of local communities to increase agency and collectivity involved to safeguard mangrove resources can be promoted through mangrove replanting programs on site and on both the western and eastern edge of Năm Căn District. This will tap into the cultural services within mangrove ecosystems to create opportunities for local recreation and tourism, as means to add economic value and support cultural identity and heritage value that reconnects people to their natural mangrove landscape.

Local Community

Small-Scale Shrimp Farmer

International Community

Identifying the three key user groups for the programmatic intervention.

Small-Scale Shrimp Farmers

Small-scale farmers are categorized as extensive method farmers, utilizing 3-5 ha of pond area and relying on lower technological and chemical inputs. Their reliance on mangrove ecosystem services are to sustain livelihood and maintain a stable income (Hecker et al. 2011). Most small-scale farmers own their own land and live adjacent to their pond. Their farming practices resemble more traditional integrated farming methods that have been practiced for decades prior around the Mekong Delta, rotating crops and livestock to suit the seasons (wet and dry season), utilizing

a closed feedback loops of natural inputs and outputs (eg. animal waste for natural fertilizer) (Hecker et al. 2011). Promoting the shift from monoculture shrimp farms to mangrove-shrimp integrated farming can add value to their production and in turn, their own sense of responsibility to their land and resources.

For the small-scale farmer, the need for resource stewardship and maintenance is critical, as they have limited access to resources (monetary or technical) compared to large-scale farmers or industrial farms that practice intensive, exploitative, shrimp monoculture (Hecker et al. 2011). In addition, many farmers lack knowledge or awareness about the implications of resource exploitation on the environment, which can be attributed to limited information and education but largely to poverty, whereby people put short-term provision over livelihood longevity (Hecker et al. 2011). Like local community members, farmers' routes are also informed by the type of parcel and plots that configure the town. New, entirely productive plot types (mangrove-shrimp integrated farms), has reshaped the town's built patterns as well as water flows and landscapes. Again, this is further expanded in a later chapter.

Rendering of a local community member traversing a mangrove-lined canal. Fishing and canal tours often take place here.

Increased education can seek to alleviate these issues for small-scale farmers. A farmer's cooperative is being proposed in Năm Căn town as the home base for a district-wide program to organize members into groups in order to facilitate courses geared towards environmental awareness and sustainable shrimp farming practices. Farming cooperatives have been appearing throughout the Mekong Delta amongst farmers and local governmental organizations as industrial and exploitative shrimp farming threatens the environment and people's livelihood. In Cà Mau province, a 2018 national statistics assessment identified 62 operating cooperatives with 970 employees in each. The average size of each cooperative is about 15 members (General Statistic Office 2018, 490). The new cooperative in Năm Căn serves to bring agency back to local farmers and communities while linking the tension between traditional practices and industrialized processes. This program is situated within an existing education system in the country at large. A high percentage of farmers do not have formal higher education as directed by the Vietnamese Ministry of Education. To

Rendering of farmers rearing shrimp amidst the mangrove-shrimp farm. Micro-topographies and striated land configurations are characteristic of these farm plots. Circulation occurs at the edges and above (farmer in the background), while aquaculture occurs between edges and below (farmer in foreground).

reach adults and youths who do not or are not able to follow the formal education system, non-formal education is available. Non-formal education seeks to provide short-term, periodic or regular courses for illiteracy eradication, diversifying knowledge and skills development. Formal and informal interactions will facilitate this. Formal training, conducted by specialists and researchers from abroad as well as local universities will provide courses for farmers to learn about shrimp seed testing, disease management, water control, best practices, and general environment concerns specific to mangrove systems and the effects of mangrove integrated aquaculture. Informal gathering spaces will open up collaboration and knowledge exchange amongst farmers that could further promote collective community action and stewardship for present and future resource use. Auxiliary programs will be workshops for learning other skills that could provide additional sources of income such as basket weaving for aquaculture tools.

International Community

The international community is identified in the assessment (Hecker et al. 2011) as tourists and individuals concerned

Rendering of tourist viewing wildlife in a mangrove reserve. Migratory birds often utilize mangrove forests for food, as a resting area, and for shelter. Protected mangrove reserves are a key way to increase biodiversity for birds and many other fauna.

with the environmental welfare around the world, such as conservationists. Their goals are driven by concern for the regulating, cultural, and supporting services provided by mangrove ecosystems. Healthy mangrove ecosystems can promote tourism with high biodiversity, clean beaches, sight seeing, and learning about the traditions and cultures of coastal communities. Opportunities for exchange between local and global users promote diversification of economy (farming and tourism), increased social knowledge and connectivity, and a large, global, sense of community.

Architectural Program

The thesis proposal consists of three buildings that relate the district-scale strategy (mangrove recreation and tourism, sustainable shrimp farming, mangrove coastal defense) to the narratives and activities of the three user groups. One building will be dedicated for shrimp farm activities, acting as the interface between sustainable shrimp collection, exchange, and economic trade. Another building will serve as a gathering and docking area for members participating in mangrove replanting programs as well as tours to the mangrove reserves. An information workshop area will serve both local inhabitants as well as tourists to learn about mangrove ecosystems and replanting techniques. A connected boat launch will then operate as a departure and arrival point that connects town to mangrove forest. The final building, which will be explored further, is a community and education centre that brings together all user groups. The three tenets of education, collaboration, and exchange will be the driving force to creating a sustainable livelihood for farmers and local community members while showcasing their cultural ties to land and water.

Chapter 5: Site

Town History and Existing Infrastructure

Land reclamation of once swampy bogs into cultivated paddies went hand in hand with the emergence of new villages (Shannon 2009). With new canals, people began settling along canal banks (silt was used from excavation to create higher ground) and the confluence of where canals met became hubs for intensive development (Pham and Pham 2011, 5-6). The resultant settlement pattern, ribbon settlements, are still visible today. Pham and Pham (2011) have identified three categorical settlement patterns as they relate to the water's edge: i) river cities, settlements that exist along the two distributaries of the Mekong River, ii) canal cities, settlements at the intersection of main waterways and established through floating markets for commerce and exchange, and iii) coastal cities, ports and stopping posts for international trade along sea routes (5-7).

Old Năm Căn town during the Vietnam War. Bombing craters visible in the ground (1969-70). (Lefebvre, n.d.a)

Năm Căn town under construction during the Vietnam War (1971-72). (Lefebvre, n.d.b)

The town of Năm Căn developed from a swampy marshland, thick with mangrove forests where locals living in the small villages made their livelihood through fishing in the numerous streams. The area remained a "frontier" yet to be developed during early colonial times, but became of importance during the Vietnam War as a place contested by VC troops with the North Vietnamese Army (NVA) and American and South Vietnamese troops (Tregaski 1975). The southern tip of the Mekong Delta was a communist stronghold after the town was evacuated and overrun following the Tết Offensive until 1969, when the Southern Vietnamese and American forces recaptured it (Marolda and Dunnavent 2015; Tregaski 1975). By then, the mangrove forests had been wiped out from the defoliation missions and land lay bare and the area became

a key strategic position to reassert the South Vietnamese government's presence in the Cà Mau region (Marolda and Dunnavent 2015). Military building operations developed in this area from a floating pontoon for the newly developed tactical riverine mobile force, to a more permanent military base on land that would act as the central operations for all river and canal military surveillance in the southern reaches of the Mekong Delta. However, the swampy lands were not able to carry the loads of a modern naval base and military equipment so dredging expedition was launched. By 1970, 640,000 cubic yards of fill was laid out on the site, creating 0.91 – 1.52 metre foundation for the military base itself, as well as a 910 metre airstrip (Tregaski 1975). The remnants of the airstrip and operating tower, although abandoned, are still visible in the landscape today, revealing a break in the town fabric.

Today, modernizations under new sentiments, from surveillance and control to industrialization, have changed the landscape again. An industrial shrimp processing plant by Seanamico, a Seafood Import Export Joint Stock Company, marks the waterfront at the intersection of the canal and Cửa Lớn River. A $43.2 million shipyard sits just outside the edge of the town. Completed in 2008, the facility, built on 58 hectares of land acquired from 127 local families, has yet to be utilized, machinery left behind to rust, due to the company's financial problems (Hoang 2019). In 2014, a plan was approved for the development of 11,000 hectares of farmland, mangroves and settlements into the Năm Căn Economic Zone by 2030 under the projections of a population increase from 34,000 people, to 45,000 by 2020 and 90,000 by 2030, between Năm Căn Town and Hàm Rồng, Đất Mới and Hàng Vịnh communes. The plan seeks

Bustling town life along the water's edge. An array of contemporary buildings show both water-based and land-based dwellings and commercial buildings.

to develop the area into a multi-sector industrial zone for international trade, with focus on shipbuilding, electronics, garments and textiles manufacturing, telecommunication, and seafood processing (Viet Nam News 2014). Much like the modernization strategies of the Mekong Delta at the larger territorial scale, Năm Căn district, with Năm Căn town being the center of development, shows similar signs of an industrial-focused approach, fixated on road construction and large warehouse facilities to house new industries. To a large extent the district remains a highly rural area, with aquaculture and forestry the main source of employment. Local inhabitants still live in traditional water-based housing along the Cửa Lớn River, however, land-based housing,

similar to those seen in large urbanized areas, are being built along the new town spine, the national highway.

Edge of mangrove-shrimp farm. Bunds in the distance with early mangrove tree growth.

Site Study

To find a site for the architectural proposal I first distilled the town into parcels that correlate inhabitation to water condition. Zooming in, I pulled out key plots for an understanding of topography, water condition, and technology/building construction to facilitate human activity. These parcels and plots were then understood within the routes of each user group (how they moved to, through, and out of them, their activities at key moments of production, exchange, and gathering. I then identified existing areas of user overlap as well as areas of opportunity for new programmatic intervention, which informed my site selection.

More traditional style residential dwellings along smaller canals.

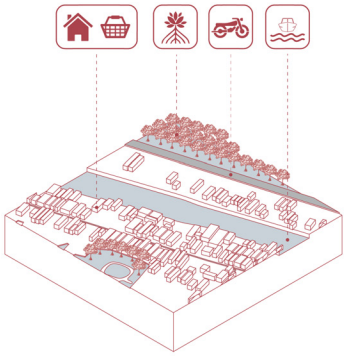
Existing Conditions: Parcels and Plots

Parcels are regarded in this study as larger tracts of land comprised of multiple building and land-use typologies. Inhabitation at the parcel scale is examined as two types: linear and nodal. Linear types are buildings that line the edge of the waterway, people utilize this for access to water as transport infrastructure. Nodal types exist at the intersection of waterways, their programs reflect higher traffic of people passing by. These two types are further differentiated by their relationship to waterways (large rivers or smaller canals). Buildings with river adjacencies relate to economy-based functions (eg. mixed commercial-residential housing) while canal adjacencies relate private dwellings (eg. residential-only).

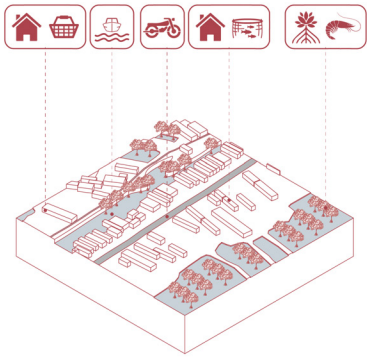
Commercial-residential dwellings along the river.

Plots are regarded in this study as singular building typologies or singular land-use types. I have broken down

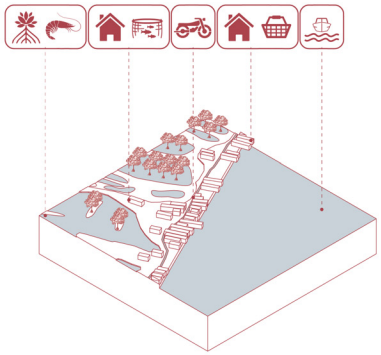
LINEAR INHABITATION TYPE



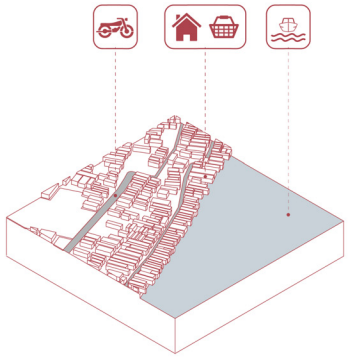
Canal



Canal

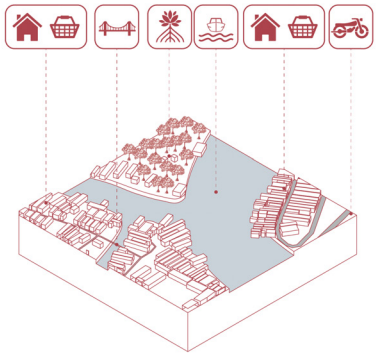


River

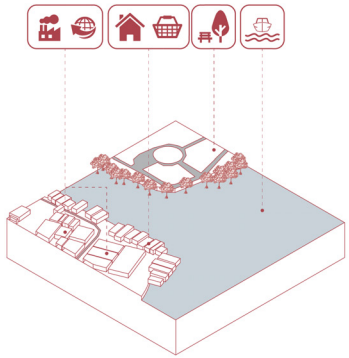


River

NODAL INHABITATION TYPE



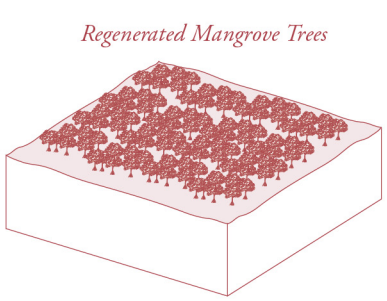
Canal - Canal



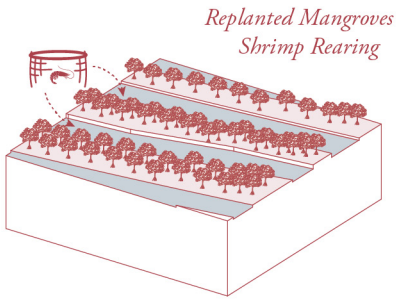
Major Canal - River

Existing parcel types. Analysis of water conditions and programmatic functions and land-use. Linear types are buildings that proliferate along the water's edge (above) while nodal types are buildings concentrated at the confluence of two waterways (below).

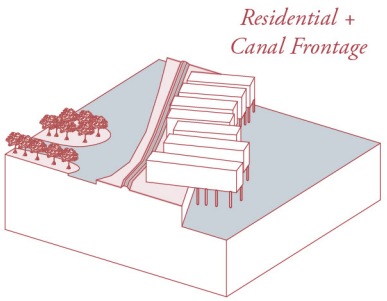
PLOT TYPOLOGIES



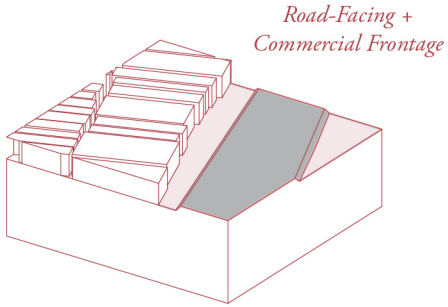
Mangrove Forest Plot



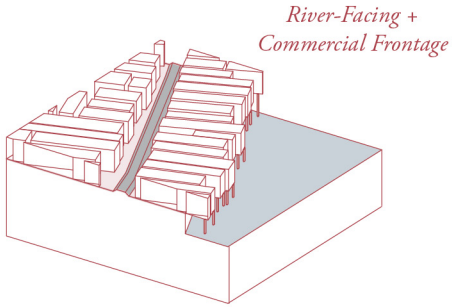
Mangrove-Shrimp Farm Plot



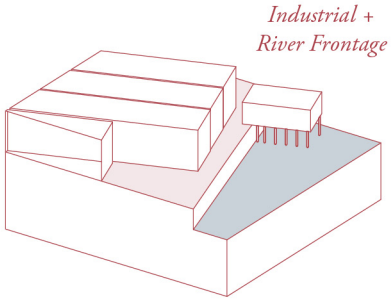
Residential Plot (water)



Residential Plot (road)



Commercial Plot



Industrial Plot

Analysis of existing plot types and the architectural response to topography and land-use patterns. Older plot types are commercial and residential plots that face the water. New plot types include buildings that face road infrastructure, industrial buildings as mechanization increases, and natural plot types like mangrove forests and mangrove-shrimp farms. An idea of above-below conditions permeate throughout.

Năm Căn into six plots that make up the town: mangrove forest, mangrove-shrimp farm, water-facing residential, road-facing residential, commercial, and industrial plot. Micro-topographies begin to play a crucial role at this scale on architectural forms. Architectural typologies are differentiated by their design response to above-below foundation conditions. For example, mangrove-shrimp plots employ elevated lands, bunds or embankment, for mangroves while shrimp rearing and harvesting take place below. Buildings (residential, commercial, industrial, and mixed residential-commercial) utilize stilts to address water inundation while road-based buildings employ shallow concrete foundations.

Local inhabitants utilizing their docking structure and access to the water. To be noted are the various vertical datums that relates human-use to fluctuating water levels and mangrove systems at the edge.

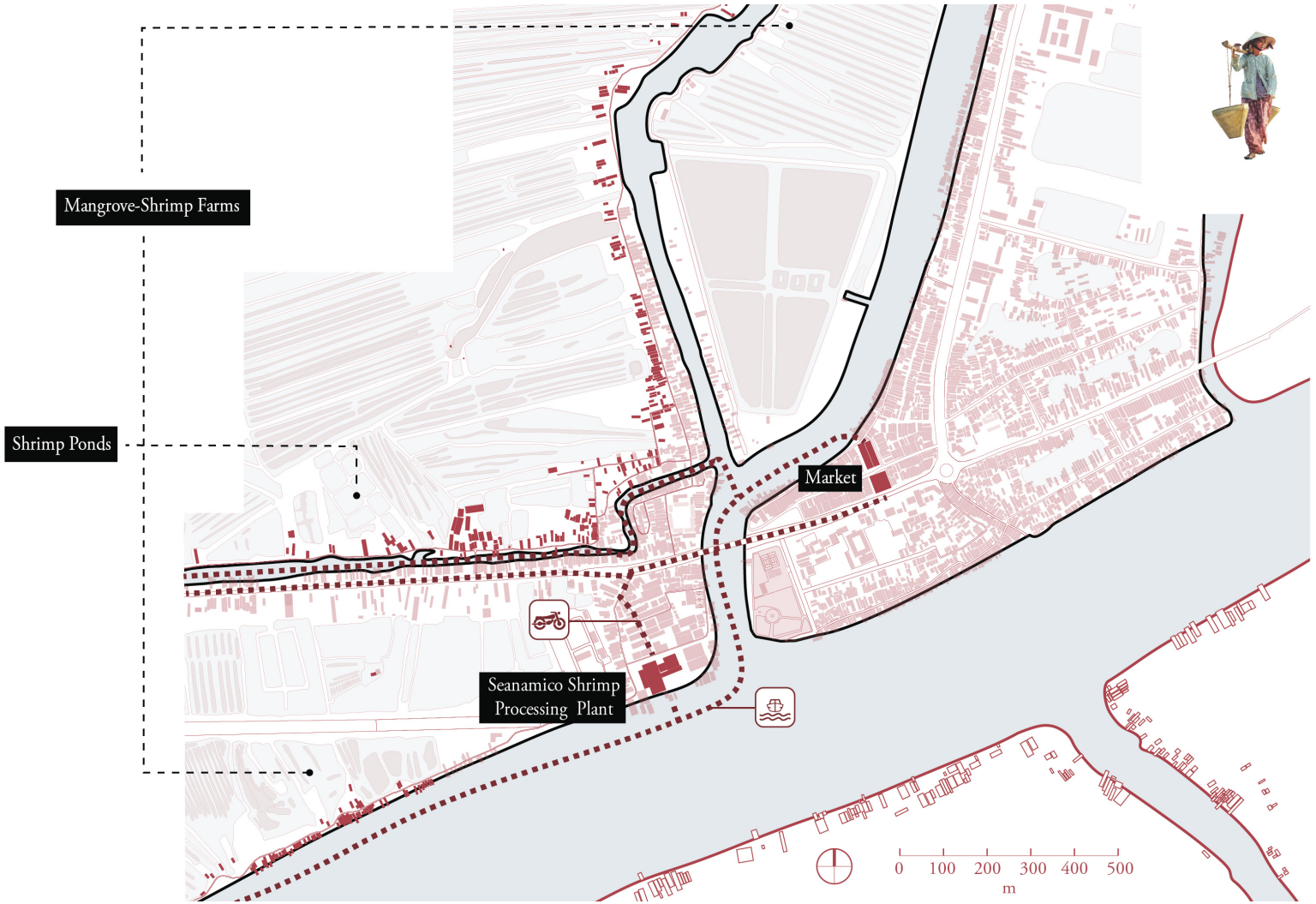
Small-Scale Shrimp Farmers

The town is divided in its land-use, with production land-use occurring primarily to the west side in the form of mangrove-shrimp integrated farming. Large rectangular ponds are attributed to intensive shrimp ponds. At the center is a protected mangrove area. Mangrove-shrimp farms typically have long linear bunds on which the mangrove trees are planted. Harvesting and production are done in the waters adjacent to the mangrove bunds. Small-scale shrimp farmers primarily produce shrimp for at-home consumption or local consumption, selling their products at the market. Any excess can be sold to collectors whom then sell to the processing plant to be packaged and shipped domestically and then internationally. Many shrimp farmers own rights to their land and so are able to live on the property as well.

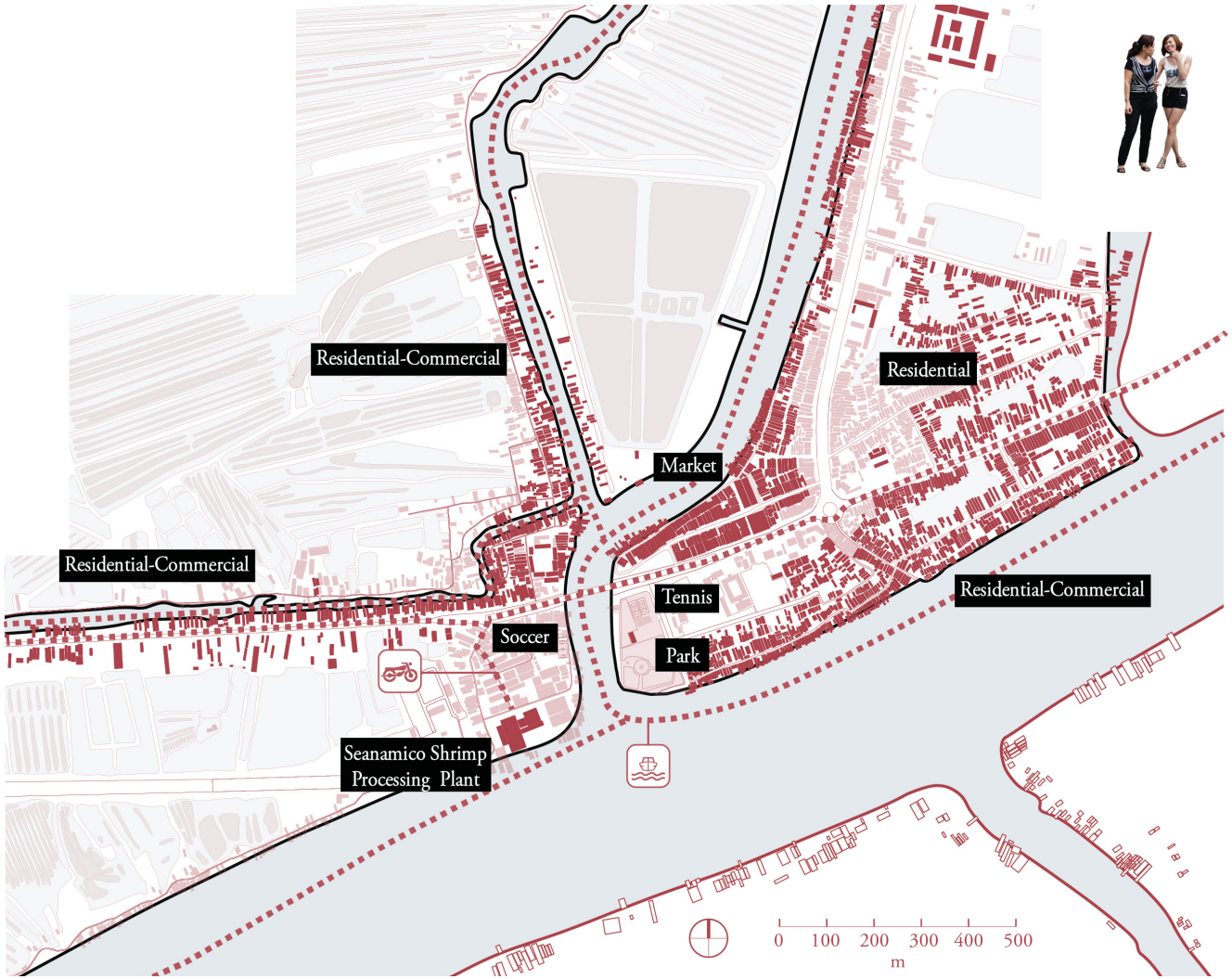
Traditional boat style in the foreground and newer tour boat in the background.

Local Communities

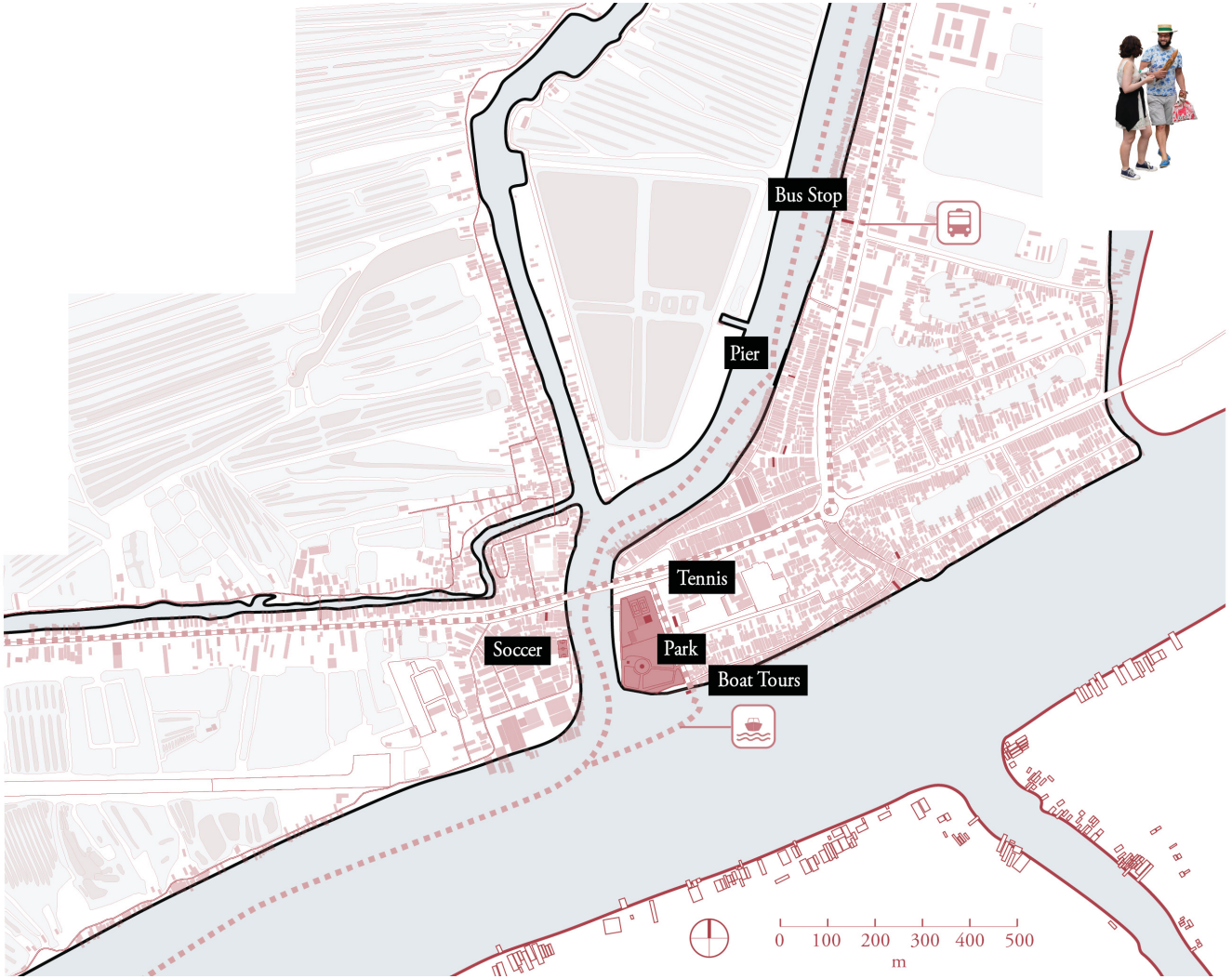
Local community members make a living by selling products as wholesalers through larger shops, at the market, or at



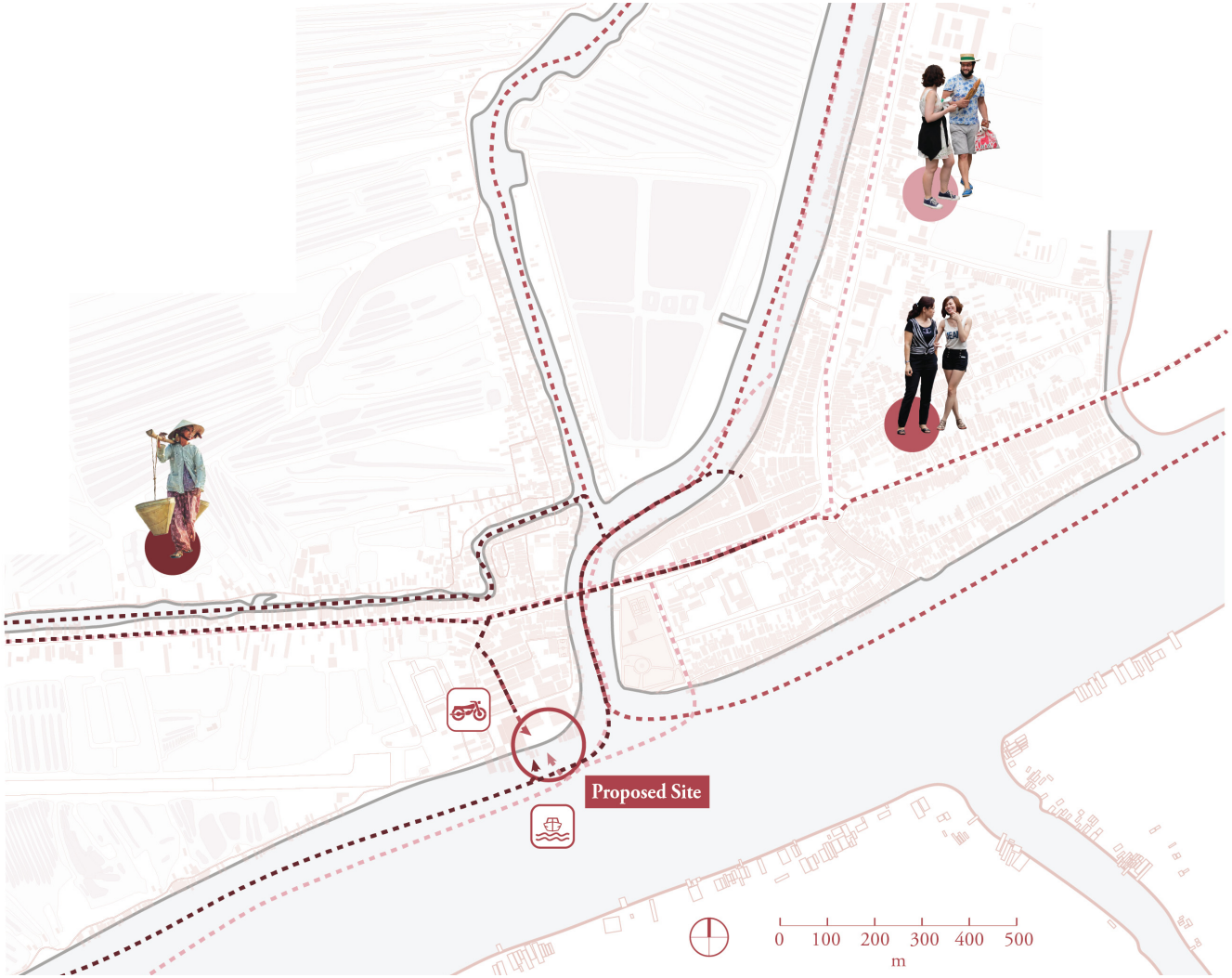
A study of a farmer's route through the town. Key areas and transportation methods are indicated. (base map from Google Maps 2019)



A study of a local community member's route through the town. Key areas and transportation methods are indicated. (base map from Google Maps 2019)



A study of a tourist's route through the town. Key areas and transportation methods are indicated. (base map from Google Maps 2019)



Proposed site takes advantage of existing user interactions and opportunities to bring tourists in. Key transportation methods are indicated. (base map from Google Maps 2019)

home via their commercial frontage which faces out onto the river or canal. Many also take part in fishing activities along the canal where mangroves serve as habitat for fish. The Seanamico shrimp processing plant also employs people in the community. They typically arrive by motorbike to their place of employment. During the evenings, many locals will gather after dinner to have light snacks and drinks with their family and friends or participate in a soccer or tennis match. The public park just at the intersection of the canal and Cửa Lớn River remains one of the few public areas not utilized as cultivation lands. It contains a monument honouring the Hon Khai Uprising, a historic revolt occurring on December 13, 1940, against French colonial rule.

Tourist

Many tourists seeking to travel through the southern delta will arrive from the larger city of Cà Mau before venturing

A boater making a purchase from a small-scale wholesaler from along the river.

onward to the Mui Cà Mau (Cà Mau Cape) and Cà Mau National Park and mangrove reserve at the tip of the Delta. Here, a large monument denotes the most southern point of not only the Mekong Delta, but of Vietnam. The travel time from Cà Mau city to Cà Mau National Park is 2 hours 20 minutes by vehicle and 3 hours by boat. The travel time from Cà Mau to Năm Căn is 1 hour 30 minute trip by land and 1 hour 15 minutes by speedboat. Năm Căn town has been slowly developing their tourism sector and currently caters for travellers as a stopping point, at the half way mark, on their way to Cà Mau National Park. For tourists coming into Năm Căn, a bus stop is located on the national highway close to the main centre where newer commercial shops have opened. For those entering by boat, a pier not far from the bus stop serves as an arrival point. Another pier on the Cửa Lớn River offers boat tours departing from Năm Căn for Mui Cà Mau and Cà Mau National Park.

Site Selection

The chosen site for the architectural intervention lies adjacent to the Seanamico shrimp processing plant along the river's edge. The location serves as the town node, central to the shrimp ponds to the west and public and urban activities to the east. It also interfaces with the river, the primary method of transportation in Năm Căn. The location is already frequented by farmers, shrimp collectors, and local community members whom work at the plant. A new programmatic strategy serves to draw other users into the site such as tourists and other local inhabitants. The site can also be linked to other key sites around the district (eg. mangrove reserves and mangrove coastal defense) and even other cities within the southern Mekong Delta (eg. Cà Mau and Can Tho) as a stopping point along a route or as a

final destination. An architectural intervention here presents an opportunity for cultural exchange and hybrid activities that is otherwise non-existent in the town. Education, exchange, and collaboration bring into focus the role of mangroves as resource, as provider of livelihoods and sustenance, and intrinsic cultural and spiritual value. At the territorial scale, the dialogue that is created by placing the centre adjacent to the processing plant connects local to global. The synergy of all user groups at this point sparks new conversations about the relationship between town and industry, local and tourists, re-evaluating the role of a dynamic culture in an increasingly global world.

Chapter 6: Design Development

The identification of any singular and true traditional form in the Mekong Delta is unclear, insofar as the development of architectural types or styles has been the result of the intermixing of various ethnic groups due to proximity and relations, as well as political influence through time (Balderstone and Logan 2003, 153). Even regionally, while the configuration varied, the overarching strategy for all was to adapt and thrive to living in specific climatic environments (Balderstone and Logan 2003, 153; Vo 2018, 2; Yeang 1987, 12). “Adapt” here means to effectively resist harsh climates and “thrive” is to exist in a space such that is aligned with one’s spiritual connection to earth and space (recalling *đất nước*, “country” and the art of *phong thủy*, feng shui). The connections between inside and outside, environment and human-use, were in this way, inextricably linked.

The early southern Viet houses closely resembled those of their South-East Asian neighbours rather than architecture developing in the northern parts of Vietnam. Typically, houses in the south were built on stilts, with the pillars placed into the ground or on a platform, much like the housing of tribal communities in now Cambodia, Malaysia, and the Philippines (Balderstone and Logan 2003, 137). The characteristics of these architectural styles varied by region and through time. Some of the types were: stilted dwellings with thatched roofs, stilted dwellings with elevated roofs to allow for windows, stilted timber houses with a thatched roof and an open terrace extending towards the front, as well as longhouses on stilts and high-roofed communal houses (Balderstone and Logan 2003, 153-154). The style most attributed to the south were dwellings built high on stilts (2

metres above the ground) and utilized the space below their floors (typically bamboo) to keep their animals with access via a ladder at one end of the house (Balderstone and Logan 2003, 154). Vernacular houses, through a very conscious approach to design and building show,

> ...an organic and creative relationship with nature, indicating respect for and awareness of the protection of natural resources…architecturally aesthetic values, and expressive values in terms of religion and spirituality, integrating wisdom and experience. (Vo 2018, 7)

Vernacular forms and strategies are still very much evident in the contemporary adaptations, especially true in rural locations. Both typologies remain in dialogue with their environmental surroundings. These typologies represent an antithesis to newer industrial and land-based building typologies that are not flexible or adaptable to natural flows. Both vernacular and adapted vernacular in Năm Căn town are studied here as they relate to their location in the town, the topography, climate, spatial configuration, and construction and material.

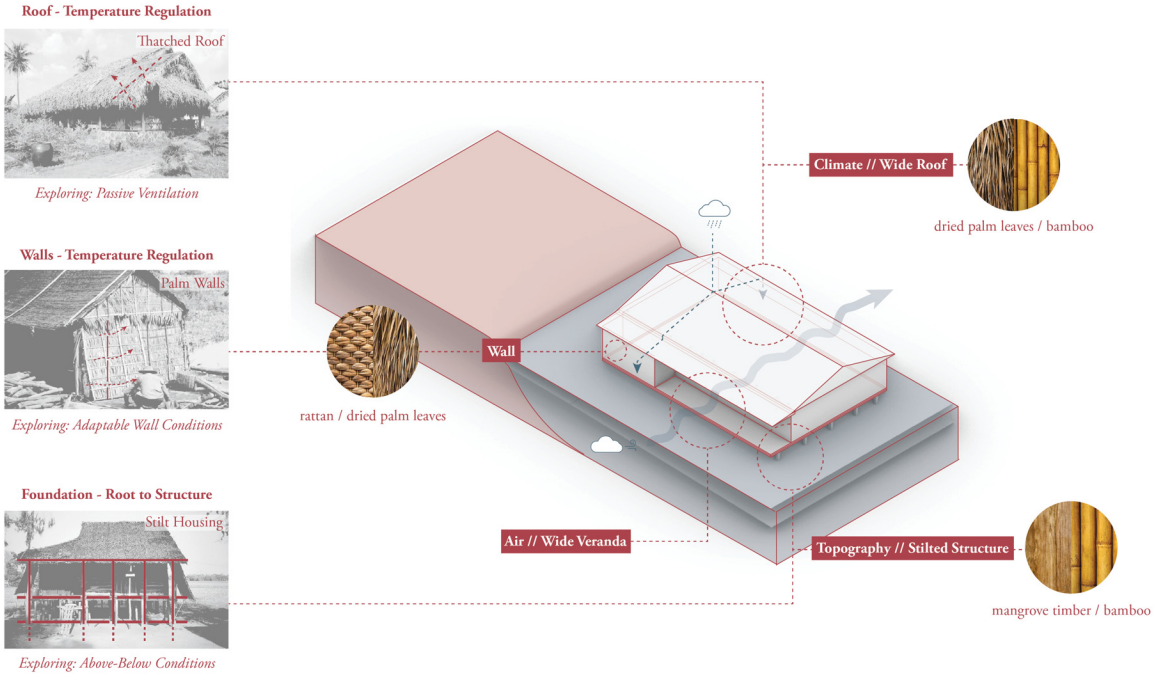
Vernacular Design

Town Location

Vernacular dwelling typologies are disappearing in the Mekong Delta, as well as in the town of Năm Căn. They are predominantly found outside of the town centre along smaller canals and streams. For inhabitants who can afford, they have opted for more contemporary housing, explored later in this chapter, located closer to the town centre.

Topography

Stilted structures are typical of vernacular buildings in the Mekong Delta to allow living in constantly changing



A diagram examining vernacular responses to climate, ventilation, construction and materiality. (base images from Dong DMC 2020; Aqua Expeditions n.d.; Mekong Smile Tour n.d.; data from Vu and Duong 2018).

conditions, that is, between floods and fields of an amphibious environment. The character of a stilted house similarly varies within different ethnic communities and topographies however the flat floodplains of the Mekong Delta has resulted in wider homes, as opposed to other regions with more mountainous landscapes (Vietnam Culture, n.d.). The varying types of dwellings are also linked to cultural associations of architecture, space, and spiritual balance. Raised floors are regarded as *yang*, while water, lower level, is regarded as *yin*. A balance between them is maintained by human interaction to take advantage of natural resources, such as utilizing the water surface below a stilted floor for cooling, while also allowing nature to regulate itself and not interfere with its processes (Vo 2018, 3).

Climate

In Vietnam, south is the favoured directionality for a house (*phong thủy*) but must utilize building strategies to regulate harsh sunlight, humidity, and storms (Vo 2018, 3-4). Some strategies include: multi-layered roofs, widely spaced columns, wide verandas, fixed or movable screens, pergolas on the front of the house and vegetation to block sunlight. The spatial organization of rooms on the interior are organized in a way that open doors allow continuous ventilation (Vo 2018, 4). Walls and materials are lightweight to encourage passive ventilation.

The roof comprises of a large part of the house, making up half or more than half of the house frontage. Roofs extend far out over the veranda, an intermediary space between exterior and interior, blocking harsh sunlight and rain from the walls while allowing cool air a place to enter the house (Vo 2018, 5).

Organization

The earliest settlements and communities in the Mekong Delta grew accustomed to utilizing the waters for transport, commerce, and aquaculture. The types of communities that emerged relate back to the conditions of the waterway. Intersections of larger rivers were hubs for commerce, exchange, and distribution. Along smaller water channels, slower and more stable water flows were suited for local commercial exchange and aquaculture activities (Vu and Duong 2018, 4).

Organization at the dwelling scale often revolved around five primary rooms: the kitchen, the bedroom, the room for entertaining guests, the room for working (eg. weaving)

and the room for worshipping a family's ancestors (Vietnam Culture, n.d.). The rooms are organized to create unity and harmony with nature, and flexibility to accommodate variations in "terrain, habit of production, living condition, family structure" and regional differences (Vo 2018, 7).

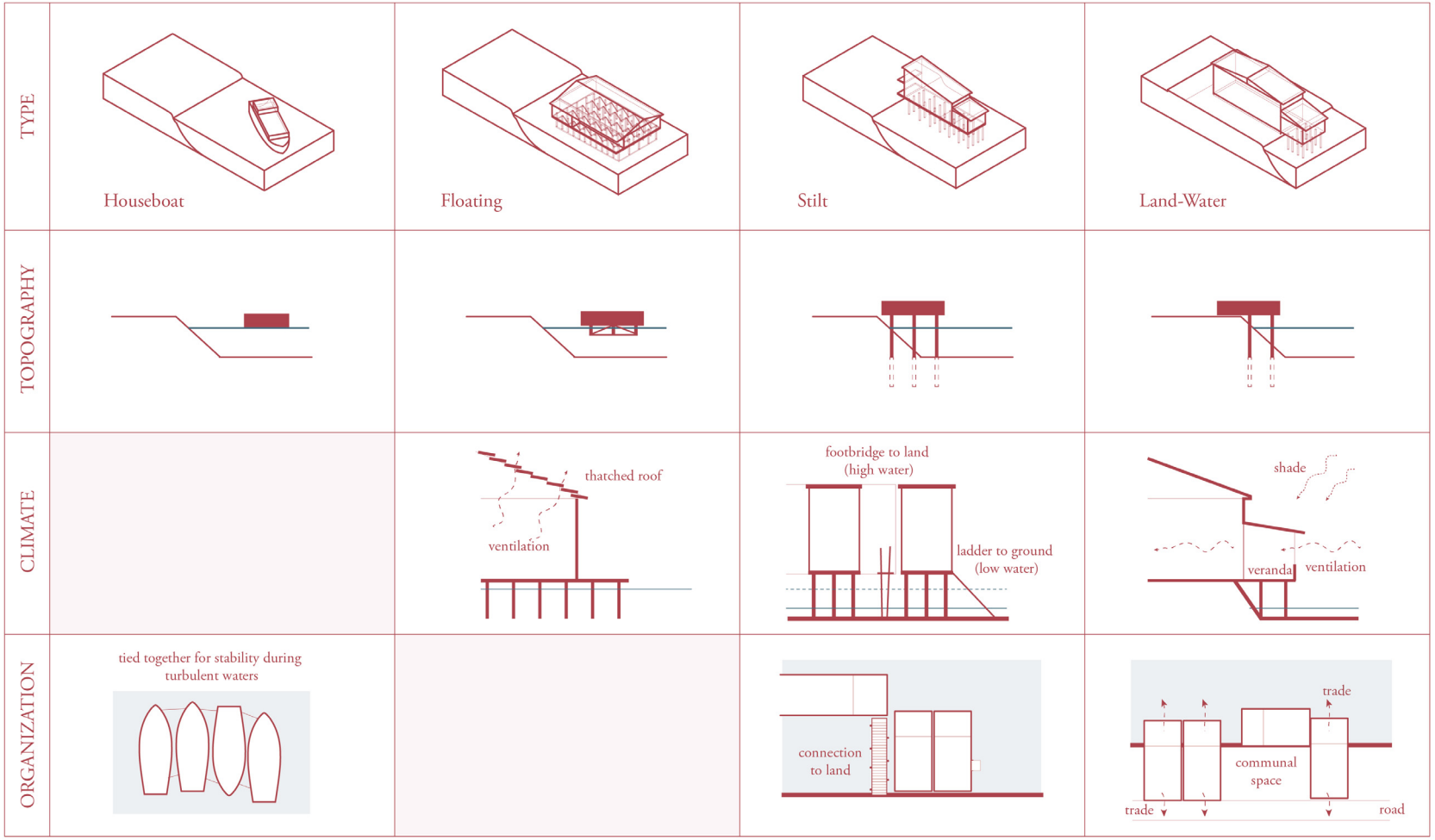
Construction and Material

Vernacular architecture of early dwellings are entirely built using local plants and vegetation in foundation system, columns, beams, wall and roof material. Wood, rattan, bamboo, neohouzeaua, palm leaves, and coconut leaves are often used to construct housing as well as local tools and objects for daily items (Vo 2018, 5; Vietnam Culture, n.d.). For daily objects, the Vietnamese conical hat, *nón lá*, is synonymous with local Vietnamese culture and more so with traditional rural culture, is handcrafted out of bamboo and palm leaves. Roof structures are typically thatched with straw, palm, and coconut leaves (Vo 2018, 5).

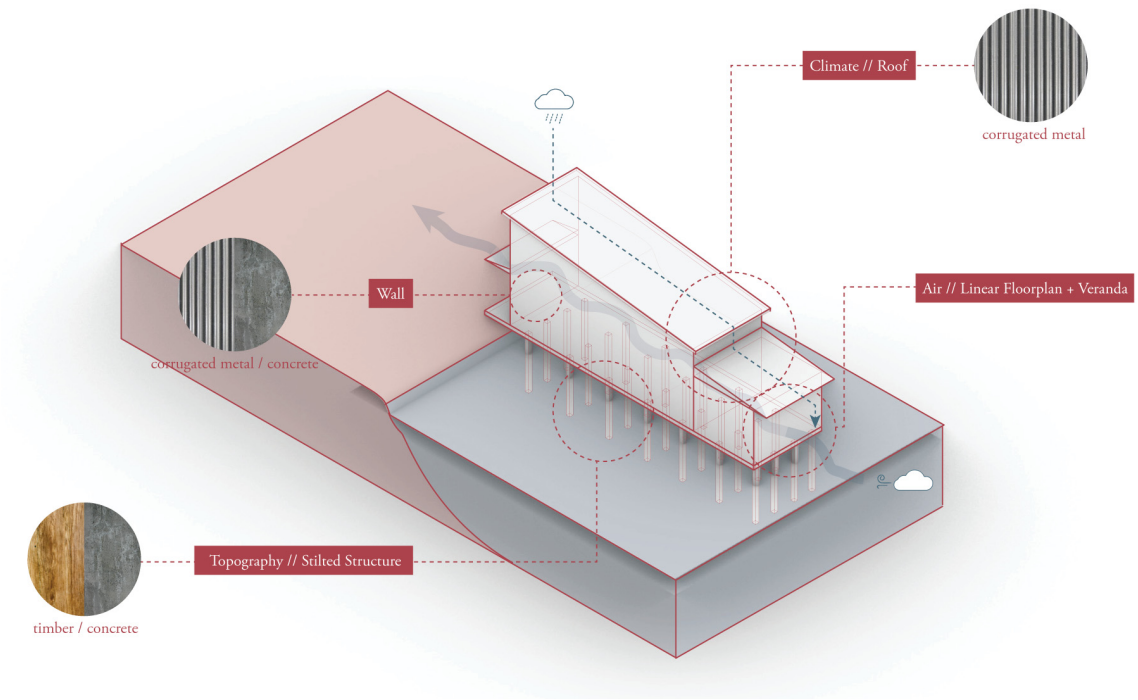
Adapted Vernacular Design

Vernacular buildings are still predominant in the Mekong Delta today, albeit some of the characteristics have evolved and new types have emerged. There are five typologies of housing that have developed to be able to adapt to topographical and geographical conditions: houseboat, floating houses, stilt houses, and land-water stilt houses.

A look at aquaculture tools, basket traps, used by locals. These tools are all woven/constructed by hand and use local vegetative materials, most notably, dried palm. Left to right, stomping net (*dậm*), fish trap, and trap and catch (*nơm*).



A matrix looking at contemporary adaptations to water-based dwellings found in the Mekong Delta. The four types are examined by their response to topography, climate, and organization of parts to facilitate user exchange and activities. (information from Vu and Duong 2018)

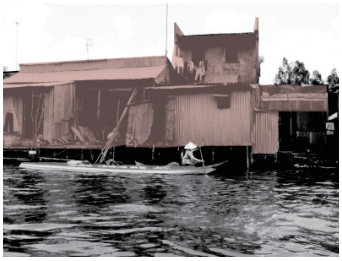


A diagram examining contemporary stilted structure and the architectural responses to climate, ventilation, construction, and materiality. (information from Vu and Duong 2018).

Land houses are a newer typology that exists in the town but will not be studied as a vernacular type seen with river communities (Vu and Duong 2018, 4-5). Each of the typologies varies in their approach to topography and level of permanence, climate regulation, and organization (how they are arranged together). Houseboats and floating houses are not tied to a location and can easily be relocated. Often these types are seen at floating markets as they travel to pick up supplies and then to markets to sell before returning home. Stilt houses are the most traditional typology seen in the Mekong Delta as land is regularly inundated with water during monsoon season. In Năm Căn they are the predominant type. The stilt house and the land-water stilt house will be further explored to formulate strategies for the thesis architectural intervention.

Town Location

Stilt dwellings and land-water stilt dwellings are found all along the edges of the river and major canals. Stilt dwellings attach to land via a footbridge and utilize the water frontage for commercial functions. Land-water stilt houses have maintained their ties to riverfronts but also have a rear, land-facing, side as well. As such, mixed residential-commercial land-water stilt houses will have two frontages for commercial functions: river-side and road-side.



A study of existing adaptations to vernacular building strategies. Corrugated metal wall material (above) and stilted structure with veranda access to water (below).

Topography

Stilted houses typically have one river-facing side and a land-facing side that dialogues with the corresponding infrastructure type and access to the community. In the situation where a stilted house has two river-facing sides, a footbridge made of bamboo or wood would connect to the land (Vu and Duong 2018, 7). Land-water stilt houses straddles the edge, situated partly on land and partly on water. Two foundation types are seen: platform brick or concrete on the land-side and stilted concrete or tole on the water-side. Main spaces are built over land while auxiliary functions extend out into the water (Vu and Duong 2018, 8).

Climate

Verandas continue to be a key interface between exterior and interior as a covered space that allows air to flow into and through the house. Contemporary adaptations have continued to utilize the veranda as a place for exchange, a storefront for mixed residential-commercial dwellings.

Organization

The larger organizational method of houses to the site are grouped by a family, expanded when member numbers increase, by close relatives and friends, or divided and rented out to tenants. Stilt houses are configured to create micro-communities by an extended family or group of families who have the same business (Vu and Duong 2018, 9). In this regard, their organization similarly uses a hybrid approach, blurring the edges between community, building, and local activity. They will utilize bamboo or wooden footbridges to connect houses back to the land through communal circulation corridor. Water-land stilt houses are grouped in a similar way but create internal alleys (*hẻm*) for commercial activity to occur on water and on land (Vu and Duong 2018, 9).

These housing types can exist as strictly residential or combined residential and with commercial trading activities. The type would in turn affect the interior spatial organization. Residential-only stilt houses have a front area containing the veranda, living area, ancestor worship space, and the bedroom. The back area would contain visitor's quarters, kitchen, storage, and toilet (Vu and Duong 2018, 7). Mixed residential-commercial will have two floors with the ground floor for public spaces (visitor quarter, worship space, kitchen, dining) while first floor is private for bedrooms (Vu and Duong 2018, 7). Land-water stilt structures with two or more floors will similarly display front-to-back and bottom-up spatial divide. The front would have the veranda for receiving guests into the worship area while at the back the kitchen, dining, storage and toilet would be. As one moves from ground floor up, private living spaces and bedrooms comprise of the upper floors. Land-water stilt houses that are

mixed residential-commercial utilizes similar configurations with the ground floor attributed to public programs such as worship, goods/products storage, platform for loading and unloading, and a small kitchen and dining area. Upper floors remain for private family member living spaces (Vu and Duong 2018, 8).

Evidently, main room types have evolved slightly from more traditional dwelling designs as stated above. Commercial spaces or spaces for trading and commercial activities, in addition to residential spaces, have become important for locals to provide a stable income (Vu and Duong 2018, 5). These organization methods allow flexibility and hybridity in function, daily rituals, and routines that are adjusted seasonally and annually (Vu and Duong 2018, 10).

Construction and Material

Materials used for construction, once entirely relying on the nature forest products, have evolved as industrialization and open markets bring more easily available (mass produced) materials. For the stilts, timber remains an often used material however inhabitants with money will also use concrete. The structure now can be made with timber, steel or concrete but remains decorated with light and natural materials like tole and leaves, which is also used for roofing material (Vu and Duong 2018, 7). A more contemporary roofing material seen in the delta and town is corrugated metal, sloped towards the water for drainage during heavy storms and wet season.

The Role of (Vernacular) Architecture

At the heart of vernacular design are the strategies attuned to the fluctuating climate and site conditions, as well as

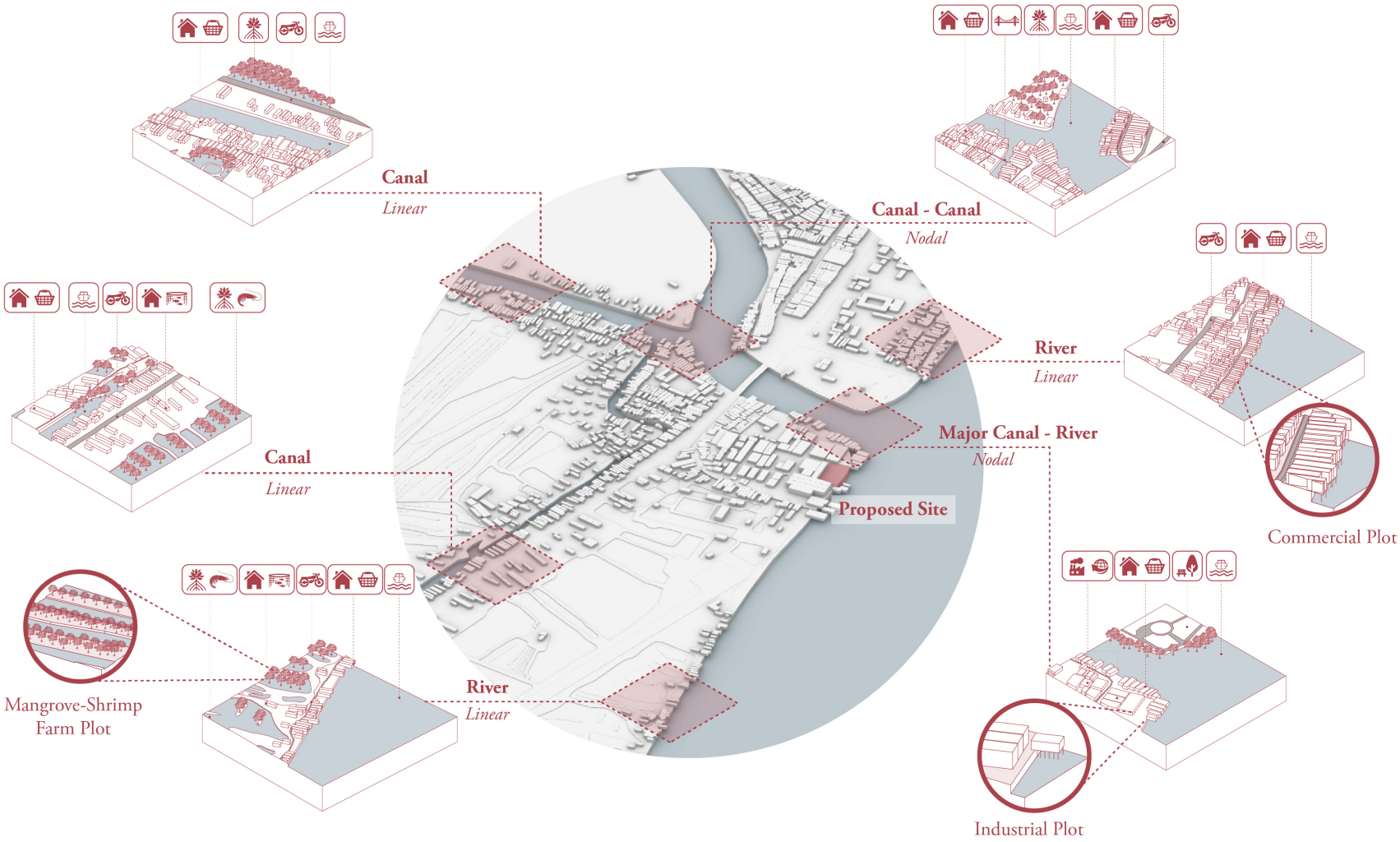
cultural changes, in order for people to successfully live in dynamic environments, shifting between sun, rain, land, flood, production, and commerce. In light of climate change, vernacular architecture needs to adapt again, as rising sea levels and erosion make the Mekong Delta inhabitants one of the most susceptible coastal communities around the world. The disjunction between human ties and responsibilities to nature, due to the historical and contemporary modernization processes, has resulted in the disappearance of place-specific cultural responses to inhabitation (Vo 2018, 9; Vu and Duong 2018, 11). Architecture here emerges as a method, and tool, to reconnect natural systems with human systems.

Chapter 7: Design

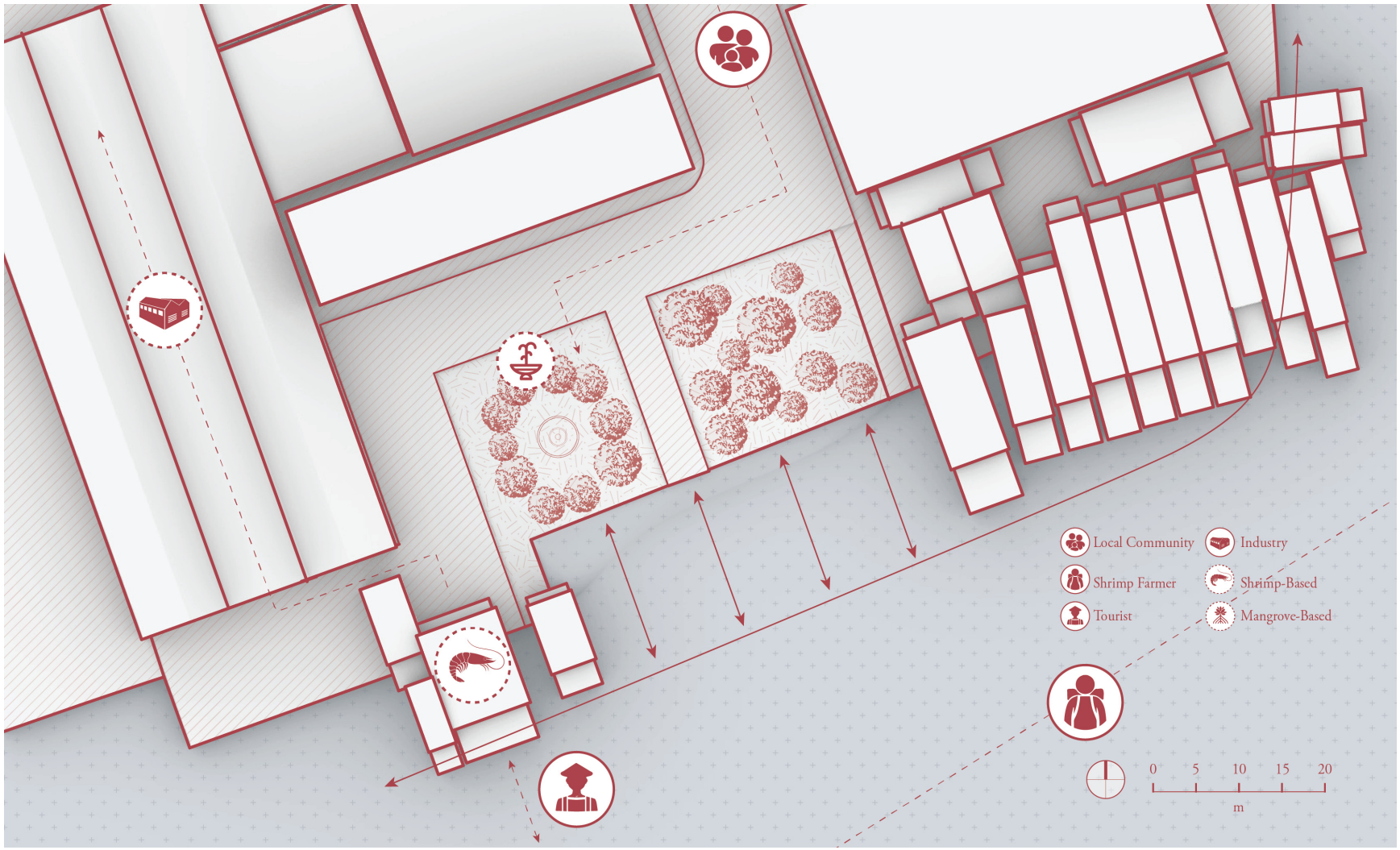
Site Strategy

The site strategy emerges from the study of the existing parcel and plot types in the town (explained in an earlier section), their variations are determined by access to water type, whether that is river or canal, and settlement pattern, linear or nodal. Linear types are comprised of canal-lined residential-farm plots. The configurations of these linear parcels are focused around transportation infrastructure, canal, river, road, or highway. From this are lines of residential, and then lines of productive farmland. Nodal types, occurring at the intersection of two waterways, are typically commercial driven, taking advantage of increased traffic at these points. Similarly, at nodal intersections, there is increased diversity of land-use, programs, and intensity of urban activities. The configurations of these nodes in the town have become outliers and zones for mixing of contemporary urban use. For example, at the major canal -river intersection is the industrial waterfront, small-scale commercial dwellings, and the public park/recreation space. These programs are unseen elsewhere in the town at this size. Zooming into the parcel I have pulled out three plot types: mangrove-shrimp, industrial, and commercial plots. While the intervention site is located at a node, the project proposes a new plot type. The striated land configuration of mangrove-shrimp plots will be interwoven with stilted inhabitation, taking advantage of the riverfront condition.

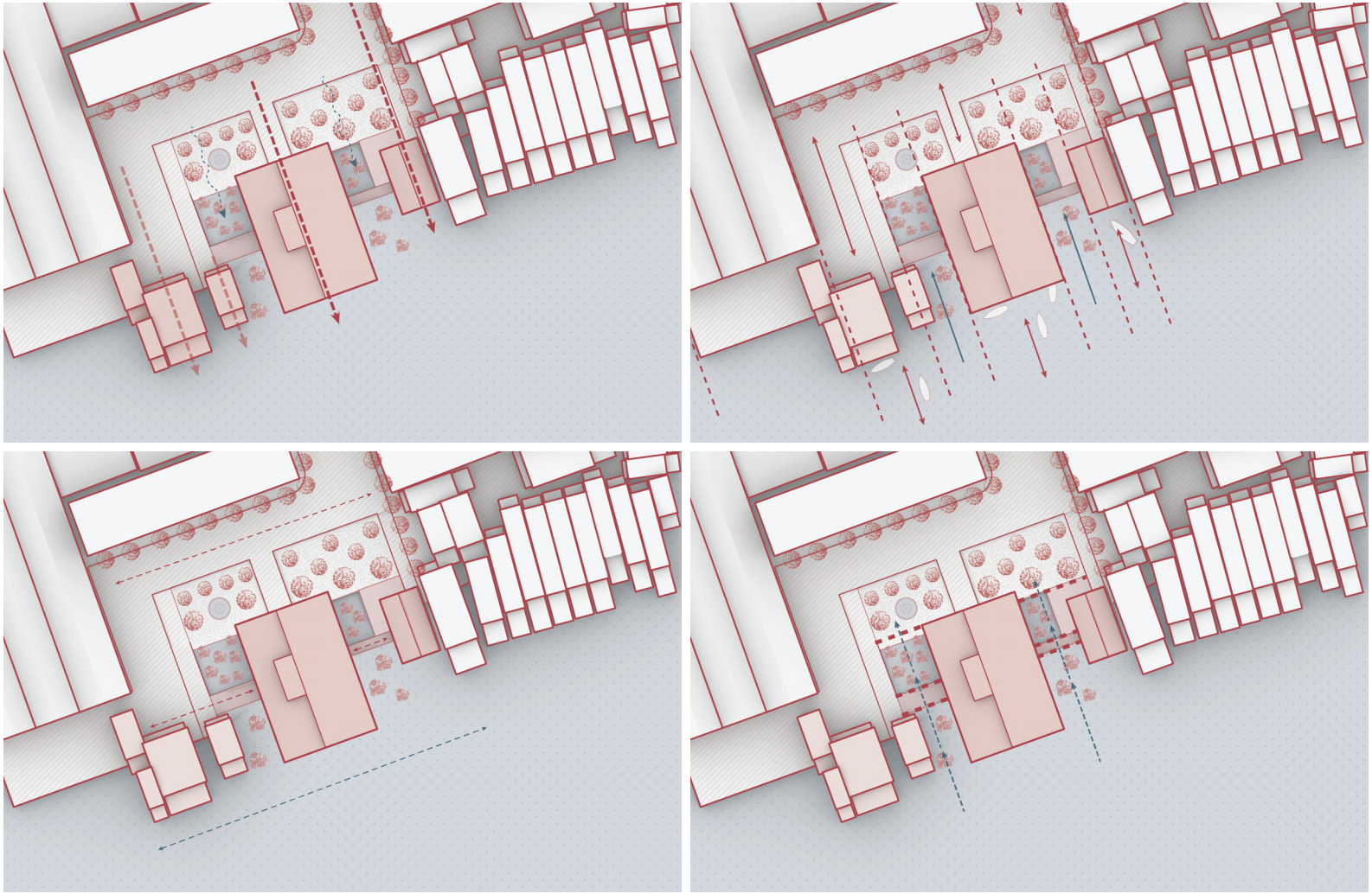
The site itself is rather insular, recessed from the flow of the river and removed from local activity, appearing as a break in the datum line created by adjacent small-scale industrial



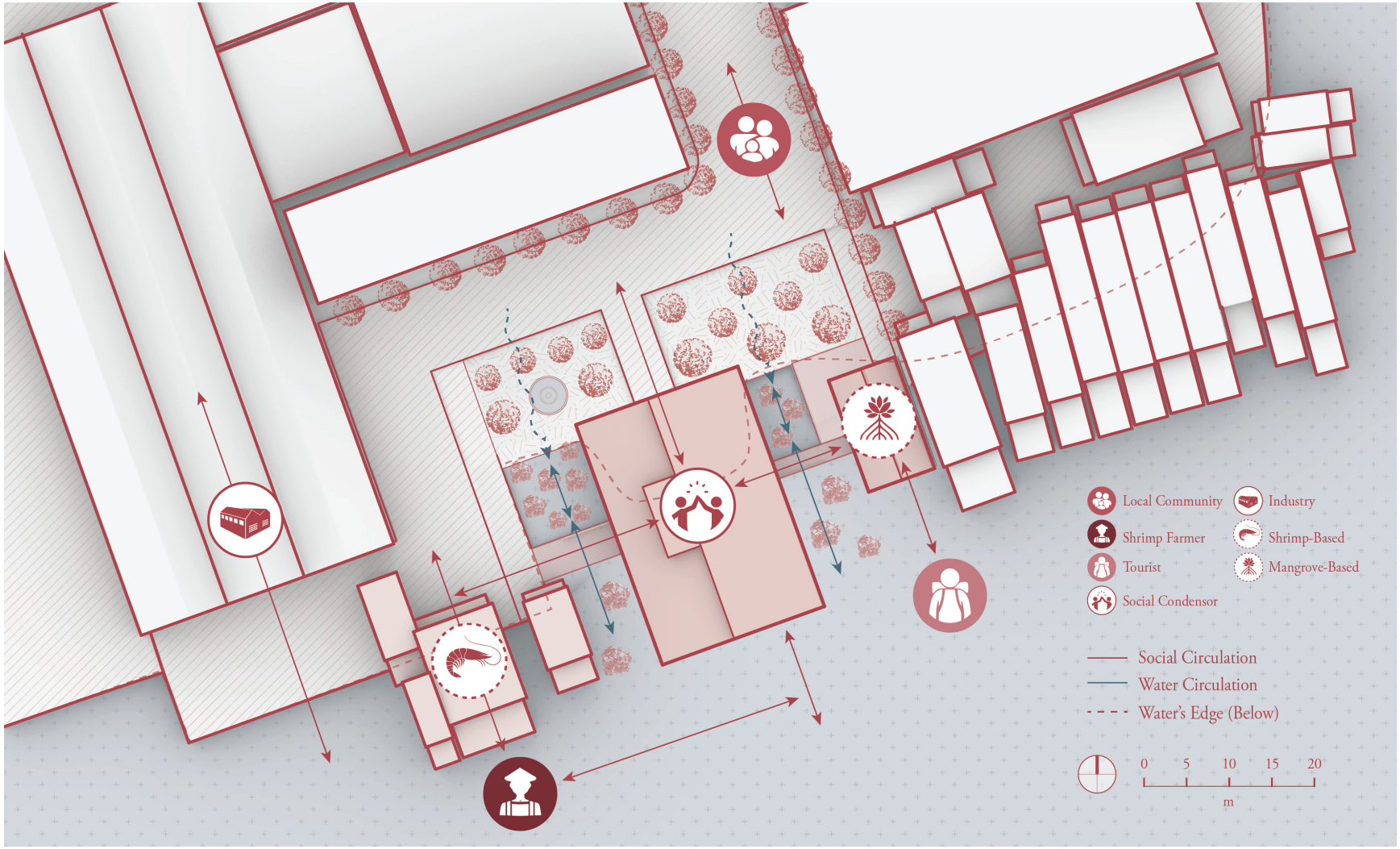
A closer study of the parcels and plots that are existing in the town in relationship to the proposed site. Parcel patterns and plot configurations are examined closely to inform the configuration of the site.



Site plan showing existing conditions: Users and activities show little overlap. Connection to the water is underutilized, being recessed from river activity and the datum created by adjacent buildings, creating a hard edge. Site strategies emerge that serve to activate the site as a connector of users (social) and nature (blurring the edges between water and land). (base map from Google Maps 2019)



Proposed site strategies: Circulation corridors are extended out into the water as inhabitable “fingers” (top left). The water’s edge is softened by alternating zones of natural space and inhabitation space. Water now flows into the site, blurring the water-land edge (top right). Cross circulation is promoted on land and on water, with inhabitable zones linked by a bridge running east-west (bottom left). This doubles as a permeable structure that captures flowing sediment for mangrove re-growth and flows into the garden (bottom right). (base map from Google Maps 2019)



Site plan showing how the proposed intervention acts as both a social and nature connector. Social connections link users together as well as connects town fabric to industrial waterfront. Nature connections link water and mangrove systems with land and garden systems that act as a reservoir during flooding events as well as porous edge to allow rain runoff into the river. (base map from Google Maps 2019)

and commercial dwellings. The site is also separated from the river by private gardens (belonging to the industrial plant) and flow of goods and activities through the site are minimal and private. The intention of the site strategy is to bridge the gap in the datum created by adjacent buildings and to re-activate and soften the edge. With the intervention in place, the site takes on a new configuration. Circulation corridors are extended out into the water as inhabitable “fingers”, reaching out to reconnect land and river. The potential for rainwater runoff from the land to the water is also promoted. Alternating zones of natural space and inhabitation space softens the water’s edge, mirroring the striated patterns of mangrove-shrimp farm plots. A bridge running east to west, creating a new circulation path, links the inhabitable zones while responding to inhabitation above water. It also doubles as a permeable structure that captures flowing sediment for mangrove re-growth on site, taking part in an act of ‘re-naturing’ the site or blurring the edges between water and land. Two new buildings are being proposed that link to an existing building, used for seafood shipping and receiving. Together the three volumes reflect user group activities and their overlap. The proposed building to the east links local community members with tourists through mangrove-based programs. The Education and Community building in the center is where all three user groups meet. This building will be further explored as a way to reconnect environment, culture, and economies through architectural strategies.

Existing Building Reconceptualized: Industry and Sustainable Shrimp Farming

The building to the west, as understood from a study of the site and imagery, is a drop off and receiving area for shrimp farmers and collectors/brokers (mediators between farmers

and industry) to exchange their supplies with the industrial plant. The plant receives, processes, packages and then ships shrimp domestically to larger ports in the country. The building is being reconceptualized to support the growth of sustainable shrimp farming and the proposed Năm Căn cooperative activities. The buildings are being reimagined to include communal spaces and informal meeting areas to house farmer cooperative activities where they can drop off their supplies, meet together before attending a class or workshop at the main Education and Community Centre. An additive program is being proposed within the scope of this thesis that ties into the circular economy that underlay an industry-farmer re-connection. Within shrimp processing, de-heading and shell removal are common practices that leave by-products and waste that can be recycled and reused (Pham et al. 2011, 2108-2110). Shrimp heads can be used for animal feed (if small-scale shrimp farmers also rear their own animals) while shrimp shells can be processed chitosan (from treated chitin shrimp shells), a polysaccharide, or chains of carbohydrate molecules, to be used in agriculture as fertilizer and for water treatment (Pham et al. 2011, 2110).

Outside the scope of this project, several other actors (whom are indicated in the mangrove stakeholder analysis) become involved. The WWF-Vietnam (World Wildlife Fund, now known as World Wide Fund for Nature) and local authorities have partnered with international organizations throughout the years to conduct projects in the coastal provinces of Soc Trang, Bac Lieu, and Cà Mau, to promote certification and Better Management Practices (BMP) to promote Shrimp Aquaculture Dialogue/Aquaculture Stewardship Council (ShAD/ASC) standards, amongst small-scale shrimp

farmers (World Wildlife Fund 2013). In a phased approach, the organization, along with international organizations like WWF-Denmark, seek to foster sustainable development and management of natural resources, improve the livelihood of lower income communities, and the “equitable sharing of the benefits and costs of natural resource use” (World Wildlife Fund 2013). The knowledge gained through farmer participation in classes and workshops in the Education and Community Centre can be brought back to the mangrove-shrimp farm plots.

Organized by the farming cooperative and operated through the project, resources like shrimp by-products can be returned to the farmers to use within their farm plots where applicable, pushing an agro-industry model for aquaculture in the town. By directly connecting industry and farmer, the project re-establishes a sustainable and synergistic supply chain (World Wildlife Fund 2013) while also increasing the basis for cooperative interactions through added value and shared environmental stewardship (Pham et al. 2011, 2110).

Proposed: Mangrove Education Building

The building to the east houses activities pertaining to mangrove education and replanting program information and workshop area. A large docking area serves as the departure and arrival point for boat tours to the Bai Boi Nature Reserve, or Dat Mui Nature Reserve, as well as mangrove replanting excursions to the eastern coastal edge, like at Tam Giang Đông. This ties into the proposed district strategy. The impacts of the design are meant to give agency first and foremost to the local community members and farmers, as their livelihood and safety are directly influenced by access to mangrove resources as well as climate protection. The main

program for this building is to facilitate mangrove education workshops that can serve as general mangrove and climate knowledge and for more specialized workshops, that teach about mangrove replanting procedures and processes. Access to on-site regenerated mangroves is supported by the permeable structure that captures sediment and promotes mangrove re-growth. A platform connected to the open-air workshop space is meant to allow real time observation of the mangrove tree as it would function elsewhere along the coastal edge or in larger mangrove forests. Access to replanting education classes and excursions are available to visiting tourists as well. Their involvement in replanting, as well as participation in proposed boat tours to mangrove reserve sites offer local members other opportunities for income (as tour guides or knowledgeable replanting guides) and evidently circles back to added income to support mangrove forest protection programs at the district scale.

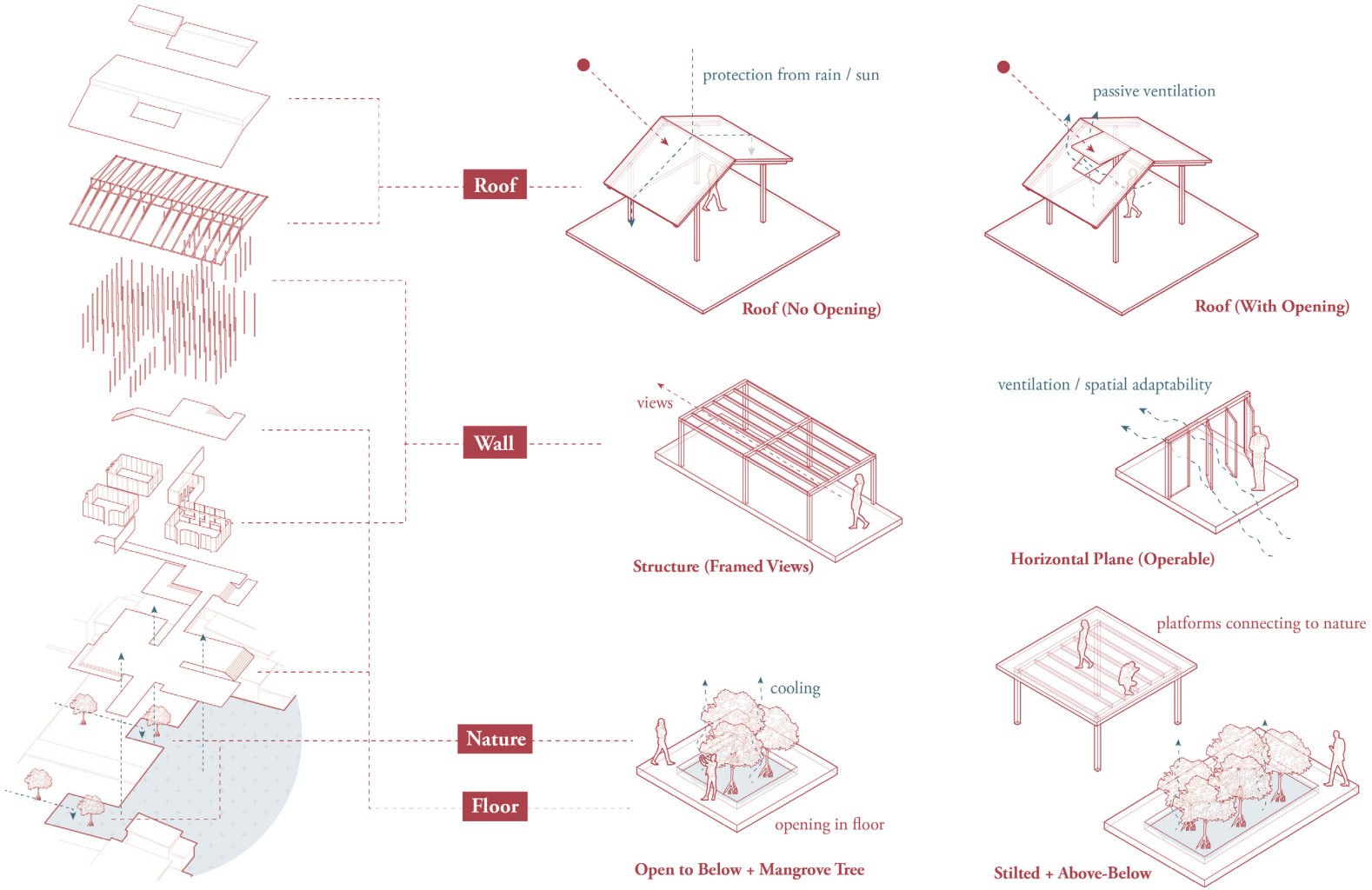
Proposed: Education and Community Centre

Design Principles

The previous studies on vernacular and contemporary housing types are revisited here to explore more specific architectural strategies that can be employed to link users to the environment through the floor, wall, and roof.

Floor

The building placement on the site straddles the river's edge so two conditions can be observed: connection to land and connection to water. Platforms from the building, as extensions of the workshop and classrooms, link the building and the users to the existing conditions of the site, mainly the garden spaces for industrial worker use. Exchange is



Exploded axonometric of Education and Community Centre. The floor, wall, and roof components are linked to a diagrammatic look at the architectural strategies. These can be utilized to optimize user comfort and connect them to the immediate environmental contexts and conditions.

promoted in this way. The floor, as it comes out over the river, utilizes cuts that allow the water from below to enter into the interior spaces. Greenery can enter into the building at these moments while passive cooling from below can also be achieved.

Wall

Mangrove roundwood timber provides the stilted structure of the building. The expression of the structure is continued up to elevate the roof structure while also carving the interior space. The grid of the structure in turn is connected to the users and activities taking place, framing views as well as delineating rooms. Three different types of operable walls are explored in the architectural design. Swing doors made of wood frame and rattan screens are allocated to the exterior, so that users can access the platforms linking building to environment to existing conditions. Rattan roller curtains are utilized on the interior to delineate rooms as a lightweight and permeable response to ventilation when opened or closed. Awning windows, also wood frame with rattan screens, are placed at moments when the floor-plate is cut through and water comes into the building.

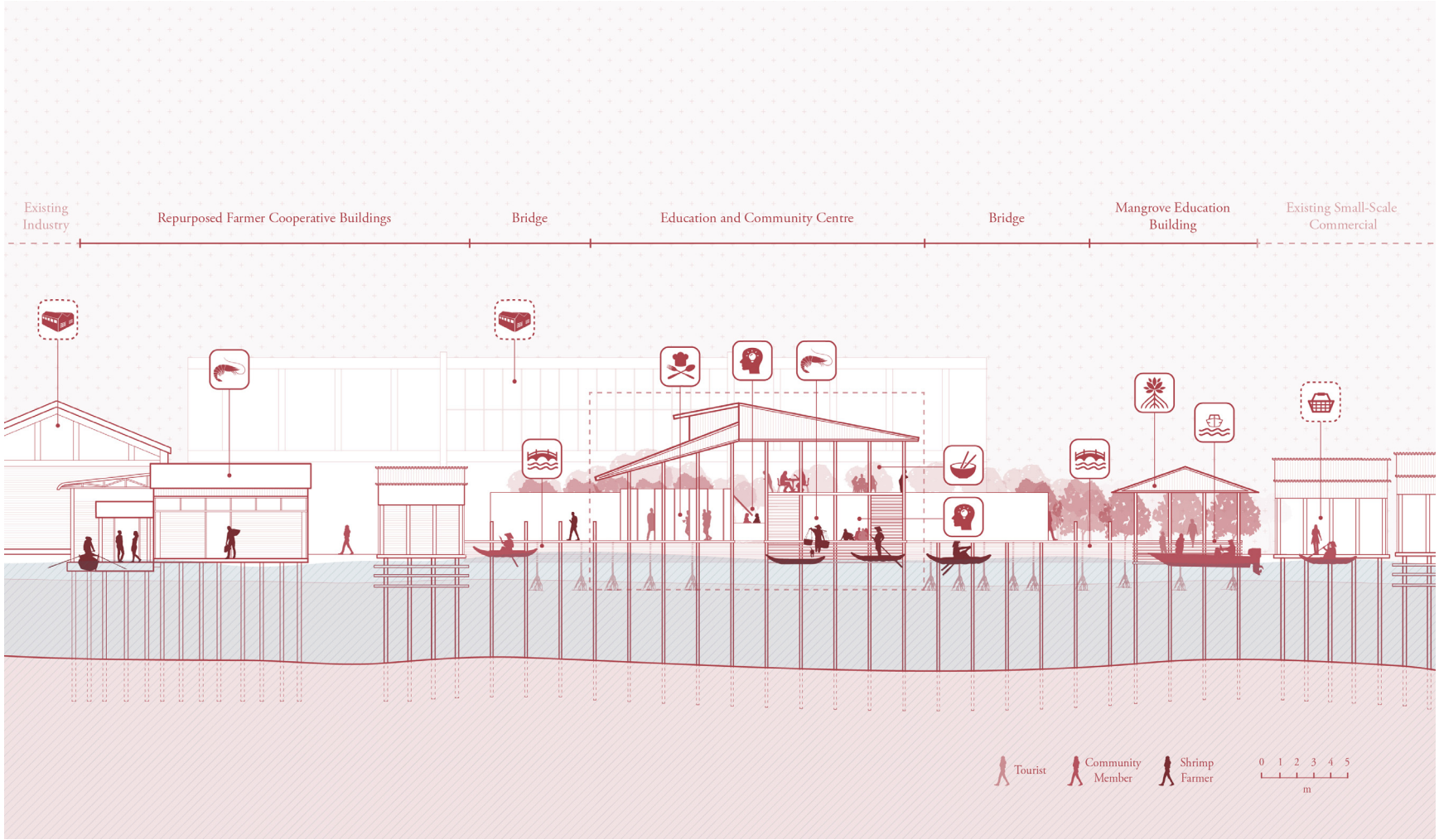
Roof

The roof protects from intense tropical sun and heavy rain but openings can facilitate passive ventilation. Openings in the roof can also be strategically placed to funnel and expel exhaust air from specific activities within the building. The roof structure is a truss system made up of three roof sections. The scale of the roof as it is divided reflects the surrounding conditions of roofs on other buildings around the site. The face in which the two major roof components meet remains open to allow air to move up and out. A central

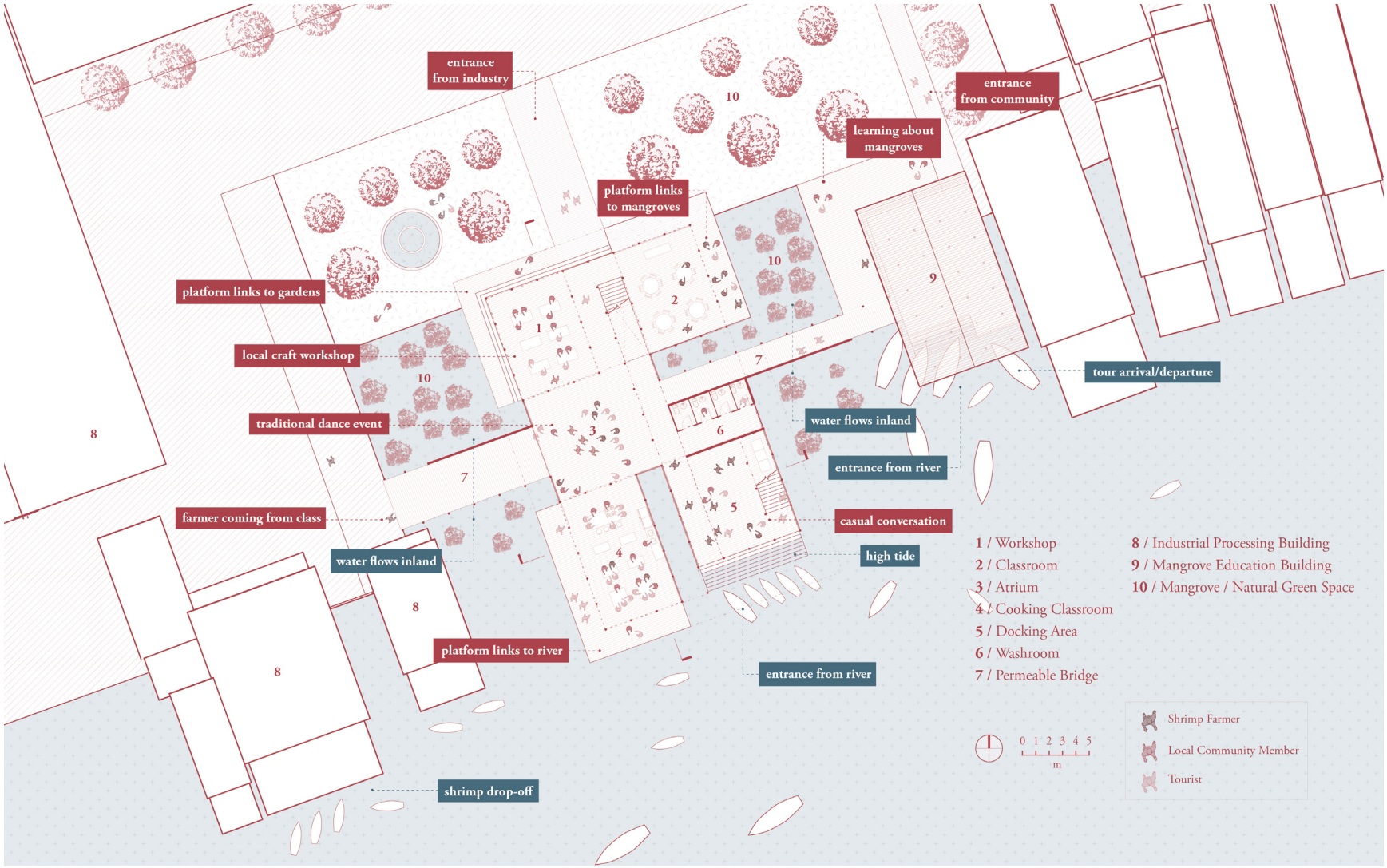
smaller puncture located above the atrium space facilitates concentrated air exchange during events or moments of high occupation in the atrium below. In all cases, the roof structure is opened to facilitate ventilation of exhaust air and cooling winds through, up, and out.

Design

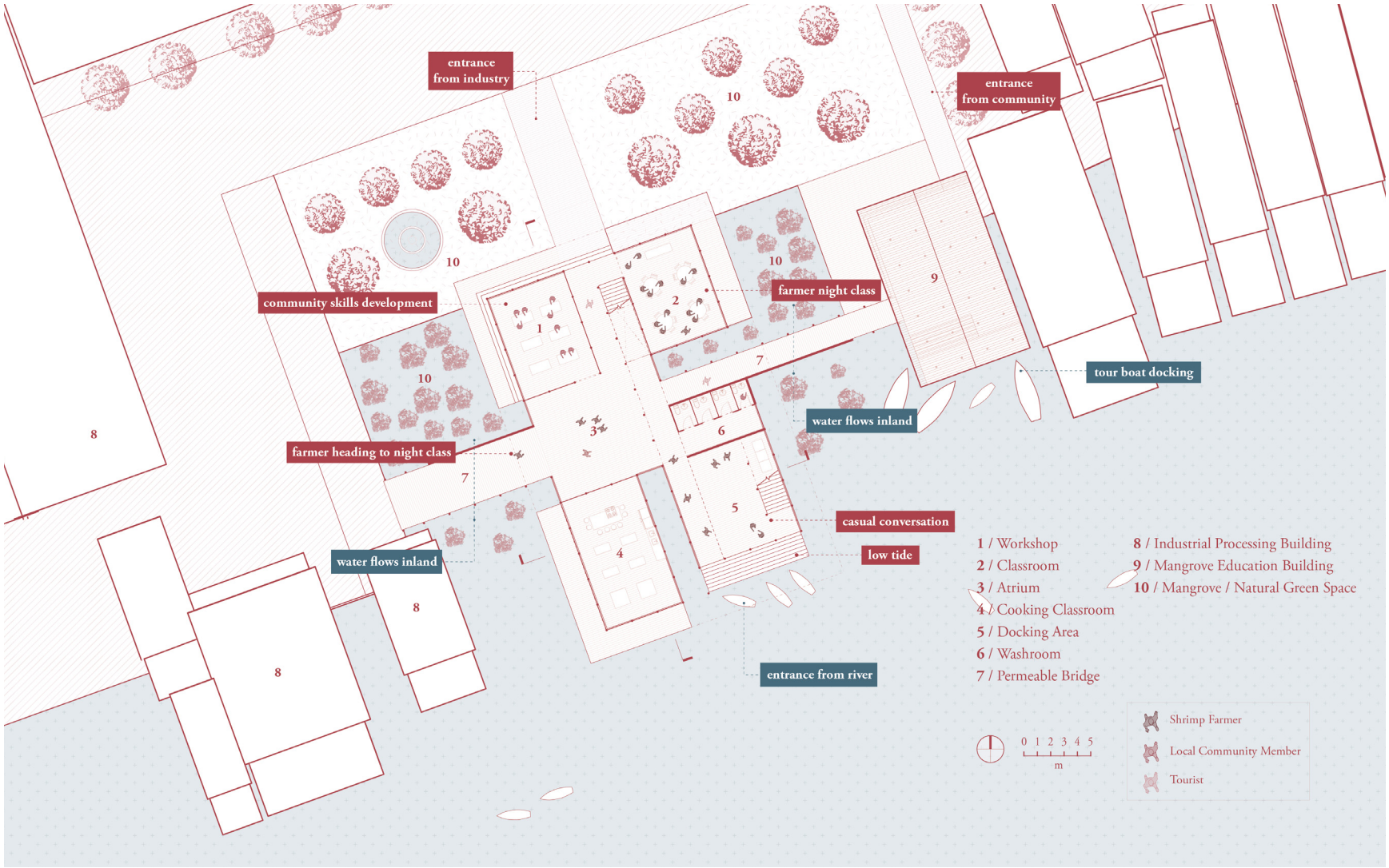
The three tenets of collaboration, cooperation, and exchange is facilitated in the main Centre via hybrid programming in conjunction with architectural strategies to bring together the three user groups and connect natural and environmental systems. On the ground floor are the open workshop, cooking classroom, classroom, and docking area that pinwheels around a central atrium. The atrium is a malleable space that can expand or contract to suit the needs of the users and activities taking place. This is achieved through operable wall systems that can be opened, to allow views into the space, or closed, to offer privacy. The atrium also doubles as a gathering place for special events, celebrations, market space, or temporary exhibition space. The workshop, cooking classroom, and classroom are meant to facilitate both small, private functions, as well as public, shared events. The spaces are primarily to hold activities for local community members as well as shrimp farmers. Workshops in this case can serve as formal and informal meeting spaces to learn, educate, and share knowledge. Local community members can use the space for casual hangouts while learning new skills. Shrimp farmers too can develop other skill sets in an informal setting. The classroom offers a place for both user groups as well. More formalized activities can be held here by visiting specialists or researchers to teach about general environmental knowledge, to promote stewardship, or more specific classes like water testing or disease prevention in



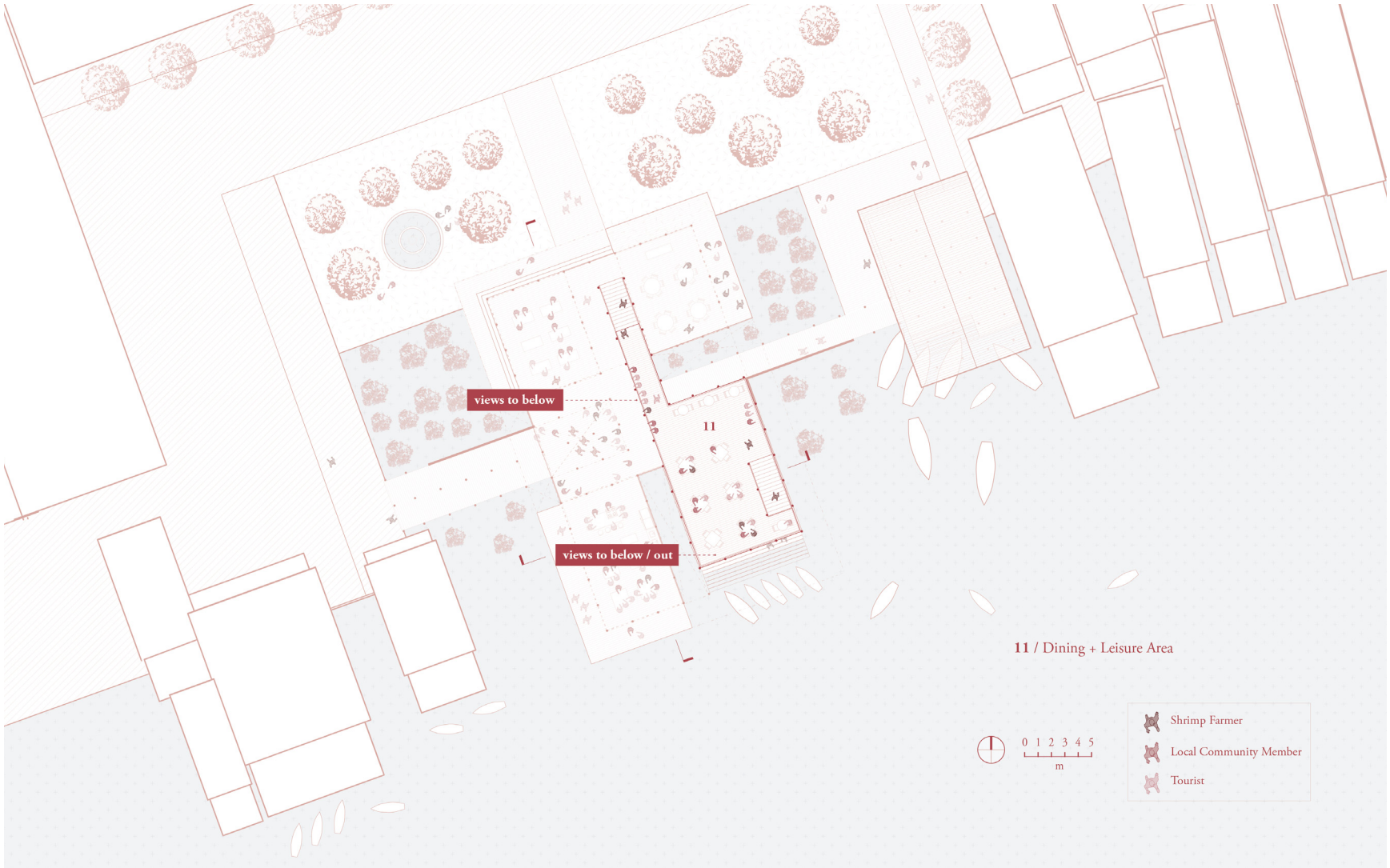
South elevation of proposed intervention within the context of existing buildings (indicated as dashed symbols). The proposal reactivates the edge through new social programs as well as nature-based functions. Highlighted is the Education and Community Centre, perspective sections of this building (on following pages) will further explore the natural and social systems at work.



Shown here is the ground floor when the atrium space becomes an extension of the workshop and the cooking class. The classroom and workshop are linked in a similar manner. (base map from Google Maps 2019)



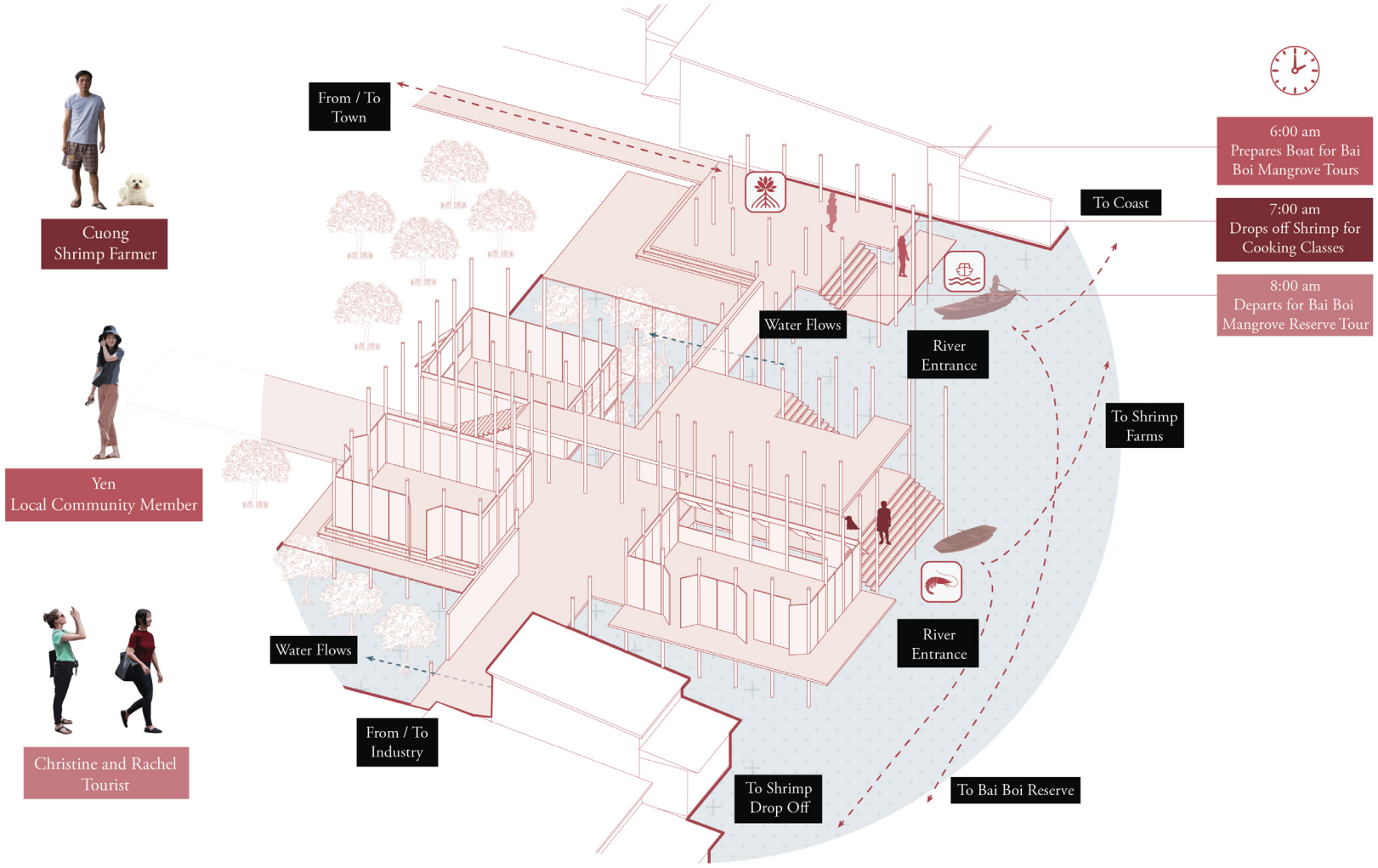
Shown here is an example of the ground floor during private activities. Rooms are closed off for smaller and more intimate meetings. (base map from Google Maps 2019)



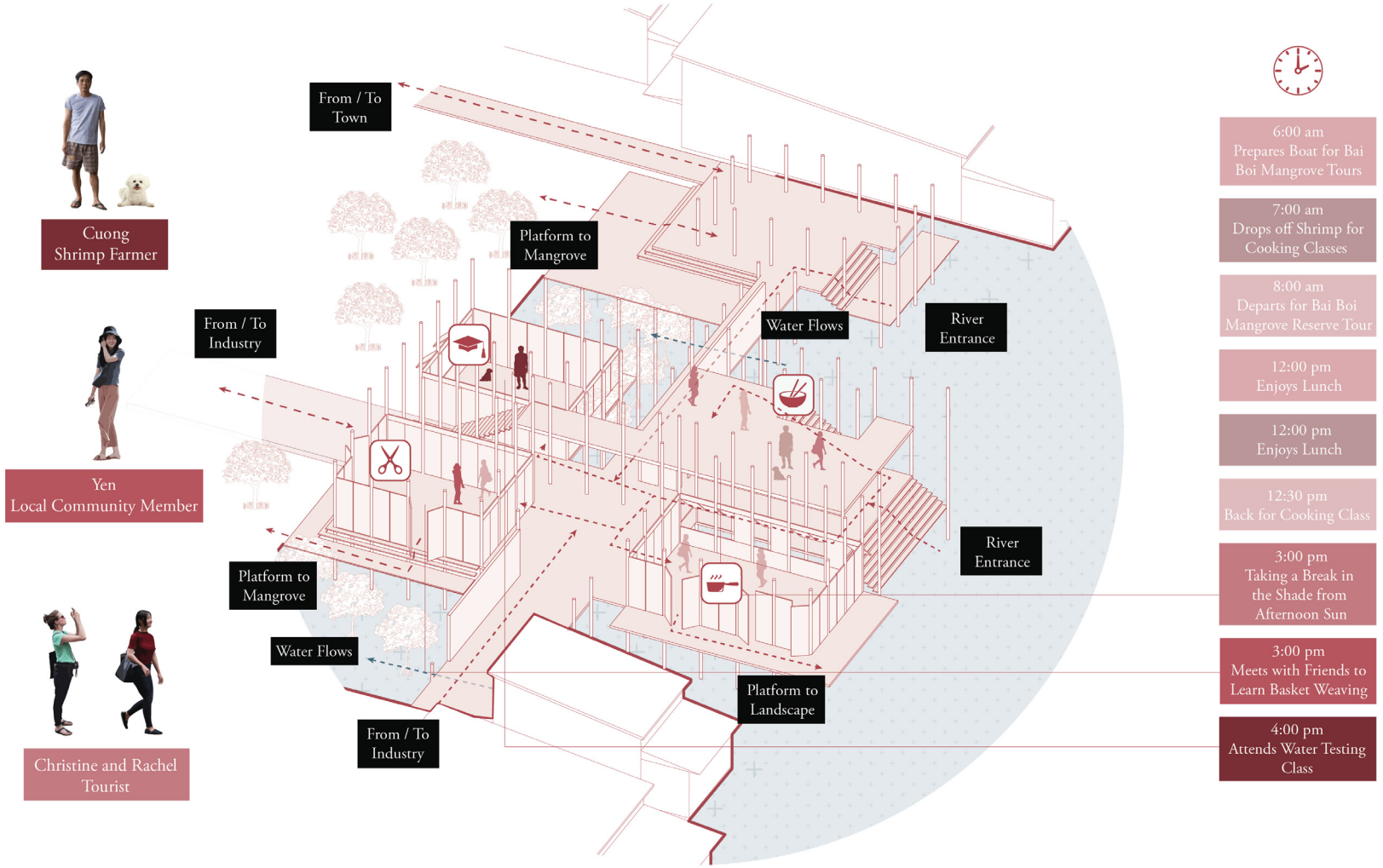
The first floor becomes a mezzanine space that looks down to the activities happening below. A dining and leisure area is located here where users can eat and enjoy the scenery or to cool down from the hot tropical climate. (base map from Google Maps 2019)

Rendering showing perspective from inside the workshop during community-led traditional craft workshop with tourists. Behind is the atrium space that opens into the cooking class with views of the river in the background. (modified photograph from Vietnam Responsible Tourism, n.d.)

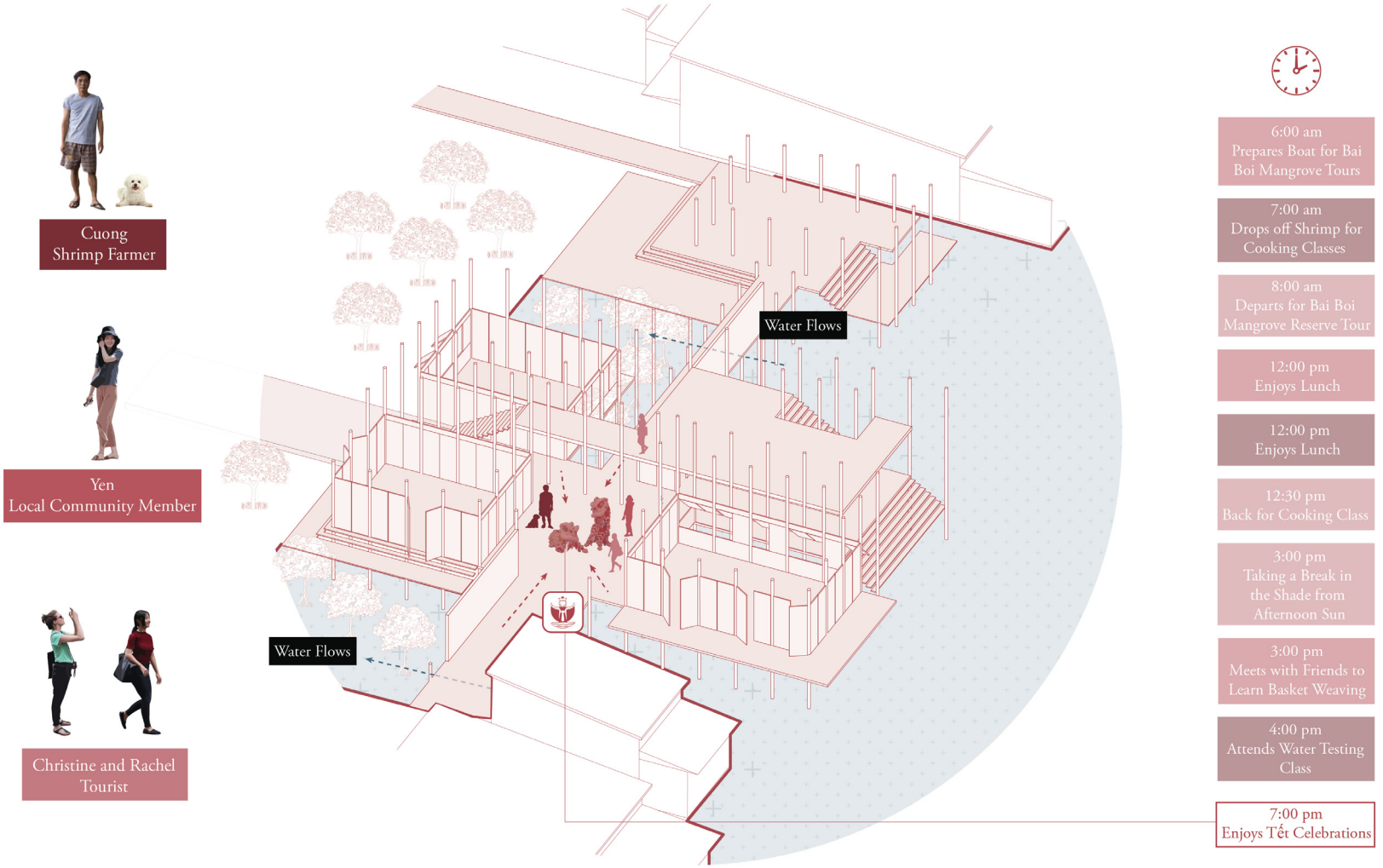
shrimp farms. Formalized education gives local members and shrimp farmers, whom may not have access to education or were not able to achieve basic education, the opportunity to enhance their knowledge. In these ways, the architectural proposal serves to instill a sense of agency into each individual, to foster strengths in knowledge and responsibilities to one another and to protect the resources of their future. This same notion is extended through to the architectural strategies, that the users have the ability



Axonometric diagram with roof removed showing programmatic sequences. Narrative: The day starts early at 6 am when Yen, a local community member, begins preparing the boat for tours to the mangrove reserves with tourists like Christine and Rachel. Not too long after, Cuong, a shrimp farmer and his dog, bring their harvested shrimp to supply food for cooking classes to take place later that day.



Axonometric diagram with roof removed showing programmatic sequences. Narrative: As the users move about the building attending their specific activities, there are also moments of condensing like at the dining and leisure area or in craft workshops.

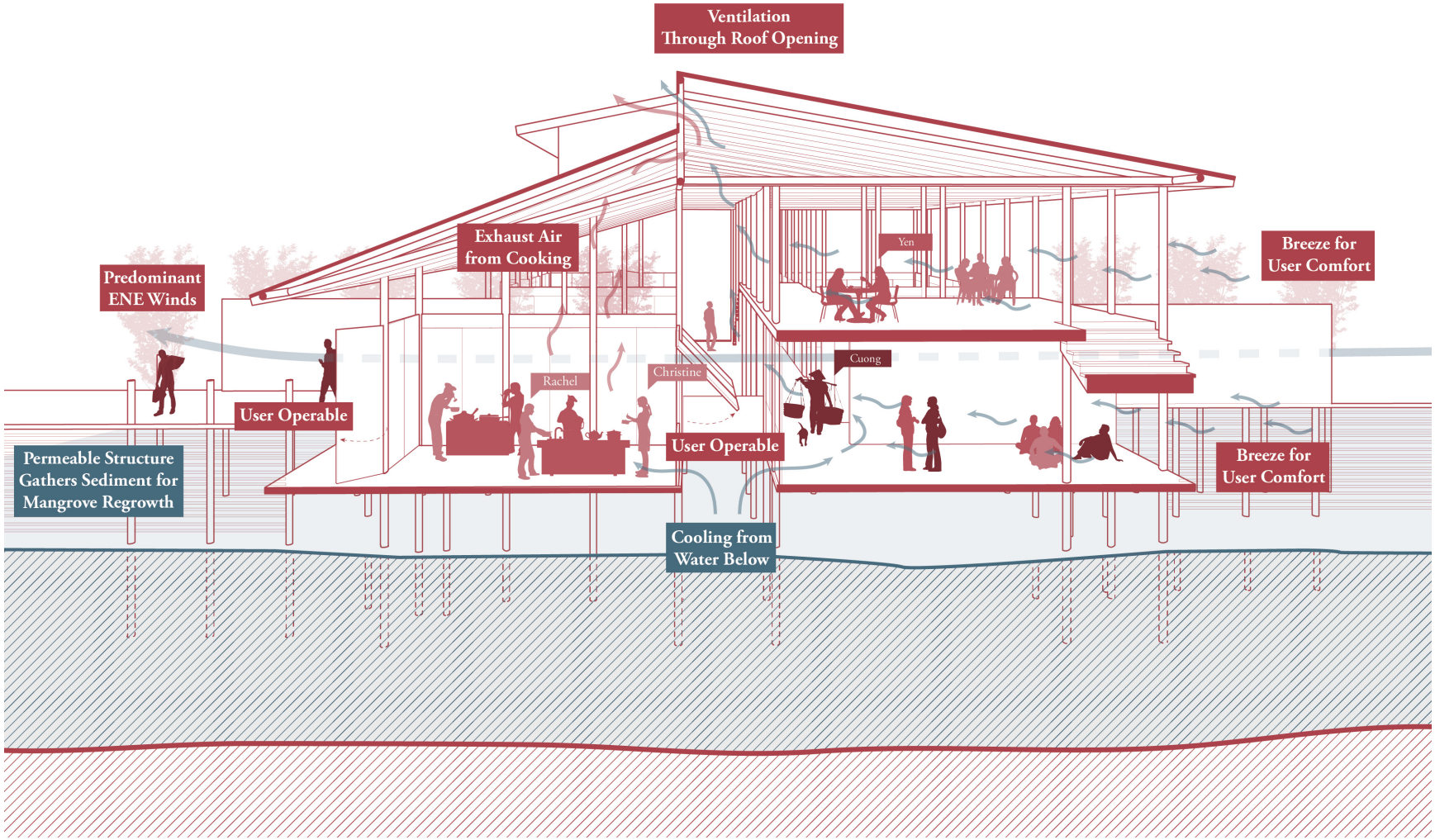


Axonometric diagram with roof removed showing programmatic sequences. Narrative: To close off the day, all user groups might meet in the atrium to enjoy festive events like the Tết Lunar New Year dragon dances.

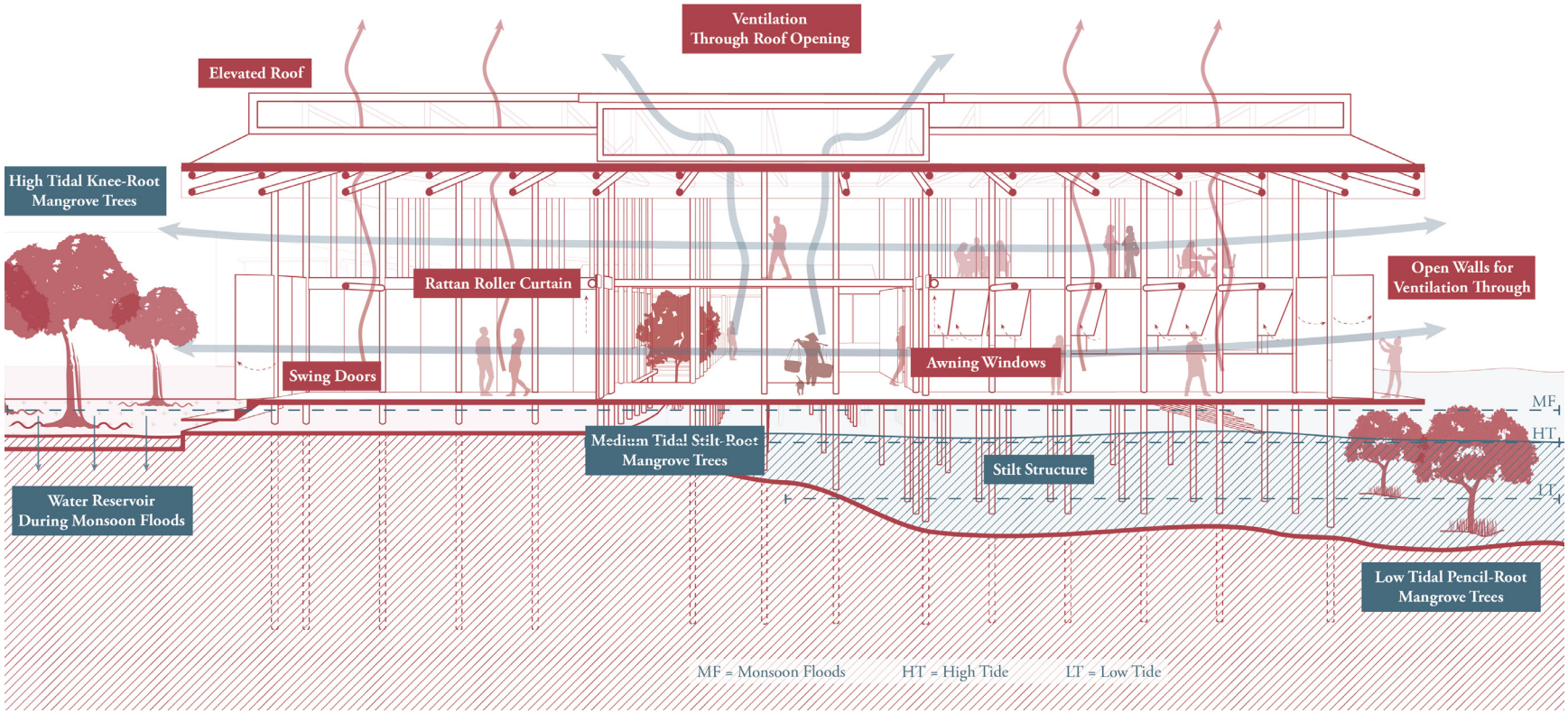
Rendering of the south side of the proposal as one might arrive by boat from along the Cửa Lớn River. The river as transportation and social space, a key cultural tradition, is promoted.

to interact with the building and change its configuration to best suit their current needs and activities. It also becomes a reflection of the vernacular approach to building and architecture, through a consideration for the context and climate in which the building and people are situated.

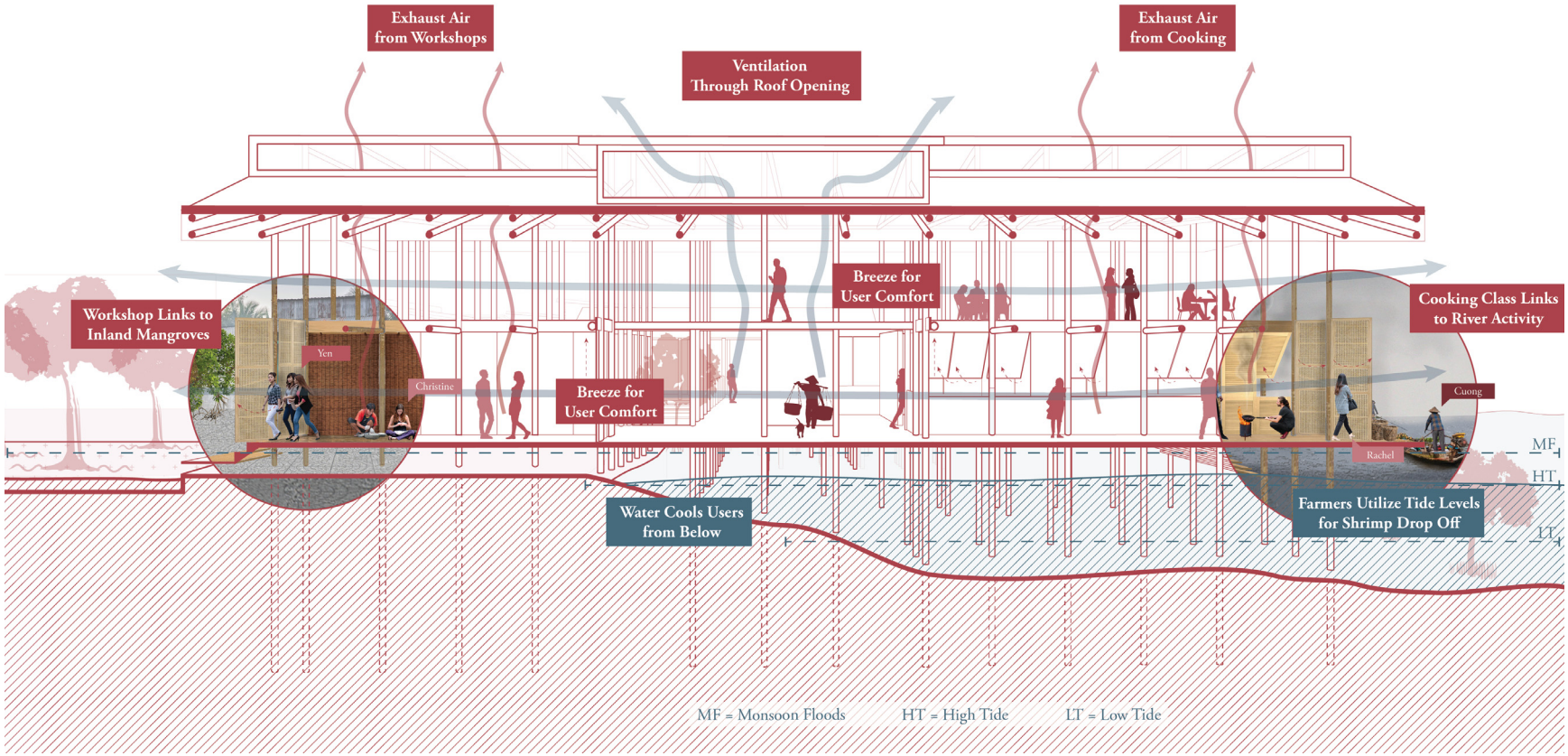
The building also seeks to include global cultural exchange through the creation of spaces for tourists to interact with local inhabitants and learn about the cultural specifics of the town and living in the coastal Mekong Delta. The workshop



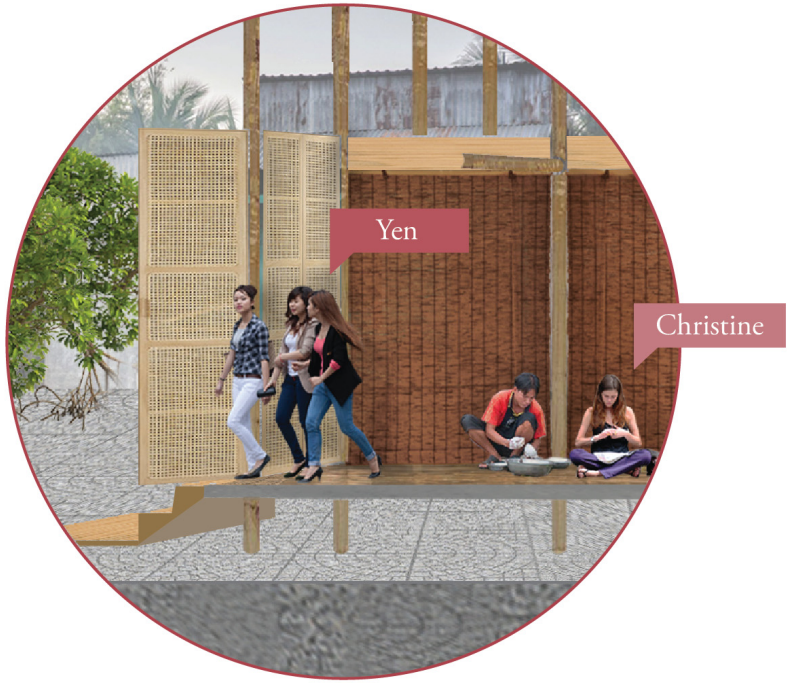
A perspective cross section of the Education and Community Centre that examines the interplay between user activities and how the building can be adapted to suit the climate and current activities.

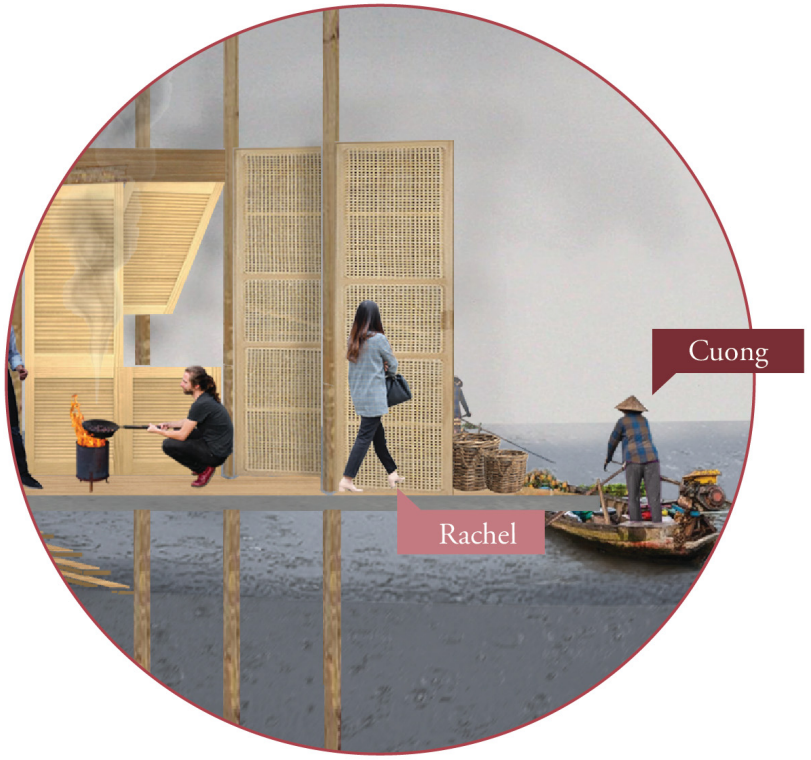


A perspective section of the building running north-south looking at the intervention's climatic response. The building employs passive ventilation strategies for moving air into, through, and out, of the building. Extending the strategy onto the site, natural conditions are reactivated to promote mangrove re-growth on site in response to land topographies and water edge conditions while also addressing changing water levels. The platform of the workshop opens out onto the garden (land-side), which serves as a water reservoir during monsoonal flooding events.



A perspective section of the building running north-south looking at user activity. Passive ventilation occurs at both ends of the building to provide comfortable spaces for the users while they participate in varies activities. The rendered perspectives show users as they interact with the building and the materials.





A close-up view of the rendered perspectives. On the north side (land-side), local community members enter onto the platform into the garden spaces. To the south (water-side), shrimp farmers drop off cooking supplies directly to the cooking classroom, as high tide raises the boat up to the platform level.

space can be reconfigured to suit varying activities from local skill development to cultural workshops that teach global community members about traditional crafts as well as contemporary crafts used for daily life. The open workshop pays homage to the floor culture that permeates Vietnamese social gatherings, that is, most will gather around on the floor on mats to converse and socialize. The cooking class is a moment that brings all three users together. Local members can facilitate cooking classes for tourists while local members as well as shrimp farmers can provide the supplies (eg. shrimp, fruits, vegetables) to cook with. Local consumption of foods is reiterated through the introduction of this activity to the site and town to promote community exchange, rather than the focus on export markets. The docking area on the south side of the building would be the point of entrance for shrimp farmers and local community members to drop off their supplies during low tide, or directly to the classroom platform during high tide.

The floor above becomes a mezzanine space that looks down to the activities happening below in all rooms as well as into the atrium, for added sightlines to events. Views are also maintained out onto the river below for all users to take in the bustling scenery of boaters travelling along. A dining and leisure area is located on the south side of the first floor where users can eat and enjoy the views or to cool down from the hot tropical climate. For those coming up to the first floor from the land-side entrance, the roundwood columns frame the views towards the river. As one passes the bridge over the atrium space, the floor opens up to the dining and leisure area and to the landscape beyond. In all instances, activities occurring within the building inform the architectural strategies for climate regulation, protection,

Rendering of the atrium as one is standing on the bridge looking east, coming from the shrimp drop-off building. Locals and visitors gather to enjoy the dragon dances during the Tết Lunar New Year celebrations.

ventilation, and access/views to the landscape. Public areas like the dining space and docking area open to the outside, taking advantage of East-North-East dominant winds to cool the space for user comfort. The opening in the roof above allows exhaust air, as well as general air circulation, to rise up and out. Moments when the water comes in to the building offer added methods for cooling from below into rooms during activities like cooking or into the atrium space.

Chapter 8: Conclusion

This thesis serves as a study of nature, architectural form, and culture, as three dynamic functions that exist independently, but more importantly, as they exist together. Their hybridity reveals the relationships between local cultural traditions and technological adaptation to perpetually changing natural forces. In this way, the connections that occur both within and between are made explicit. This highlights the resiliency that comes from collective action and diversification of these components rather than preservation or compartmentalization.

Current Hybrid Landscapes

The body of work presented in this thesis introduces multi-layered discussions around the role and responsibilities of architecture and its impacts on ecology, culture, and economy within a coastal context. As a reflection, architecture and its programming become an active component, working together with local community members, small-scale shrimp farmers, tourists, and nature. It highlights cultural exchange and cooperation through spaces that connect people, their daily rituals, while promoting new interactions. It utilizes form and technologies that speak to local economies (materials and local craft) while also linking the outputs of these economies (shrimp aquaculture and mangrove reforestation). In this way, the building impacts the site through re-imagining the interactions that can take place between people, infrastructure, economies, and the environment. A further study of this thesis would involve revisiting how the site and town are remade over time as the building changes, as the programs develop, and as nature changes. In this way, the thesis uses a prototypical method

that highlights the embedded scales of processes in the Mekong Delta, as a way of thinking, about environmental, cultural, and economic specificities that could be hybridized to reveal unique architectural responses around the delta.

Future Hybrid Landscapes

The drawings and diagrams presented in this thesis attempt to portray the temporal characteristics of architecture, program, nature, and culture, within the larger dynamics of the Mekong Delta, but can only pinpoint certain moments in time. Indeed, the Mekong Delta is undergoing larger processes of transformation. Climate change creates future scenarios for human inhabitation and settlements that architecture needs to respond to. Sea level rise, reduced sedimentation, land subsidence, coastal erosion, and resource extraction are conditions that require acknowledgement and action. Iterative architectural and land/water forms need to continually respond to its local environment, be authentic to these conditions, while also contributing to local narratives (Yeang 1987, 95). The strength and resiliency of people in the Mekong Delta can be traced to the earliest struggles against imposition and foreign rule, but before that, of the struggle to survive amidst the fluctuating conditions of nature itself, shifting livelihoods and lifestyles between flood and field, water and land. Life in the Mekong Delta is a palimpsest of continual change on all fronts: environmentally, culturally, economically, and politically. As a larger community, the people begin to move away from an identity built on war and survival and towards agency that pays homage to the rural traditions that the region and country have been founded upon. This reconnection of natural systems and human systems, historical and present, begin a course for future hybrid landscapes in the Mekong Delta.

References

Alpha History. n.d. “French Colonists and the Heads of ‘Bandits’ (Vietnamese Rebels)”. Photograph. Accessed April 14, 2020. https://alphahistory.com/vietnamwar/resistance-to-french-colonialism/.

Aqua Expeditions. n.d. Photograph of Tonle Sap Village. Accessed April 14, 2020. https://www.aquaexpeditions.com/mekong-river-cruise/cultures-religions-of-vietnam-and-cambodia/.

Avermaete, Tom, Véronique Patteeuw, Léa-Catherine Szacka, and Hans Teerds. 2019. “Revisiting Critical Regionalism.” *OASE* 103, 1-6. https://www.oasejournal.nl/en/Issues/103/RevisitingCriticalRegionalism.

Balderstone, Susan and William Logan. 2003. “Vietnamese Dwellings: Tradition, Resilience, and Change.” In *Asia’s Old Dwellings: Tradition, Resilience, and Change*, edited by Ronald G. Knapp, 135-158. New York: Oxford University Press.

Balica, Stefania, Quang Dinh, Ioana Popescu, Thanh Q. Vo, and Dieu Q. Pham. 2014. “Flood impact in the Mekong Delta, Vietnam.” *Journal of Maps* 10, no. 2: 257-268.

Bao Da Nang. 2020. “Tổng Bí thư Nguyễn Văn Linh - người khởi xướng công cuộc đổi mới”. Photograph. January 20, 2020. https://www.baodanang.vn/channel/5399/202001/tong-bi-thu-nguyen-van-linh-nguoi-khoi-xuong-cong-cuoc-doi-moi-3269327/.

Benedikter, Simon. 2014. “Extending the Hydraulic Paradigm: Reunification, State Consolidation, and Water Control in the Vietnamese Mekong Delta after 1975.” *Southeast Asian Studies* 3, no. 3: 547-587.

Biggs, David. 2010. *Quagmire: Nation-Building and Nature in the Mekong Delta.* Seattle: University of Washington Press.

Bria, Maggie. 2017. “Hồ Chí Minh at the French Communist Party’s First Congress in 1920”. Photograph. March 30, 2020. https://briahistorica.com/2017/03/30/what-did-the-1919-paris-peace-conference-have-to-do-with-the-vietnam-war/.

Brocheux, Pierre. 1995. *The Mekong Delta: Ecology, Economy, and Revolution, 1860-1960*. Madison: Center for Southeast Asian Studies.

Buttinger, Joseph. 1958. *The Smaller Dragon: a Political History of Vietnam*. New York, NY: Praeger.

Callison, Charles Stuart. 1983. *Land-To-The-Tiller In the Mekong Delta*. Lanham: University Press of America, Inc.

De Meulder, Bruno and Kelly Shannon, eds. 2013. “Mangroving Cà Mau, Vietnam.” In *Water Urbanisms East UFO3: Explorations of Urbanism*, 118-137. Zurich: Park Books.

De Meulder, Bruno, and Kelly Shannon. 2019. “The Mekong Delta: A Coastal Quagmire.” In *Sustainable Coastal Design and Planning*, edited by Elizabeth Mossop, 293-314. New York: CRC Press.

Dong DMC. 2020. “Homestay”. Photograph. Last edited April 3, 2020. https://www.dong-dmc.com/blog/homestay-mekong-delta-treasured-experiences-foreigners.

Eggener, Keith L. 2002. “Placing Resistance: A Critique of Critical Regionalism.” *Journal of Architectural Education* 55, no. 4 (May): 228-237.

Frampton, Kenneth. 1983. “Towards a Critical Regionalism: Six Points for an Architecture of Resistance.” In *The Anti-Aesthetic: Essays on Postmodern Culture*, edited by Hal Foster, 16-30. Seattle: Bay Press.

Friedman, SGM Herbert A. n.d. “Psyop of the Strategic Hamlet in Vietnam”. Accessed November 18, 2019. http://www.psywarrior.com/VNHamletPSYOP.html.

Gandy, Matthew. 2014. *The Fabric of Space: Water, Modernity, and the Urban Imagination*. Cambridge: MIT Press.

General Statistic Office. 2018. “The Statistical Yearbook of Viet Nam 2018.” https://thongke.gov.vn/wp-content/uploads/2019/10/00.-Nien-giam-2018.pdf.

Ginsburg, Norton. 1991. “Extended Metropolitan Regions in Asia: A New Spatial Paradigm.” In *The Extended Metropolis: Settlement Transition in Asia*, edited by Norton Ginsburg, Bruce Koppel, and T.G. McGee, 27-46. Honolulu: University of Hawaii Press.

Google Maps. 2015. Map of The Mekong River Basin, Vietnam and the Mekong Delta, Vietnam. Accessed October 16, 2019. https://www.google.ca/maps.

Google Maps. 2019. Map of Cà Mau Province, Năm Căn District, and Năm Căn Town, Vietnam. Accessed February 2, 2020. https://www.google.ca/maps.

Green Left. 1993. “Vietnam: War and Environment.” *Green Left Weekly*. July 13, 1993. https://www.greenleft.org.au/content/vietnam-war-and-environment.

Hecker, Jeanna Hyde, Patrick Huntjens, Geraud de Ville, and Wouter Veening. 2011. “*Environmental Security Assessment: Mekong River Basin: Case Study of the Nam Can District, Vietnam*.” The Hague: Institute for Environmental Security.

Hoang, Hanh. 2019. “$43-million shipyard left to rust.” VnExpress. December 31, 2019. https://e.vnexpress.net/news/news/43-million-shipyard-left-to-rust-4035315.html

Hong, Phan Nguyen, and Hoang Thi San. 1993. “*Mangroves of Vietnam*.” IUCN Wetlands Programme. Bangkok, Thailand. https://portals.iucn.org/library/efiles/documents/WTL-006.pdf.

Hynes, Patricia. 2015. “Chemical warfare and Agent Orange”. Photograph. February 8, 2015. https://climateandcapitalism.com/2015/02/08/pentagon-pollution-3-chemical-warfare-and-agent-orange/.

Jamieson, Neil L. 1993. *Understanding Vietnam*. Berkeley: University of California Press.

Joffre, O., M. Prein, P.B.V. Tung, S.B. Saha, N.V. Hao, and M.J. Alam. 2010. “Evolution of Shrimp Aquaculture Systems in the Coastal Zones of Bangladesh and Vietnam: a Comparison”. In *Tropical Deltas and Coastal Zones: Food Production, Communities and Environment at the Land-Water Interface*, edited by Chu T. Hoanh, Brian W. Szuster, Kam Suan-Pheng, Abdelbagi M. Ismail, and Andrew D. Noble, 48-63. Wallingford: Centre for Agriculture and Bioscience International.

Kesteloot, Chris. 2015. “21st Century Desakota: Challenges, Issues and Opportunities for the Mekong Delta.” https://www.researchgate.net/publication/317580397_21st_Century_Desakota_Challenges_Issues_and_Opportunities_for_the_Mekong_Delta

Lefebvre, Ed. n.d.a. “Photo 27 Solid Anchor Construction 1969-1970”. Photograph. Accessed March 20, 2020. https://brownwater-navy.com/vietnam/S1anchor.htm.

Lefebvre, Ed. n.d.b. “Closeup of Solid Anchor from the south”. Photograph. Accessed March 20, 2020. https://brownwater-navy.com/vietnam/S2anchor.htm.

Liu, Paul J., David J. DeMaster, Thanh T. Nguyen, Yoshiki Saito, Van Lap Nguyen, Thi Kim Oanh Ta, and Xing Li. 2017. *“*Stratigraphic Formation of the Mekong River Delta and Its Recent Shoreline Changes*.” Oceanography* 30, no. 3 (September): 72-83.

Lusterio, A.C. 2009. *“*Living with Water: The Settlements of Vietnam Mekong Delta*”.* In *Water & Urban Development Paradigms,* edited by Jan Feyen, Kelly Shannon and Matthew Neville, 55-65. London: Taylor & Francis Group.

Marchand, Marcel, Dieu Quang Pham, and Trang Le. 2014. “Mekong Delta: Living with Water, But for How Long?” *Built Environment* 40, no. 2: 230-243.

Marolda, Edward J. and Blake Dunnavent. 2015. *Combat at Close Quarters: Warfare on the Rivers and Canals of Vietnam*. Washington: Naval History and Heritage Command.

McGee, Terry Gary. 1991. “The Emergence of Desakota Regions in Asia: Expanding a Hypothesis.” In *The Extended Metropolis: Settlement Transition in Asia*, edited by Norton Ginsburg, Bruce Koppel, and T.G. McGee, 3-26. Honolulu: University of Hawaii Press.

Mekong Delta Plan. n.d. “Overview of Key Messages.” Accessed October 3, 2019. https://www.mekongdeltaplan.com/mekong-delta-plan/key-messages.

Mekong River Commission. 2016. “Basin Development Strategy 2016-2020 For the Lower Mekong Basin.” http://www.mrcmekong.org/assets/Publications/strategies-workprog/MRC-BDP-strategy-complete-final-02.16.pdf.

Mekong Smile Tour. n.d. “Wood house with palm thatched roof, water jug on corner and canoe underneath, Mekong River Delta Region, Vietnam”. Photograph. Accessed April 14, 2020. https://mekongsmiletour.com/thatched-roof-exceptional-design-in-mekong-delta-area/.

Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-being: Synthesis*. Washington: Island Press.

NASA Earth Observatory. n.d. “Wet-Season Floods Along the Mekong River”. Photograph. Accessed January 22, 2020. https://earthobservatory.nasa.gov/images/6970/wet-season-floods-along-the-mekong-river.

Nguyen, Dinh Ninh. 2007. “The Development of irrigation systems for sustainable agricultural development in Viet Nam.” *In The Future of Large Rice-Based Irrigation Systems in Southeast Asia*, 141-149. Thailand: FAO Regional Office for Asia and the Pacific.

Nguyen, Duong. 2017. “The Fall of Saigon, 1975”. Photograph. September 19, 2017. https://www.washingtonpost.com/opinions/where-is-the-south-vietnamese-side/2017/09/19/9e794e90-9cba-11e7-b2a7-bc70b6f98089_story.html.

Nguyen, Hoai. 2019. “Shipping Containers are Seen at a Port in Hai Phong City, Northern Vietnam”. Photograph. December 13, 2019. https://e.vnexpress.net/news/business/economy/vietnam-trade-to-climb-to-record-high-despite-global-woes-4026828.html.

Open Development Mekong. 2015. *Hydro Basins Level 3 Mekong.* Scale 1:1. Map from GIS data, using *ArcGIS Pro.* Rome, Italy: FAO-UN Land and Water Division - AQUASTAT.

Open Development Mekong. 2016. *Administrative boundary of Vietnam*, *District administration of Vietnam*, *Provincial administration of Vietnam*. Scale 1:1. Map from GIS data, using *ArcGIS Pro*. Hanoi, Vietnam: Department of Survey and Mapping, Ministry of Nutural Resources and Environment-Vietnam.

O’Rourke, Dara. 2004. *Community-Driven Regulation: Balancing Development and the Environment in Vietnam*. Cambridge: MIT Press.

Page, Tim. 2002. *Another Vietnam: Pictures of the War from the Other Side*. Washington: National Geographic.

Pham, Quang Dieu and Thi Thanh Thao Pham. 2011. ‘Urbanizing Mekong Delta in Vietnam: The Challenges of Urban Expansion Adapting to Floods’. Presented at The 5th International Conference of the International Forum on Urbanism (IFoU), Singapore, February 24-26.

Pham, Thi Anh, Tran Thi My Dieu, Arthur P.J. Mol, Carolien Kroeze, and Simon R. Bush. 2011. “Towards Eco-Agro Industrial Clusters in Aquatic Production: The Case of Shrimp Processing Industry in Vietnam.” *Journal of Cleaner Production* 19 (July): 2107-2118.

Renaud, Fabrice G., and Claudia Kuenzer. 2012. *The Mekong Delta System: Interdisciplinary Analyses of a River Delta*. Dordrecht: Springer.

Robinson, Tracy. 1907. *Panama: a Personal Record of Forty-Six Years, 1861-1907*. New York: The Trow Press.

Saboureau, Roger. 2016. “Parachutiste en Indochine: Naissance d’une légende”. Photograph. November 18, 2016. https://www.secoursdefrance.com/2016/11/18/parachutiste-en-indochine-naissance-dune-legende/.

Shannon, Kelly. 2009. “Water urbanism: Hydrological infrastructure as an urban frame in Vietnam.” In *Water & Urban Development Paradigms*, edited by Jan Feyen, Kelly Shannon and Matthew Neville, 55-65. London: Taylor & Francis Group.

Spalding, Mark, Francois Blasco, and Colin Field, eds. 1997. *World Mangrove Atlas*. Okinawa: The International Society for Mangrove Ecosystems.

Stoop, Bianca, Dimitrios Bouziotas, Jill Hanssen, Johannes Dunnewolt, and Mark Postma. 2015. “Integrated Coastal Management in the Province Cà Mau – Vietnam.” Report as part of Masters Hydraulic Engineering and Water Management, TU Delft. https://pdfs.semanticscholar.org/c355/77fe5b45d30f8a8af58a9385f7b856f9782b.pdf.

Tommy Japan. 2014. “Photograph of canal construction in 1875”. Photograph. Flickr. https://www.flickr.com/photos/97930879@N02/15712347956/in/album-72157634520602463/.

Tran, Lan. 2014. “Nguyễn Dynasty”. Image. July 17, 2014. https://saigoneer.com/vietnam-heritage/2341-17-photos-of-royal-life-during-the-nguy-n-dynasty.

Tregaskis, Richard. 1975. *Southeast Asia: Building the Bases The History of Construction in Southeast Asia*. Washington: United States Government Printing Office. https://www.history.navy.mil/content/history/museums/seabee/explore/online-reading-room/tregaskis-photographs.html.

Tusinski, Andrzej and Henk Jan Verhagen. 2014. “The Use of Mangroves in Coastal Protection.” *Coastal Engineering Proceedings*, no. 34 (January): 1-13.

Tvedt, Terje, and Terje Oestigaard. 2014. “Urban Water Systems – A Conceptual Framework.” In *A History of Water Series III, Volume 1 Water and Urbanization*, edited by Terje Tvedt and Terje Oestigaard, 1-21. New York: I.B.Tauris & Xo. Ltd.

Van, T.T., N. Wilson, H. Thanh-Tung, K. Quisthoudt, V. Quang-Minh, L. Xuan-Tuan, F. Dahdouh-Guebas, and N. Koedam. 2015. “Changes in Mangrove Vegetation Area and Character in a War and Land Use Change Affected Region of Vietnam (Mui Cà Mau) Over Six Decades.” *Acta Oecologica* 63 (February): 71-81.

Veettil, Bijeesh Kozhikkodan, Raymond D. War, Ngo Xuan Quang, Ngo Thi Thu Trang, and Tran Hoai Giang. 2019. “Mangroves of Vietnam: Historical development, current state of research and future threats.” *Estuarine, Coastal and Shelf Science* 218 (March): 212-236.

Vietnam Culture. n.d. “Traditional Stilt Houses.” Accessed April 29, 2020, https://www.vietnam-culture.com/articles-220-34/Vietnamese-Traditional-Stilt-Houses.aspx.

Viet Nam News. 2014. “Economic Zone Gets Go-Ahead in Cà Mau.” January 9, 2014. https://vietnamnews.vn/economy/249930/economic-zone-gets-go-ahead-in-ca-mau.html.

Vietnam Responsible Tourism. n.d. “Basket Weaving”. Image. Accessed June 12, 2020. https://www.vietnamresponsibletourism.com/tour-activity-type/basket-weaving/.

Vo, Khac Tri. 2012. “Hydrology and Hydraulic Infrastructure Systems in the Mekong Delta, Vietnam.” In *The Mekong Delta System: Interdisciplinary Analyses of a River Delta*, edited by Fabrice G. Renaud and Claudia Kuenzer, 49-81. Dordrecht: Springer Science+Business Media.

Vo, Thi Guong and My Hoa Nguyen. 2012. “Aquaculture and Agricultural Production in the Mekong Delta and its Effects on Nutrient Pollution of Soil and Water.” In *The Mekong Delta System: Interdisciplinary Analyses of a River Delta*, edited by Fabrice G. Renaud and Claudia Kuenzer, 363-393. Dordrecht: Springer Science+Business Media.

Vo, Thi Thu Thuy. 2018. “Sustainable approaches to nature in traditional architectural space, their application in the teaching of architecture and interior design.” *MATEC Web Conferences* 193 (August): 1-12, https://doi.org/10.1051/matecconf/201819304006.

Vu, Thi Hong Hanh and Viet Duong. 2018. “Morphology of water-based housing in Mekong delta, Vietnam.” *MATEC Web Conferences* 193 (August): 1-11, https://doi.org/10.1051/matecconf/201819304005.3.

Wittfogel, Karl August. 1957. *Oriental Despotism*. New Haven: Yale University Press.

WNYC Studios. 2017. “A U.S. Military Convoy Moves into the Mekong Delta”. Photograph. January 6, 2017. https://www.wnycstudios.org/podcasts/takeaway/segments/first-week-january-when-america-changed-forever.

World Wildlife Fund. 2013. “Promoting sustainable shrimp production in Vietnam”. Last modified October 21, 2013. https://wwf.panda.org/wwf_news/?211632/promoting-sustainable-shrimp-production-in-Vietnam.

Yeang, Ken. 1987. *Tropical Urban Regionalism: Building in a South-East Asian City*. Singapore: Concept Media Pte Ltd.

Zasloff, Joseph J. 1962. “Rural Resettlement in South Viet Nam: The Agroville Program.” *Pacific Affairs* 35, 4: 327-340.