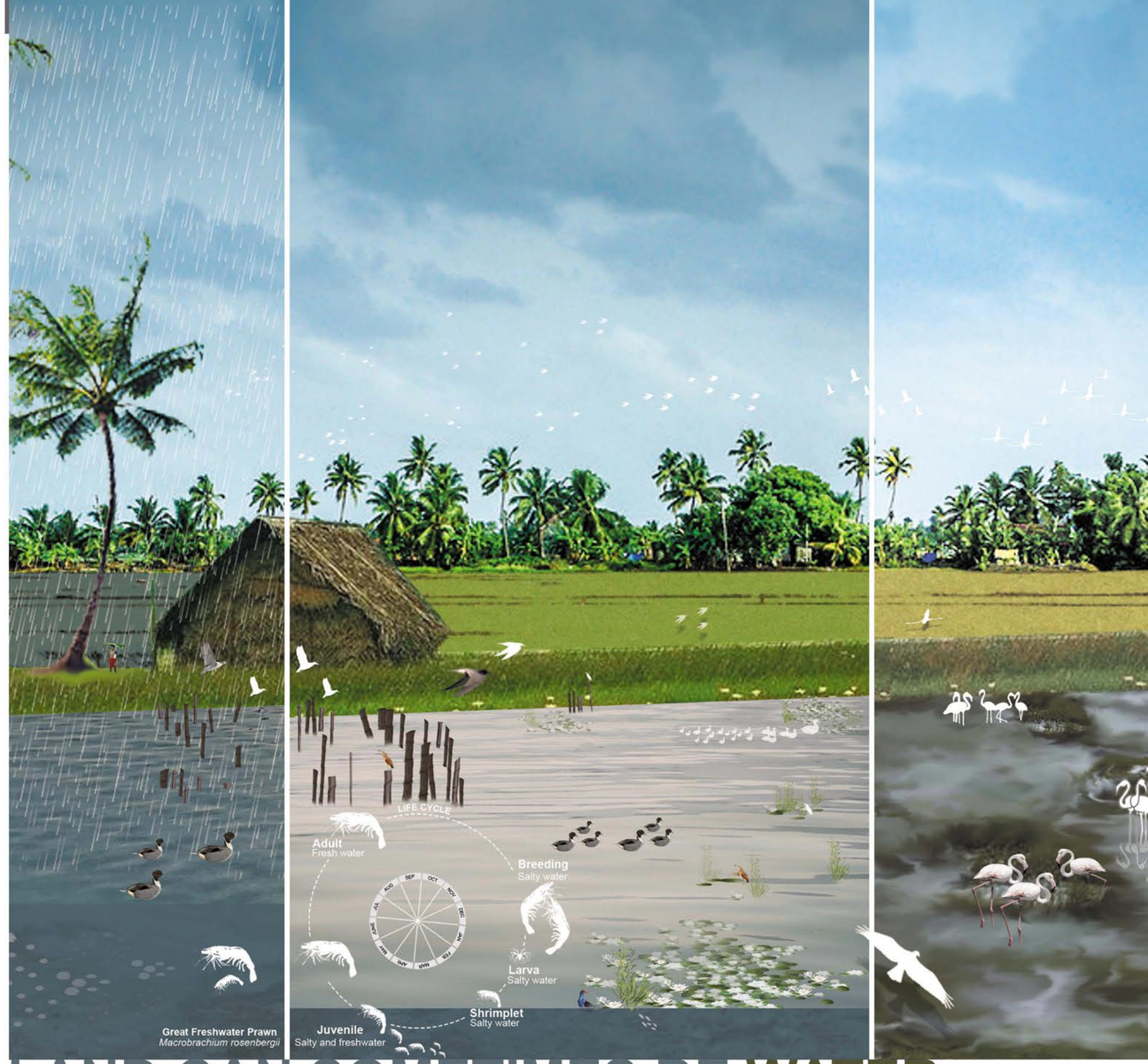
“ Today it is land, Yesterday it was water and Tomorrow…….....
I don't know”

28th November, 2019
Author’s account during field visit in Kuttanad, India



LAND CAN SOMETIMES BE WATER

Bridging the dichotomy between land and water through amphibious landscapes

Naeema Ali
MSc Landscape Architecture Thesis:July, 2020
Delft University of Technology

Master Thesis

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Bridging the dichotomy between land and water through amphibious landscapes

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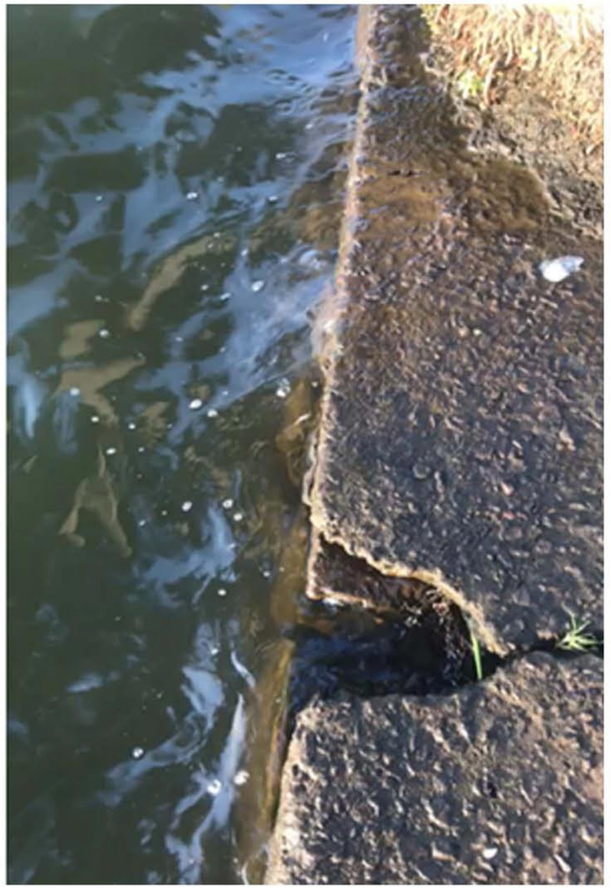
“I saw the earth slowly rising above water, she looked so peaceful, divine and stable. The luminosity of water was intriguing but I knew she would not give me a chance to set my foot on her. Elsewhere, I saw a glimpse of water and then suddenly it was land. Today it is land, Yesterday it was water and Tomorrow……... I don't know”

28th November, 2019
Author’s account during field visit in Kuttanad, India

PREFACE



Land and water has for long been perceived as foundational binaries that exist as separate entities. Today, our visual and spatial literacy is built upon this dichotomy between land and water. Static land and Moving water…… *Terra firma* and *Aqua Fluxus*. And as a result of the interplay between these two forces our cultural perception has always forced us to think in favour of t*erra firma*. Water is synonymous to uncertainty, unpredictability, worthlessness and vulnerability. We are living in times where our discipline is opening its doors towards concepts such as flexibility, adaptability and resilience in response to climate change. But how can we possibly look for solutions with the same thinking that created the problem itself? Why should we run away from water? Why are we building walls to stay away from water?

Keeping this in mind, this project, “Land can sometimes be water” is a humble attempt to bridge the dichotomy between land and water and advocate an amphibious life that transitions between land and water.

ABSTRACT

In an excerpt from the fictional work “Waterland” (Swift, 1992), the narrator Tom Crick labels water as “Nothing,” implying land and humans as “Something.” This was more of a philosophical expression that can alternatively be inferred from the real-world processes like land reclamation. Land was always associated with value, stability, certainty and utility in contrast to water. Subsequently, early civilizations and modern-day habitations fundamentally removed or controlled water. However, the traditional water systems did this in a more sustainable fashion. Here, water management was a unit of cultural expression of the site-specific challenges faced by people, be it in terms of topography, climate or social hierarchy. One such traditional water system, where land and water assumed identities of being something and nothing respectively is the “Kuttanad Kayalnilam Farming System”: a long-established land-water utilization system that practices paddy farming below sea level for more than a century now in Kerala, India. Positioned at the mouth of a delta, this agrarian landscape deals with the threat of periodically fluctuating water levels resulting in seasonal flooding which adversely influences the livelihood of the inhabitants. Taking the case of the Kuttanad deltaic landscape, this thesis brings to the foreground, a radical departure from the tenets of classical terrestrial centric approaches for creating a flexible landscape by redefining the relationship between land and water in order to improve the quality of life and space in the delta.

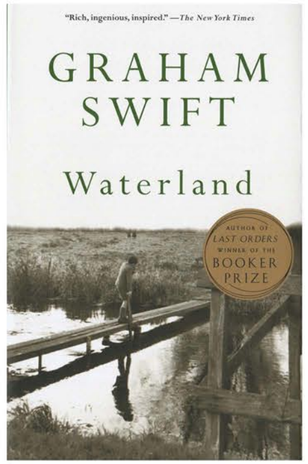
The new fluid geographical approach was based on a systematic understanding of the amphibious qualities embedded in the site context through a four-lens approach. The lenses being volatility, hydro-sociality, rhythm and wetness, and reflect respectively: radical emergence of lives and landscapes, the mutual implications of social life and water flows, the pulsating temporality in hydro-social relations and the materialisation of water in everyday life (Krause, 2017). Together these lenses led to a site-specific spatial framework for enhancing the amphibious value of landscapes. In the specific case of Kuttanad, this called for a revival of the indigenous relationship between land and water which can be accomplished by moderately restoring the cyclical movement of salt and water. This radical change is envisioned over a large time frame, a period of say 20 plus years, by means of a slow landscape architectural process where nature and humans evolve and adapt to the cycle of salt and water. Furthermore, an adaptive design calendar or water calendar was formulated to guide this slow landscape transformation. The water calendar is a very site-specific tool that can be used for both visual communication and decision making regarding the function, quality and diversity of space and life in a flexible landscape operating within the spatio-temporal context of any deltaic region. Ultimately, it will guide to gradually build a complex narrative of how humans and nature exchange roles between being makers and takers of the landscape over time. On the other hand, the role of the landscape architect is to facilitate this narrative by envisioning a slow landscape architectonic transformation. On the whole, this is a generic approach that can be applied to any other delta facing similar challenges and can be a model for the future direction of flexible and resilient landscapes.

Keywords:
Land, water, amphibious, volatility, hydro-sociality, rhythm, wetness, slow landscape architecture, adaptive design calendar

“For what is water, which seeks to make all things level, which has no taste or colour of its own, but a liquid form of Nothing? ”

From *“Waterland”*,
By Graham Swift

1. INTRODUCTION



[1] *"Waterland"* is a postmodernist novel echoing the dichotomies between man and nature in the setting of the Fenlands in Eastern England. Just as the paradoxical title puts forward this work problematizes present day land-water division in the Fens where land and water used to co-exist permanently. This dilemma was also apparent in the choice of words used; for example, while reclamation suggested a terrain biased language, words like drainage was somewhat in between land and water: *"drain the land"* or *"drain the water"*. This was particularly of interest to me to see how this land/ water divide is quintessentially a cultural construct which has also influenced our lexicon.

[2] The term radical ingenuities was picked from the recent publication, *"Lo-TEK: Design by Radical Indigenism"* by Julia Watson as an interesting terminology to describe the significance of vernacular or traditional water systems, which sees water management as a story of how people managed water rather than a set of precise technical solutions. Julia Watson teaches urban design at the Harvard Graduate School of Design, and at Columbia University's Graduate School of Architecture, Planning and Preservation.

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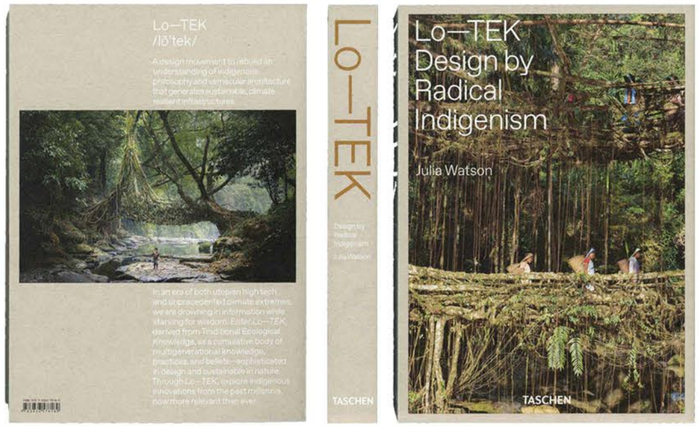

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Accessed in June 2020

Figure 1.1: fascinations
inspirations from literature

1. INTRODUCTION

In a passage from Graham Swift's work of fiction, *"Waterland[1]" (1992)*, the narrator Tom Crick labels water as *"Nothing"* , implying land and humans as *"Something"* . This was more of a philosophical expression that can alternatively be inferred from the real-world processes like land reclamation. Land was always associated with value, stability, certainty and utility in contrast to water. Subsequently, ancient civilizations and modern-day habitations fundamentally removed or controlled water. The tension between water and land also translates to the tension between nature and man.

Does this mean that by bridging the dichotomy between land and water we can also fix the ever-growing dichotomy between nature and humans?

Can this be a key player in mediating natural resource management and social well-being?

Finally, how can the "liminal spaces" of hybrid water/lands not be treated as isolated entities separated by lines but as zones of interaction, transformation, transgression, possibility and opportunity (Howitt, 2001; in Lahiri-Dut, 2014)?

The search for these answers lies somewhere beneath possibilities of non-confrontational coexistence of land and water as in the case of traditional water systems.In the past the traditional water systems dealt with the dichotomy between land and water in a more sustainable fashion. Next to the benefit for humans, these systems were relevant and valuable for the ecosystem due to their positioning as a unit of the larger blue-green networks (Bobbink, 2019). These systems developed over an extended period of time by trial and error and establish an accumulative body of multigenerational knowledge, practices, skills and beliefs critical to the region (Watson, 2019). Here, water management is a unit of cultural expression of the site-specific challenges faced by people, be it in terms of topography, climate or social hierarchy. These radical ingenuities[2] tell us stories of how humans and nature exchanged roles between being makers and takers of the landscape.

One such traditional water system, where land and water assumed identities of being something and nothing respectively is the *Kuttanad Kayalnilam Farming System*: a long-established land-water utilization system in India that practices paddy farming below sea level for more than a century now. The most modest imagination of the deltaic landscape of Kuttanad would be that of a polder system laid with an intricate network of canals and water channels. Due to this resemblance with the traditional Dutch landscape, Kuttanad is often referred to as the "*Holland of the East"*. But after the arrival of the Industrial Revolution, today a major part of these hitherto glorious agricultural landscapes stagnate ostentatiously in the middle of the delta and bear testimony to the common grief, distress and anxiety experienced by the local people in stark contrast to a saga of agricultural magnificence.

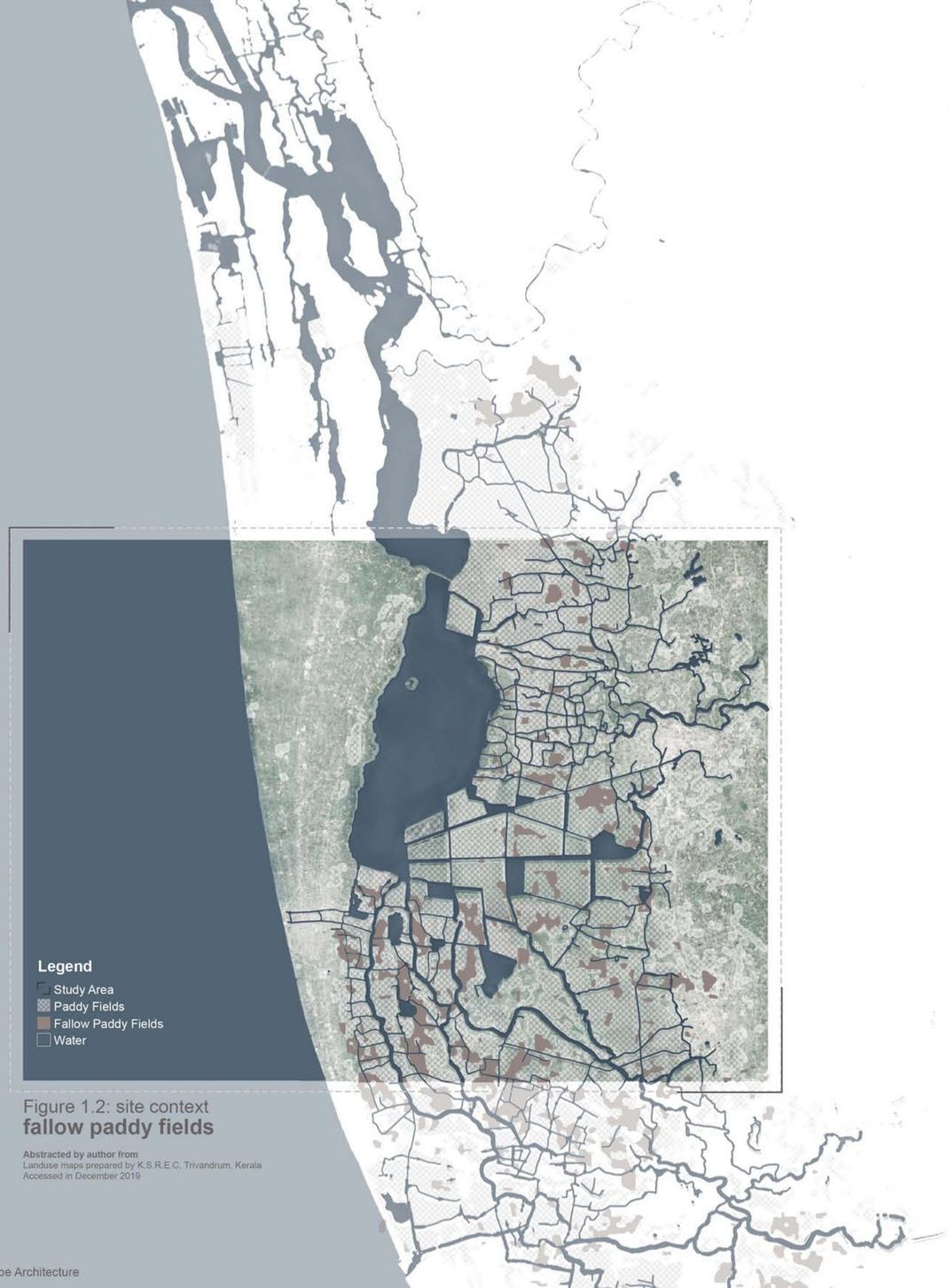


Figure 1.2: site context
fallow paddy fields

Abstracted by author from
Landuse maps prepared by K.S.R.E.C, Trivandrum, Kerala
Accessed in December 2019

1.1. PROBLEM STATEMENT, HYPOTHESIS AND RESEARCH QUESTIONS

1.1.1 PROBLEM STATEMENT

The deterioration of world deltas caused by the increasing pace of human development is altering the functionality of ecosystems and instigating escalating socio-economic impacts in food producing areas (Rogers et al, 2013). Likewise, Kuttanad which once earned the sobriquets- “The granary of Kerala” or “The rice bowl of Kerala” is slowly disappearing. The prime cause of this could be attributed to a paradigm shift from the traditional farming techniques to the modern-day agricultural intensification techniques disrespecting the hydrological regime of these landscapes. In Kuttanad, the invisible ecological, political and cultural costs of these practices modelled on Green Revolution became visible after four decades as shown in figure 1.3a,1.3b and 1.3c, rendering many of the paddy fields fallow as shown in figure 1.2 (Sreeja et al, 2015).

These improper landscape management practices were essentially modelled on a terrestrial centric ontology. These approaches kept water and the natural dynamics behind water under control to pave way for anthropocentric activities as in the case of Kuttanad. The concrete dikes, dams and salt barriers are monofunctional infrastructures that cannot cope with the changing levels of water. Subsequently, in 2018 during the monsoons, there was a cloudburst flooding which brought massive destruction to the agricultural fields and rural settlements as shown in figure 1.3d, 1.3e and 1.3f. Apart from the massive blow to the agriculture-based livelihoods, people’s lives were at stake and they were surrounded by water from all sides and stranded in their houses.

Hence, **the inadaptability of the agricultural landscapes has reduced their socio-economic value drastically resulting in poor quality of living causing severe social distress.**

Source
Available at https://twitter.com/PIB_India/status/1030752647702167553
Accessed in June 2020

Source
Available at https://990theanswer.com/news/politics/trains-bring-drinking-water-to-flooded-southern-indian-state
Accessed in June 2020

Source
Available at http://samagravikas.in/ourwork/Rehabilitation.asp
Accessed in June 2020

Figure 1.3[3]: photo collage
problems in Kuttanad

[3] Some of the problems persisting in the area are: figure1.5a parts of the paddy fields have dried or decayed even before the harvest pointing to low productivity; figure1.5b fallow paddy field; figure1.5c paddy field abandoned seasonally when water levels are higher; figure1.5d the bridge partially submerged during monsoon showing the inadaptability of hard edge infrastructure; figure1.5e cloudburst flooding in 2018; figure1.5f flooding disrupting daily life severely pointing to the social distress faced by the people

Figure 1.4: social life in Kuttanad
lines imposed in the landscape

1.1.2 HYPOTHESIS

Separating land from water on the earth's surface is one of the most fundamental and enduring acts in the understanding and design of human habitation (Da Cunha, 2012). For centuries we have been trying to keep the dynamics of nature outside our territories of habitation. Conversely, these dynamics can be invited into the terrestrial boundaries to generate new spatial qualities unique to the delta. This will pave way to create a resilient future which is not solely dependent on the performance of concrete bunds or dike structures in the Kuttanad region.

Even with contemporary approaches like building with nature while dealing with deltaic regions, there exists a spatial boundary for water or the lines of flow. These lines of flow as shown in figure 1.4, which has been crossed, breaching the terrestrial boundaries of habitation and cultivation are not existing lines drawn but lines imposed for the functioning of the cultural landscape (Da Cunha, 2012). Consequently, the positioning of these lines should be investigated in the light of considering the terrestrial regions as an intermediate spatial quality of varying levels of wetness and dryness.

Overall, in the case of Kuttanad, the landscape redefined to resonate with hydrological processes, which was once a traditional practice, can dim the boundaries between land and water. This can be the guiding tool to design a framework for flexible landscapes in the deltaic region of Kuttanad. By hydrological, the term does not restrict itself to the natural phenomena occurring, but also the associated social processes.

You are looking at a watery terrain intermingling with soil and paddy crops.This is a typical view of the paddy fields of Kuttanad during the month of November and they are essentially spatial qualities where land and water enter in relational processes.It is difficult to categorize paddy fields under land or water. So understanding the relationship between what we intepret as land and water is crucial here.

Figure 1.5: paddy field
dim boundaries between land and water

1.1.3 RESEARCH QUESTIONS

Proceeding from the hypotheses, the principal research question is:

MAIN GENERAL RESEARCH QUESTION

How to create a flexible landscape by redefining the relationship between land and water in order to improve the quality of life and space in a Delta?

MAIN SPECIFIC RESEARCH QUESTION

How to create a flexible landscape by redefining the relationship between land and water in order to improve the quality of life and space in the Kuttanad Deltaic region?

Sub-questions include:
Knowledge questions

1. What are the hydro-social processes that shaped the deltaic region of Kuttanad?
2. What is the relationship between the hydrological processes and social processes, if any?
3. What are the recurrent, evolving patterns in the spatiotemporal extent of these processes?
4. How do the hydrological processes affect the materialization of the amphibious landscapes?

Preceeding these questions are a set of preliminay inquiries,

• What are the existing theoretical foundations describing land and water in theories of landscape architecture?
• What are the existing dichotomies between land and water, and which of these need to be bridged?
• What frameworks for adaptive/ flexible landscapes already exist, and which one of these best matches the particular scope of flexibility elaborated in the preceding?
• Which aspects of this framework are thorough, and which needs to be reviewed?
• What is ‘amphibious’, and what are the spatial qualities associated with amphibious landscapes? How do we map these amphibious qualities?

1.2 RELEVANCE, SCOPE AND LIMITATIONS

All across the planet, extreme weather and water scarcity now inflame and exacerbate existing social conflicts (Parenti,2012). Deltas are characterized by an ever-changing interplay of land and water as a result of flooding, draining, drying and irrigating, sinking, silting, sedimentation, channeling, erosion, and reclamation. In short, delta life is amphibious. Hence, there needs to be a new design paradigm in dealing with deltas, wherein the current terrestrial centric approaches giving less importance to the natural fluid dynamics will be challenged.

The specific case of Kuttanad is a unique cultural practice below sea level and so this can serve as a reference elsewhere for creating resilient agricultural practices, threatened due to the rising sea levels helping bolster food security against climate change in water stressed environments.

It could also be applied to any other real time scenario with similar challenges, especially in deltaic regions as shown in figure 1.6.

Deltas occur at the mouth of rivers; they are acted upon by forces from the source and the terminus of its parent river systems. However, this research does not consider the entire watershed of the delta especially the impacts of the upstream and downstream parts of the river due to the extensive nature of the project. Additionally, the site is located in a developing country like India where there is a lack of open source digital data with which the scientific legitimacy of the project could have been improved.

Figure 1.6: major deltas in the world
project relevance

1.3 RESEARCH STRUCTURE

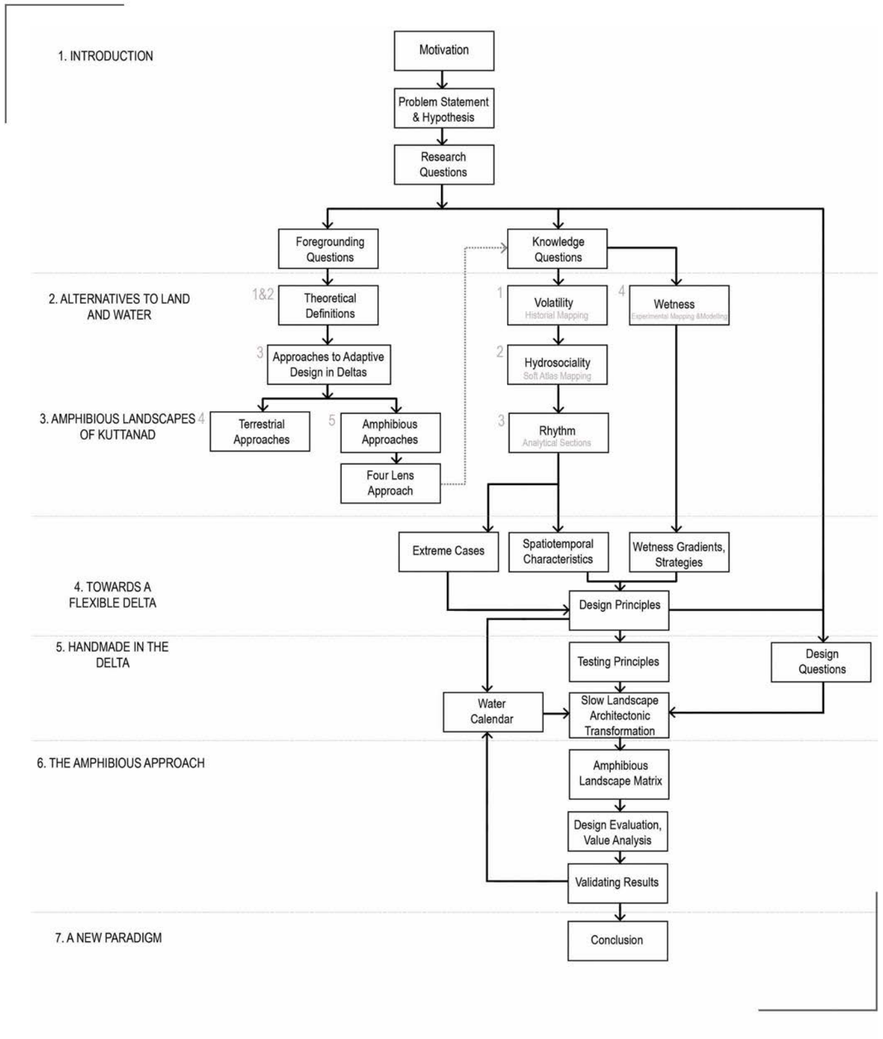


Figure 1.7:methodology
research structure chart

This thesis broadly aims to explore the relationship between land and water and mediate the dichotomy between these two foundational binaries taking the case of a deltaic landscape in Kerala, India.

In the introductory chapter: **INTRODUCTION**, the problem, the principle research questions and the general scope and relevance of the project will be outlined.

Further the second chapter: **ALTERNATIVES TO LAND AND WATER**, presents an introductory description about the site and the theoretical dimensions behind land and water. It will also discuss new approaches while designing deltas in contrast to the existing terrestrial centric approach. The new approach takes root from the work of Krause (2017) where he elaborates a four-lens approach to study life in delta.

The succeeding chapter: **AMPHIBIOUS LANDSCAPES OF KUTTANAD**, will systematically analyse the amphibious character of the deltaic landscapes of Kuttanad through the four-lens approach making use of oral narratives, literature and manifold illustrative and experimental drawing techniques.

The fourth chapter: **TOWARDS A FLEXIBLE DELTA**, builds on the preceding chapter to methodically arrive at design principles four the four lenses.

The fifth chapter: **HANDMADE IN THE DELTA**, will test the design principles at a strategic test location to come up with a design coherent at different scales. This design will be managed by the people making use of an adaptive design calendar.

The pre final chapter: **THE AMPHIBIOUS APPROACH**, will draw critical reflections and generalize the results by testing them on another test location to lay the significant facets for the amphibious approach from the perspective of landscape architecture.

The final chapter: **A NEW PARADIGM**, will essay a shift crucial to the field of landscape architecture.

“Water is everywhere before it is somewhere.”

Anuradha Mathur, Dilip Da Cunha

2. ALTERNATIVES TO LAND AND WATER

A man bringing back his daily catch of black clam from the backwaters of Vembanad. He leaves early in the morning before sunrise and comes with the procure only by forenoon

A young boy rowing his way back home after going shopping in the market in the city. It's a common sight of the inhabitants to be commuting through their boats. Even small children like this boy know how to operate a boat.

This is one of the multiple boat race festivals that take place in the region. Since they were a society geographically isolated and water locked their recreation also shaped around water. This is one of the most celebrated festivals and people from other parts of the country and other parts of the world come to witness this celebration on water. Along with men rowing on the boats, the women and children sing and cheer to their beats.

"Thithithaara Thithithai Thithai Thaka thai thai thom"

Source
Available at https://www.india.com/travel/articles/nehru-trophy-boat-race-photos
Accessed in July 2020

Figure 2.1: site context
social life in kuttanad

2.1. IN THE DELTAS

2.1.1 INTRODUCTION TO KUTTANAD

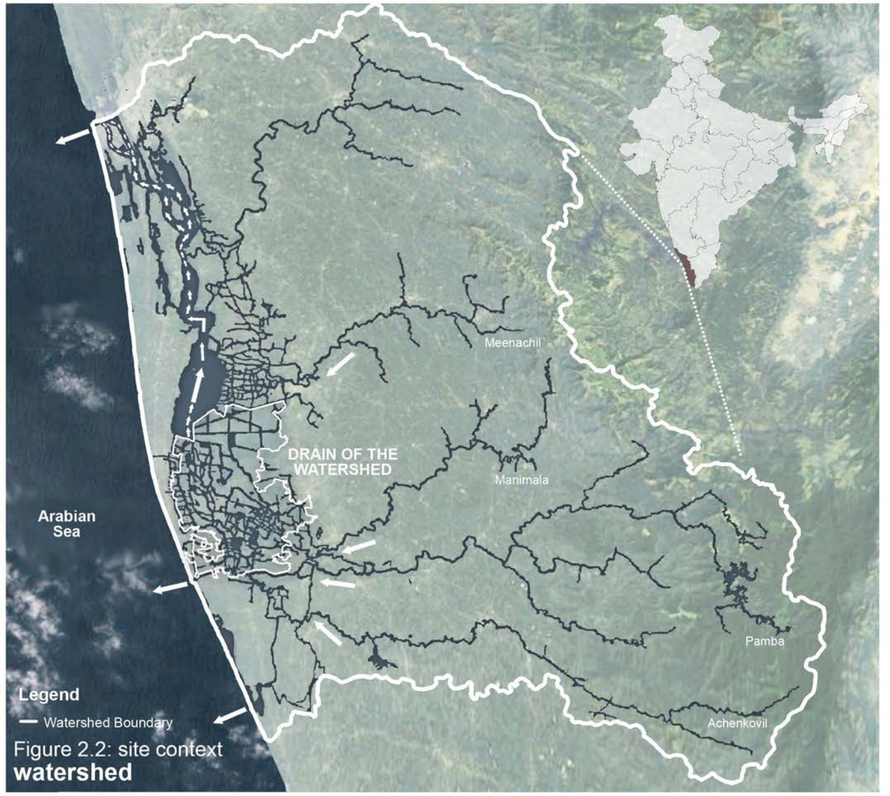


Figure 2.2: site context
watershed

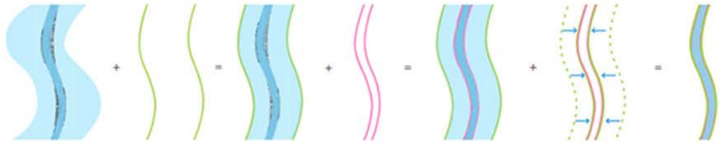
Kuttanad is a coastal wetland in India's southernmost state of Kerala as shown in figure 2.2. It is a deltaic formation through which five rivers drain into the sea. Located in fertile low-lying areas (0.6 to 2.2 m below mean sea level) adjoining the Vembanad backwaters, it was transformed into an agrarian landscape where paddy farming was practiced below sea level from almost a century ago in response to the then socio-economic context[4] of the region. Over the years, unique water-centred cultural traditions, social institutions and lifestyles also evolved around the wetlands as shown in figure 2.1.

[4] Initially the adjoining hilly areas marked in figure 4 were used for paddy farming. With the advent of colonization, the paddy farms were converted into spice, tea and coffee plantations, leading to a deficit in the region's rice production. This food scarcity hit the economically weaker sections the hardest and they subsequently moved to the low-lying areas. They encroached into the water through land reclamation practices and planted the first seeds of paddy for their survival.

Fig 2.3a

[5] These definitions hold good as long as you are looking at fig 2.3a where there seems to exist a line of separation. But then how do you explain fig 2.3b? **Is it land or water?** These in between spaces question the idea of separating static land from moving water, *"terra firma"* from *"aqua fluxus"*. Kuttanad is also a paradox that neither confines to *"terra firma"* nor *"aqua fluxus"* and challenges existing design imaginations. Kuttanad provokes a rethinking in the relationship between land and water.

Figure 2.3: visuals from Kuttanad
landscape of paradox



Source
Prominski et al, 2017

Figure 2.4: imposing limits for flood control
terrestrial centric approach

2.2. DEFINING THE TERMS "LAND" AND "WATER"

2.2.1 LAND AND WATER

The common notion of land is best expressed in the Oxford Dictionary's definition for "land": the part of the earth's surface that is not covered by water. On the other hand, the Oxford Dictionary's definition for "water"[5]: a stretch of water, such as a river, sea, or lake. Additionally, this implies that land excludes swamps, estuaries, tidal areas, lakes, ponds and streams. Classical geomorphologists and geography scholars have always understood and explained land by excluding water and vice versa (Dutt, 2014). Likewise, the traditional theories in geography have described land and water as two unconnected entities constituting the earth .This division was further elucidated in Graham David's work "Waterland" personifying the paradoxical title. The narrator from this novel Tom Crick describes land reclamation while exploring the dilemmas between land/water and man/nature.

"Before human intervention, fenlands existed for thousands of years with almost no change, and removing either water or land effectively destroys the landscape."

"What silt began, man continued. Land Reclamation."

"Is it desirable, in the first place, that land should be reclaimed? Not to those who exist by water: not to those who have no need of firm ground beneath their feet. Not to the fishermen, fowlers and reed-cutters who made their sodden homes in those stubborn swamps, took to stilts in time of flood and lived like water rats."

"They ceased to be water people and became land people: they ceased to fish and fowl and became plumbers of the land. They joined in the destiny of the Fens, which was to strive not for but against water."

"For what is water, which seeks to make all things level, which has no taste or colour of its own, but a liquid form of Nothing? And what are the Fens, which so imitate in their levelness the natural disposition of water, but a landscape which, of all landscapes, most approximates to Nothing?"

These excerpts from the *"Waterland"* was certainly a reflection of the then society that echoed a human centred worldview which puts land as the magnificent superior and pulls water down to nothing or something less valuable. Man saw water as something uncertain and vulnerable. Consequently, conventional water-related engineering projects have managed amphibious[6] spaces through terrestrial approaches premised on removing or controlling water, just as discussed in the case of land reclamation and drainage (Jenson, 2017). In the book River Space design this approach is clearly illustrated as shown in figure 2.4. Here, the terrestrial centric approach imposes limits or lines in the landscape purposefully for an anthropocentric living.In contrast, the new approach should adapt to changes in the quality and flow of water especially in areas like deltas[7] characterized by ambiguous and fluctuating forms of nature. Hence, the indissoluble dichotomy between one of the existing foundational binaries, that is land and water, can be arbitrated with a more fluid geographical approach to land and water.

[6] Etymologically, the term Amphibious comes directly from the Ancient Greek word amphı´bios, which refers to life (bio) that has the quality (ous) of operating on two sides (amphi), particularly in relationship to land and water (confluence). Here, it refers to places where there is an interplay of land and water.

[7] Deltas are essentially a non-permanent form of nature, as silt is stored and reassorted by rivers at their own free will (Dutt, 2014). Rivers do not flow along a fixed route and the land adjoining them are also not permanent (Dutt, 2014). Likewise, the rivers of Kuttanad are seasonal and show their wrath during the monsoons.

[8] Just like Sloterdijk compares humans to amphibious creatures, I too could draw coparisons between the people of Kuttanad and amphibians. Their ability to oscillate between land and water may not be as developed as frogs, crocodiles or salamanders but they are amphibious to some extent, for example, in figure 2.3 the man is walking over water while crossing the canal.

Figure 2.5:man from Kuttanad
amphibious life in Kuttanad

2.2.2. **FLUID GEOGRAPHICAL APPROACH**

The conventional terrestrial centric approaches can be contrasted with amphibious approaches that take water flows per se and organize life around it—as exemplified by living in floating villages or houses on stilts, commuting by means of water as a primary mode of transportation or making a livelihood by growing crops in water.

In the past philosophers like Peter Sloterdijk have been in the forefront to interpret and translate the amphibiousness of human life. Sloterdijk penned a very detailed account that recognizes the existence of life at the interface of land and water. He draws parallels between humans and amphibious creatures[8] since humans can dive and immerse themselves in water, build islands to dwell on water and construct bridges to traverse across water (Gagné and Rasmussen, 2016). However, his work is based on conceptual explorations lacking real-time examples and further fails to delve into the social and physical particulars behind the functioning of amphibious landscapes. A less abstract version illustrating the concept of amphibious living was discussed by Gagné and Rasmussen (2016), which outlined how understanding the relation between land and water was critical for creating a good quality of living. They quoted selected examples which examined the generation of space and the consequent impact on human life in the light of this relationship. However, this was more of a generic approach that entails the importance of understanding the movement of water through both time and space. On the other hand, an amphibious geographical approach is much more than analysing the physical and cultural dimensions behind the movement of water. Considering the fact that this is a relatively new approach, a more articulate approach with a dedicated vocabulary needs to be established to investigate the amphibious qualities of landscapes.

A more specific and analytical approach was laid by Krause (2017), where he **etched out four lenses[9] as an alternative generic approach to study the amphibious life in deltas, namely: Hydro sociality, Volatility, Wetness and Rhythm.** His work however, revolves around the theme of anthropology considering the academic background of the author. It will be interesting to apply this approach in the field of landscape architecture to methodically investigate how the moving water-land interface can act as a valuable living environment for nature as well as humans.

[9] The lenses being volatility, hydro-sociality, rhythm and wetness, and reflect respectively: radical emergence of lives and landscapes, the mutual implications of social life and water flows, the pulsating temporality in hydro-social relations and the materialisation of water in everyday life (Krause, 2017).

Figure 2.6:ancient cartography

Map based on the geography of Hecataeus of Miletus

Source
Available at https://www.britannica.com/biography/Hecataeus-of-Miletus
Accessed in November 2019

Figure 2.7a:conventional map

Figure 2.7a:map shwoing a scenario when the world is flooded

Figure 2.7a:map showing the regions which will be flooded

Figure 2.7:modern cartography

wishful moments traced in cartography

2.2.3. **AMPHIBIOUS CARTOGRAPHIES**

The classical definitions of land and water has also been extended to cartographies. One of the early attempts of a cartographic representation of earth recorded in history is that of Hecataeus of Miletus as shown in figure 2.4, where he fixes on one moment in the hydrological cycle. But this diagram would be different in another moment. Even,modern cartographers have developed a world map which only represent this wishful moment as shown in figure 2.7a. However, another cartographer has mapped the world when it is flooded as shown in figure 2.7b and there is markedly a difference between the former and the latter.

In their seminal work *"Design in the terrain of Water"*, Anuradha Mathur[10] and Dilip Da Cunha[11] argues that maps paint distorted realities of watery imaginations generally coloured blue. Although water is omnipresent[3], we often see it confined within or behind lines in maps (Mathur et Da Cunha, 2014). These lines are fundamental to visual literacy and are imposed by cultural interventions. Also, the visual literacy it imparts is false as it only represents a moment in time like that of Hecataeus of Miletus. Just like how even after the flat earth theory being proved wrong and we still resort to twodimensional techniques in cartography; new alternatives to representing the intermingling dynamics of land and water will be less explored. Nevertheless, these emerging amphibious cartographies will add new insights to the design process besides being a method of visual representation. Hence, there needs to be a new cartographic method to represent this amphibious nature of the in between spaces as shown in figure 2.7c. The lens approach of analysing landscapes maybe combined with amphibious cartographic methods to understand the amphibious qualities embedded in the landscape.

[10] Anuradha Mathur, an architect and landscape architect, is Professor in the Landscape Architecture Department at the University of Pennsylvania.

[11] Dilip da Cunha, an architect and planner, teaches at Harvard University, and Columbia University.

“In all the ages that crocodiles existed, the last species they saw were humans ”

From *“Meesha”* (translated as Moustache in English),
By S.K. Hareesh

3. AMPHIBIOUS LANDSCAPES OF KUTTANAD

“The site was a palimpsest, as was all the city, written, erased, rewritten.”

Teju Cole

3.1. **VOLATILITY**

When studying delta life, we must consider the change of social and material configurations and look into the responses by which delta inhabitants deal with transformations (Krause, 2017). For example, the place we try to map currently was something else previously. So, understanding these changes is essential to predict the future of the delta. The method used here is landscape biographical drawings.

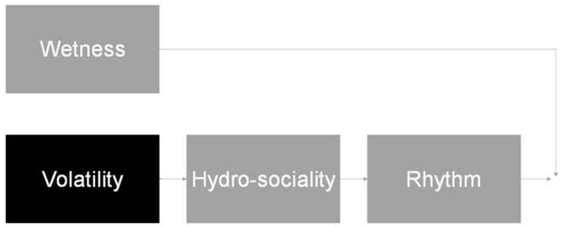
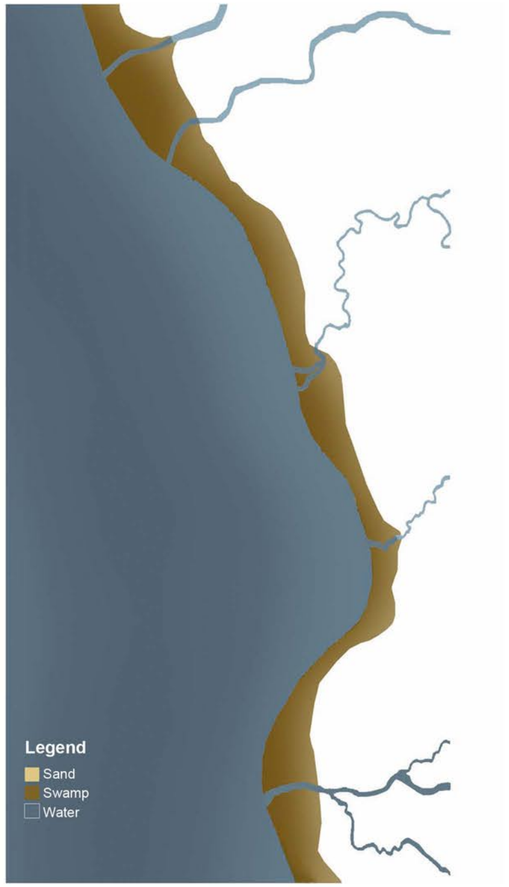


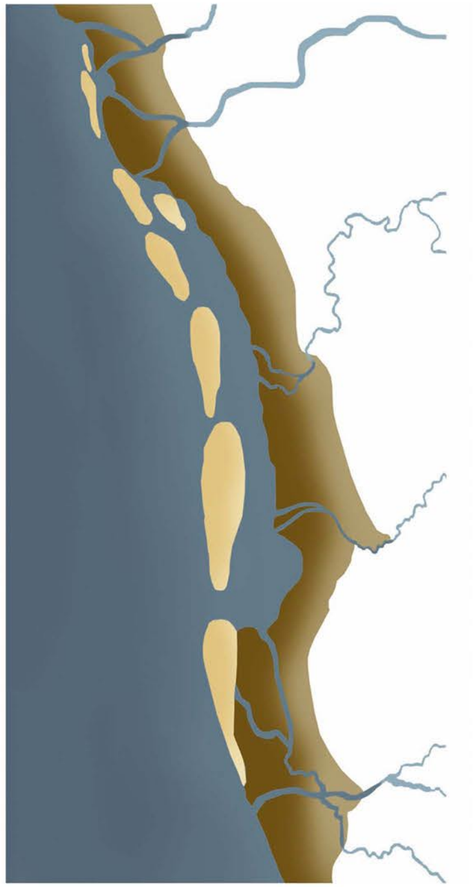
Figure 3.1: four lens approach
research methodolology

3.1.1. THE NATURAL LANDSCAPE



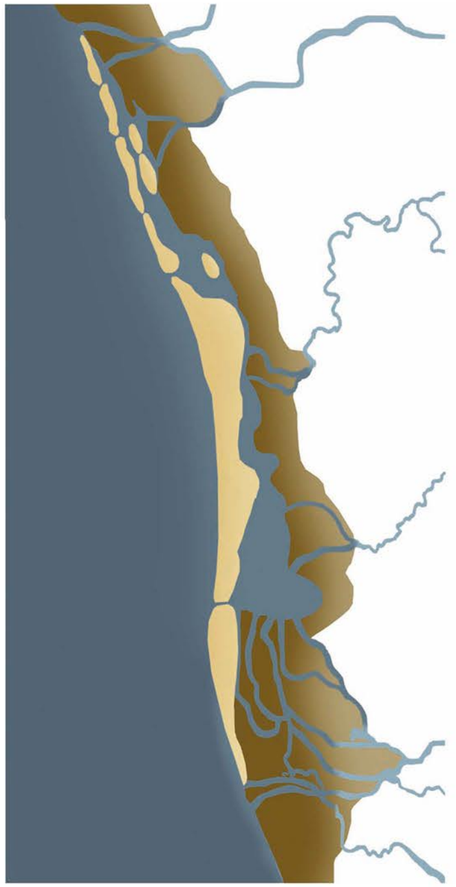
pre-Holocene
shallow embayment

If we trace the genesis of this deltaic landscape, the Vembanad backwater and the adjoining landscape of Kuttanad evolved over the Holocene Period. During the Pre-Holocene period this was an extensive shallow embayment in the Arabian Sea into which rivers drained (Padmalal et al, 2014).



middle-Holocene
open lagoon system

The rising sea level coupled with northward drifting littoral currents were responsible for the progradation of sand barriers across this embayment in the Early–Middle Holocene (Padmalal et al, 2014). Subsequently by the Middle- Holocene, a sand barrier system was developed parallel to the coastline.



late- Holocene
closed lagoon system

These sand narriers were breached into barrier islands due to the reduced supply of sand. The resulting open lagoon setting, was transformed into a partly closed lagoon with limited inlet–outlet systems in the regressive phase of the Late Holocene due to the constant supply of sediments (Padmalal et al, 2014).

19th century
backwater system

The lagoon was separated from the sea by sand barriers. With the fall in sea level, this barrier system became much more continuous. In due course, a major part of the Vembanad Lagoon and barriers further silted up giving rise to a backwater[12] system and a shallow fertile region at the mouth of the backwaters.

Figure 3.2: landscape biography
natural transformation of the landscape

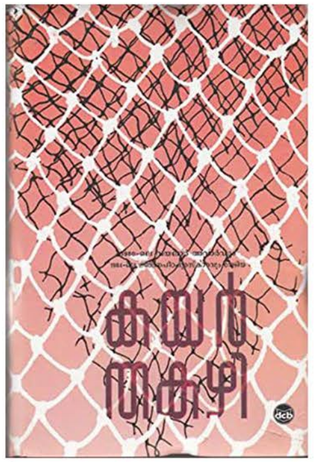
Abstracted by author from
Padmalal, D., Kumaran, K. P. N., Nair, K. M., Limaye, R. B., Mohan, S. V., Baijulal, B., & Anooja, S. (2014). Consequences of sea level and climate changes on the morphodynamics of a tropical coastal lagoon during Holocene: An evolutionary model. Quaternary International, 333, 156-172.

[12] Vembanad backwaters is commonly misconceived as a lake or a lagoon. By analysing the evolution of this landscape, it is clear that this landscape has gone through major morphological transformations over the years due to various natural processes as discussed above before acquiring the quality of a backwater system. This was previously a lagoon landscape which was later transformed into a backwater landscape. A backwater is a part of a river in which there is little or no current.

"This pristine landscape was later subjugated **for the benefit of men and women** and how they did this narrates the legend behind the existing cultural landscape of Kuttanad."

Figure 3.3: photograph taken during mid 20th century
group of women involved in intensive agricultural labour

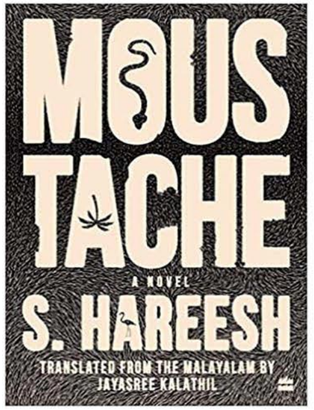
Source
Available at https://imgur.com/a/oR69N#0
Accessed in May 2020



Source
Available at https://www.goodreads.com/book/show/40197208-kayar
Accessed in May 2020

[13] Thakazhi Sivasankara Pillai was a noted Indian novelist who was born and raised in a small village in Kuttanad. Kuttanad was the central setting of many of his novels. In his magnum opus *"Kayar"* (translated as rope in English, 1971), time and landscape acquired the persona of narrators where fundamental questions about man's relationship with land were raised. The story unfolds an unpleasant transformation of this relationship where the Industrial Revolution was portrayed as one the main antagonists.

[14] *"Meesha"* (translated as moustache in English, 2019) is a work of fiction by S. Hareesh a contemporary Indian novelist who also hailed from Kuttanad. The story is set in the backdrop of Northern Kuttanad and discusses the landscape, its inhabitants and unique ecology from the perspective of the central character, Meesha: the man with a big moustache. Both these works echoed popular myths, legends and folklores from over a century ago and presents the oral narrative of Kuttanad. Meesha even had a whole chapter made up of songs and hymns that were sung by the locals. These oral narratives for me as a researcher was a starting point to understand the evolution of the relationship between man and nature in this deltaic landscape.



Source
Available at
https://www.aninews.in/news/national/general-news/dc-books-publishes-malayalam-novel-meesha20180801155634000 1/
Accessed in May 2020

Figure 3.4: noted literaterary works
eco-centric critique about Kuttanad

3.1.2. THE CULTURAL LANDSCAPE

The cultural landscape evolved due to the anthropogenic activities centred in and around the backwaters. Humans have always transformed and managed natural flow in a particular area over the years for various reasons (Bobbink, 2019). This cultural transformation in the Kuttanad delta was point of interest for many eco-centric writers and critiques. Thakazhi Sivasankara Pillai [13] (1971) described Kuttanad as a dying Paradise due to man's ignorance while trying to control nature for their benefits. On the other hand, S. Hareesh[14] in his novel Meesha (2019) had a more romanticized take on this and describes the landscape to be lifted out of clay and swamps by the continuous toil of humans. What is common to both of these accounts is a precious testimony of the influence of man in shaping this landscape as we see it today.

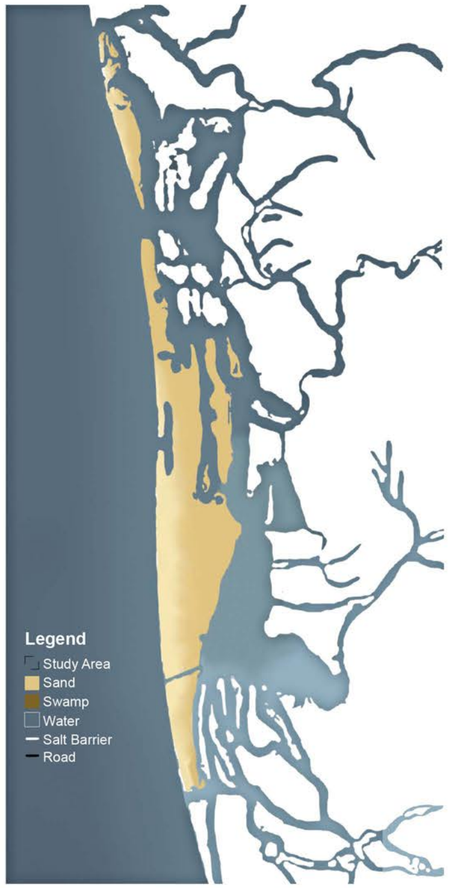
"Manushyan chathuppil ninnum mannil ninnum kuthi undakiya sthalam".
"A place lifted out of soil and swamps by man".

"Meesha"
By S. Hareesh

Figure 3.5: photograph taken during mid 20th century
landscape shaped by the continuous toil of humans

Source
Available at https://imgur.com/a/oR69N#0
Accessed in May 2020

add swamps



19th century
natural landscape

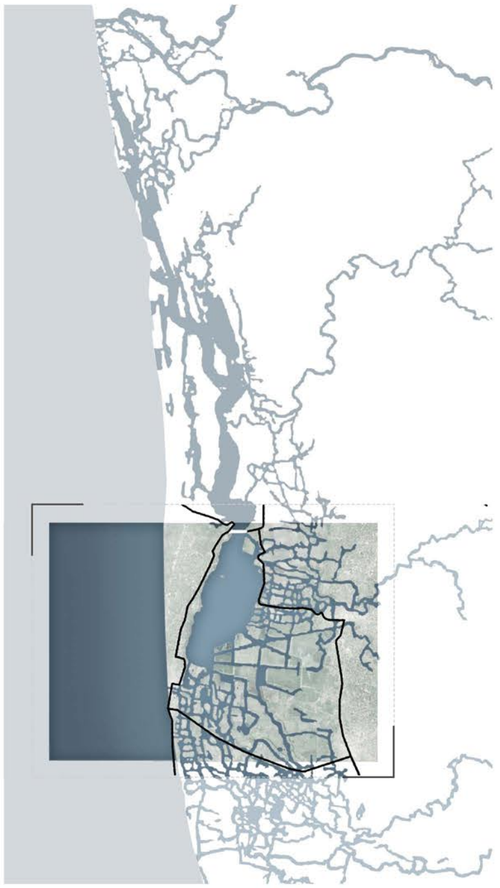
Over 6500 hectares of land was reclaimed from the Vembanad backwaters which led to a major change in the morphology of its hydrological structure between 1850 and 1945. Chronologically, the most important anthropogenic activities that had resulted in these changes in the deltaic landscape was:

1850-1945
land reclamation

(1) land reclamation of a part of the Vembanad Backwaters and the adjoining low-lying landscape

1945- 1976
salt barrier construction

(2) construction of a salt barrier across the backwaters as a part of the agricultural intensification process



present day
other infrastructural changes

(3) other infrastructural changes like roads in response to the needs and aspirations of a modern-day society

Figure 3.6: landscape biography
cultural transformation of the landscape

Abstracted by author from
Padmalal, D., Kumaran, K. P. N., Nair, K. M., Limaye, R. B., Mohan, S. V., Baijulal, B., & Anooja, S. (2014). Consequences of sea level and climate changes on the morphodynamics of a tropical coastal lagoon during Holocene: An evolutionary model. Quaternary International, 333, 156-172.

A total of 4400 hectares of land were reclaimed from the backwaters between 1880 and 1945 in three phases as shown in figure 3.6. The first phase starting from 1880 to 1888 were started by the lower caste population since this marginalized section did not have access to land (Chandran et Purkayastha, 2018). When the Travancore region was facing food scarcity during this period, the authorities saw the potential of Kuttanad to counter this deficit. The second phase of Kayal reclamation started around 1888 and continued till 1903 when reclamation of Kayal became more intensive. These paddy fields on the reclaimed land were then considered as an important economic asset by the people (Chandran et Purkayastha, 2018). However, 1903 to 1912 Kayal reclamation was stopped because of the apprehension of its impact which may adversely affect the functioning of the nearby port (Chandran et Purkayastha, 2018). With the revoke of the ban on reclamation in 1912, a revival of these activities started all over again which continued till 1945, and this marked the final phase of the reclamation process.

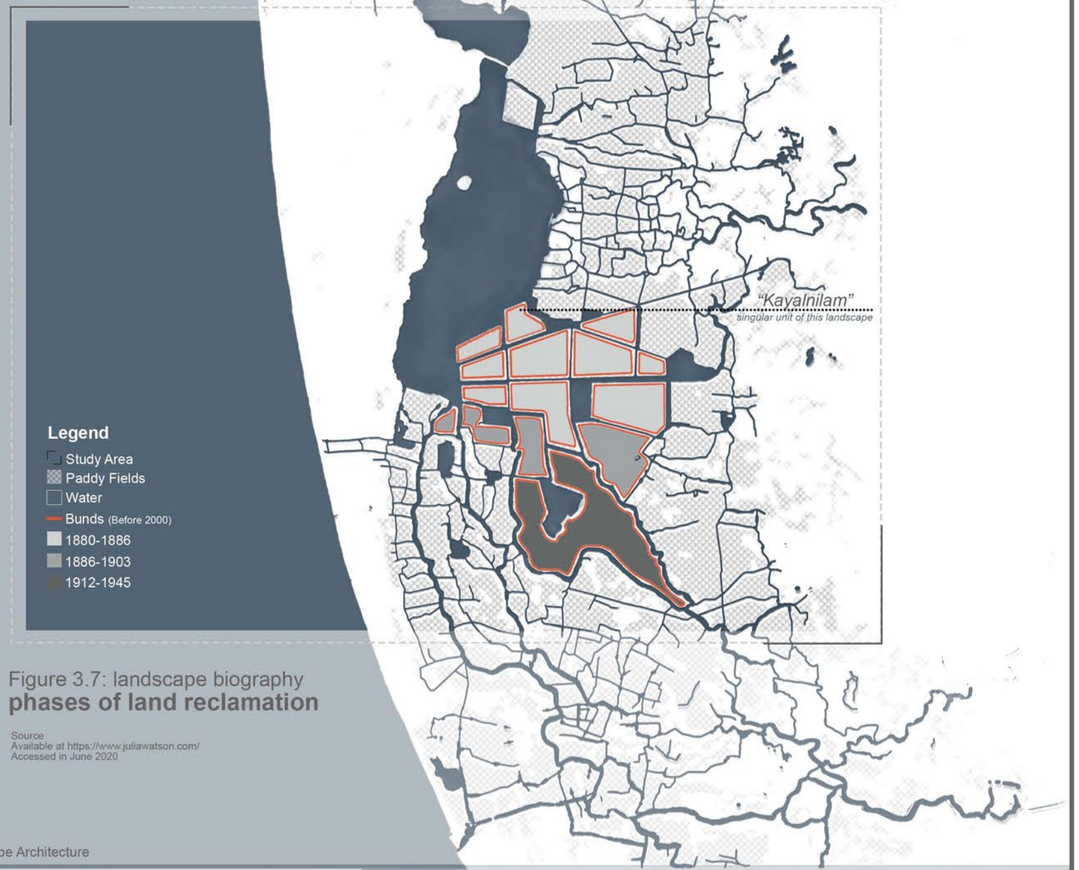
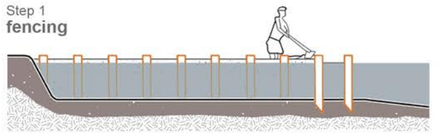


Figure 3.7: landscape biography
phases of land reclamation

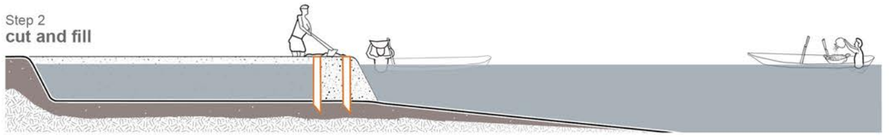
Source
Available at https://www.juliawatson.com/
Accessed in June 2020

3.1.3. **LAND RECLAMATION**

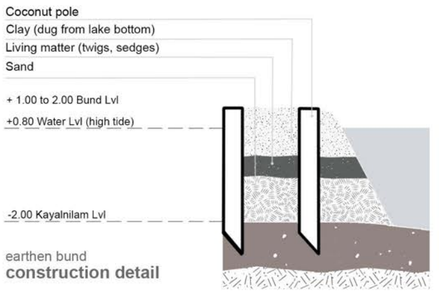
The birth of the cultural landscape was marked by the onset of the land reclamation process, colloquially known as *"Kayalkuthu"*. At first, an ostracized fabric of the society struck a chord of harmony with smaller patches of these wetlands. They reclaimed only as much as what was needed to feed their families. When the region encountered acute food shortage in the late 1800s, these virgin landscapes were considered as a gift from the backwaters. Over the years, they were consequentially brought to agricultural glory under the leadership of Joseph Murickan, the father of the modern-day agrarian landscape of Kuttanad. The singular unit of this landscape is the *"Kayalnilam"* which is synonymous to the polder seen in Dutch landscapes as marked in figure 3.7 . It is an artificially created landform where land (something) was lifted out of water (nothing) through the collective toil of humans. Nearly 400 to 500 men were engaged in a year to complete the reclamation process of about 2000 ha of land. This labour-intensive process as shown in figure 3.8 would start with the identification of the shallow regions in the Backwaters.

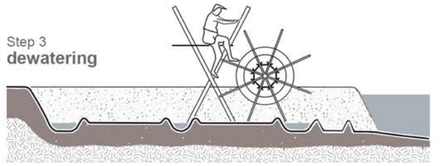


1. Once the area is identified, the first step is to mark the boundaries. Then an array of long and stout coconut poles would be hammered deep enough into the lake bed in two rows, normally in 1.5m to 2.5m width, enveloping the entire area. Then they would be fenced with bamboo mats on either side to form a skeleton for the bund.



2. Then the channels of the bund would be filled to the desired height, first with sand, followed by twigs, sedges like Typha and Sheoneplectus (*Kora Pullu*) and dead materials that were brought from distant places and interspersed with high quality clay that was dug from a depth of 20-25m from the lake. Clay digging was called *"Kattakuth"*, which involves diving deep in to the lake-bed. In this manner, the earthen bunds are constructed and they are further stabilized or strengthened by planting vegetation cover.





3. The final step is dewatering or removing excess water from fields. Traditionally, water wheels of 10-12 ft diameter with blade width of 1 to 15 feet were used, which were pedalled manually by men. The water wheel ranges from 4-leaved to 18 leaved. Water is pumped out periodically into the surrounding lake or canals.

Figure 3.8: *Kayalnilam*
construction process of a *Kayalnilam*

Abstracted by author based on information from
Swaminathan, M. S. (2007). Measures to mitigate agrarian distress in Alappuzha and Kuttanad wetland ecosystem. Chennai, India: Swaminathan Research Foundation, Union Ministry of Agriculture.

"The construction and functioning of these Kayalnilams demonstrates years of human strength, wisdom and ingenuity while dealing with water management in Kuttanad."

."

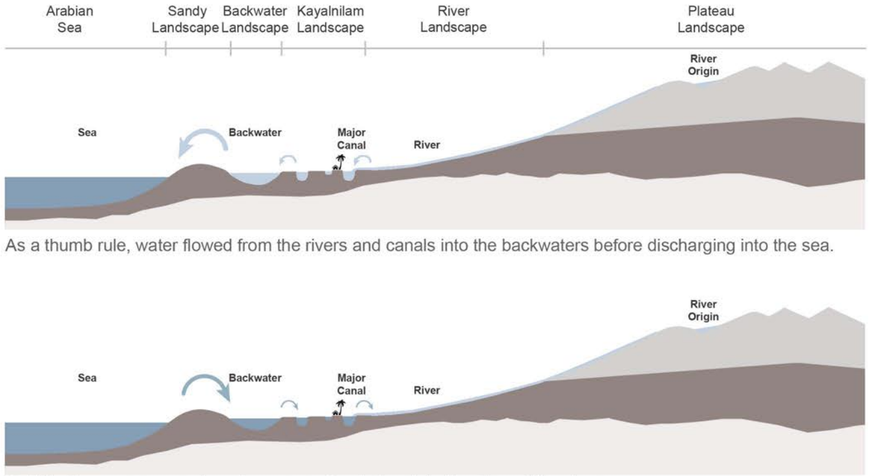
Figure 3.9: photograph taken during mid 20th century
dry ploughing[14]; farmer preapring the ground with the help of indigenous tools and animals

Source
Available at https://imgur.com/a/oR69N#0
Accessed in May 2020

[14] Dry ploughing is the action of turning up the earth in a particular area of land with a plough that is made of locally available materials, wood in the case of Kuttanad, in order to improve the workability of the soil. In olden days and even nowadays some of the farmers employ cattle like cows to pull the plough manually as shown in the picture.

3.1.4. SALT BARRIER CONSTRUCTION

With the increased area for paddy cultivation due to the intensive reclamation process, Kuttanad was proclaimed as a rice capital for the region. Coupled with this, new agricultural techniques were introduced in the region in the second half of the 20th century as a part of the Green Revolution movement. The indigenous landscape management practices were gradualy being replaced by sophisticated agricultural practices. These techniques rapidly transformed Kuttanad into a highly productive operational landscape where paddy farming was practiced extensively. However, one of the major challenges faced by the farmers was the prevention of seasonal salt-water intrusion into the paddy fields.



As a thumb rule, water flowed from the rivers and canals into the backwaters before discharging into the sea.

But this flow was reversed post monsoon due to the dwindling flow of the rivers.

Figure 3.10:concpetual section
water flow in the watershed

During the months of December to almost mid-may there is a net decrease in the total inflow of water from the rivers into Kuttanad owing to the rainfall pattern as shown in figure 3.11. This marks the entry of salt from the sea into the low-lying areas due to tidal action.

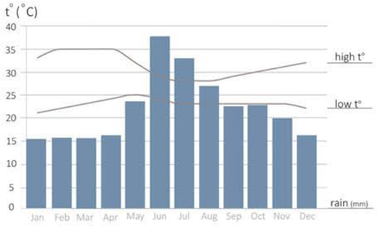


Figure 3.11: climate graph
fluctuating water levels

Abstracted by author
Available from https://en.climate-data.org/asia/india/kerala/alappuzha
Accessed in April, 2020

To prevent this seasonal salinity intrusion a regulator or salt barrier was constructed at Thaneermukkam to help the farmers during high tides and lean times for farming. The construction of this permanent salt barrier was completed in 1974 and is functional since 1976. Ever since then, the Vembanad Backwaters was divided into two qualities as shown in figure 3.13; brackish water with tidal action to the northern side of the barrier and freshwater with no tidal action to the southern side of the barrier. The major economic advantage of this intervention was the addition of a second crop to the harvest cycle which contributed to a boom in the agricultural production in the immediate years.

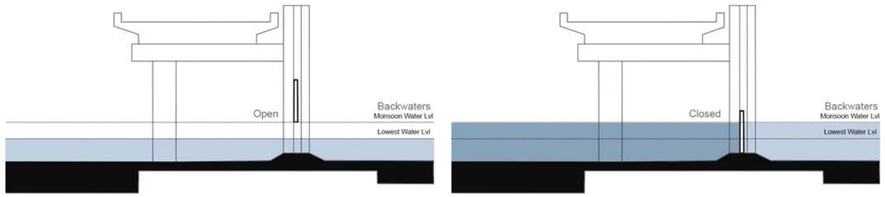


Figure 3.12: salt barrier
functioning and detailing

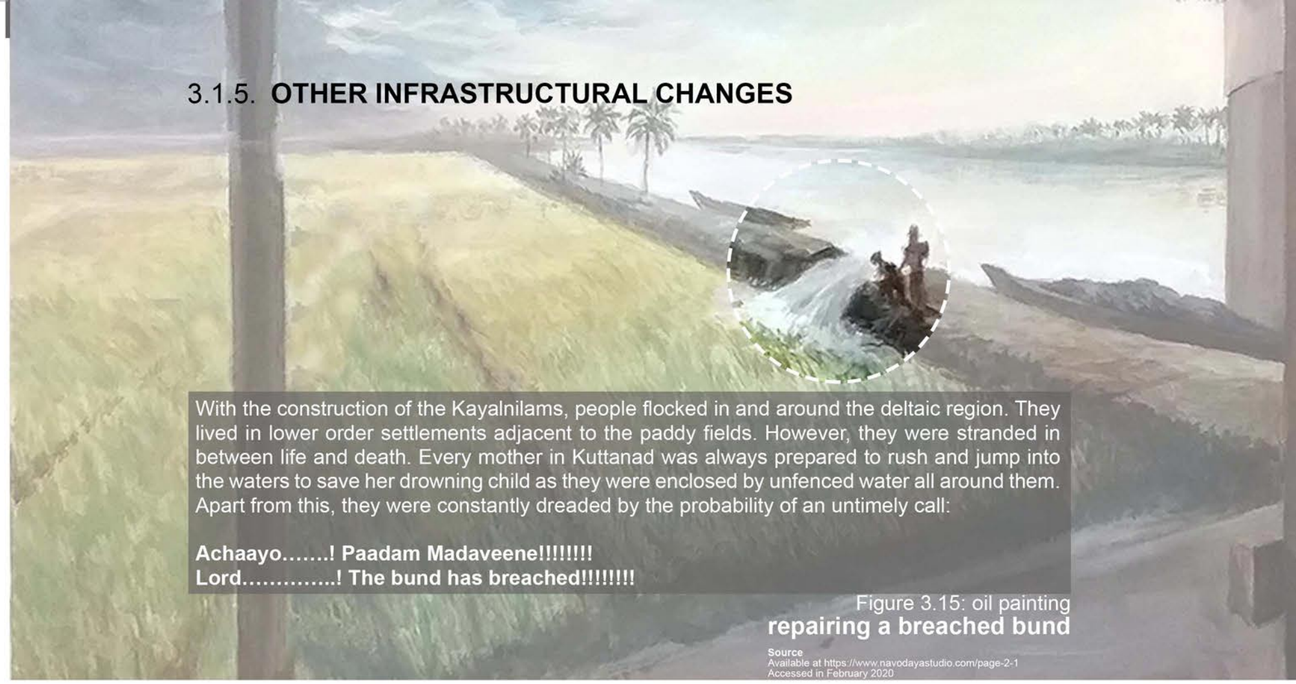
Figure 3.13: salt barrier
barrier creating two different water qualities

Abstracted by author
Available from https://www.youtube.com/watch?v=WPbVLR85_sE
Accessed in November, 2019

Figure 3.14: site context
infrastructural lines

Abstracted by author from
Landuse maps prepared by K.S.R.E.C, Trivandrum, Kerala
Accessed in December 2019

3.1.5. OTHER INFRASTRUCTURAL CHANGES



With the construction of the Kayalnilams, people flocked in and around the deltaic region. They lived in lower order settlements adjacent to the paddy fields. However, they were stranded in between life and death. Every mother in Kuttanad was always prepared to rush and jump into the waters to save her drowning child as they were enclosed by unfenced water all around them. Apart from this, they were constantly dreaded by the probability of an untimely call:

Achaayo…….! Paadam Madaveene!!!!!!!!
Lord……..! The bund has breached!!!!!!!!

Figure 3.15: oil painting
repairing a breached bund

Source
Available at https://www.navodayastudio.com/page-2-1
Accessed in February 2020

If this distress call was before the harvest, it was synonymous to their children drowning as the breached bunds would mean the forceful invasion of the water from the canals and rivers into the paddy fields rendering them drowned in a pool of misery for the coming year. They would even be deprived of grains for their daily supper. These earthen bunds which were the prime infrastructural demand in the olden days were made of locally available materials like coconut poles, bamboo poles, aracanut poles, woven coconut leaf plates, sand, twigs, sedges, clay dug from the bottom of the backwaters and other dead materials as shown in figure 3.15 (Swaminathan, 2007). But as the story goes by in the event of a bund breach there was a practise of human sacrifice based on the belief of death giving way to life. So, a section of these earthen bunds would also have dead bodies stacked and buried in an exhilarating depth of mud to stop water from entering the paddy fields. But this unsustainable practice was eventually discontinued with the problem of the breaching of bunds remaining unresolved.

These bunds which acted as soft edges susceptible to flooding were subsequently replaced by granite or concrete as shown in figure 3.14 by the start of the millennium. These hard edge constructions were seen to be a more stable and viable solution to the breaching of the bunds during heavy rainfall. However, today the annual flooding occurring during the monsoon still challenges the defence mechanism behind these hard edge bunds. Another infrastructural change was the construction of roads to improve the accessibility to Kuttanad. In 1957, a road passing through the middle of Kuttanad was constructed as shown in figure 3.14. Later on, several roads and hard edge bunds were built which eventually led to blockage in water flow and subsequently causing floods in the region. Evidently, these new infrastructural changes could not cope up with the wrath of the monsoon.

[14] *The volatility diagram was prepared after delineating the most important changes in the delta. The inner circle mentions these changes and the outer circle shows the resulting conditions and the corresponding responses*

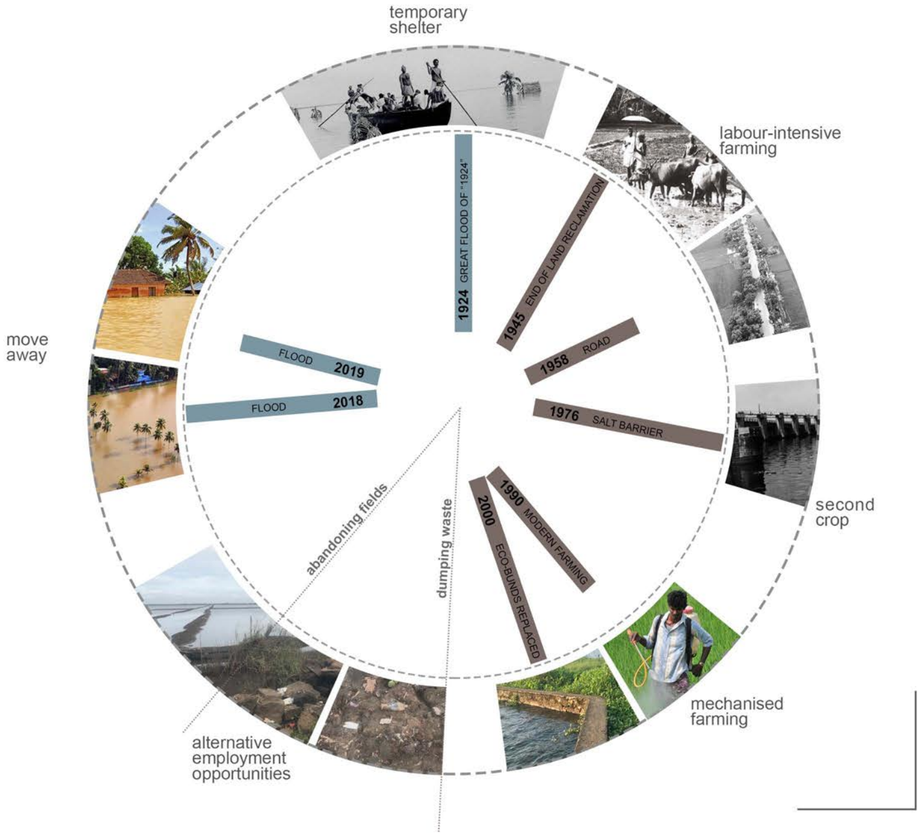


Figure 3.16: volatility diagram[14]
changes and responses in the delta

3.1.6 **CREATIVE RESPONSE OF THE DELTA**

The agricultural glory associated with the Industrial Revolution did not prevail for long. Towards the end of the 20th century many of the paddy fields started to gradually disappear as shown in figure paving way to an era of agrarian distress. Many farmers found paddy farming unprofitable due to the increasing cost of production, lack of price for the produce and the lower productivity of these fields. Adding to the agrarian distress was the failure of the new hard-edge flood defence infrastructures. As a result, there was a cloudburst flooding in this deltaic region in the years 2018 and 2019. However, flooding was not a new experience for Kuttanad and this was evident if you look at the opening lines from another celebrated short story by Thakazhi, *"Vellapokkathil"* (translated as "In the Flood" in English, 1999).

Water! Water Everywhere!
All the inhabitants of that place had gone in search of dry land.

"Vellapokkathil"
By Thakazhi Sivasankara Pillai

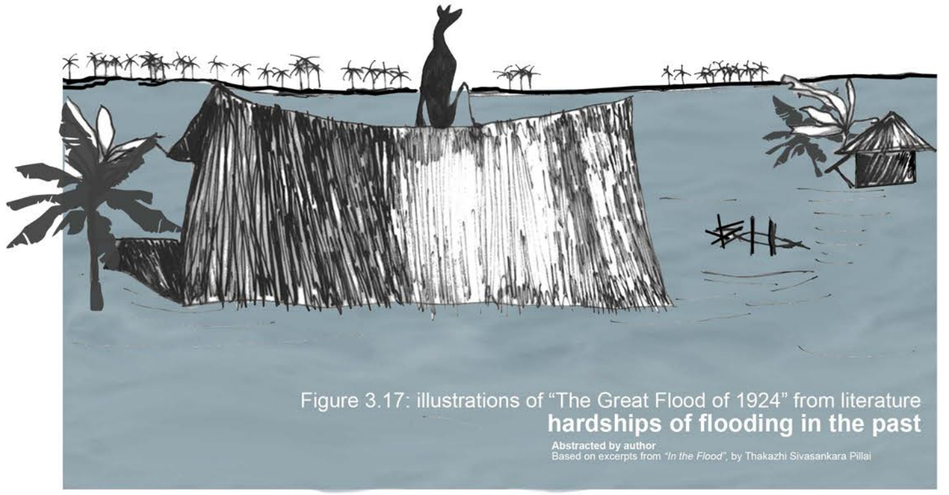


Figure 3.17: illustrations of "The Great Flood of 1924" from literature
hardships of flooding in the past
Abstracted by author
Based on excerpts from *"In the Flood"*, by Thakazhi Sivasankara Pillai

Drawing inspiration from "The Great Flood of 1924", the writer narrates the story of a dog waiting for its master during a flood and its eventual death. If we trace the occurrence of flooding in this landscape it was not just limited to 1924. Hence, what has changed considerably over the years is not the occurrence of flood events but perhaps the response of people to those events. Clearly, the modern-day society sees water as a threat to the quality of life and aspires to neutralize the dynamics associated with water through high-tech infrastructures like concrete bunds and salt barriers. They intend to condition the landscape to suit their current programmatic choices and cultural consciousness . In the past, while the traditional water system was in practice this cultural consciousness was oriented towards an amphibious living.

“Particular instances of water become embedded in social relations while at the same time providing sites for changing those relations.”

Jessica Budds

3.2. HYDRO-SOCIALITY

On identifying the critical anthropogenic processes as entailed in the previous section, it is important to understand the relations manifested in these processes. The cultural transformation initiated with the land reclamation process was a conflict between land and water and this conflict was aggravated in the subsequent processes. An analytical ground for understanding this mutual implication of humans and water flows would be capturing the hydro-sociality embedded in these landscapes. The central idea behind this lens based on hydro-social relations is that water flows must not be considered as an external dynamic while studying the anthropogenic processes (Krause, 2017). In that sense, hydro-sociality insists that the investigation of delta life must not be limited to using either a purely social or a strictly hydrological lens, but rather be considered holistically. The method used here is an illustrative technique to make a soft atlas map for the region highlighting elements of water and how people interact with these elements through narratives recorded from literature and oral history.

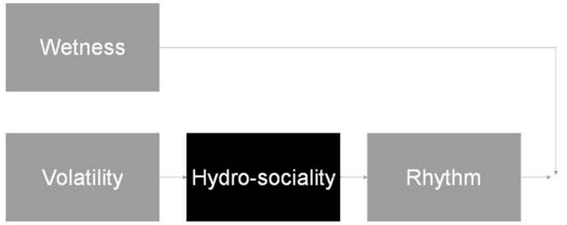


Figure 3.18: four lens approach
research methodolology

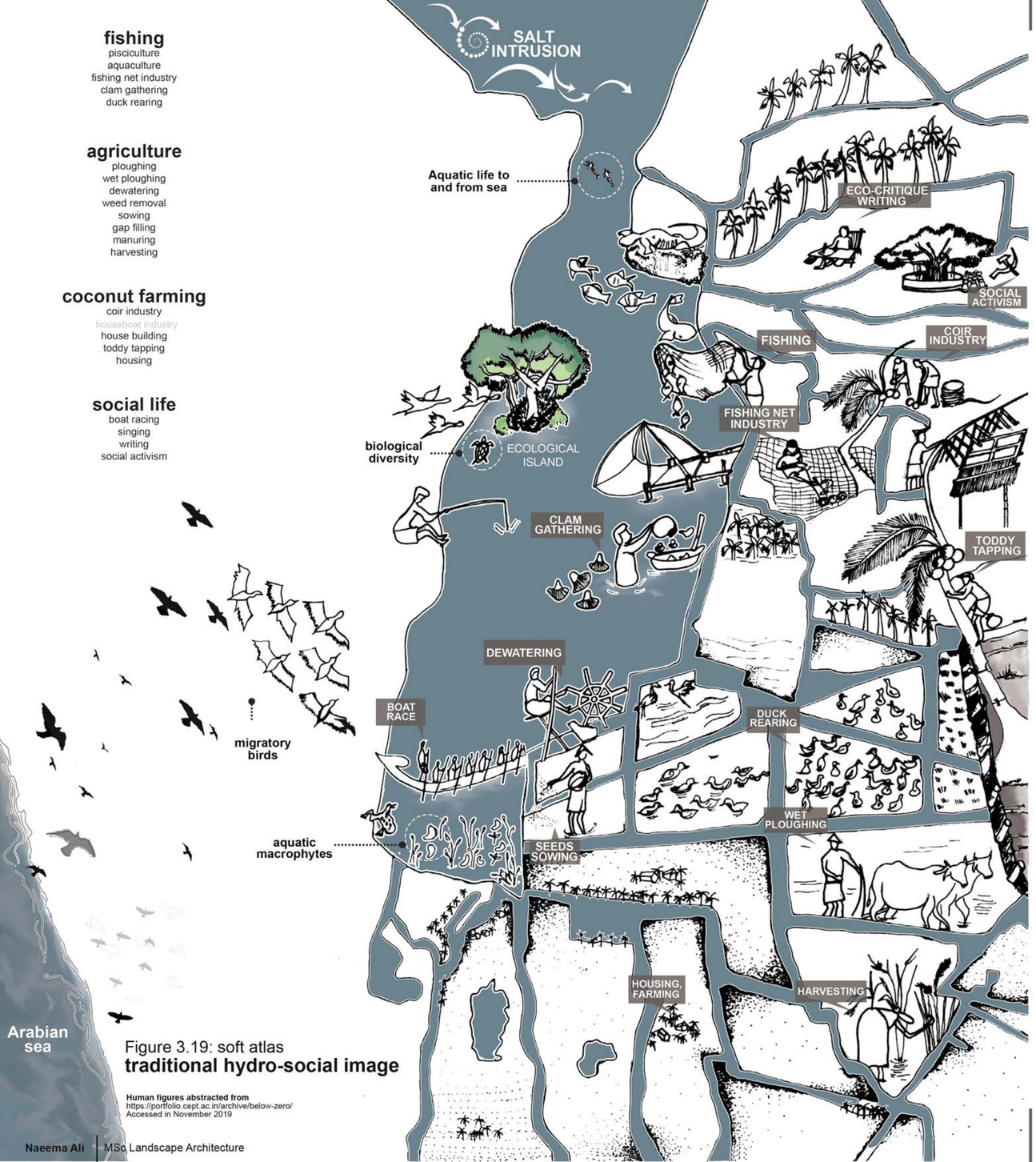


Figure 3.19: soft atlas
traditional hydro-social image

Human figures abstracted from
https://portfolio.cept.ac.in/archive/below-zero/
Accessed in November 2019

3.2.1. TRADITIONAL LIVING

The hydro-social image of Kuttanad in the olden times before the construction of the salt barrier as shown in figure 3.19, points to a history of large numbers of women and men working on the paddy fields. Alongside paddy cultivation, there was a thriving duck, fishing and clam industry. Besides farmers, fishing communities also stayed close to the backwaters benefitting from the seasonal saline environment where plenty of fishes and other aquatic life migrates from the sea to the backwaters. People also made a living out of weaving coir, toddy tapping, making fishing nets and so on. Hence, majority of these livelihood strategies were directly linked to the ecosystem services provided by the backwaters and the adjacent low-lying lands. Even after facing the wrath of the monsoon every year through perpetual flooding episodes they chose to dwell on the reclaimed Kayalnilams. They not only chose to live between land and water, but they also celebrated this hybrid existence. Women sang folklores to celebrate the harvest season as they reaped the paddy grains and men raced on boats rowing in unision to the rhythm of *"Vanchipaatu"*(translated as boat song in English): a song sung during the boat race festivals to cheer the boat rowers.

Kuttanad punchayile!
Kochupenne kuyilale,
Kottuvenam kuzhal venam, kurava venam.

Oh, girl from the Kuttanad Punja Fields!
Your melody sounds like the song of a cuckoo.
We also need a good beat, drum and a trumpet to celebrate this song.

3.2.2. MEANING OF LAND AND WATER

In the past, being geographically secluded, the only way to go back and forth from Kuttanad was by means of a *"vallam"* (translated as boat in English). In this forced setting, water and the sliver of land they stepped on were not just related to people in the material sense but also spiritually, symbolically and experientially. People were dependent on their land and water for survival.

"Our land gave us everything. Water gave us fish and land gave us rice and coconuts. Our land never left us go hungry. We could catch fish from the rivers that flowed in front of our houses".

Neeleswari, Agricultural Labourer from Kuttanad

Source
Vallikappen, T. (2012). Where blessing and curse merge with life and death: local beliefs in contemporary Lower Kuttanad (Master's thesis, The University of Bergen).

This intimacy, dependency and attachment to the land where they sowed their seeds and the water that irrigated their fields led them (especially the inhabitants who are Hindus) to personify and worship these resources as "Devi" or Goddess (Vallikappen, 2012). In their eyes, challenges imposed by these resources are challenges imposed by the Goddess. So, their cultural consciousness while dealing with floods or the dynamics associated with water was not to run away from it but work together to face the Goddess. In the event of excess rainfall, the farmers and the agricultural labourers would harmoniously unite to save the fields. When they entered the paddy fields out of respect for the soil, they walked bare footed. The respect for land and water was evident from these narratives that considered both land and water as equally sacred.

“Reap the paddy to fill the measuring pot,
Reap the paddy to till the bottom standing in a row,
With the rhythm of bangles,
Stack and thresh the reaped paddy and fill the stack yard.
Clear the chaff and measure the grains.
Let’s fill the granary with the grain!!!
The paddy field that gives golden harvest ”

Folk song called “Koyithupaatu”,
sung while harvesting

Figure 3.20: harvest season
women singing and harvesting

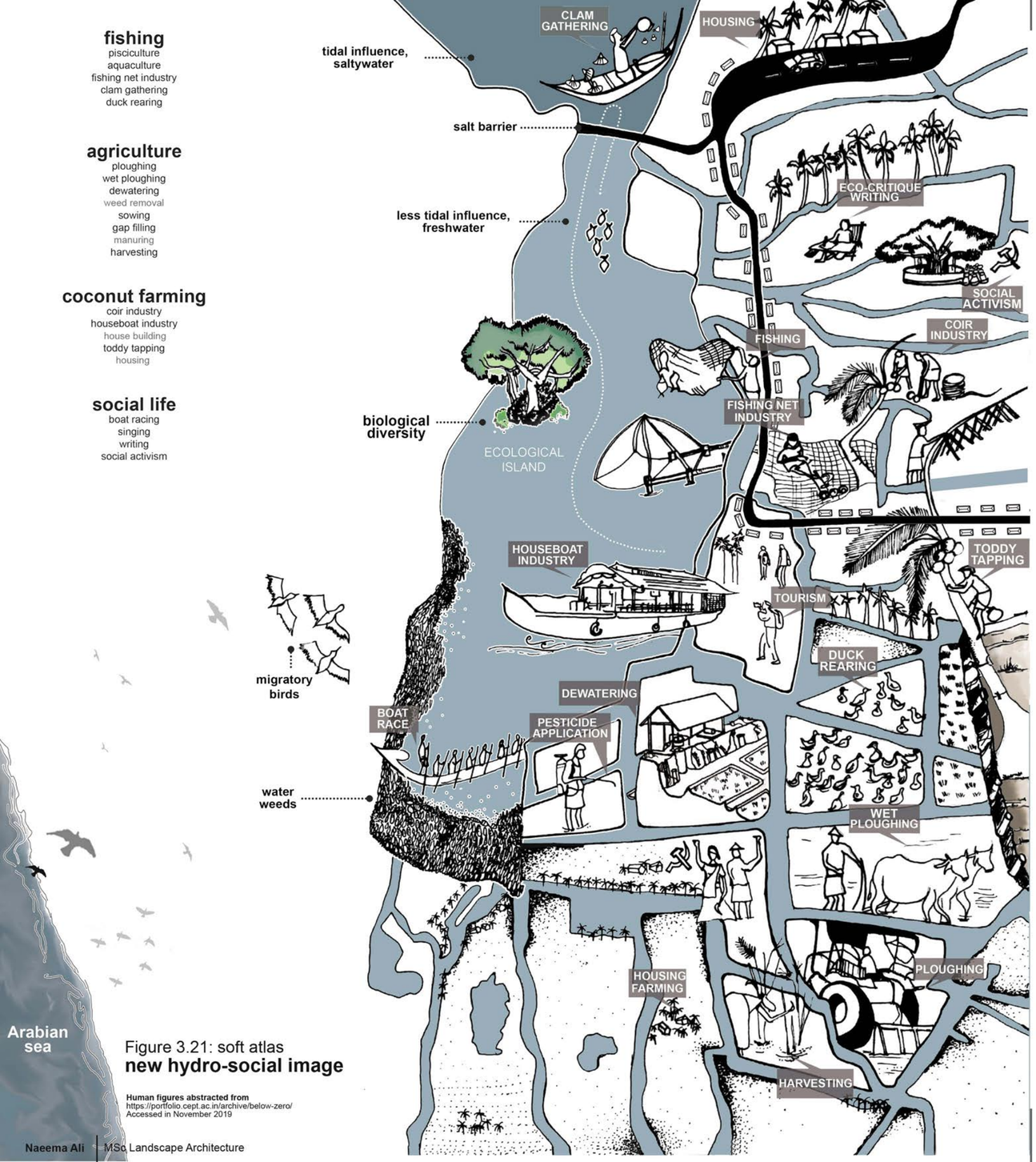


Figure 3.21: soft atlas
new hydro-social image

Human figures abstracted from
https://portfolio.cept.ac.in/archive/below-zero/
Accessed in November 2019

3.2.3. CHANGE IN HYDRO- SOCIAL RELATIONS

"The paddy field where our life lies is disappearing and our future remains uncertain".

Leelamma,
Agricultural Labourer from Kuttanad

"We don't know any other job than paddy cultivation." says Gopalachan, an old agricultural labourer.

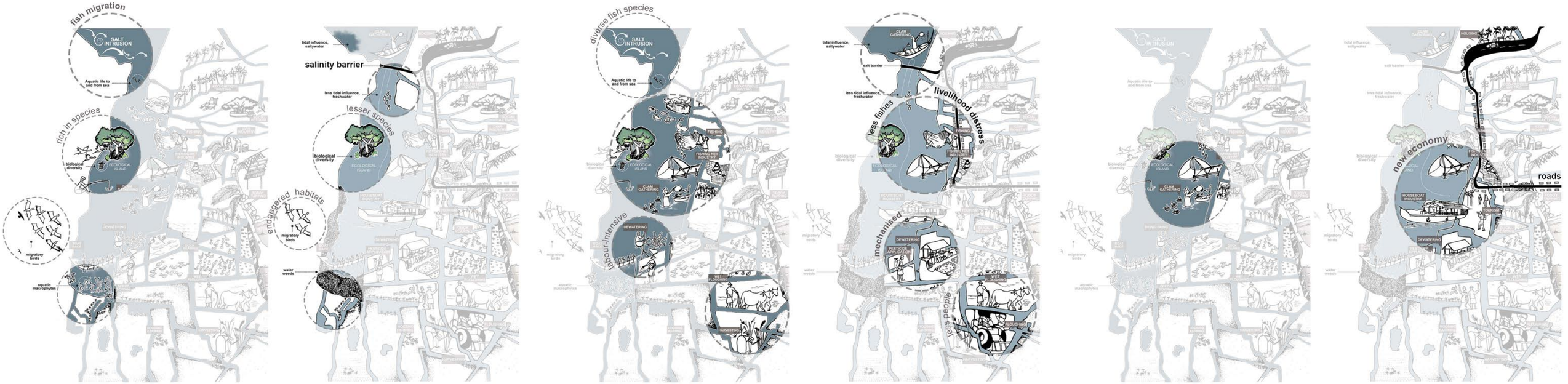
Gopalachan,
Agricultural Labourer from Kuttanad

"This is our hereditary occupation. I like my occupation and will do it till I die. I am known by this occupation which is my identity in this region. But this occupation must end with me. I will not let my children enter the fields."

Keshavan,
Agricultural Labourer from Kuttanad

Source
Vallikappen, T. (2012). Where blessing and curse merge with life and death: local beliefs in contemporary Lower Kuttanad (Master's thesis, The University of Bergen).

The agrarian class can no longer rely on the natural resources like before and they feel the soil beneath their feet is slowly disappearing. Within a span of four decades the relationship between man and the once considered sacred paddy fields and water seems to be strained. Geographers have long attended to this changing relationship between water and society as one aspect of the relation between nature and society, but these explorations were more productive only after the 1990s where scholars started understanding the mutual influences between water and society rather than investigating the isolated effect of one on the other (Linton et Budds, 2013). The terminology hydro-social brings to the forefront the idea of hybridity within the relationship between man and water- they are related internally rather than externally (Swyngedouw, 2007). This implies a shift from analysing relations between entities, for example, from trying to understand the impacts of humans on water, to understanding how the these relations are manifested in other entities like **ecological, social and economic processes** (Linton et Budds, 2013).



impact on ecological processes
decreased ecological diversity

The seasonal mixing of saline and freshwater which served an important ecological function of naturally cleansing accumulated wastes in the water body was obstructed (Swaminathan, 2007). Today, parts of the backwaters are breeding grounds for mosquitoes, and the aquatic macrophytes have been replaced by aquatic weeds like the “African Payal” which adversely impacts the quality of the waterbody. Additionally, previous studies show a significant reduction in the population of the migrant birds (Narayanan et al, 2011) which can possibly be an added consequence of this change in habitat. The salt barrier disrupted the ecological well-being of the area.

impact on social processes
severe livelihood distress

The reclamation which was a very labour-intensive practice was discontinued by 1945. Subsequently, agricultural practices became more mechanised. Hence, the hydro-social image illustrates lesser number of men and women working in these fields. The prevention of salinity intrusion through the permanent salt barrier also thwarted seasonal sea fish migration gravely affecting the fishing industry. The fishermen and the clam gatherers has to cross to the northern side of the salt barrier to procure their daily catch. All of this points to a radical decrease in the livelihood opportunities causing widespread economic distress for famers as well as fishermen.

impact on economic processes
evolving tourism-based economy

With the traditional livelihoods being at stake people were forced to commute outside Kuttanad for alternative employment opportunities. In response to this, roads were constructed and settlements evolved along these roads without considering the hydrological regime and thereby blocking the natural flow of water. As a result, the hydrological carrying capacity of the area was reduced which further intensifies the issue of flooding. Amidst these negative impacts, a new found economy is the rise of houseboat tourism with more than 2000 functioning houseboats. This led to a boom in the backwater tourism, attracting visitors from all over India and other parts of the world.

Figure 3.22: change in hyro-social relations
impact on ecological, social and economic processes

The city of Alappuzha is one of the most coveted tourist destinations in southern India owing to its proximity to the Vembanad backwaters. The backwater tourism evolved in the area at the start of the millennium. Kumarakom which is home to a wide variety of flora and fauna is another popular eco-touristic destinations set in the backdrop of the backwaters. Tourists usually cover both these destinations while they visit the region and the backwaters act as an important spatial corridor connecting these two destinations.

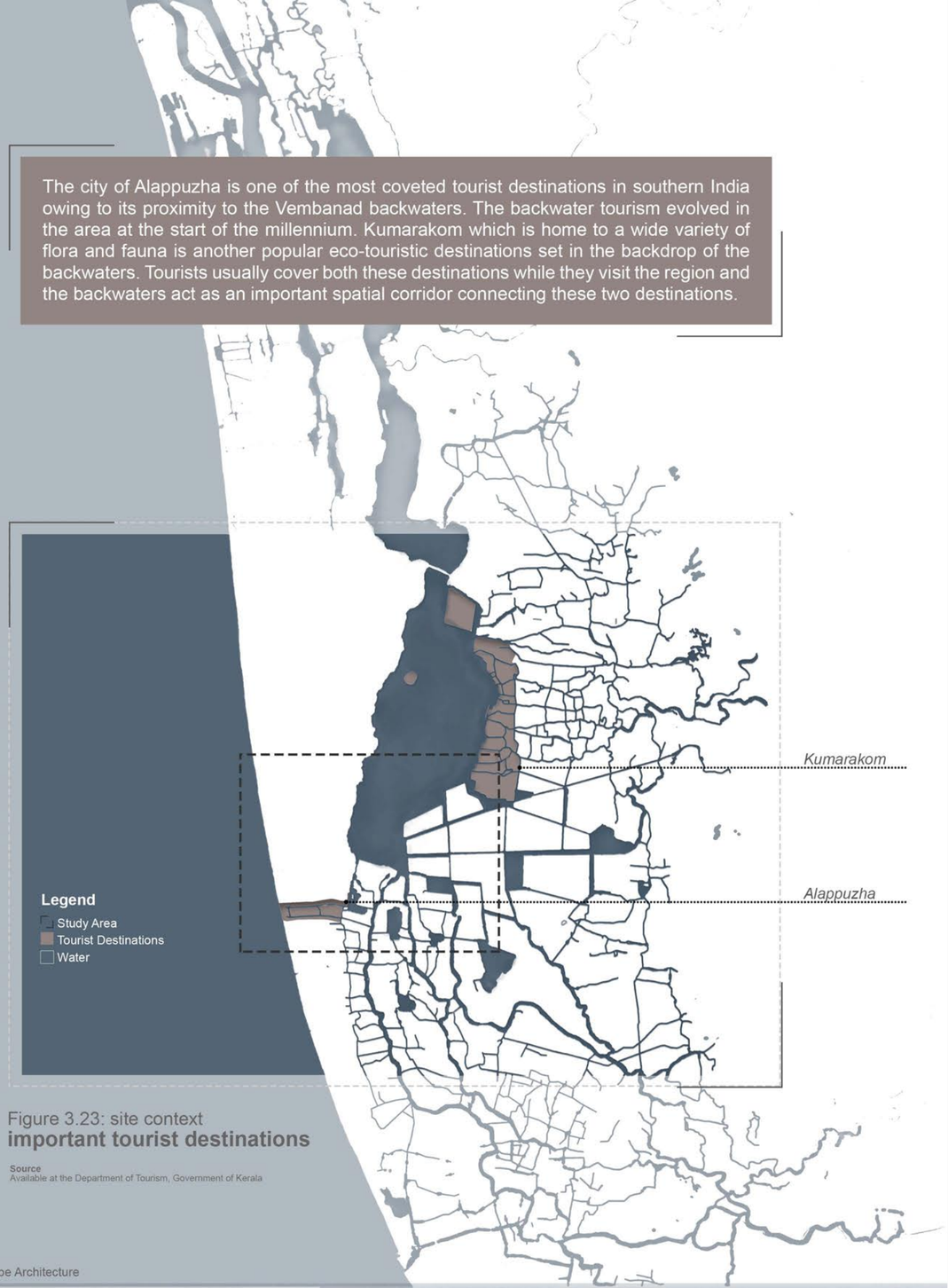


Figure 3.23: site context
important tourist destinations

Source
Available at the Department of Tourism, Government of Kerala

3.2.4. **TOWARDS A NEW ECONOMY**

The most popular water tourism circuit in the region starts from the houseboat terminal located in the city of Alappuzha and ends in the eco-tourism villages of Kumarakom as shown in figure 3.23. This route crosses the paddy fields and villages of the Kuttanad deltaic landscape with merely no entrance points. Kuttanad simply merges with the scenic beauty of the backwaters. Today, most of the seasonally unemployed farmers and fishermen are employed in this house-boat industry. Some of them also see this as a more economically viable livelihood. So once again there is a focus on the backwaters but from the perspective of improving the houseboat tourism industry. For this reason, the traditional Kayalnilams in the Kuttanad deltaic landscape is losing its value.

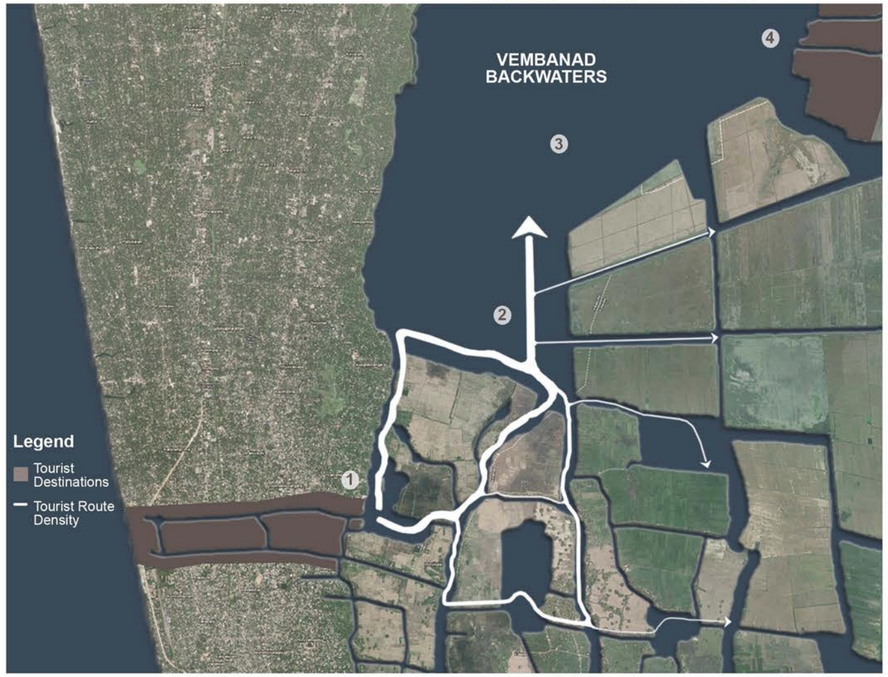


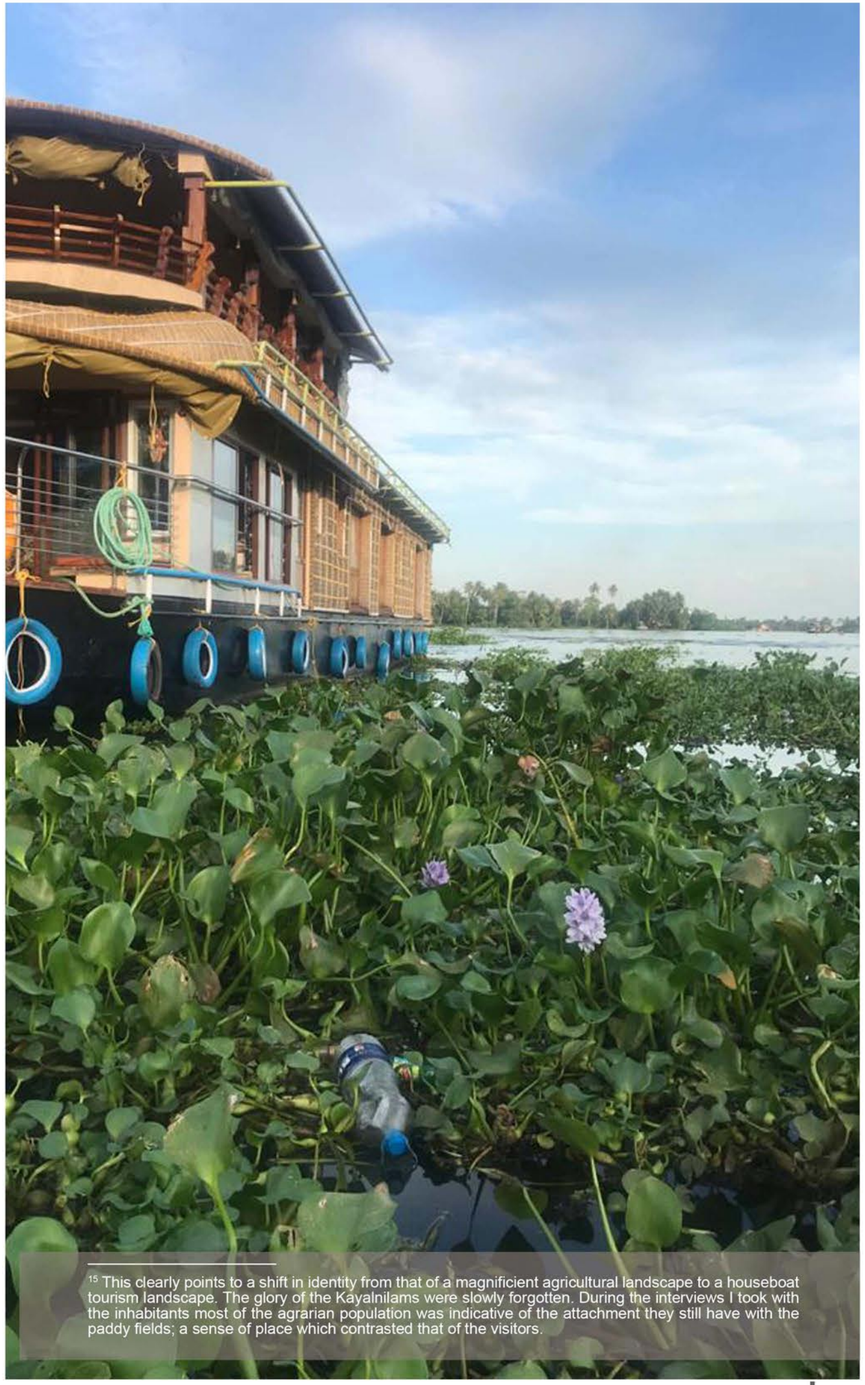
Figure 3.24: Site Context
existing tourism circuit

Source
Available at the Department of Tourism, Government of Kerala

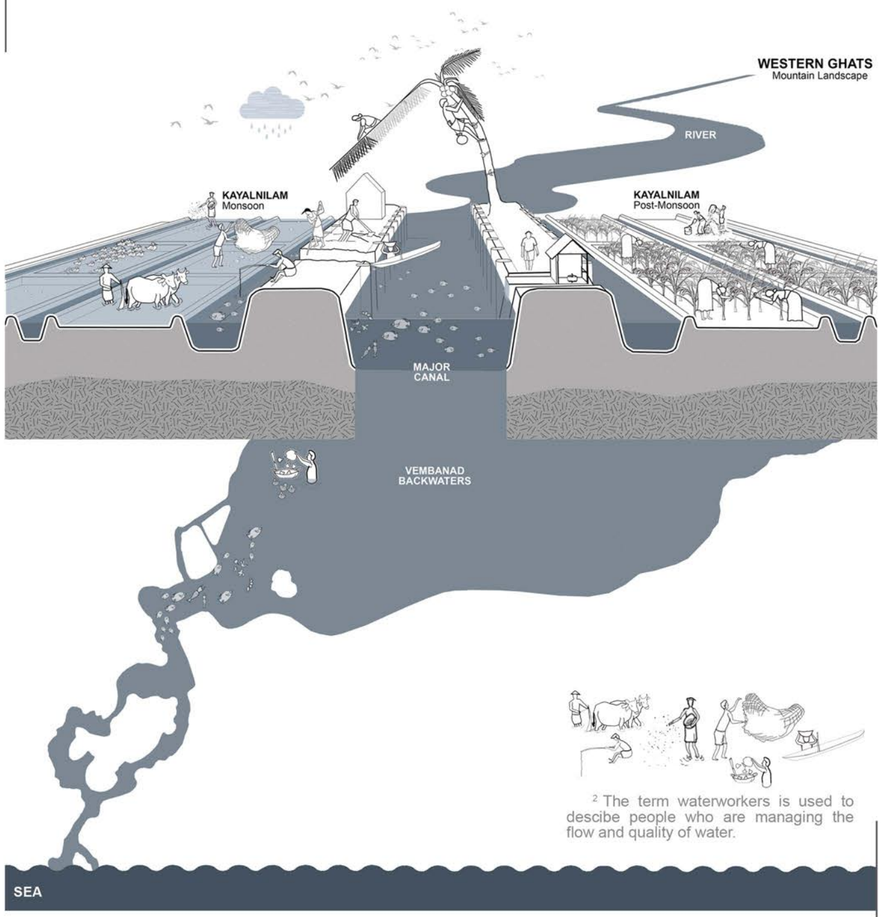
“This landscape transformed from an isolated black soil waterscape that preserved its insulated identity from external contacts into a hot (high temperature) touristic destination[15].”

Thakazhi Sivasankara Pillai,
famous Indian novelist based in Kuttanad

Figure 3.25: new economy
houseboat tourism



[15] This clearly points to a shift in identity from that of a magnificient agricultural landscape to a houseboat tourism landscape. The glory of the Kayalnilams were slowly forgotten. During the interviews I took with the inhabitants most of the agrarian population was indicative of the attachment they still have with the paddy fields; a sense of place which contrasted that of the visitors.



[2] The term waterworkers is used to descibe people who are managing the flow and quality of water.

Figure 3.26: traditional water system
symbiotic relationship between man and water

3.2.5 CHANGE IN VALUES

Water and society make and remake each other over space and time through socio-natural processes, and analysing the changes in these processes can be proposed as an analytical tool for investigating hydro-social relations. The change in ecology, society and economy points to a change in values and worldviews shared by the people. Land and water was once synonymous to God to the inhabitants of Kuttanad and today they are in a state of neglect. This can be inferred from the work of fiction *"Meesha"*, which has two chapters dedicated to the life of crocodiles , the first showing the harmonious relationship between man and crocodiles in the olden days and the second about a heroic act of the central character to hunt down the last crocodile so that it could be shot by the British colonial rulers. A comparison of both these chapters set in two different periods is a clear testimony of how Kuttanad went from an eco-centric society to an anthropocentric society as shown in figure 3.27.

"A family was stranded in their boat during monsoon amidst thunderstorm and lightning. Hearing their cries the crocodile comes to their rescue and takes them to a safe shelter on his back."

"I remember my grandmother saying my grandfather was friends with one of them(crocodiles), and when he called him it would come and go back when he asked him to leave."

"The central character defeated the last crocodile and brought it to the Britisher's bungalow. The general shot it to make sure that it was dead and took a photograph with it which he framed on his wall"

Figure 3.27: illustrations from *"Meesha"*
change in values of the people
Abstracted by author
Based on excerpts from *"The Last Crocodile"*, *"Meesha"* ,by S.K. Hareesh

This change in values could be attributed due to their decreasing dependence on the natural resources. This also pointed to the fast disappearing of the old intimacy people had towards their land and water since they were survived by these resources as shown in figure 3.26. With the introduction of the salt barrier and modern-day farming practices nature was losing its rhythm and the traditional practices were based on the knowledge of this rhythm. The farmers and fishermen who were the waterworkers[1] as shown in figure 3.26 as well as the stakeholders, i.e. givers and takers of the landscape respectively, could no longer predict land and water. So, if this relationship has to be renewed land and water should become productive increasing the dependence of the inhabitants on the natural resources.

“What time is this place?”

Kevin Lynch

3.3. **RHYTHM**

From the volatility analysis it was clear that deltas are shaped by both repetitive natural processes and non-repetitive social transformations. Additionally, the hydro-social relations as identified in the previous chapter is a clear testimony to the correlation between these natural and social processes. This implies that the non-repetitive transformations influenced the repeating cycles or vice versa and there is a pulsating temporality in these relations. Hence, it is it is important to understand recurrent and evolving patterns in these processes to identify challenges and opportunities explicit to the case of Kuttanad. The method used here is illustrative analytical sections depicting time based character of the landscape linked to the English Calendar.

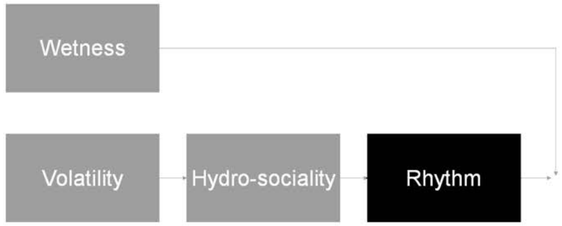


Figure 3.28: four lens approach
research methodolology

3.3.1. **HYDROLOGICAL RHYTHM**

The hydrological rhythm diagram as shown in figure 3.29 traces the months during which flooding occurs. Hence, the dike system made of granite or concrete blocks fails during the months of July and August. In 2018, there was a cloudburst flooding where the area shaded in pink was under water for more than 30days. This severely disrupts the daily activities of the people. However, this discrepancy is only during these two months.

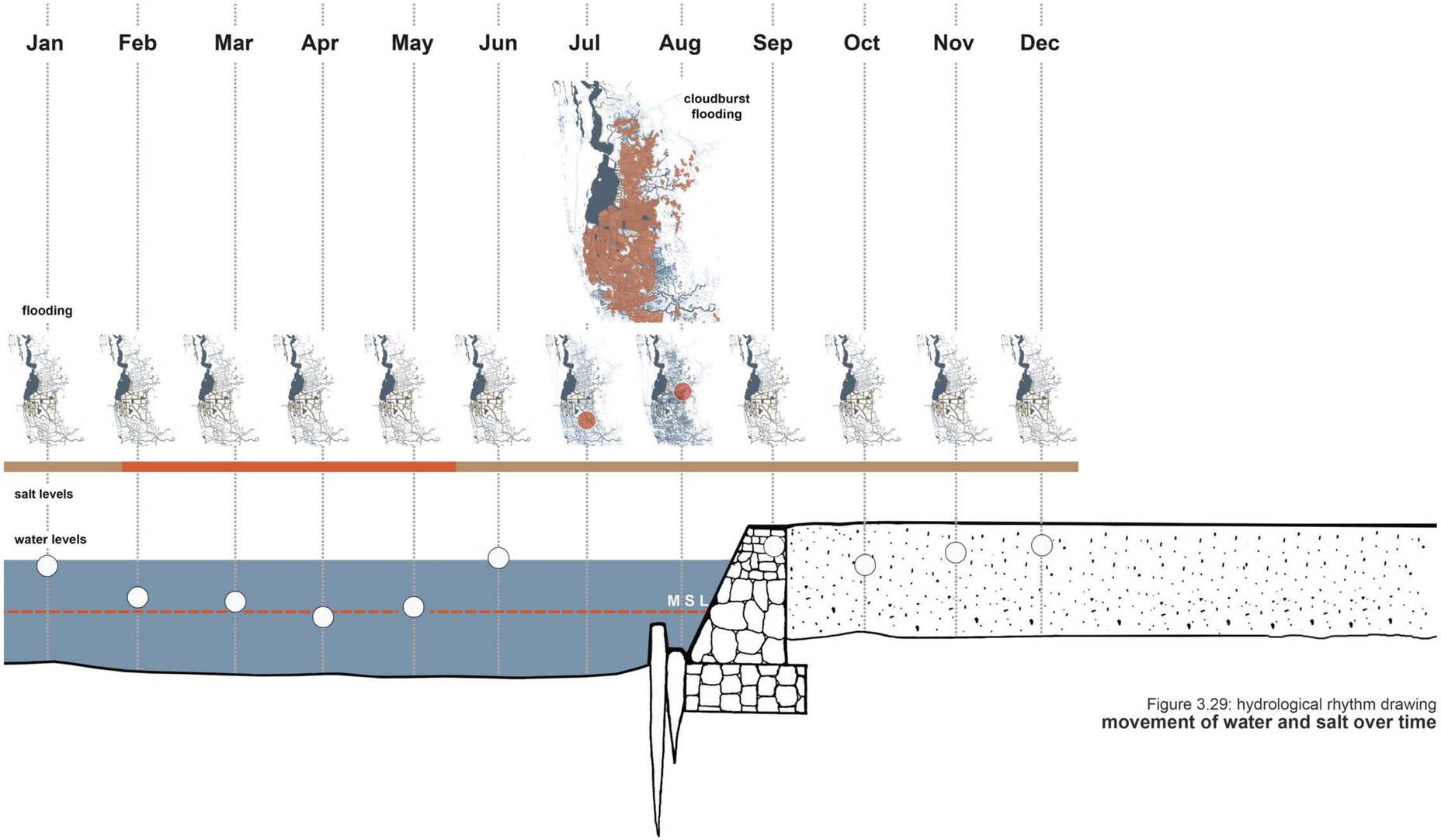


Figure 3.29: hydrological rhythm drawing
movement of water and salt over time

3.3.2. **ECOLOGICAL RHYTHM**

The ecological rhythm diagram as shown in figure 3.30 traces the pattern of the ecosystem of the delta. Fishes are unequally distributed in terms of quantity and diversity. Some months like August, September and April also have very little fishes in the system. Even the life cycle of these fishes is disrupted especially in the case of the Great Freshwater Prawn, considering that the juveniles can only hatch in brackish water. Likewise, the breeding habitats of birds have also changed. This has clearly impacted the migration of these birds, especially the Euro Fly away birds. At the same time predator species like the African Catfish and Common Moorhen are on the rise. Hence the change in quality of water due to the operation of the salinity barrier has disrupted the migration of many organisms. This has eventually led to the loss of some species and the abundance of some other species like the African Payal, a type of waterweed. These radical ecologies also need to be conserved along with restoration of the threatened species.

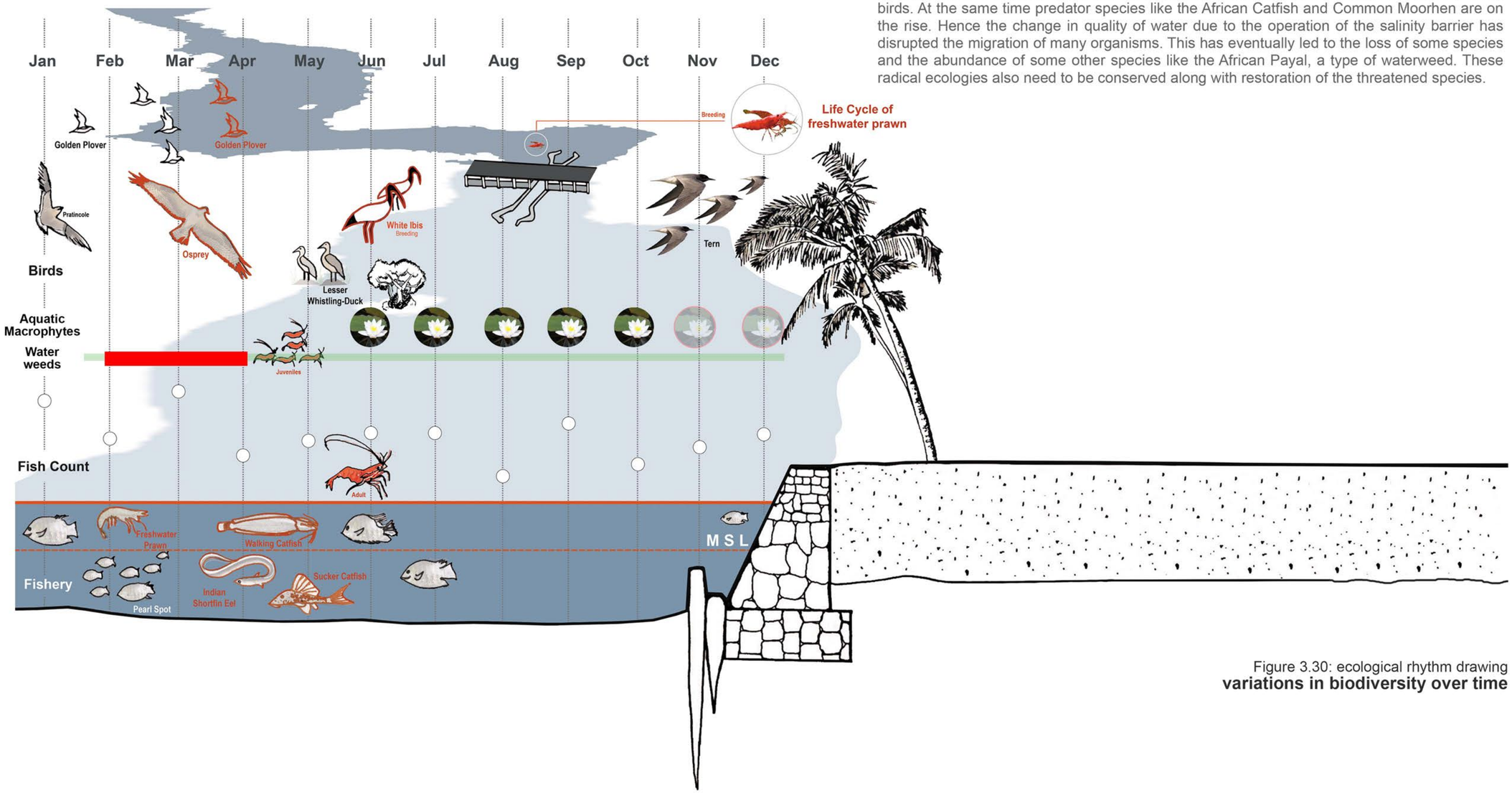


Figure 3.30: ecological rhythm drawing
variations in biodiversity over time

3.3.3. SOCIAL RHYTHM

The social rhythm diagram as shown in figure 3.31 traces the livelihood pattern of the inhabitants of the delta. Although, paddy farming runs all through the year, only during certain months active labour is required. This means that these farmers are disguisedly employed during the rest of the year which is a clear indication of the agrarian distress prevailing in the region. Likewise, opportunities for the fishermen are considerable only during the months of December, January, February, March, June and July. Consequently, they need to find alternative livelihood options during the lean times. Some of them are seasonally employed in the tourism sector which is also another important ecosystem service currently. The flow of tourists is the maximum in the post monsoon season and the month of May. Evidently, the months of July and August the number of visitors is drastically low. It is also interesting to note that both the agricultural sector and the fishing industry are also inconspicuous during these months. Hence there is a very unsustainable distribution of livelihood opportunities and this disparity needs to be moderated.

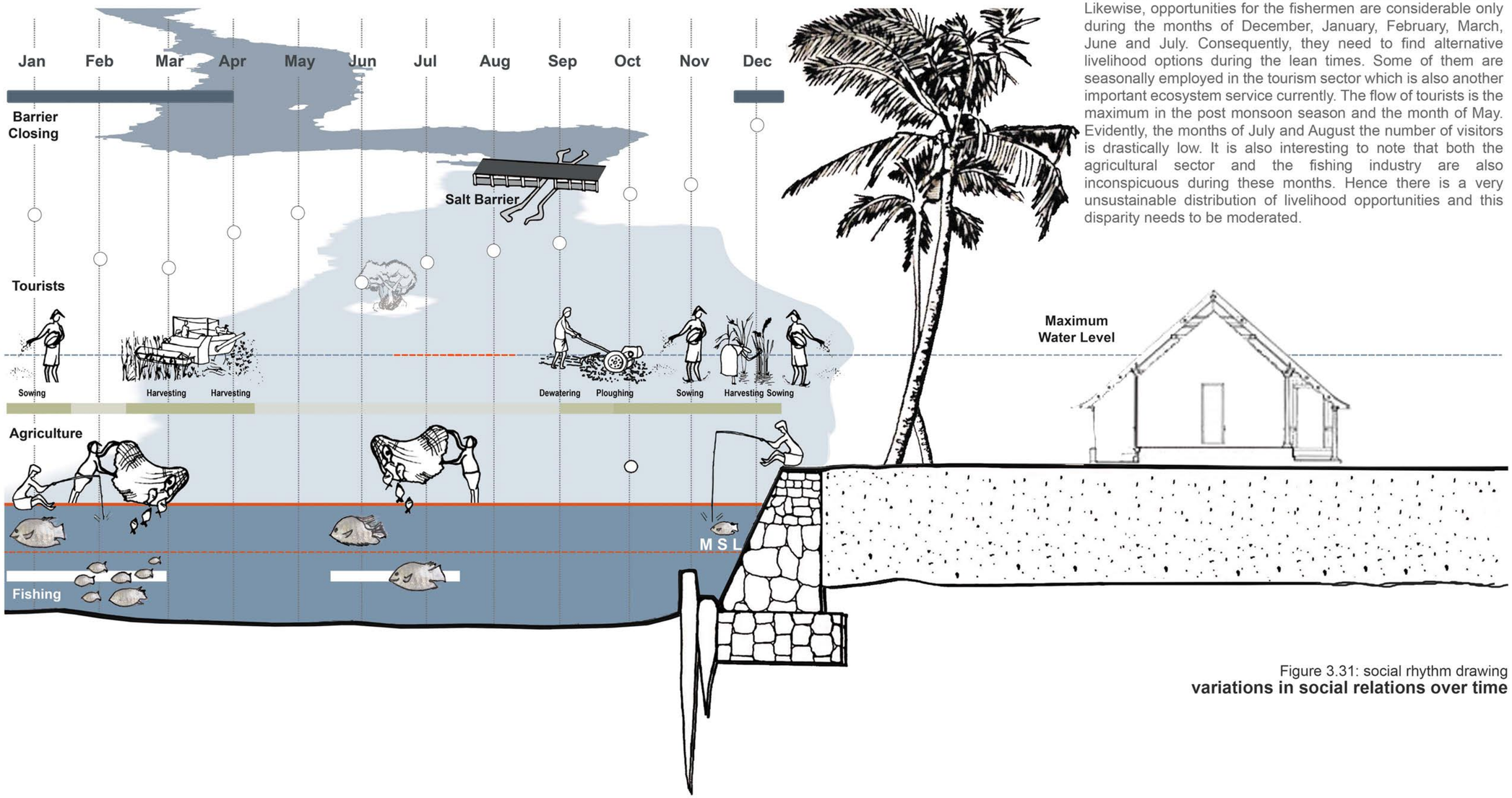


Figure 3.31: social rhythm drawing
variations in social relations over time

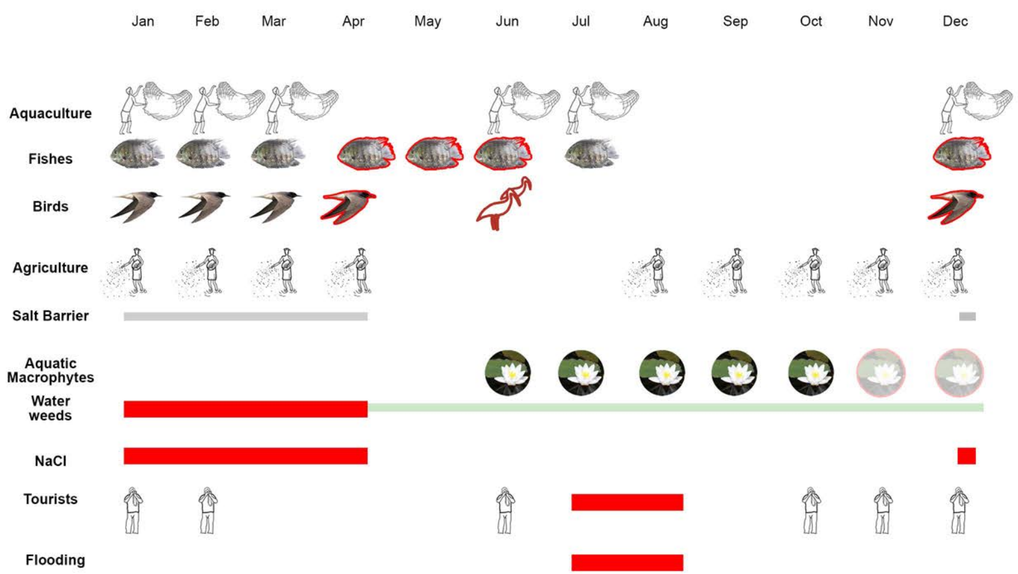


Figure 3.32: rhtyhm conclusion
opportunities and challenges

3.3.4. **CHALLENGES AND OPPORTUNITIES**

If you overlay the hydrological, social and ecological rhythm drawings, as shown in figure 3.32, we can see a correlation between them. People's spatial and temporal distinctions arise out of their differing activities that resonate with changing environmental conditions (Krause, 2017). For example, the most popular months for aquaculture are when fishes are abundant in the ecosystem. This in turn is influenced by the salinity levels in the water. It was interesting to note that all the altered patterns directly or indirectly pointed to the alteration in the salinity pattern. For example the prawn aquaculture is edangered as prawns need salinity during a considerable phase of their life. Also, the agricultural activities were extended to two crop cycles when compared to the traditional water system. However, the problem of seasonal employment asscciated with agriculture still persists.

These identified patterns within the associated processes will eventually help to define the delta in terms of its spatiotemporal characteristics, establishing the thresholds for design conditions and the dynamic identity of the delta. Ultimately, this could form the basis of an adaptive design framework for a flexible landscape that will be guided by these dynamics specific to the particular delta, in this case the Kuttanad delta. Here, the patterns highlighted in red which was derived systematically point to the change in salinity pattern, hence this is the most critical pattern that needs to be addressed.

“Water is everywhere before it is somewhere.”

Anuradha Mathur and Dilip da Cunha

3.4. **WETNESS**

On analysing the cyclical dynamism behind the deltaic landscape of Kuttanad through the rhythm analysis, the next step is to understand the specific material form these dynamics take in the Kayalnilams : the basic unit of the Kuttanad Deltaic landscape. The method used here is experimental mapping and modelling using information from satellite images.

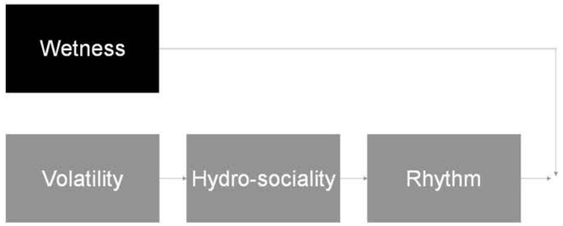


Figure 3.33: four lens approach
research methodolology

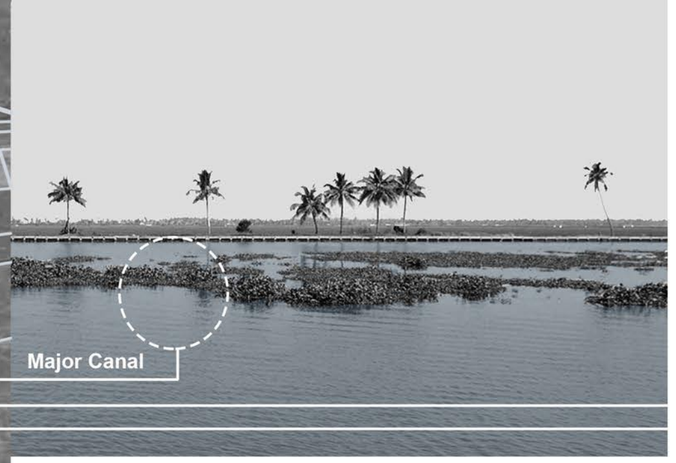
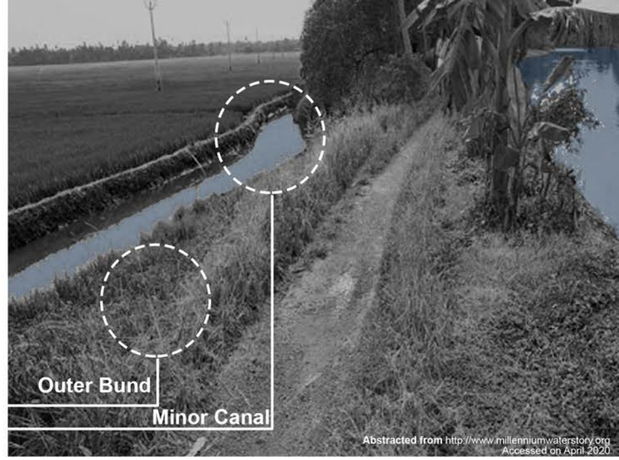


Figure 3.34: aerial view
Kayalnilam landscapes
Abstracted from
https://www.godsowncountry.co.in/alleppey.html#
Accessed on April 2020



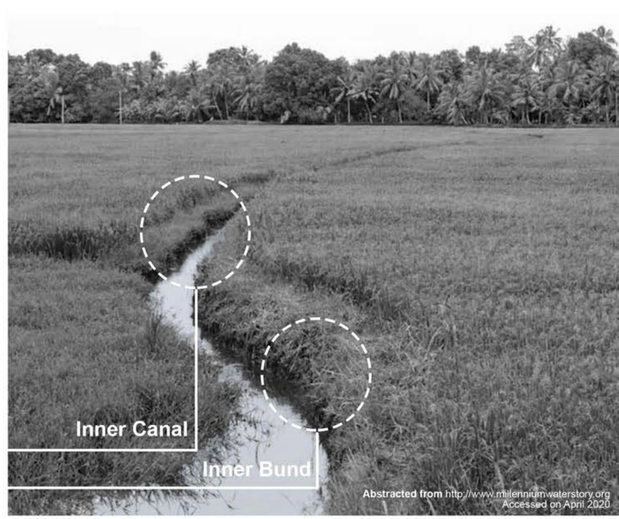


Figure 3.35: photographs
different spatial qualities
Abstracted from
Multiple sources as mentioned above

3.4.2. **EXISTING TYPOLOGIES AND TERMINOLOGIES**

The *"Kayalnilams"* as shown in figure 3.34 are the singular units of the Kuttanad deltaic landscape. They could be credited as a colloquial term which best fits into the modern-day definitions of a reclaimed polder seen in the traditional Ductch landscape. If you look at the etymology of this term, Kayalnilam is coined by pairing two words from the Malayalam language (regional language of Kerala), *"Kayal"* and *"Nilam"*, which literally translates to backwaters and ground respectively. Interestingly these morphemes were arranged in such a way that it ends with ground synonymous to land. This etymology itself is biased towards terra firma disregarding the liquidity associated with Kayalnilams. Furthermore, a report on Kuttanad by MS Swaminathan (2007) classifies this Kayalnilam landscape into elements such as coastal backwaters, rivers, water ways, paddy fields, marshes, ponds, garden lands and edges. A more simplified classification was done by Rahul Sukumaran (2013) into water areas, cropped lands, paddy fields and flooded lands. Both these classifications are based on the traditional terrestrial approach which does not consider the landscape adaptations borne out of fluid dynamics. The existing spatial typologies within Kayalnilams as shown in figure 24 also ignores the presence of water in paddy fields and bunds in the form of wetness.

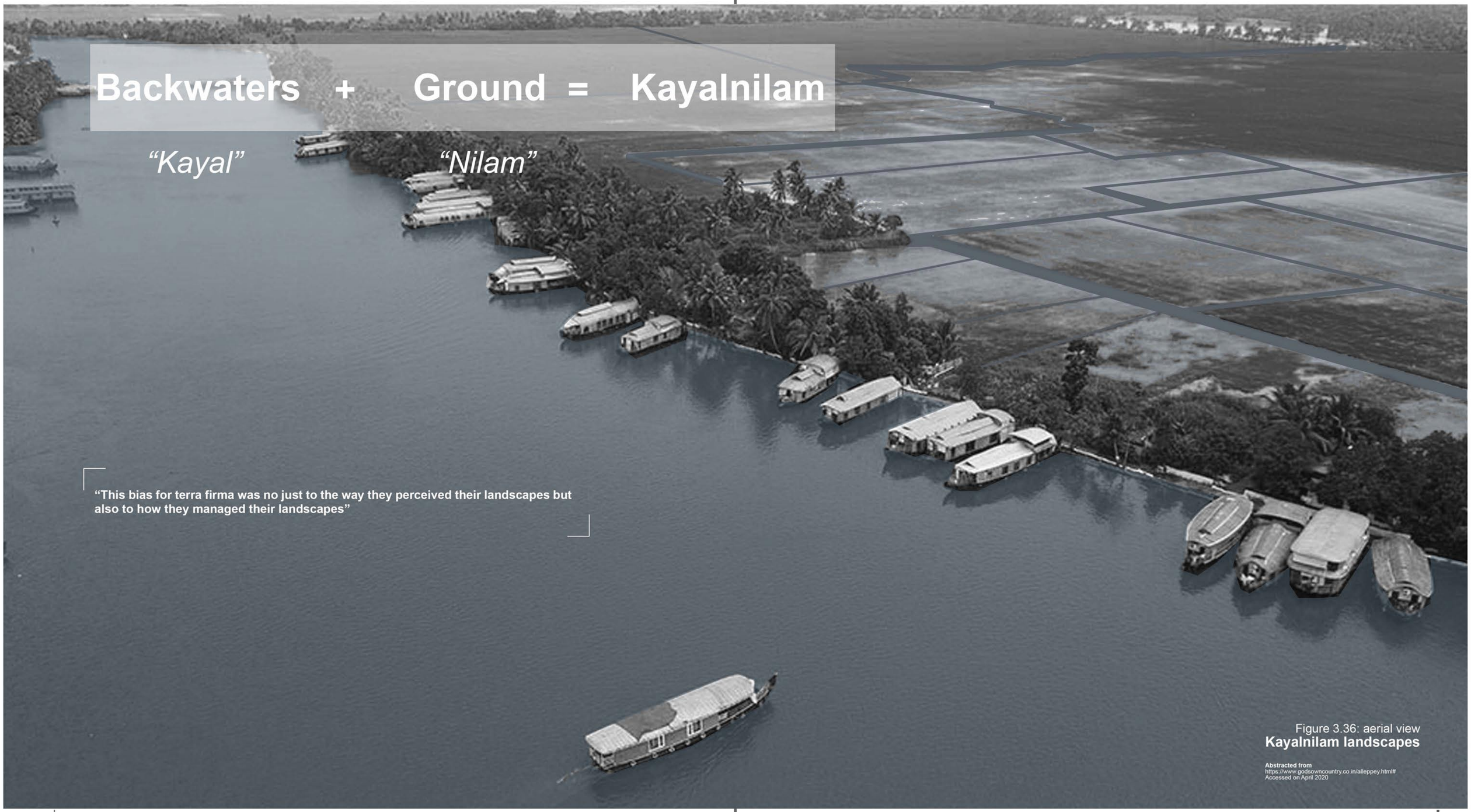


Figure 3.36: aerial view
Kayalnilam landscapes

Abstracted from
https://www.godsowncountry.co.in/alleppey.html#
Accessed on April 2020

Change in the morphology of the hydrological structure of the Kuttanad deltaic system as idenified from the volatility lens has resulted in a drastic reduction of the water carrying capacity of the system. The artificial ground of the Kayalnilams gets submerged every year under this fluctuating hydrological world. The flooding episodes occur between 3 to 30 days, which is long enough to disrupt the lives of the people.

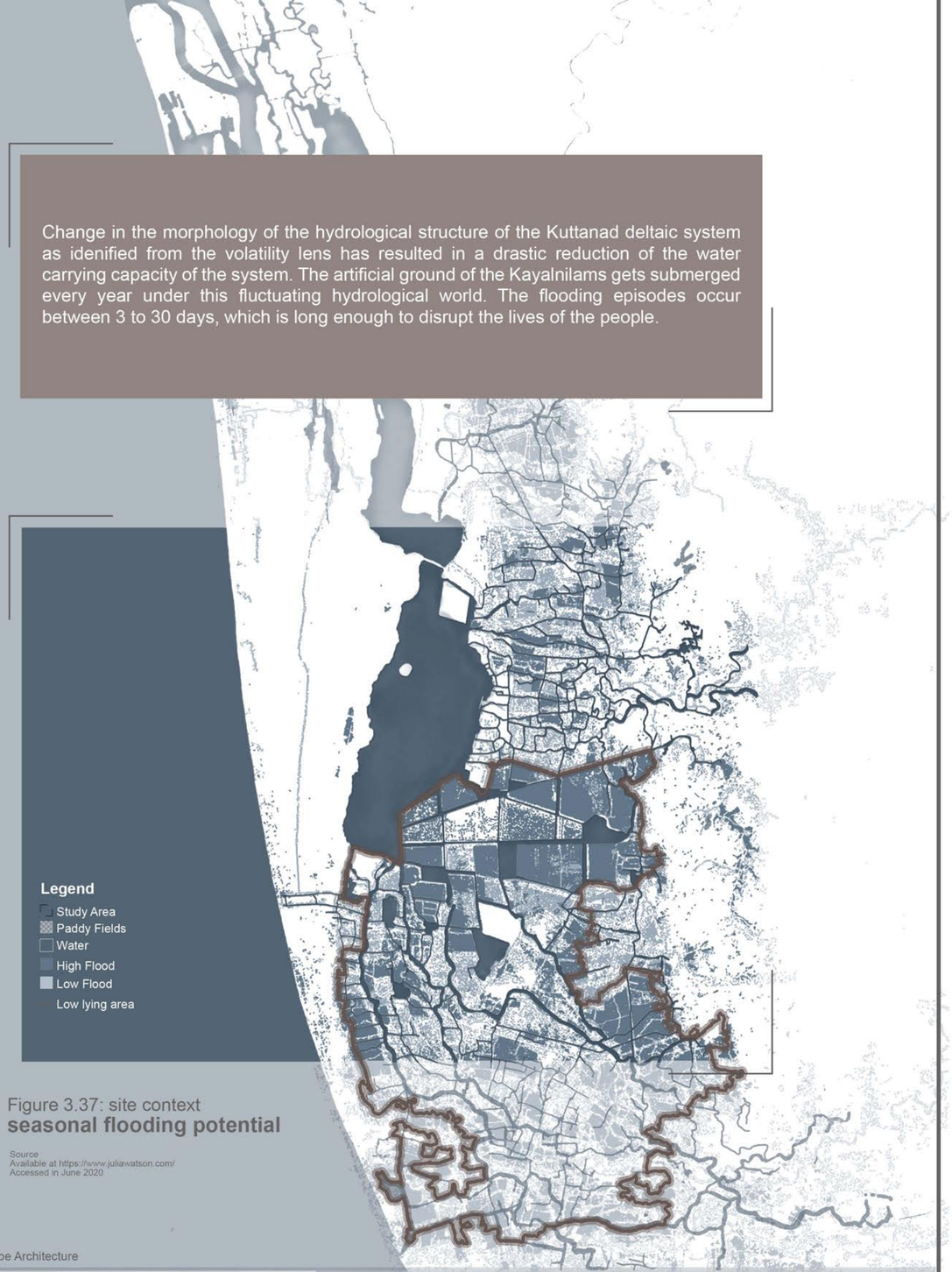


Figure 3.37: site context
seasonal flooding potential

Source
Available at https://www.juliawatson.com/
Accessed in June 2020

3.4.3. **MANAGING BELOW ZERO**

Since this below sea level landscape was prone to seasonal flooding as shown in figure 3.37, managing water was a common denominator for both agriculture and habitation. The singular unit Kayalnilams were separated by canals or rivers as shown in figure 3.38. There was a flexible outlet that pumped water out of the Kayalnilams to these canals or rivers with the help of a dewatering wheel or motor. Within every Kayalnilam for the purpose of irrigation, the paddy fields were further divided by minor and inner canals lined by earthen bunds. Water entered the paddy fields through a sluice that was kept open in the event of nil or less rainfall and this sluice remained closed when there was adequate rainfall. Hence, the Kayalnilam was an intricate network of paddy farm lands divided by the earthen bunds yet interlinked by water. But the functioning of this intricate network confined land and water to specified lines. The fluctuating or changing quality of the deltaic landscape was overlaid with a fixed man-made infrastructure for precise water management.

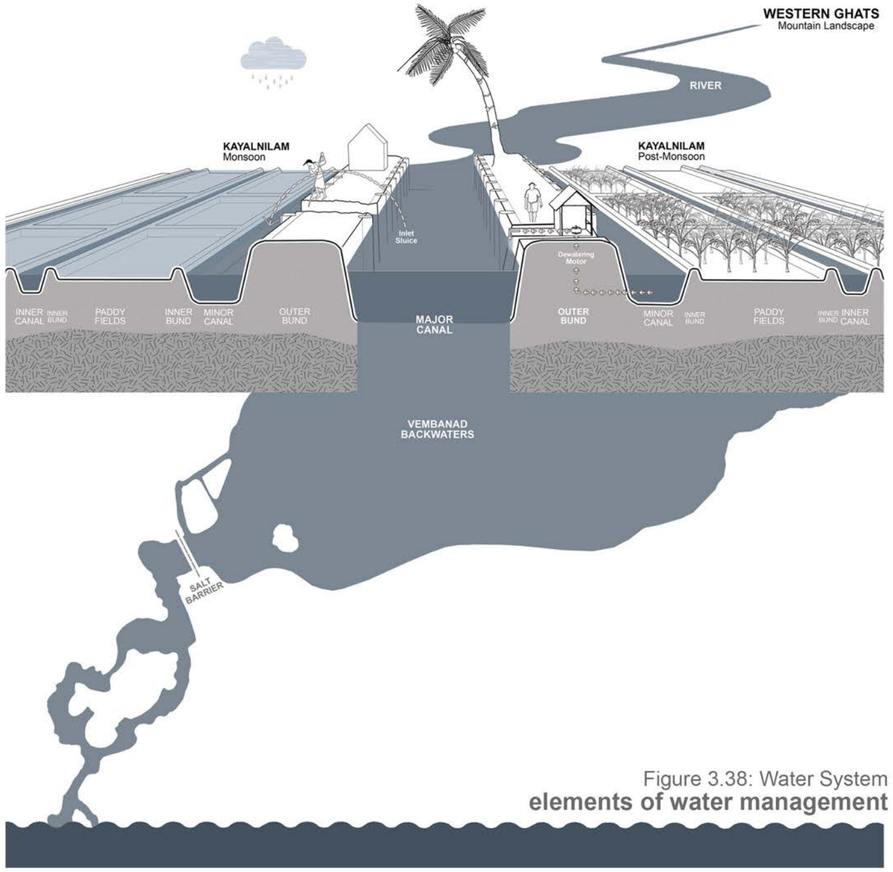


Figure 3.38: Water System
elements of water management

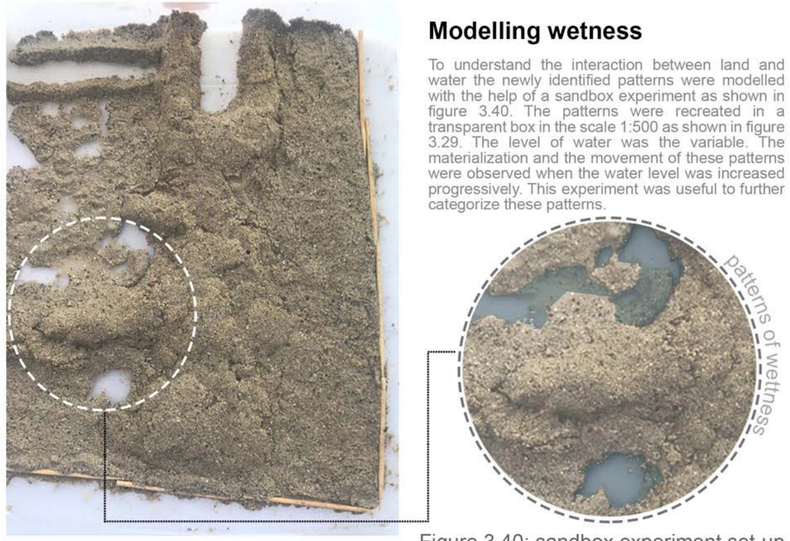
3.4.4. CONCEPT OF WETNESS

The concept of wetness within landscapes conjures the idea that *"Water is everywhere before it is somewhere"* [16] (2002). Wetness is an indication of the presence of water in any form. Water assumes multiple narratives other than limiting itself to flow within confined boundaries or lines. Water can precipitate, soak, seep, irrigate, drain, dewater, inundate, transpire, evaporate and so on. Hence, wetness breaks all the conventions of geography which explains land by excluding water and vice versa. When it comes to Kuttanad the idea of confining land and water to the infrastructural lines was essentially a cultural expression of how the inhabitants perceived, understood and managed water. This culture was also translated to our visual literacy.

[16] This phrase was quoted by Marilyn Jordan Taylor in the foreword chapter of the book "Design in the terrain of Water. This phrase originally coined by renowned by the authors of this book is said to have initiated a rethinking towards understanding the dynamic qualities of landscapes with respect to changing forms of wetness

Figure 3.39: Wetness
wetness in paddy fields which come under land typology

3.4.5. **UNDERSTANDING WETNESS**



Modelling wetness

To understand the interaction between land and water the newly identified patterns were modelled with the help of a sandbox experiment as shown in figure 3.40. The patterns were recreated in a transparent box in the scale 1:500 as shown in figure 3.29. The level of water was the variable. The materialization and the movement of these patterns were observed when the water level was increased progressively. This experiment was useful to further categorize these patterns.

Figure 3.40: sandbox experiment set-up
observing materialization of wetness

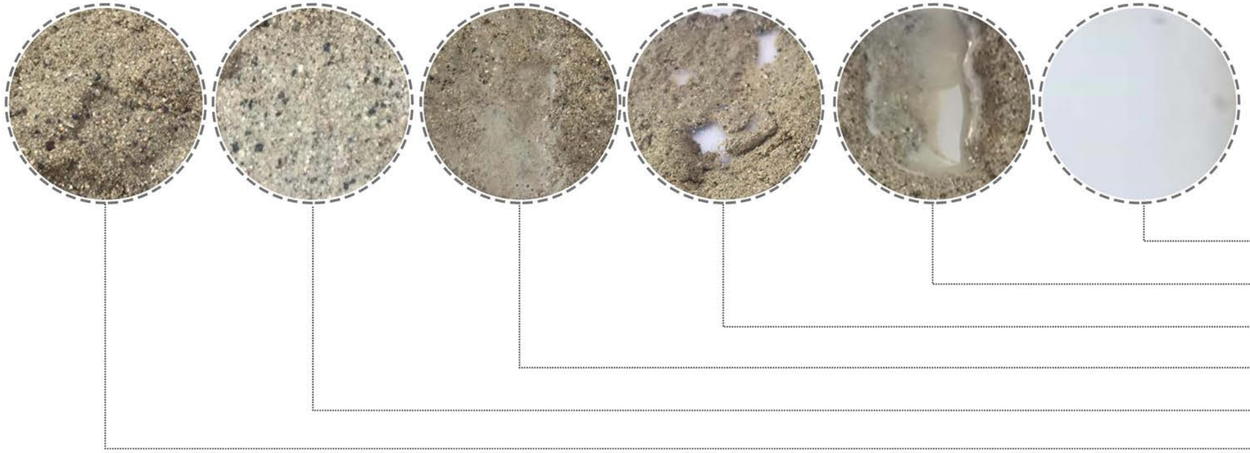


Figure 3.26: experiemental modelling
different types of of identified patterns

Based on the existing visual literacy, a hydrological mapping of a Kayalnilam as shown in figure 3.41 illustrates a two-tier water management system where water is confined to lines imposed by canals and bunds.

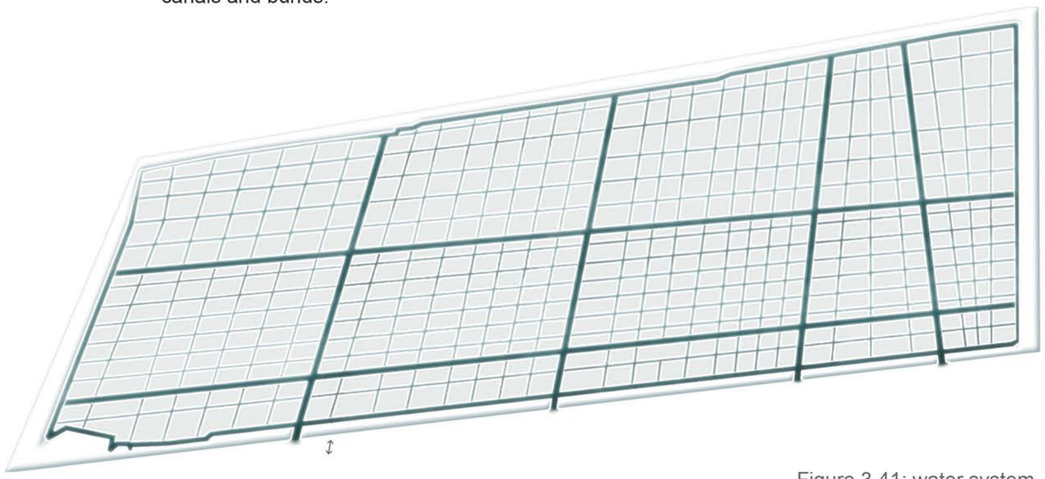


Figure 3.41: water system
conventional mapping

Tracing wetness

On the other hand, if we look at a google earth satellite image in figure 3,42, we see patterns of wetness and dryness in relation to the man-made infrastructural lines of water. By delineating these patterns some information about micro-topography can be assumed logically.

Figure 3.42: satellite image
modified mapping technique

Source
Available at https://www.juliawatson.com/
Accessed in June 2020

3.4.6. **THE WETNESS MATRIX**

From the mapping and modelling experiments it was evident that wetness and dryness which are generally perceived as foundational binaries are merely the opposite limits of a spectrum that indicates the presence of water. A new approach for spatial typological classification should shift from a single landscape form like paddy fields, forests, bunds, garden lands etc. to a matrix of landscape forms varying according to the wetness properties of the surfaces as shown in figure 3.43. The patterns identified from the sandbox experiment was related to the qualities on site resembling these patterns. Accordingly, three different typologies were identified- dry, wet degree 2 and wet degree 1. Ultimately, these wetness gradients can act as a cue for creating assorted spatial qualities which are site-specific.

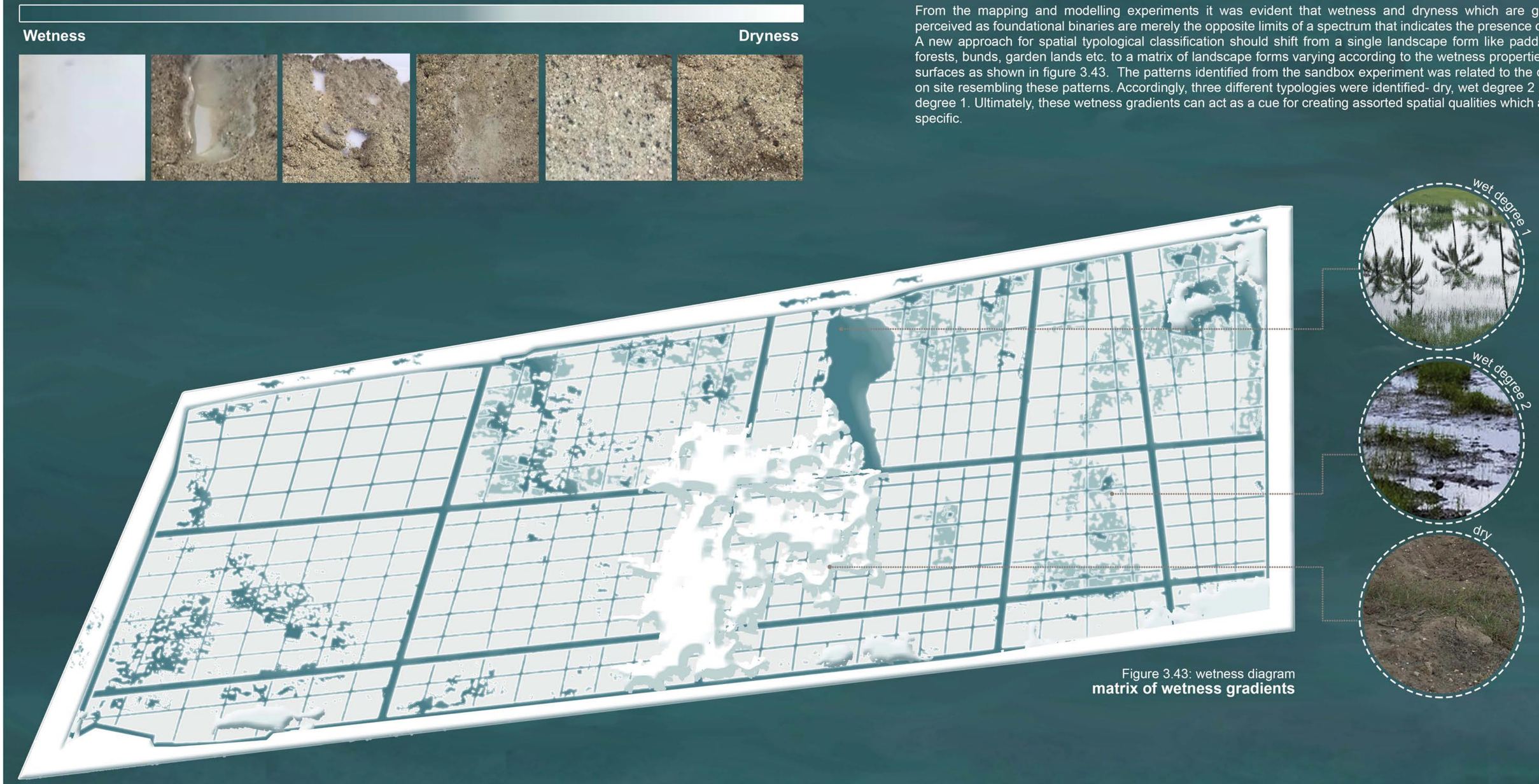


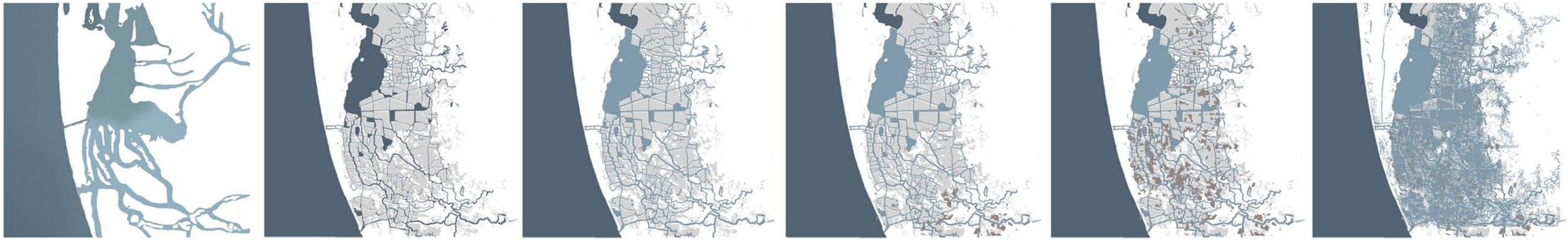
Figure 3.43: wetness diagram
matrix of wetness gradients

“What we wish upon the future is very often the image of some lost, imagined past ”

From *“Waterland”*,
By Graham Swift

4. TOWARDS A FLEXIBLE DELTA

4.1 **EXTREME CASES**



19th century
natural landscape

1850-1945
land reclamation

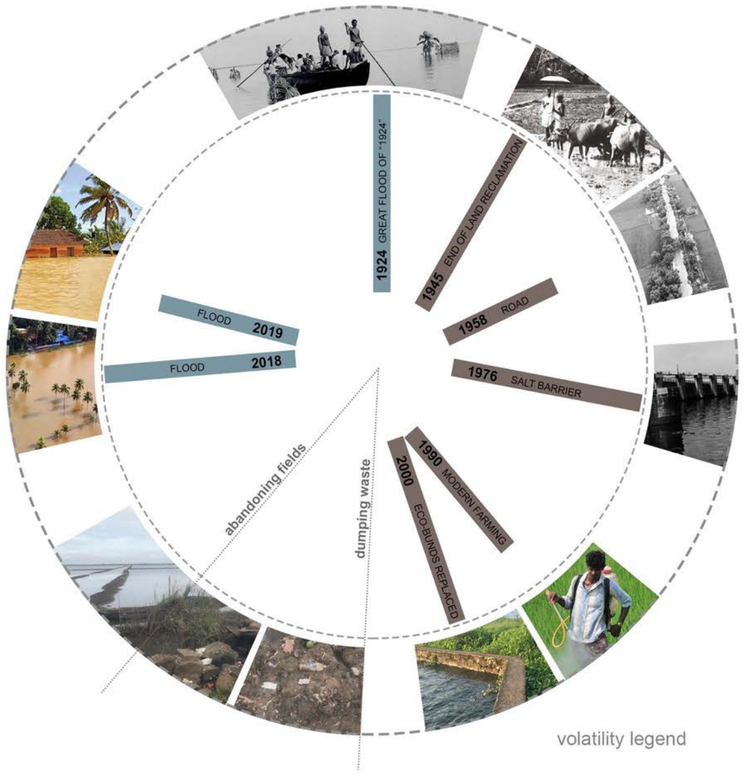
1945- 1976
salt barrier construction

1976- 2000
diasappearing paddy fields

2000- 2020
diasappearing paddy fields

business casual
completely below sea level

Figure 4.1:extreme case scenario
based on volatility lens analysis



The lens ‘’Volatility” outlines the most critical problems faced by the landscape through a biographical or historical analyses which will sequentially investigate the changes in the landscape and their consequences. If these changes, both natural or cultural and the subsequent creative response of the people to these changes are projected to the future situations, we can arrive at the business casual model for the delta as shown in figure 4.1. Ultimately this also points to the extreme case scenarios which will challenge the existence of the landscape in the future. In the case of Kuttanad, the identified scenarios are: (1) the weather extremes of annual flooding(1.5m above sea level) and the predicted future sea level rise(1.5m above sea level during low tide and 2.1m above sea level during high tide) and (2) the loss of agricultural lands which will topple the economy purely based on agriculture causing severe social distress.

In conclusion this lens will answer the questions,

1. **What are the most critical problems faced by the delta and its inhabitants that need to be tackled?**

2. **What are the extreme case scenarios the design needs to address?**

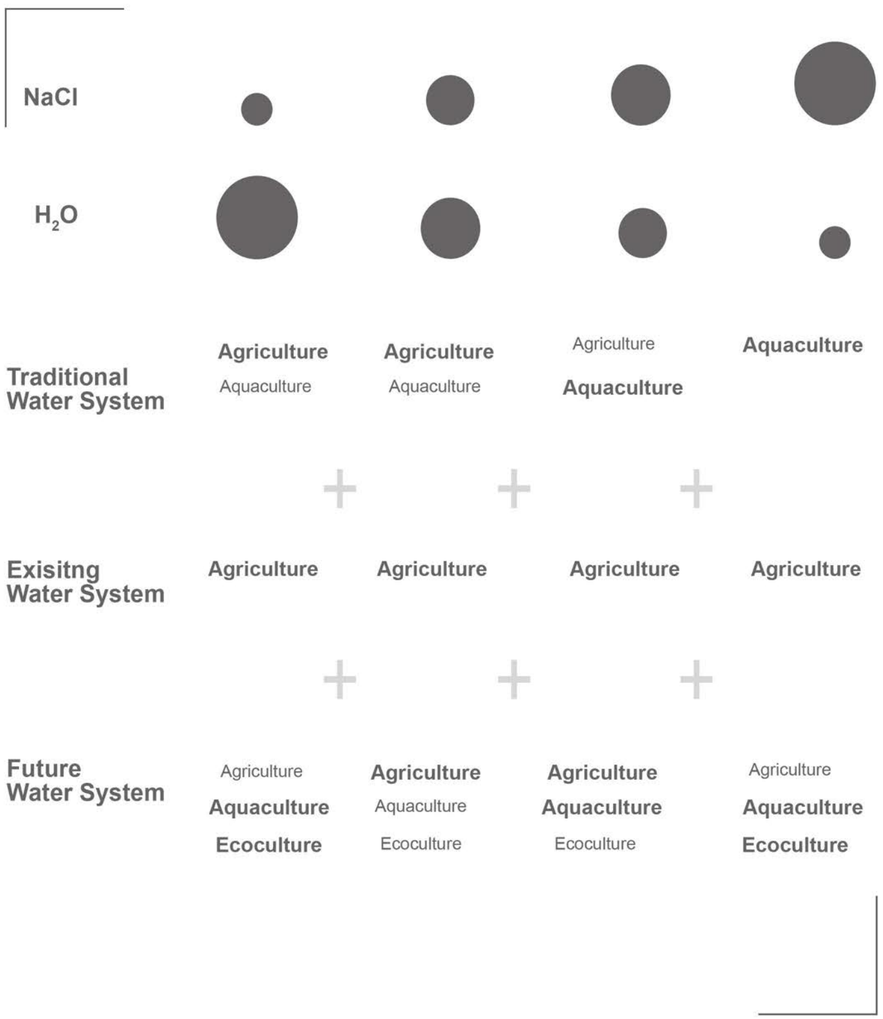


Figure 4.2:design principle 2
based on hydro-sociality lens analysis

4.4. RETHINKING MAN AND WATER

The lens Hydro-sociality outlines how society organizes themselves to manage their natural resources and vice versa. This was done through a comparative analysis of hydro-social images drawn for two different time periods corresponding to changes that were critical to the evolution of the landscape as identified from the volatility lens. This will also help in understanding the significance of land and water in the respective societies which is a critical reflection of the common worldviews and values shared by the people. Kuttanad boasts of a culture which goes by the saying “God created the earth and man created Kuttanad. Evidently, change in culture influences water management and in turn change in water flow and quality influences culture. So, this is an iterative process where water is embedded in the social relations and can act a site for changing these relations in order to resolve the strained relationship between man and water. In the case of Kuttanad, it was found that this relationship can be enhanced only if land and water once again becomes providers of natural resources for the people increasing their dependence on these resources. Four the last four decades man was shifting his dependance to land alone and hence Kuttanad also shifted from a diverse landscape into a monocultural landscape. Land and water have an inherent rhythm and this has to be revived. This can be done only by reintroducing or partially restoring the original dynamics associated with salt and water as shown in figure 4.2 in the system since the downfall of this landscape was traced to the change in the movement patterns of salt and water. The livelihood paterns should move from purely agriculture to an agro-aqua-eco cuture (eco here refers to ecology).

In conclusion this lens will answer the questions,

1. What is the role/significance/ meaning of land and water to the people?

2. How does the society organize themselves to manage natural resources?

3. How does the natural resources respond to man-made processes?

4. How can you reconnect people with nature?

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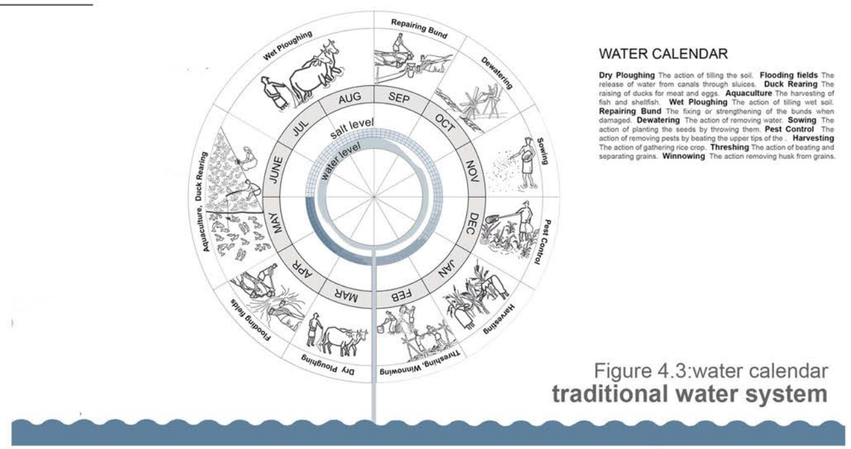

Figure 4.3:water calendar
traditional water system

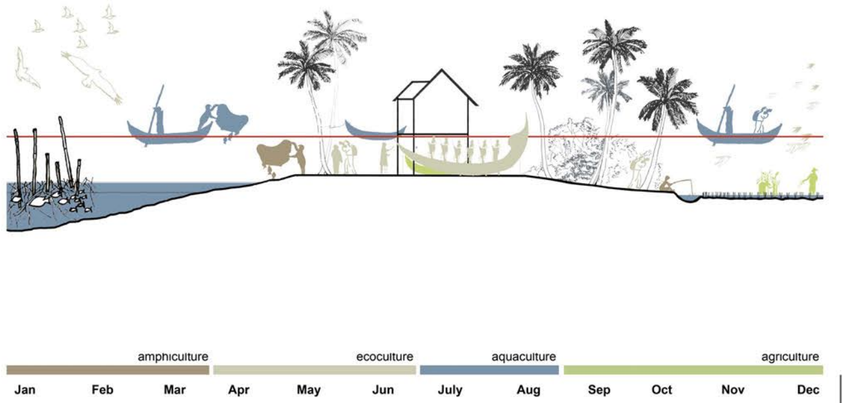

Figure 4.4:design principle 3
based on rhythm analysis

4.5. THE DYNAMIC IDENTITY

The lens rhythm categorizes the patterns in the landscape on a temporal basis to delineate the specific opportunities and challenges in the context of the delta. The movement of salt and water is a cyclical one that repeats itself in a time frame of one year and this was found to be the identity of the delta. This was essayed in the traditional water system as shown in figure 4.3. A complete set of the cyclical design and maintenance strategies if arranged in a time-based sequence is analogous to a modern-day cropping calendar. These kinds of calendars are quintessentially a cultural construct. Generally, they inform people about the different decisions to be taken. But when it comes to envisioning complex flexible systems as in the case of the Kuttanad deltaic landscape, we need an adaptive design calendar which informs people about the mutual consequences of these input decisions on each other and the corresponding effects on the ecological and social conditions. Since the relationship between man and water in Kuttanad fluctuates according to the water and salt cycle, the design calendar can be labelled as a water adaptive design calendar or simply “water calendar”.

The new relationship between man and water as projected in the hydro-sociality diagram will resonate with this cyclical movement and a design calendar will be a useful tool to help people understand and maintain this relationship. In the proviso of the Kuttanad deltaic landscape, the zoning of a water calendar should define separate layers for water levels, salt content, general function of the system, functioning of the salt barrier, other design operations and emerging biodiversity. At a regional scale it will tell people about the different relationships they can have with land and water from a a temporal point of view as shown in figure 4.4.

In conclusion the lens rhythm answers the questions,

1. What temporal patterns in the landscape are critical to the identity of the delta?

2. What is the pulsating temporality behind the relationship between man and water?

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4.4 **TERRAIN OF WETNESS**

The lens “wetness” incites a fluid thinking through which the hidden terrains of the landscape can be unveiled with the help of the wetness gradients identified through satellite imagery and experimental modelling based on a sandbox experiment. If the reason behind the formation of these patterns are further investigated, this varying wetness gradients corresponds to a variety of naturally occurring or man-made processes where water and matter moves and organizes itself into different landscape formations. The river brings down water and sediments and deposits in the canals separating Kayalnilam as it flows. Then water from the canals are let into the paddy fields for irrigation. Here, the wettest gradients occur as a result of water settling down in lower parts of the polder by the process of waterlogging and the drier gradients occur as sediments settling in higher parts of the polder by the process of sedimentation as shown in figure 4.5 In reality, this difference in height is only by a few inches and generally they are all relatively perceived to be seen at the same elevation. Hence, the wetness gradients unveil the hidden terrain of Kayalnilams which are otherwise overlooked. Flowing, irrigating, silting, sinking, elevating and water logging were identified as processes specifically critical in shaping the micro-topography of the Kuttanad deltaic landscape.

In conclusion this lens will answer the questions,

1. What is the micro-topography of this low-lying landscape?

2. What are the site-specific processes that are key variables in the topographical definition of the delta?

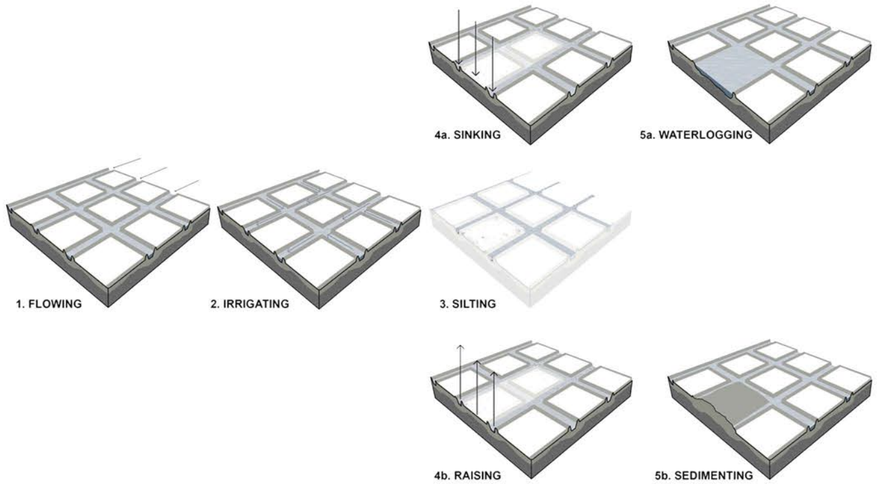


Figure4.5 : wetness properties
site specific processes shaping wetness

The wetness gradients are micro-topographical features which can be further exacerbated to give more room for water as well as create land and maintain the equilibrium of the delta. This manipulation of topography will be more operative if the processes of waterlogging and sedimentation that were key variables in the formation of these gradients are accelerated. In the end, this will help arrive at a very site-specific approach. For this purpose, the sandbox experiment was reconducted to experimentally model and evaluate various possibilities. Correspondingly a set of strategies was devised.

These strategies were also evaluated from the point of view of maintenance, based on which there were three possibilities: 1) maintained by the inhabitants 2) maintained by the inhabitants and natural processes 3) left undisturbed.

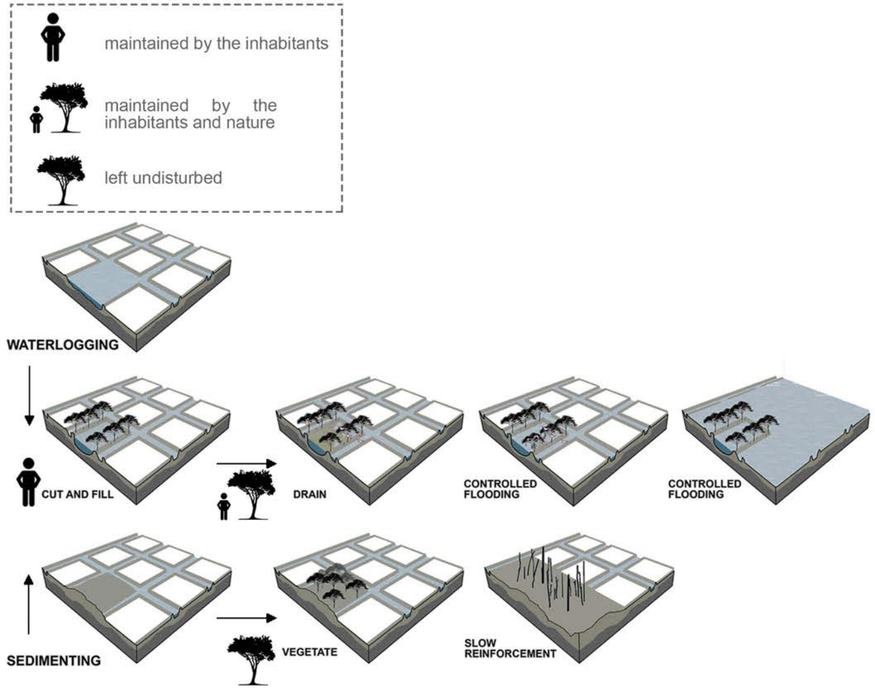


Figure 4.6: design principle 4
wetness maintenance strategies

Figure 4.7: design principle 5, regional scale
amphibious link to blue green network

4.4.4 SCALING WETNESS CONTINUUM

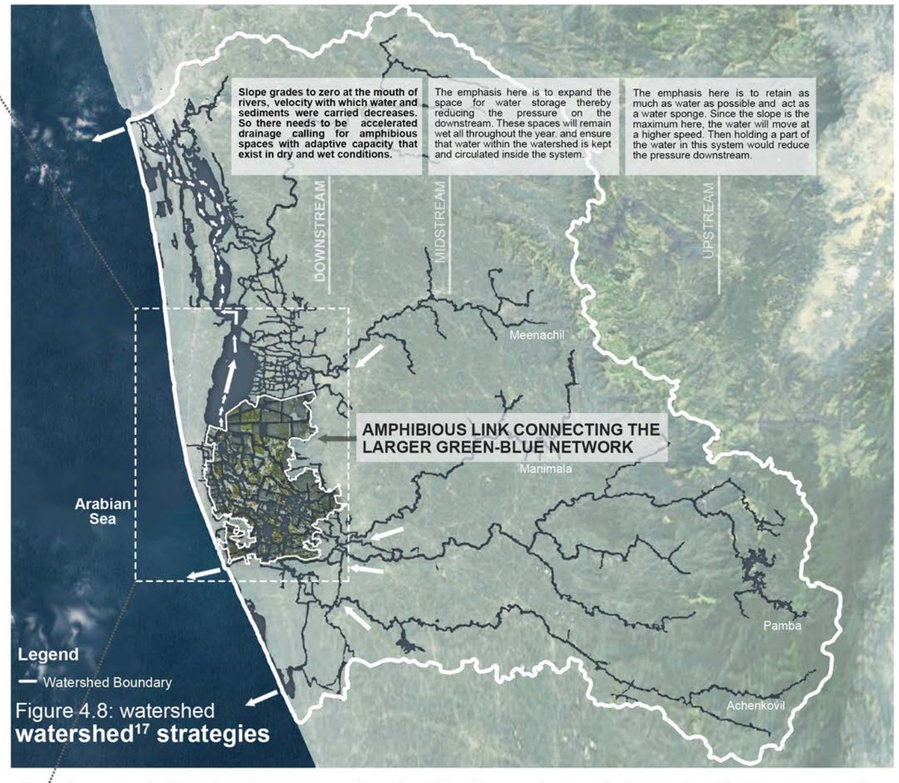


Figure 4.8: watershed
watershed[17] strategies

Despite water's heroic efforts to confine itself to the engineered channels, she has to overflow into the territory of land as demarcated by the inhabitants of the Kuttanad deltaic landscape. This landscape of seasonal flooding results in a landscape of conflict. Instead of seeing it as a conflict the shift in paradigm but forward by the concept of designing in the terrain of wetness should see this as an opportunity. Applying this concept at the regional scale, the landscapes which are seasonally under water is the terrain which can act as a dynamic zone where water can be released quickly in the event of excess rainfall. **This dynamic zone act as an amphibious space which is valuable even when it is under water and can easily transition and operate between land and water.** By that logic, parts of a Kayalnilam, which is the singular landscape unit of this delta should have spaces which are valuable even when they are flooded. As a thumb rule, the traditional practice kept 20-30% of the system under water during the monsoon season and this can be applied to the modern-day context as shown in figure 4.7. These amphibious spaces along with the existing paddy fields will function as smaller elements connecting the larger green-blue network in the watershed.

[17] The existing approaches in planning limit the boundaries of regional scale plans to administrative boundaries. In India, these administrative boundaries were a result of the colonial rule and does not respect the present-day situation. The new paradigm for amphibious landscapes based on wetness while designing deltaic landscapes should begin at the regional scale by replacing the administrative boundaries with the watershed boundaries as shown in figure 4.8 to make room for flexible landscapes in the local level. . At the watershed scale, the landscape is divided into three zones: upstream, midstream and downstream and each of these zones require a specific approach. This project deals with the downstream part of the watershed only, considering the increased land to water dynamics here.

4.4.5 CYCLE OF SALT

The entire system is governed by a cycle of water and salt as understood from the lens analysis. This movement of salt in a hypothetical situation demarcates zones on a temporal basis, based on the entry of salt as shown in figure 4.9. This hypothetical scenario mapping ultimately aids in arriving at a spatio-temporal zoning of salt in the system as shown in figure 4.10 and this principle can aid in the design of a landscape that fluctuates with the movement of salt

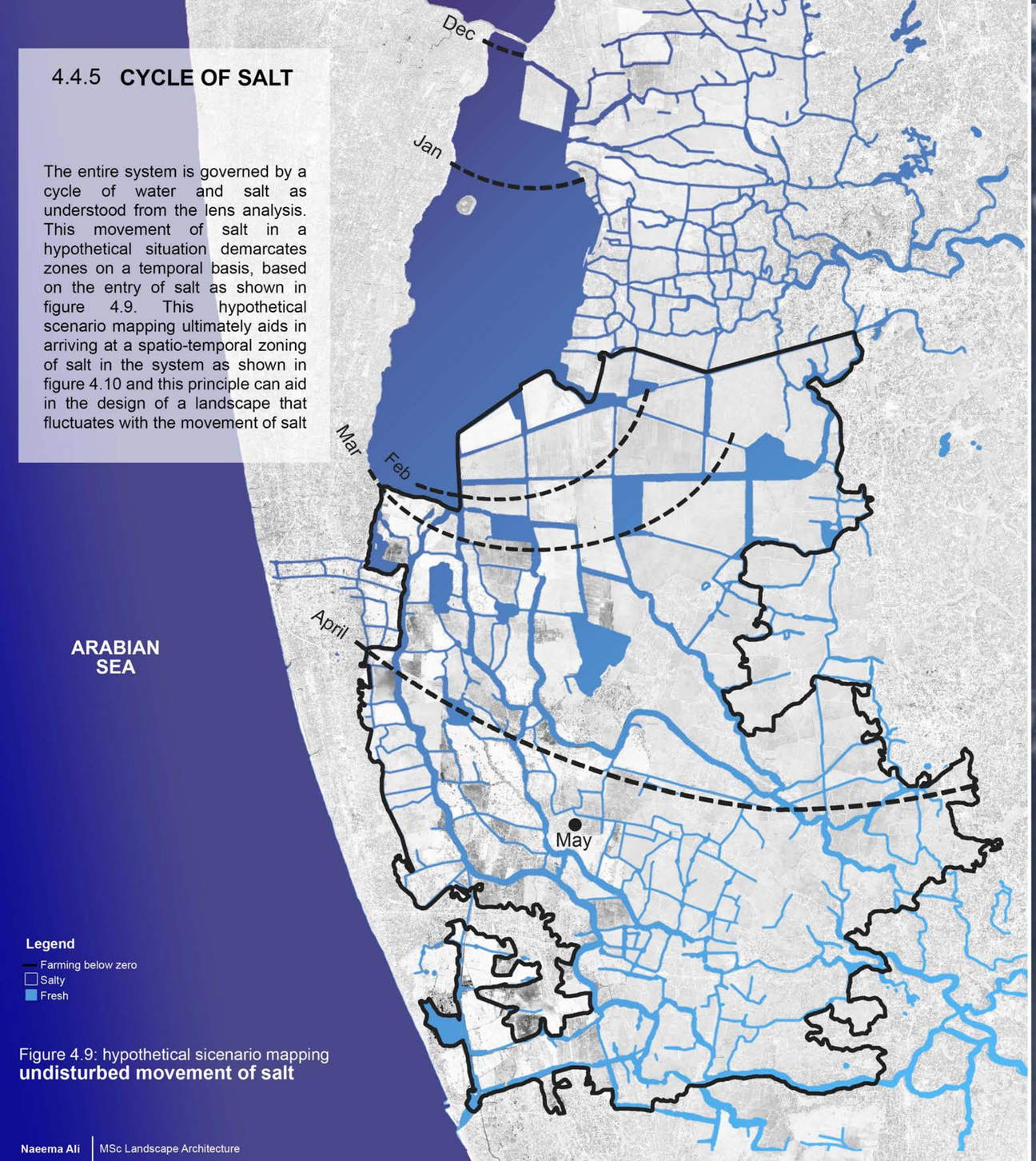


Figure 4.9: hypothetical sicenario mapping
undisturbed movement of salt

Accordingly, the cycle of salt will reach the upper region of reclaimed polders once in every year, while it reaches the middle region once in two years and the lowest region will remain fresh. This will further enhance the dynamic identity of the system, where the effect of the restored cycle of salt will only be pronounced in the reclaimed polders region. This will create a zone of opportunity opportunity for designing an amphibious landscape where the flow and quality of water is transient.

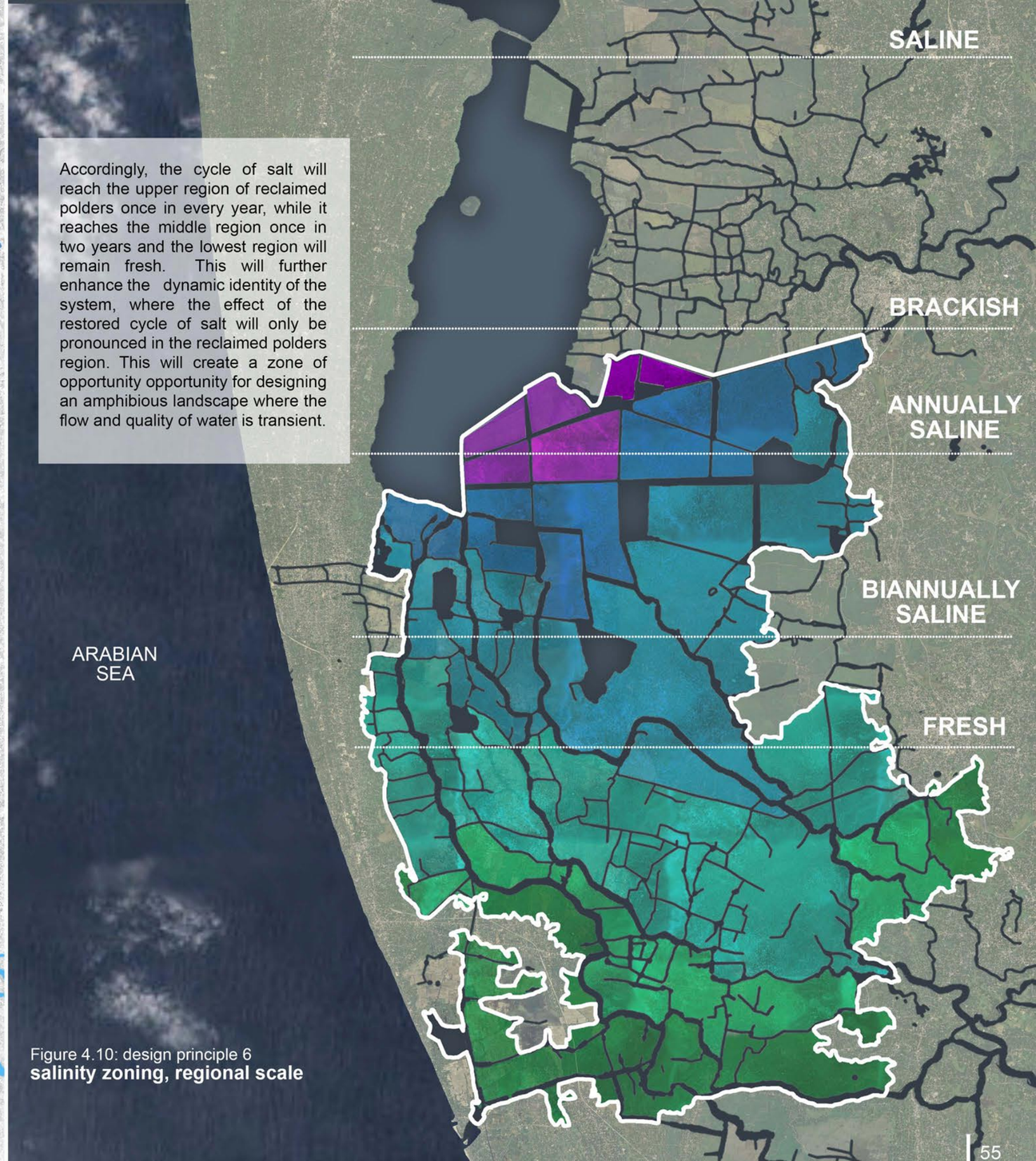


Figure 4.10: design principle 6
salinity zoning, regional scale

“Climate Change has shown us that our survival is not dependent upon superiority, but upon symbiosis ”

Julia Watson

5. HANDMADE IN THE DELTA

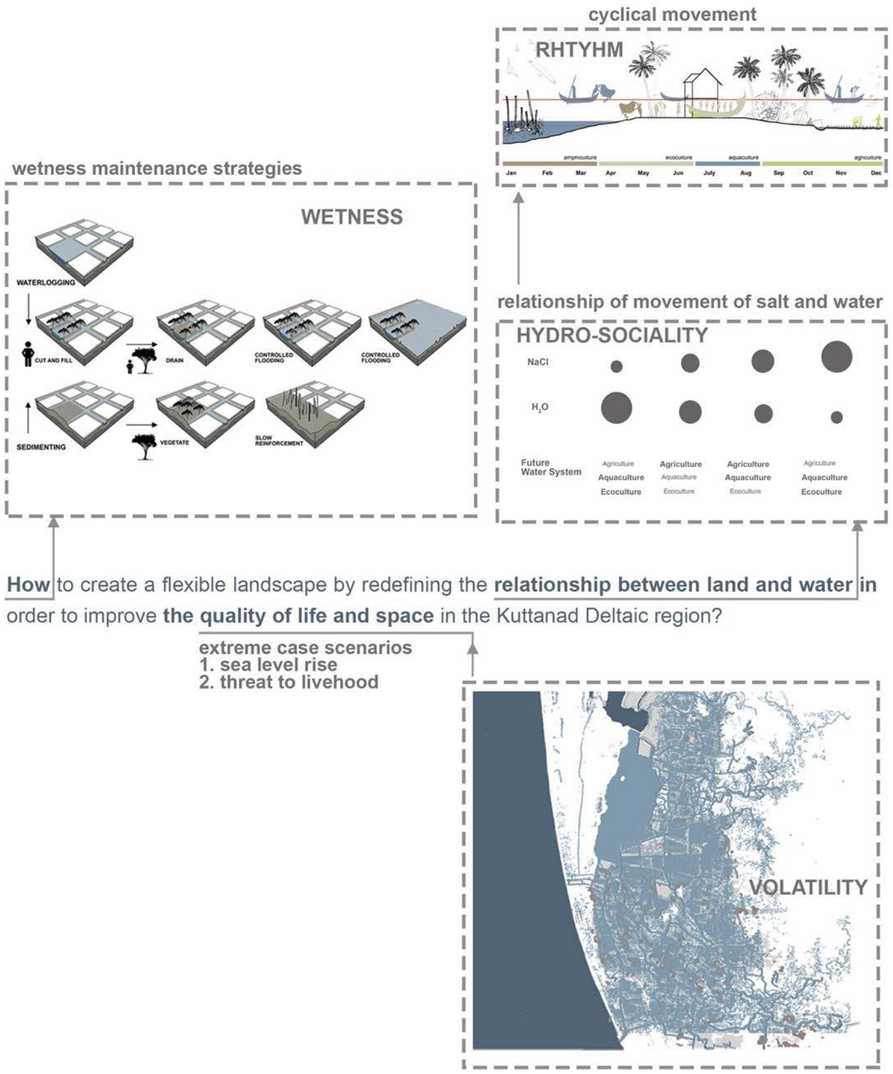


Figure 5.1:design framework
design question formulation from lens analysis

5.1. DESIGN QUESTIONS

Proceeding from the analysis based on the four lens approach, the principal design question is:

MAIN DESIGN QUESTION

How to transform seasonally flooded agricultural landscapes into amphibious landscapes that can resonate with the cyclical movement of salt and water?

Sub-questions include:

a. How can these new amphibious landscapes be valuable to inhabitants by offering year-round livelihood opportunities?

b. How can tourism be integrated with these livelihood opportunities?

c. How to bring about this transformation gradually without disrupting the existing functioning?

d. What is the role of the inhabitants, nature and the landscape architect in bringing about this transformation?

5.2. DERELICTION OF SITE ZOOM IN

In order to initiate the design process, the design principles will be tested on one polder, as shown in figure 5.2. This location is chosen as it is the least populated and the existing tourism circuit crosses this polder. The polder hence can act as a gateway to Kuttanad .

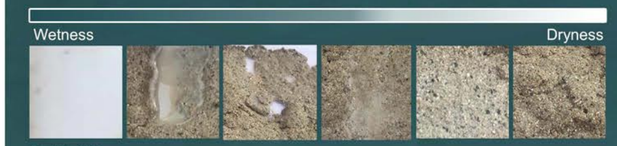
Figure 5.2:zoom in site
dereliction of site

5.3 SLOW LANDSCAPE ARCHITECTURE

Exaggeration of wetness and dryness gradients to let the interplay of land to water interplay dynamics take over parts of the Kayalnilam landscape. Anticipated natural processes of precipitation, waterlogging and silting and intended cultural processes of agriculture, aquaculture and eco-tourism will transform the polder gradually over time. The ecological and recreational values will contribute to a new economy that is aimed to compensate for the loss of some parts of the agricultural lands lost in the transformation process over the years. This model will work only if a maximum of 30% of the agricultural fields are converted into amphibious qualities and some of these qualities are still able to raise economy through agriculture and aquaculture. Since this is a radical change for the current agriculture base economy, this transformation requires a larger time frame giving enough room for nature and humans to adapt to these changes.

5.3.1. **YEAR 0**

Firstly, the wettest part of the Kayalnilams will be lowered into ponds and selected adjoining drier areas will be elevated to create polder parks as shown in figure 5.3. These seasonal rain ponds will add to the seasonal water retention capacity. The polder ribbons act as an accessible circulation path from which both the traditional paddy fields and the emerging flora and fauna in the new amphibious qualities can be observed. The polder parks enhance the recreational value of the Kayalnilam making the new amphibious landscape valuable.



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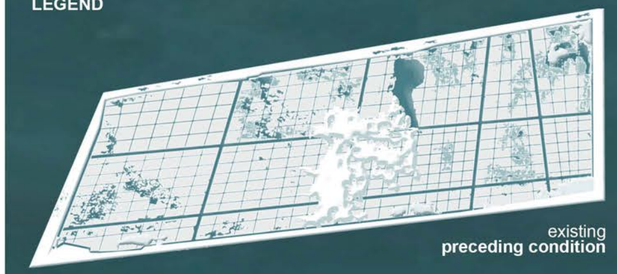


existing
preceding condition

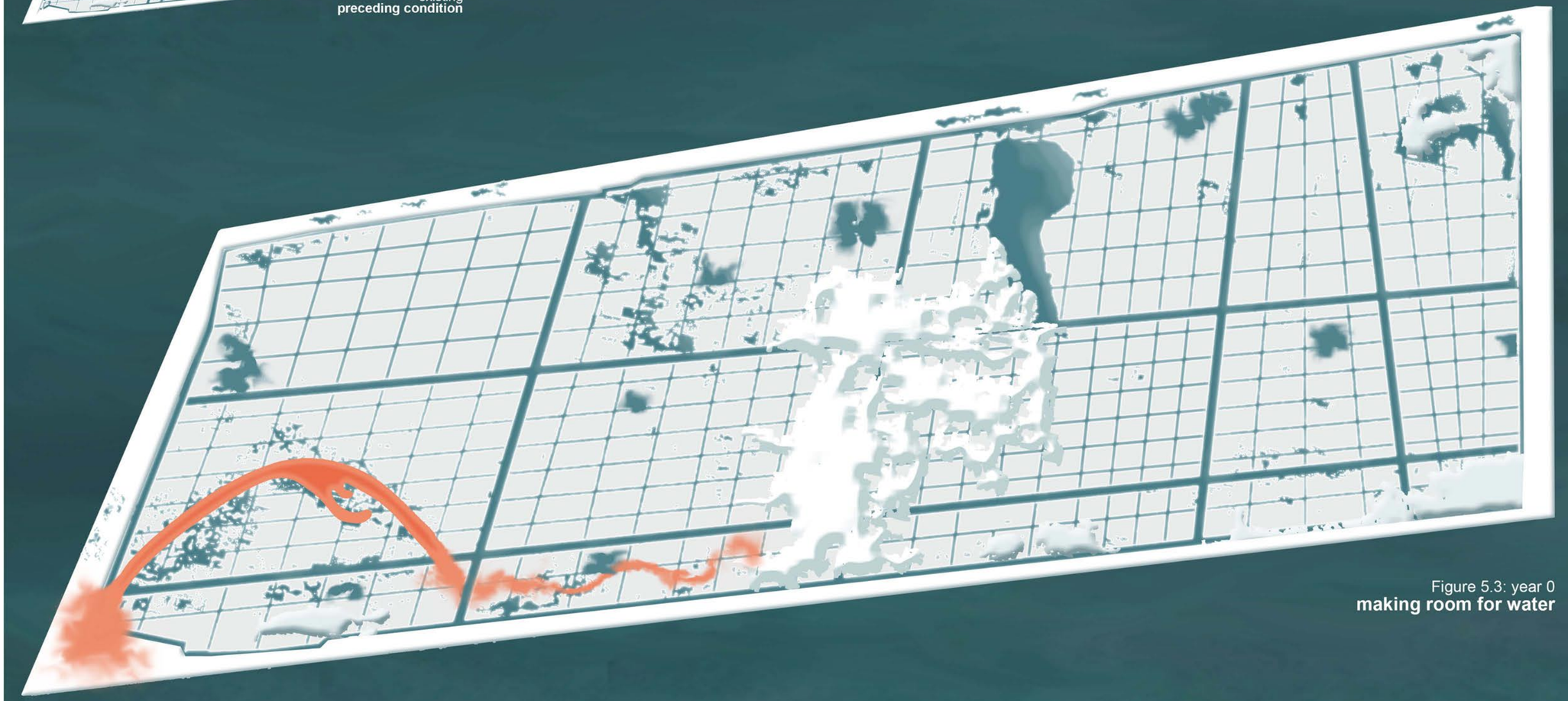
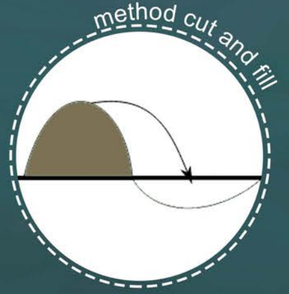
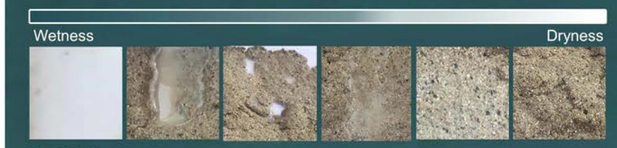


Figure 5.3: year 0
making room for water



5.3.2. **YEAR 3**

Edges of the polder where wetness patterns were identified will be naturalized. This will create an intertidal zone, an interesting habitat for birds and fishes. Adding to this biodiversity will be that of the rain ponds which is allowed to evolve and adapt over time increasing the ecological values of this Kayalnilam. By introducing artificial substrates like boardwalks and bamboo sticks sedimentation along the edges may be increased. While the boardwalk serves as a spatial corridor to the backwaters, the bamboo sticks arranged in groups will act as a fish trap and the incoming fishes during high tide will stay in the complex habitat structured by the newly added substrates.



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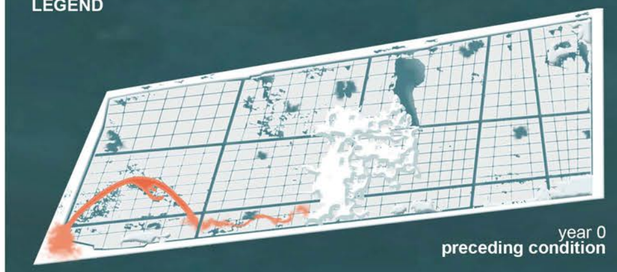
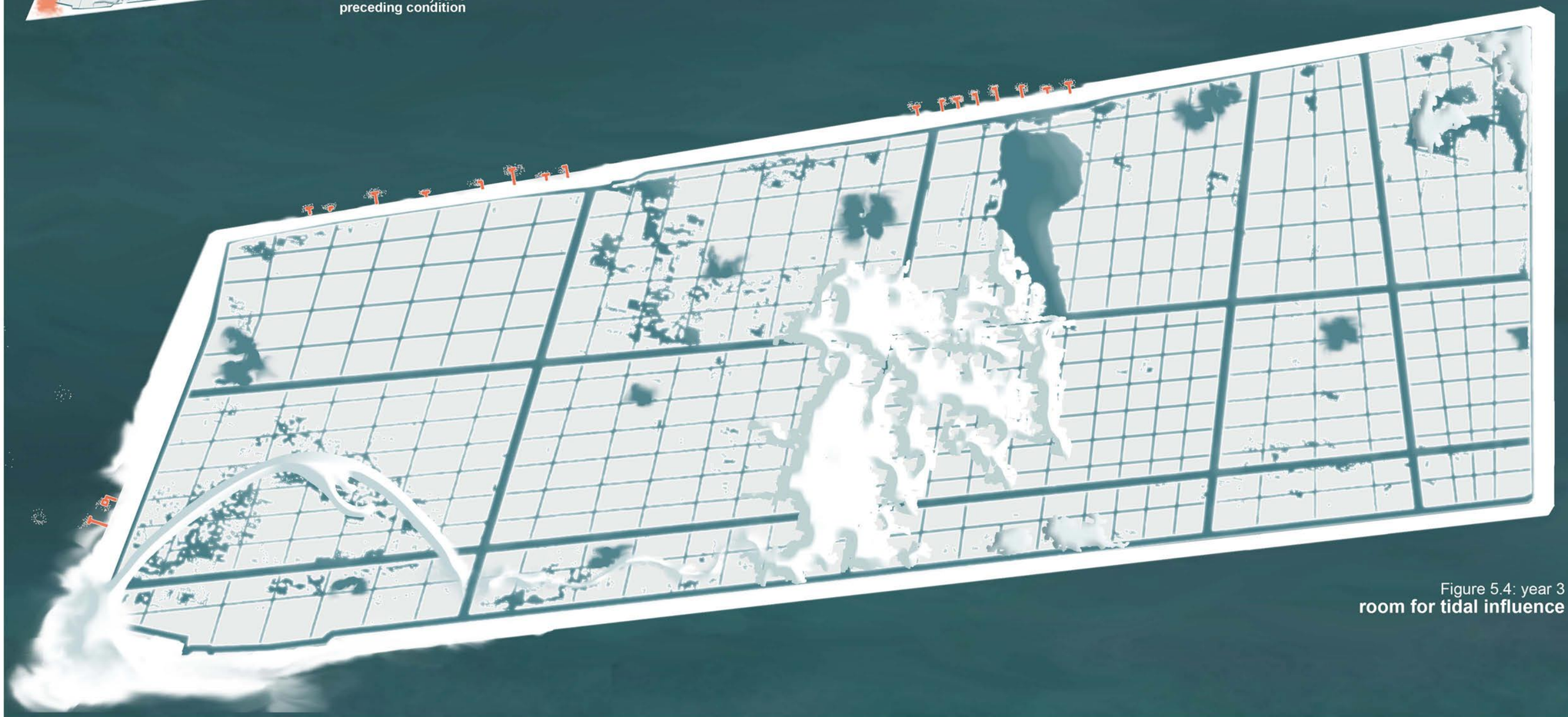


year 0
preceding condition



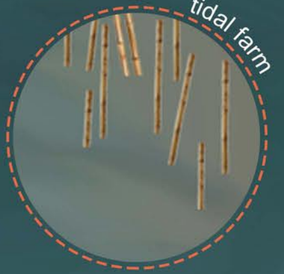
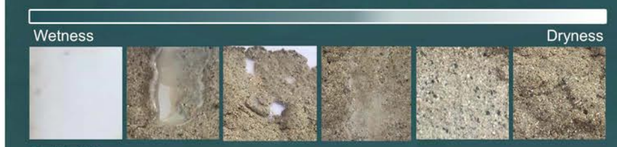


Figure 5.4: year 3
room for tidal influence

5.3.3. **YEAR 5**

The ponds left undisturbed will evolve and reeds will grow in the drier parts of the ponds, facilitating a gradual transition into a wetland garden. The water level in these wetland gardens is adaptive according to rainfall patterns. Hence, wetland gardens add to the seasonal retention capacity. Additionally, more rain ponds will be consolidated to form a larger water bodies and thereby increasing the retention capacity. Here, the adjoining drier parts will be elevated to form a polder park so as to make all these new spatial qualities accessible.



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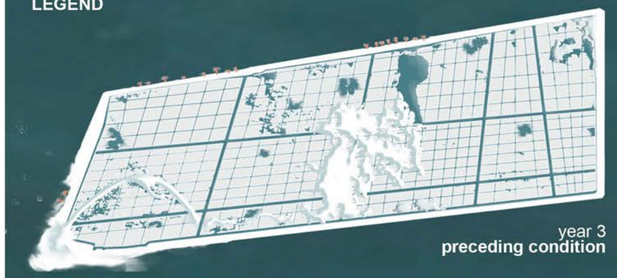


year 3
preceding condition

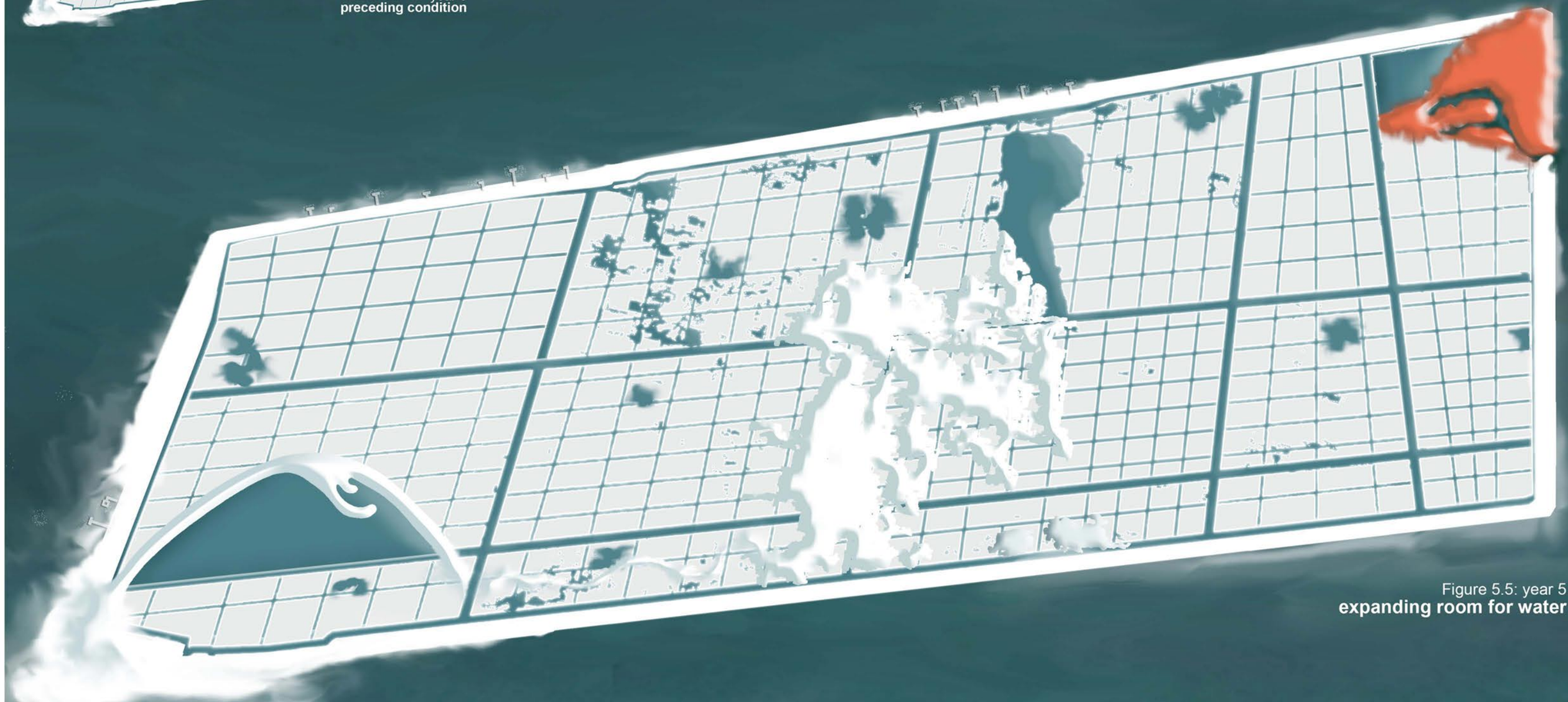
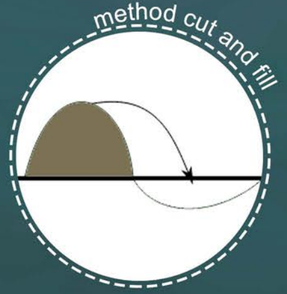
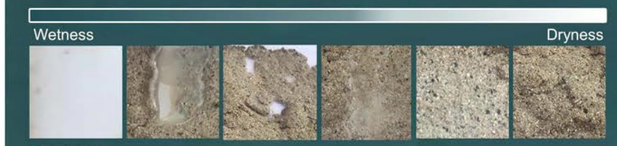


Figure 5.5: year 5
expanding room for water

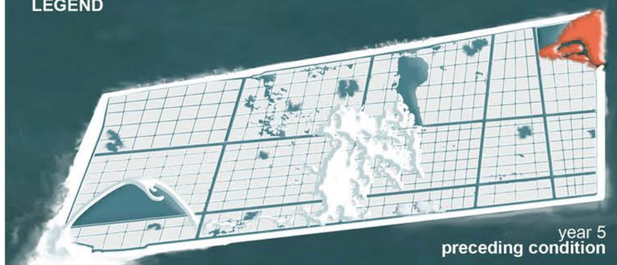


5.3.4. **YEAR 10**

By this time the south-west and north-east corners of this landscape will be developed organically into recreational qualities attracting visitors. The recreational programme will be further enhanced by transforming the driest gradients located in the centre of the polder into a polder park, an island of coconut trees and other fruit plantations. This polder park will be lined by polder ribbons and connected to the diagonally opposite corners of the site establishing a well-connected routing sequence across the polder. The polder ribbons also connect this centrally placed polder park to the paddy fields to get a wellness and hands on experience of amphiculture.



LEGEND



year 5
preceding condition

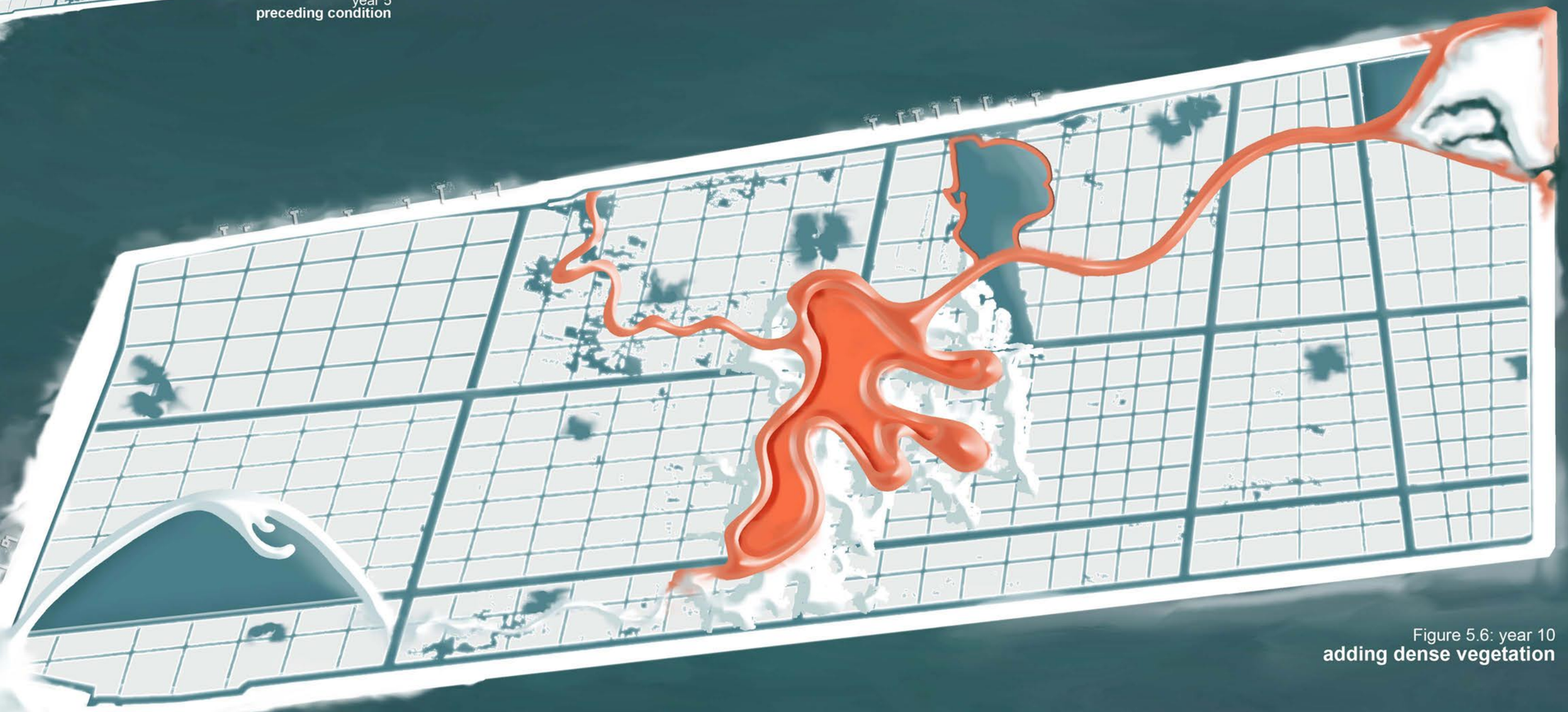
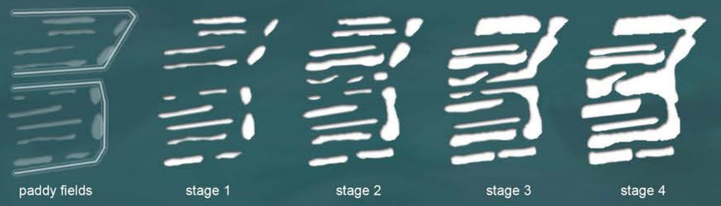


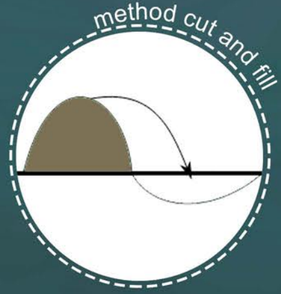
Figure 5.6: year 10
adding dense vegetation

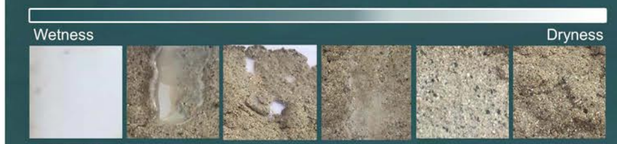
5.3.5. **YEAR 20**



evolution of raised fields

Some of the parts around the central part of the polder park will be raised slightly in stages as shown above. The adjoining areas will be lowered to create more space for water.





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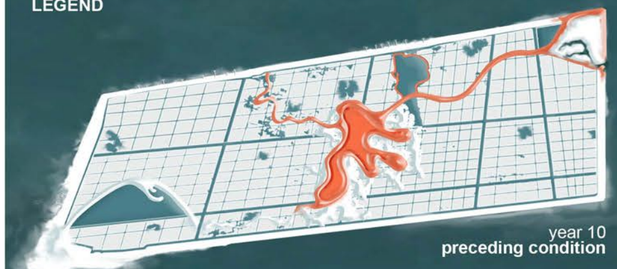


year 10
preceding condition

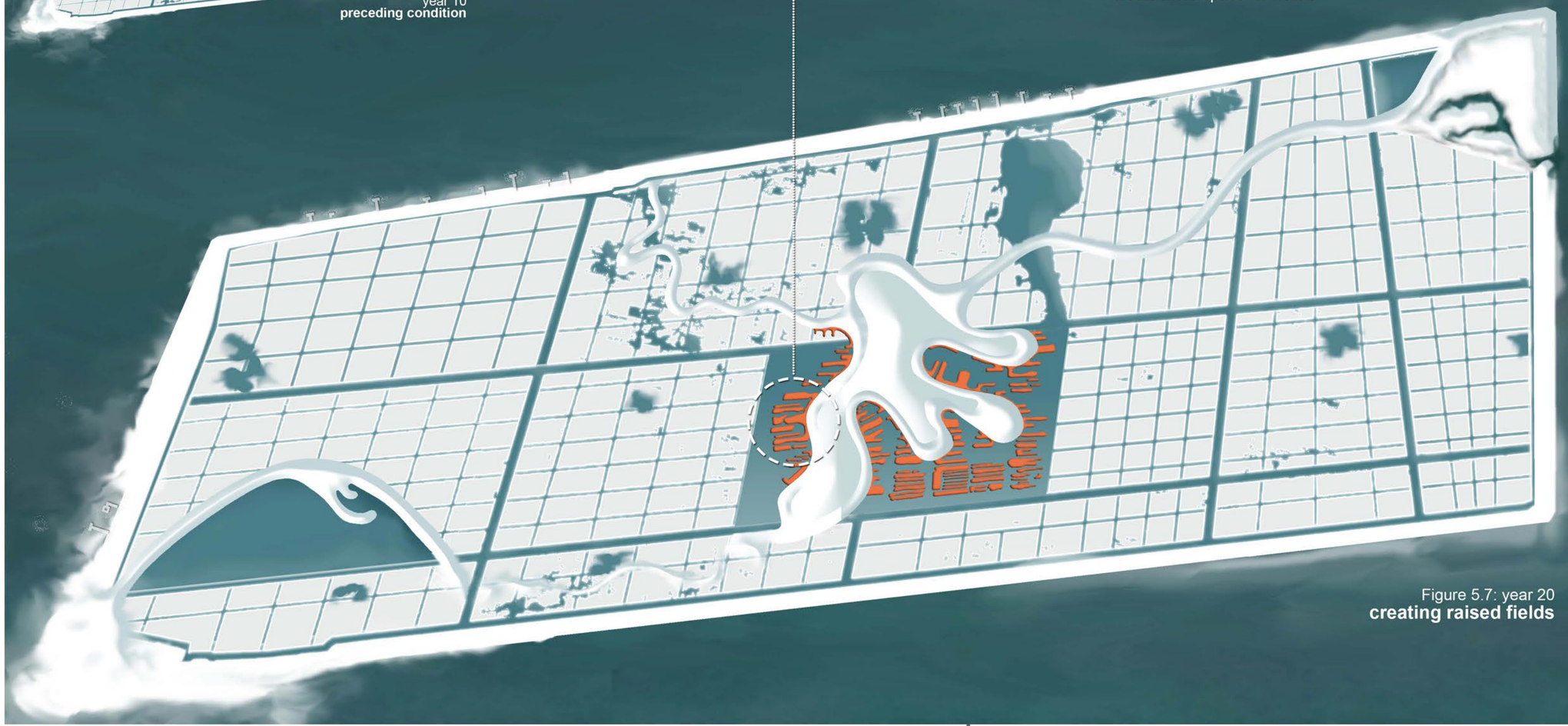


Figure 5.7: year 20
creating raised fields

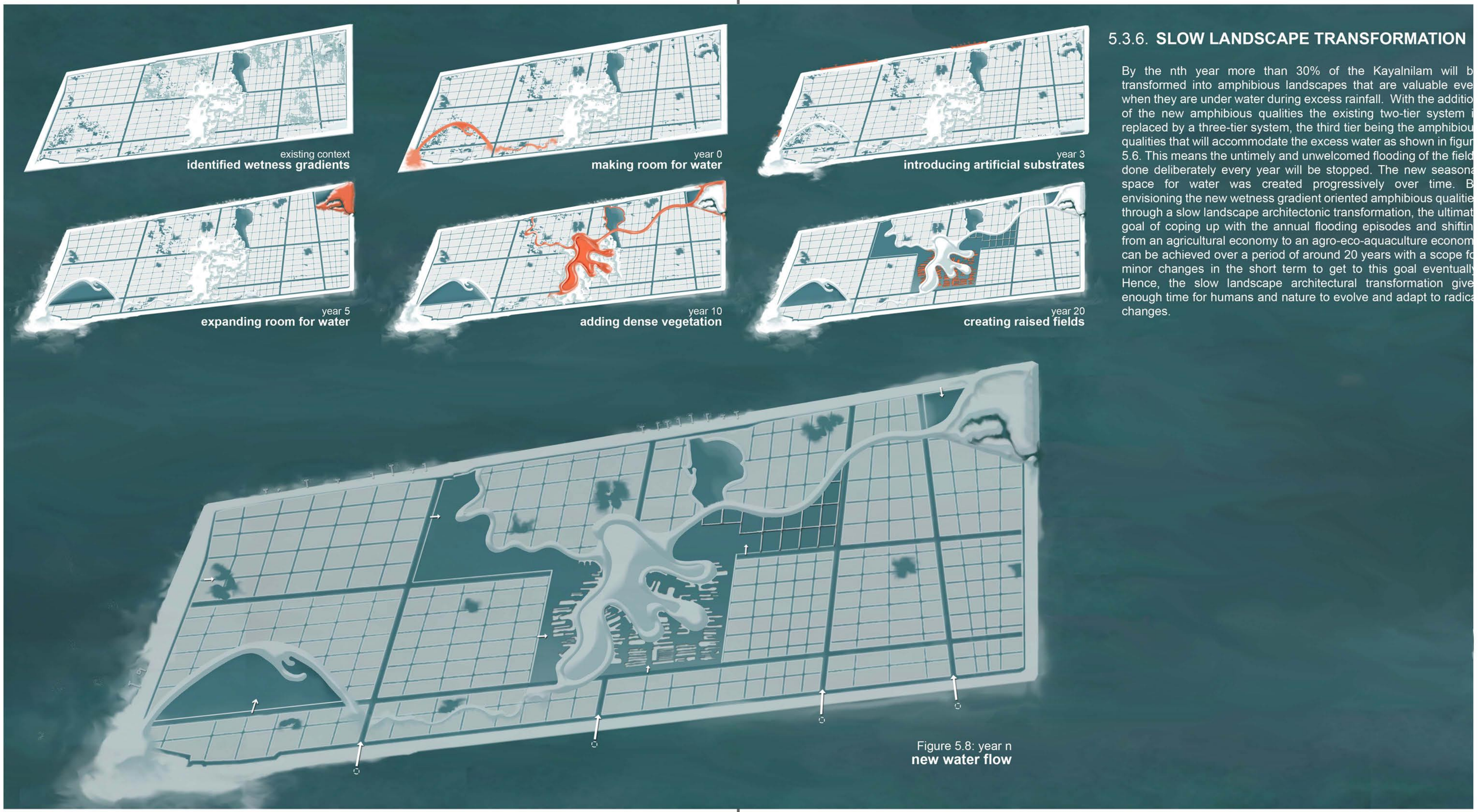


Figure 5.8: year n
new water flow

5.3.6. SLOW LANDSCAPE TRANSFORMATION

By the nth year more than 30% of the Kayalnilam will b transformed into amphibious landscapes that are valuable eve when they are under water during excess rainfall. With the additio of the new amphibious qualities the existing two-tier system i replaced by a three-tier system, the third tier being the amphibiou qualities that will accommodate the excess water as shown in figur 5.6. This means the untimely and unwelcomed flooding of the field done deliberately every year will be stopped. The new seasona space for water was created progressively over time. B envisioning the new wetness gradient oriented amphibious qualitie through a slow landscape architectonic transformation, the ultimat goal of coping up with the annual flooding episodes and shiftin from an agricultural economy to an agro-eco-aquaculture econom can be achieved over a period of around 20 years with a scope fo minor changes in the short term to get to this goal eventuall Hence, the slow landscape architectural transformation give enough time for humans and nature to evolve and adapt to radica changes.

Figure 5.9: year n

new “amphibious” landforms

The visitor’s journey through this Kayalnilam or polder is a multi-sensory experience: they have a view to the indigenous practices and hence the culture of the people; they are connected to the history of the site through paddy fields and the polder parks; they are enlightened by the traditional practices here, they learn the system of native agriculture and aquaculture. It will be interesting for them to see the contrast in experience in all these new spatial qualities, yet a harmony of culture as a whole. The design appeals to the local community on a daily basis. Beyond their livelihoods, recreational and educational programs bring the community activities to the polder and they may engage with tourists which is an expression of the contemporary culture of backwater tourism that is unique to Kuttanad.

5.4 VALUABLE AMPHIIBIOUS LANDSCAPE

An improved living experience on amphibious landscapes which will be valuable to people all throughout the year irrespective of the degree of wetness or dryness. The new landscape would become an accessible dynamic zone that can operate in the event of any unforeseen water level rise with added recreational and ecological values. These new qualities are created by the collective effort of people. Being the makers of these amphibious qualities people will be further connected to the landscapes.

year n

new “amphibious” landforms

The visitor’s journey through this Kayalnilam or polder is a multi-sensory experience: they have a view to the indigenous practices and hence the culture of the people; they are connected to the history of the site through paddy fields and the polder parks; they are enlightened by the traditional practices here, they learn the system of native agriculture and aquaculture. It will be interesting for them to see the contrast in experience in all these new spatial qualities, yet a harmony of culture as a whole. The design appeals to the local community on a daily basis. Beyond their livelihoods, recreational and educational programs bring the community activities to the polder and they may engage with tourists which is an expression of the contemporary culture of backwater tourism that is unique to Kuttanad.

5.4.1.**TIDAL AQUACULTURE**

The Kayalnilams currently operate outside the tidal influence because it was built on traditional agricultural model which did not integrate with aquaculture. In the event of rising water levels a more sustainable model will be one which benefits from both agriculture and aquaculture. The bunds which are a hard edge construction can be naturalized along edges where wetness grade 1 patterns persist. An intertidal zone will be created and an environment suitable for the incoming aquatic life during the high tides need to be created. Tidal farms can be set up for this purpose. Alongside these farms, fish sanctuaries are installed in the shallow regions of the backwaters which can act as a habitat for birds and fishes.

Figure 5.11: sectional view
tidal aquaculture

The fish sanctuaries acts as an artificial substrates which are excellent habitats for fishes and protective environment for the juveniles.

The fish sanctuaries are temporary habitats for migratory birds and they can also feed on the smaller fishes and other aquatic species.

The disappearing species will resurface over time enhancing ecological restoration and add increase opportunities for aquaculture.

The intertidal region will be a habitat for crabs and can promote crab catching among local fishermen. By increasing the sedimentation rate of the tidal flats it will be made more suitable for shrimp farming.

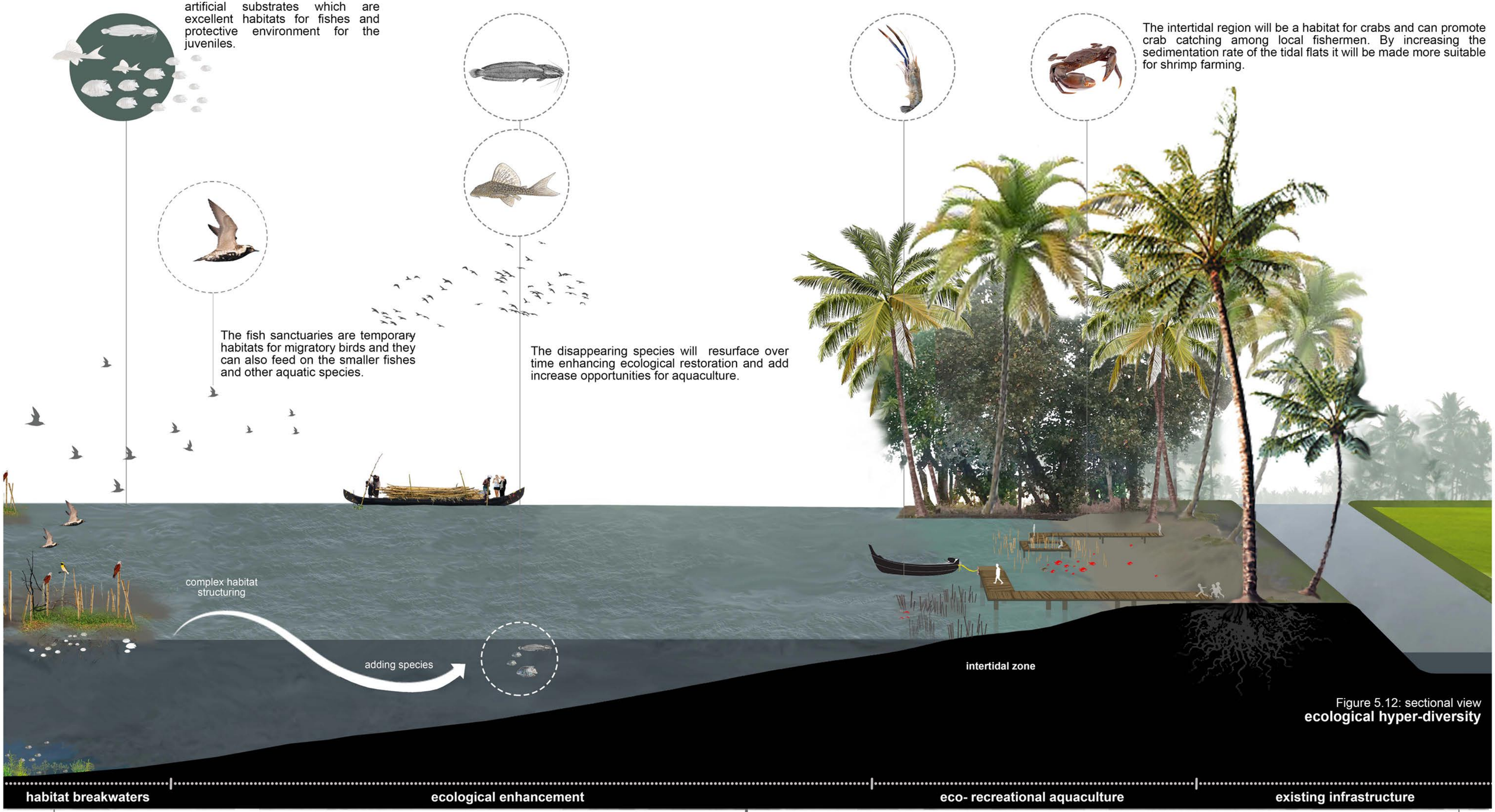


Figure 5.12: sectional view
ecological hyper-diversity

FISH SANCTUARIES

The fish sanctuaries are constructed in the backwaters by laying bamboo poles and tree branches to create an artificial substrate. These substrates left over time will catch sediments act as a habitat for fishes and birds. This will also lead to intensification and diversification to aquatic life. It is also an interesting space for visitors to visit, establishing an experiental spatial connection with the fish sanctuaries. Since it is built and maintained by the people it also enhances community living.

A conceptual diagram explaining why the structural complexity provided by the fish sanctuaries increases other aquatic life in terms of both diversity and abundance

Figure 5.13:fish sanctuaries
construction and maintanence

WATER QUALITY

The fish sanctuaries act as a habitat for smaller aquatic species as well, like the black clams. The black clams, which are filter feeders, would also help clean the water that passes through them. In this manner by increasing the ecological diversity which will bring more species like the black clam the quality of water will also be improved. Their population count is an excellent bio- indicator.

Figure 5.10: fish sanctuary
zoom in view

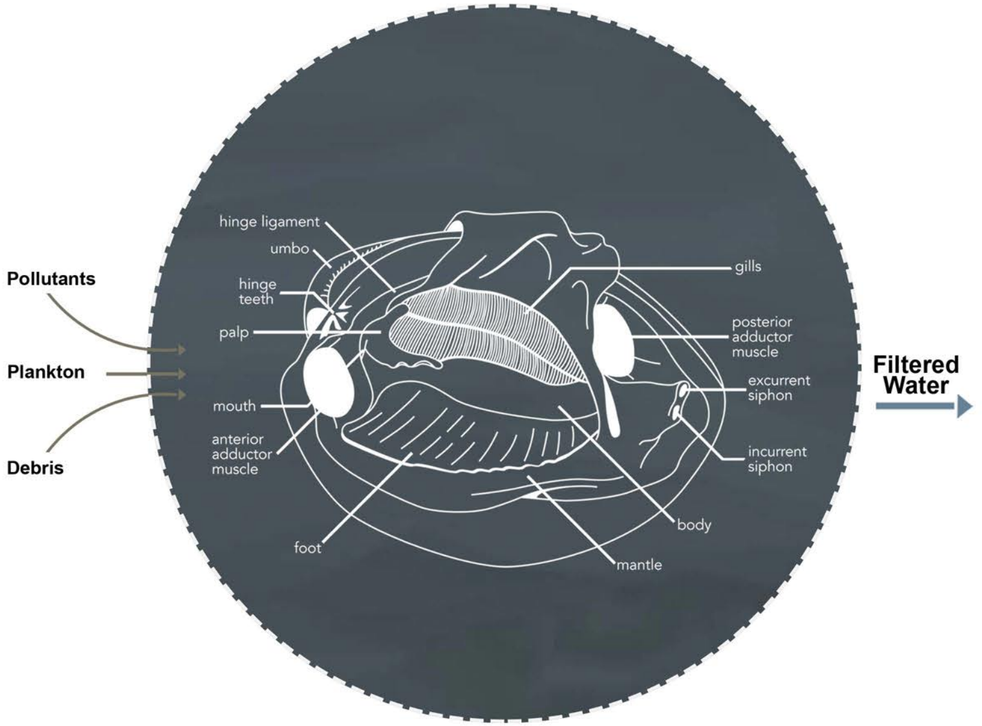


Figure 5.14: anatomy of black clam
ecological significance of clam cleaning mechanism

TIDAL FARMS

Artificial substrates like bamboo sticks and boardwalks are introduced to tap the tidal aquaculture potential. While the boardwalk acts as a recreative corridor that connects to the backwaters, the bamboo sticks can structure a complex habitat that will intensify and diversify aquatic life. The visitors can closely observe the functioning of these farms.

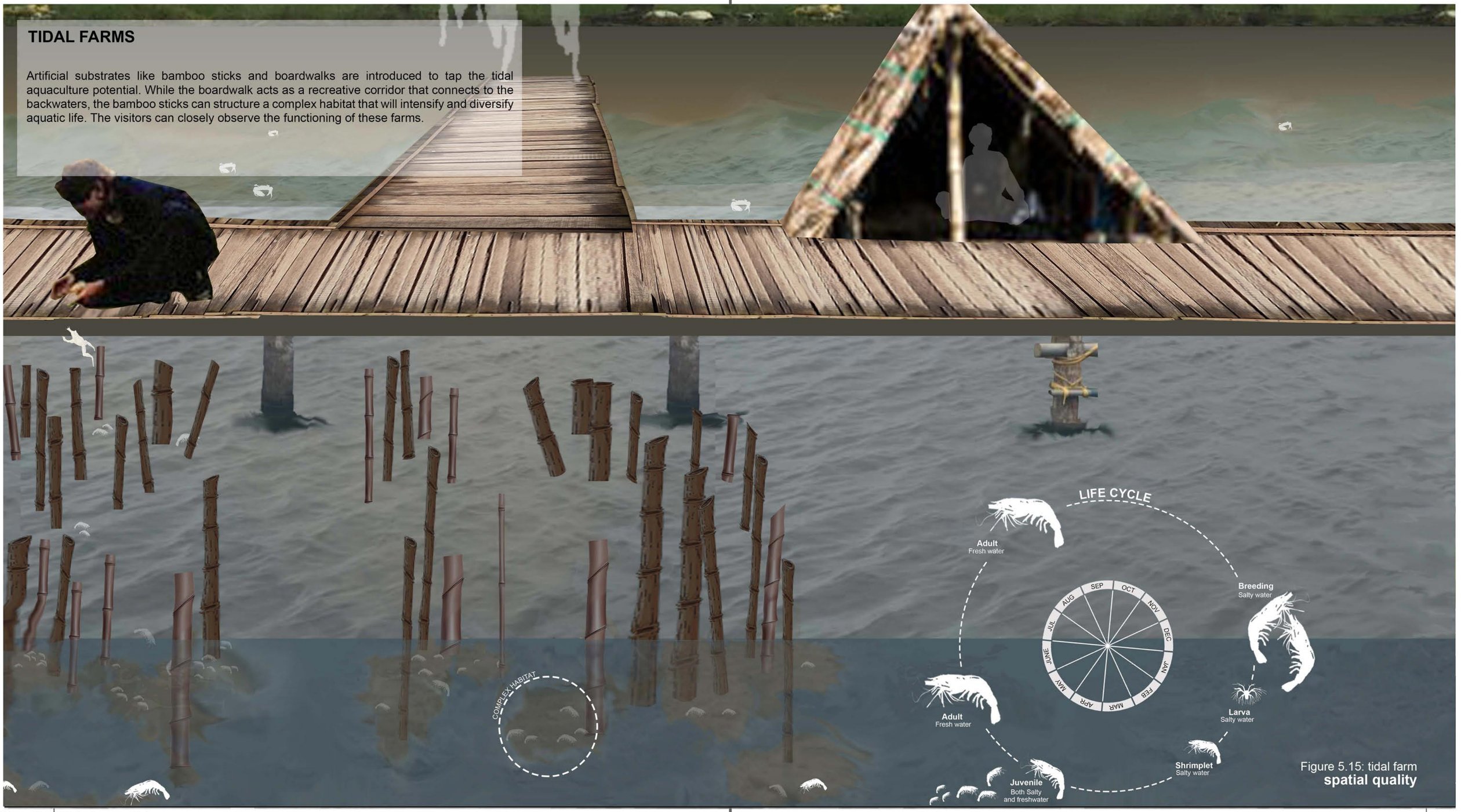


Figure 5.15: tidal farm
spatial quality

The boardwalks also act as a spatial corridor to the backwaters where people can rwlax and enjoy the view to the backeaters. During low tide, high tide and other expected or unexpected events of water level rise, this structure stays intact since its above the predicted mean sea level rise. Some of the boardwalks also makes room for visitors to see it's indigenous construction.

Figure 5.16: tidal farm
spatial corridor to backwaters, low tide

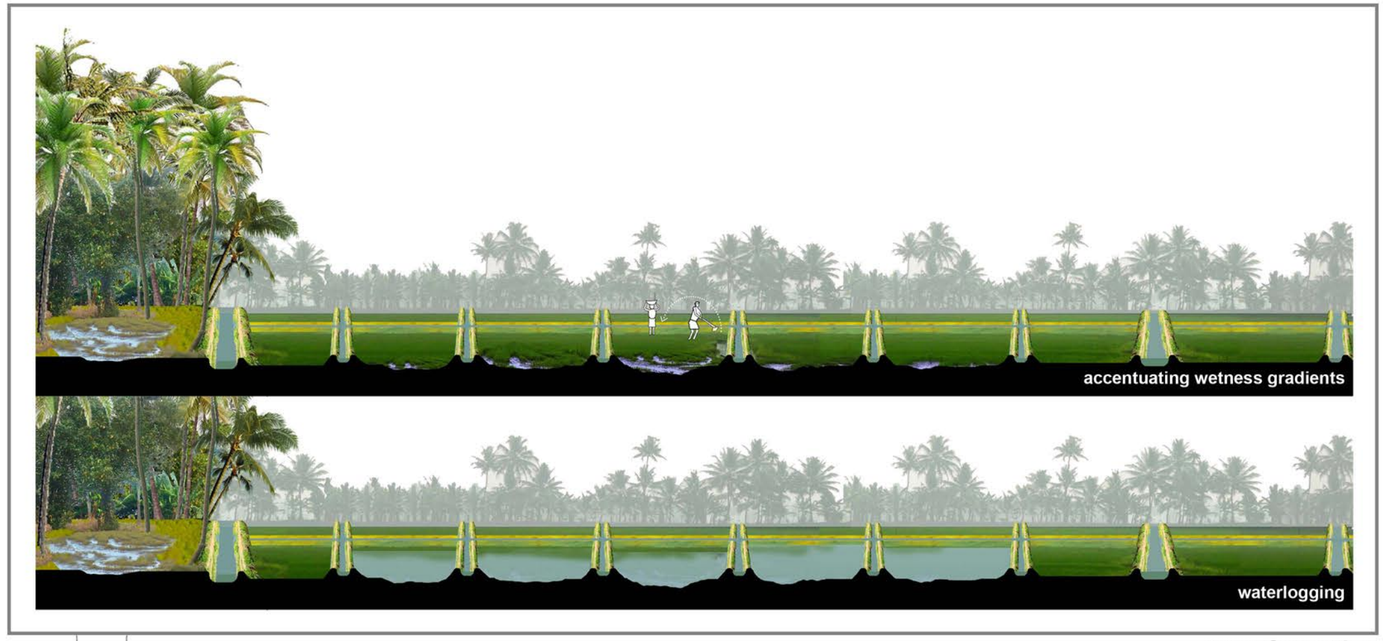
During high tides, the aquatic anmals will be directed towards the Kayalnilams and will dwell on the complex habitats structured by the artificial substrates.

Polehulas consist of ropes suspended from a band that can be wrapped around a pole. They can be habitats for smaller aquatic animals.

Figure 5.17: tidal farm
spatial corridor to backwaters, high tide

5.4.2. **DYNAMIC AGRICULTURE**

The Kayalnilams showcase a history of below sea level farming for more than 100 years, but monocultural farming practices has led to a loss of diversity. As an alternative strategy, paddy farming maybe practiced alongside natural reserves like wetlands. These artifically created wetlands are formed by manipulating the identified wetland gradients. They will add to the adaptive capacity and enrich the soil as well which will help tackle flooding and low productivity associated with the paddy farming respectively. These qualities re most adaptive when it comes to flooding.



transformation

Figure 5.19: sectional view
dynamic agriculture

WETLAND GARDENS

The wetland gardens are formed through cut and fill method by converting the wet degree 1 parts of the paddy fields into a retention pond and periodically draining and flooding them. They add to the adaptive storage capacity of water. They also act as a hotspot for flora and fauna attracting bird watchers and other visitors.

Figure 5.20: sectional view
wetland garden

Figure 5.21:wetland garden
partially flooded

Figure 5.22:wetland garden
completely flooded

Figure 5.23: dynamic agriulture
partially flooded

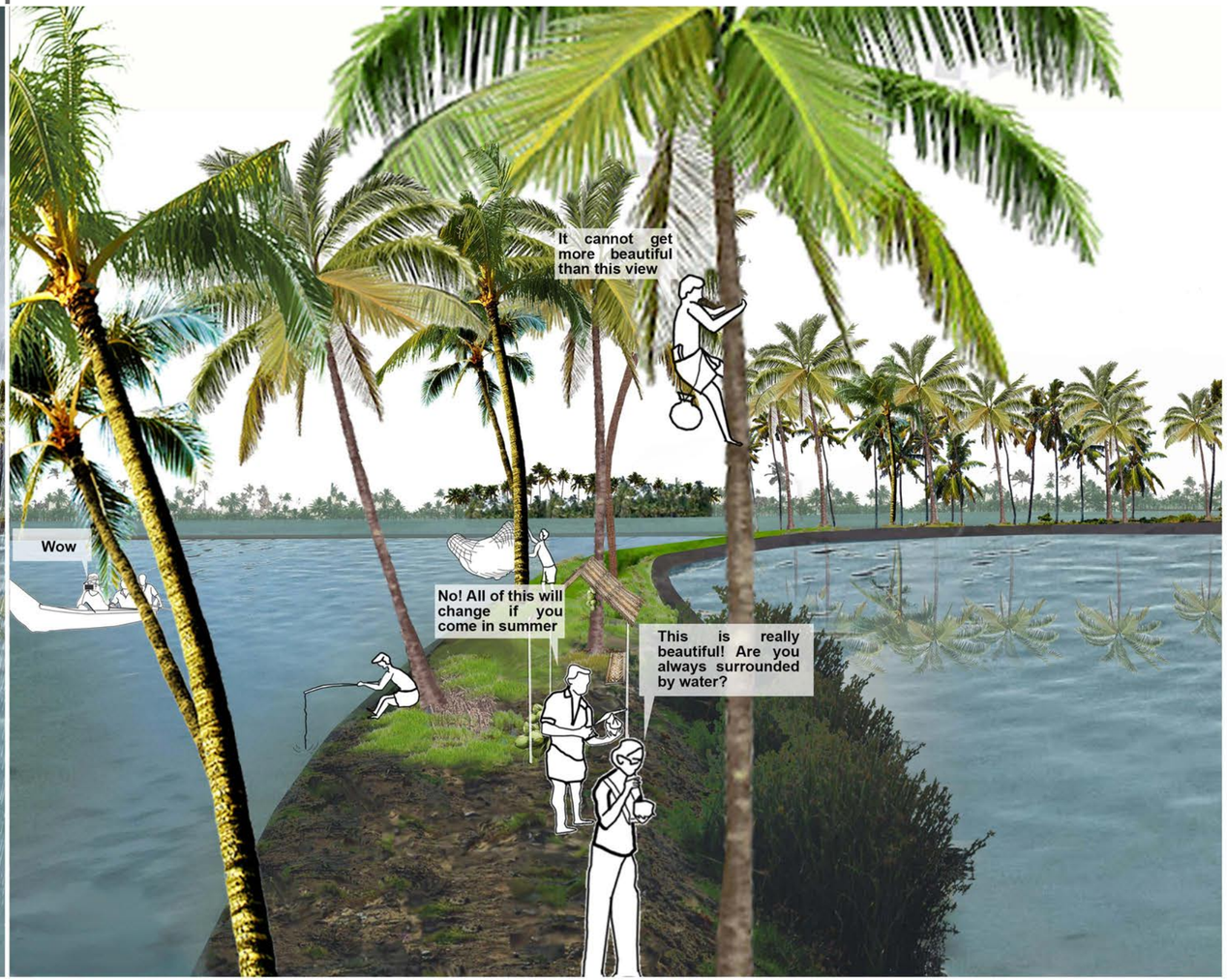


Figure 5.24: dynamic agriulture
completely flooded

The wetland garden will receive the excess rainfall and be transfomed into a water body, echoing the central idea, “Land can sometimes be water”. The remaining paddy fields can carry out all the operations as usual and the disruption of the daily lives and uncertainity associated with their livelihood patterns can be addressed by this new amphibious structure which adds to the adaptive capacity of the system. The visitors can walk along the polder park and experience the history and identity of the landscape from one side, the paddy fields and the future and the contemporary identity of this landscape from the other, the wetland gardens. This contrast will set them thinking further about the dichotomy associated with land and water. Ultimately, this is an aesthetic of engagement that these qualities put forward.

In the case of an uncertain event like a cloudburst flooding or rise in the level of water more than expected, the paddy fields will also be flooded owing to their inherent amphibious quality. The visitors are still welcome and they can access the new waterscape like quality through the polder park. The visitors can take a boat or canoe ride in these polders which will be a different spatial experience than that in the bakwaters as it is a more enclosed space. The inhabitants can practice aquaculture during these times and if these uncertain periods are prolonged the future alternative will still be agriculture, taking water as the new ground, thus becoming adaptive and resilient to time and context. This is an extreme case scenario and the landscape can still act as a valuable link between humans and nature.

Figure 5.25: dynamic agriulture
eco-recreation

Apart from flood resilience the wetland gardens will be home to a lot of indigenous flora and fauna and a source of ecstasy for the visitors.. The most noted amongst these species is the presence of aquatic macrophytes. They recycle the nutrients in the water enhancing the water quality. The roots of the macrophytes act as a high quality fertilizer and this will enhance the productivity of paddy farming in the area. However, most of these species die with the entry of salt and reapper during monsoon. Their life cycle was very much adapted to the cycle of salt like the fishes.This will be a solution to stagnating water weeds like *Salvinia molesta* which are in abundance today. Salt water will check the population of these species and maintain the ecological balance.

ECO- RECREATION

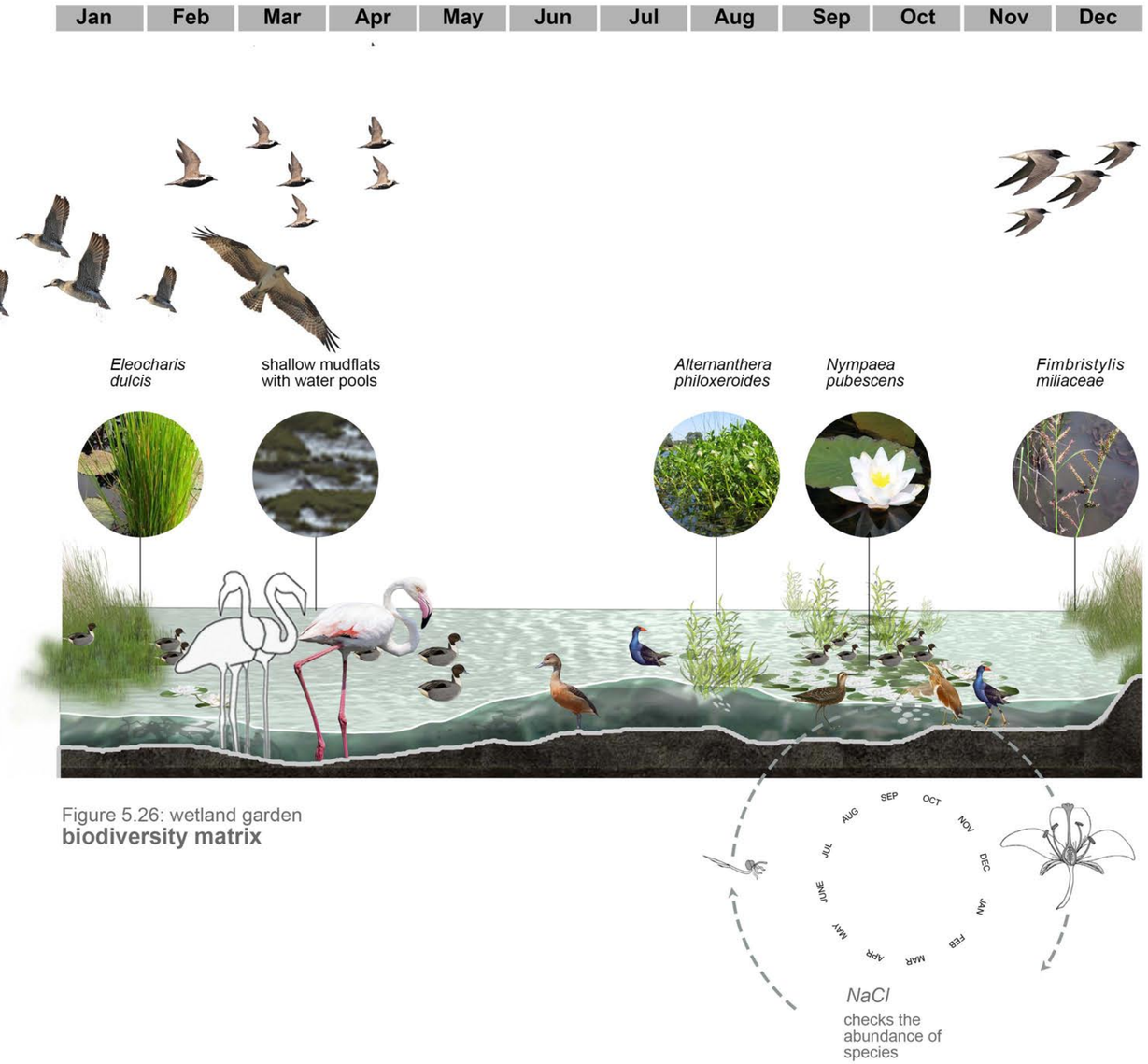


Figure 5.26: wetland garden
biodiversity matrix

PADDY FIELDS

The paddy fields are formed by continuing the agricultural operations in the wet degree 1 parts of the paddy fields. The canals and inner bunds have to maintained periodically through the cut and fill method in case of any repair after the monsoon period. Unlike the tidal farms and fish sancturies the seasonal cycle of salt is a curse for paddy fields. The rice variety used here are intolerant to higher salinities. Hence this creates a conflict among the fisherman and farmers, the two different stakeholders. The design challenge is to reach on a broad consensus to resolve the cycle of salt which is a blessing for fishermen and a curse for farmers.

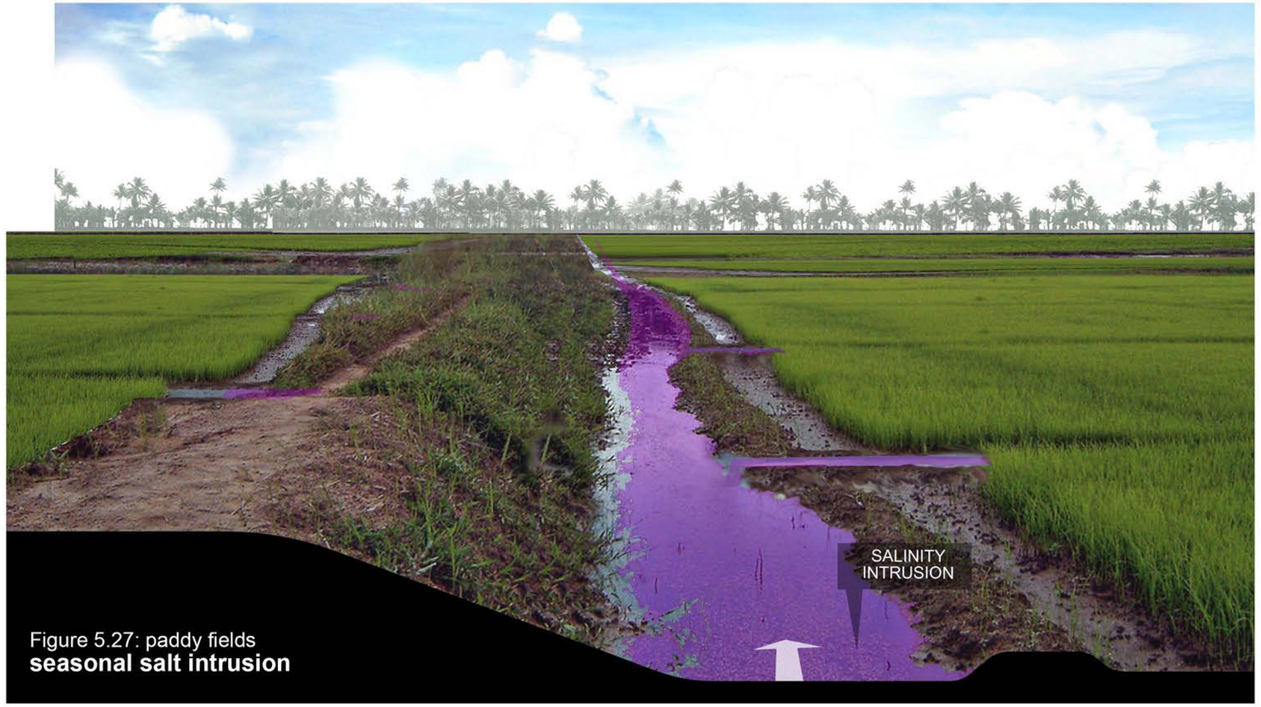


Figure 5.27: paddy fields
seasonal salt intrusion

To stop salinity intrusion during the months on April and May, an ndigenous practice which was part of the traditional water system may be employed. The inlet to the respective fields will be blocked with twigs and sacks of sand and the salt water will not enter the fields. Even if there is a rise in water the barrier is built above the level of salt. This is a flexible system that allows room for fulfilling all stakeholders aspirations. These kind of flexible systems are in stark contrast to the existing hard high-tech infrastructures and ultimately this will add to the amphibious nature of the landscapes.

Figure 5.28: paddy fields
flexible temporary salt barrier

Figure 5.29: paddy fields
blocking inlet and continuing farming

Figure 5.30: paddy fields
conflict

FROM A "LANDSCAPE OF CONFLICT"

TO "LANDSCAPE OF CONSENSUS"

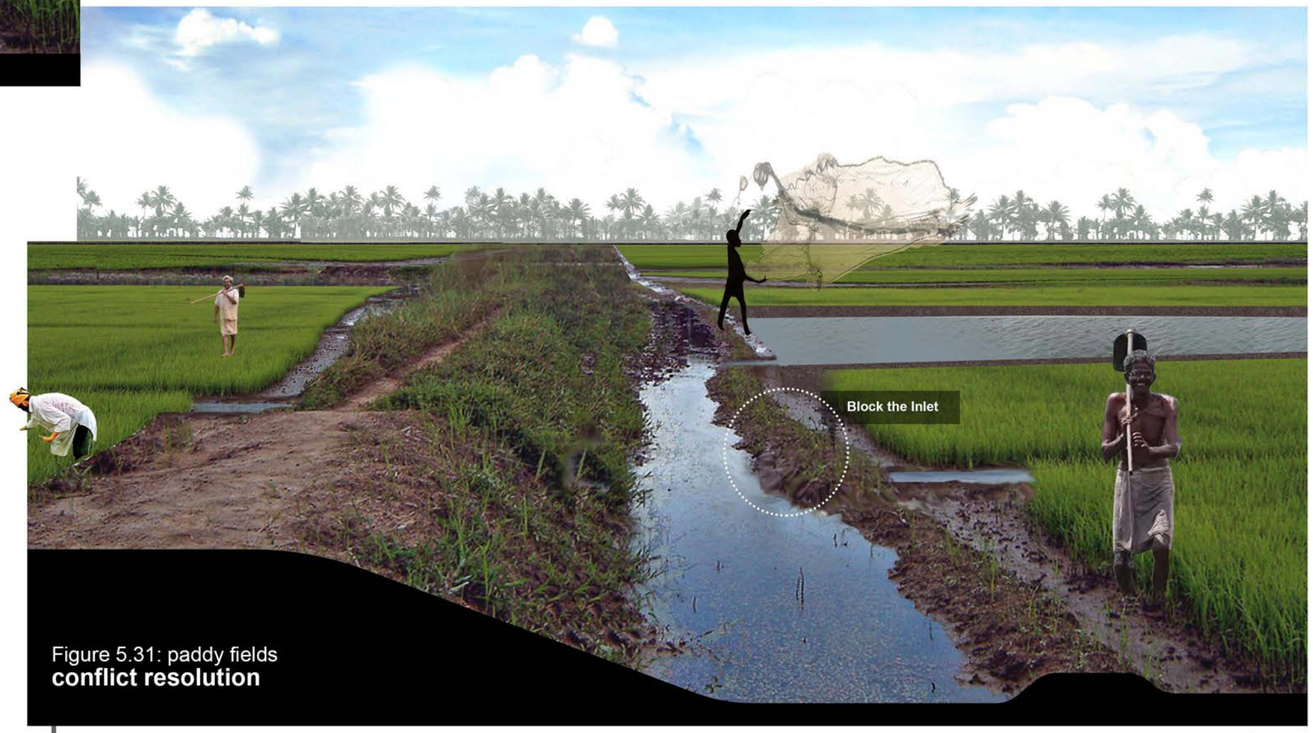


Figure 5.31: paddy fields
conflict resolution

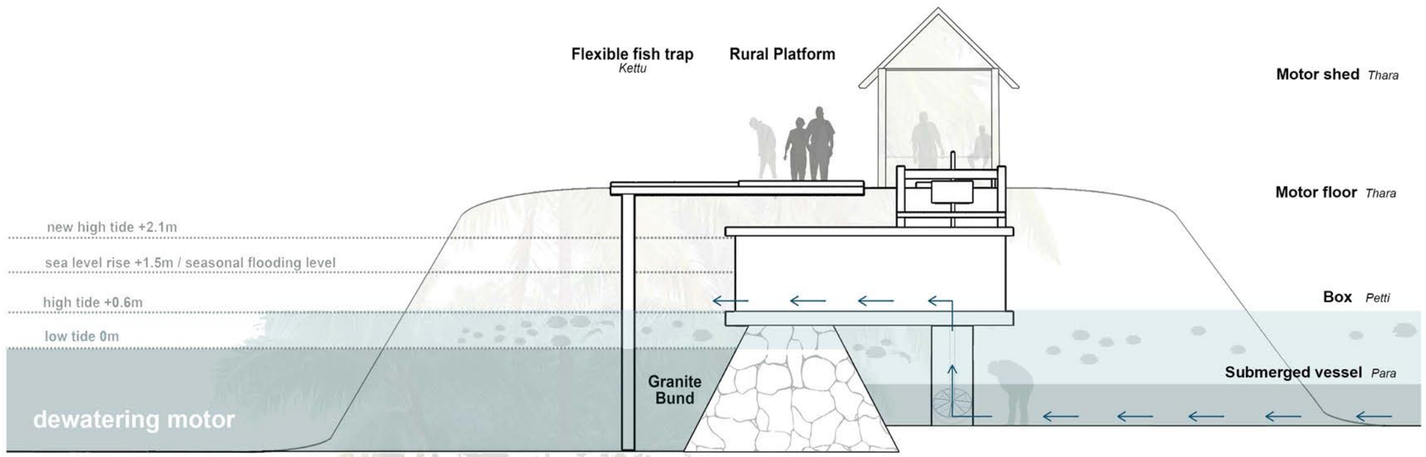
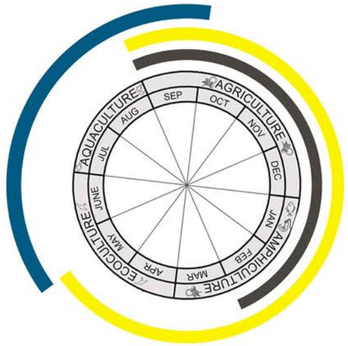


Figure 5.32: dewatering mechanism
polder park

POLDER PARK

The polder parks are formed by vegetating dry parts of the bund or paddy fields with coconut trees and other fruit plantations. They can act as a circulation path connecting otherwise inaccessible parts of the polder. While they will continue to elevate due to catching of sediments, the vegetation has to be maintained periodically to ensure accessibility. They are demonstration parks acting as a widndow to view and experinece the life of people on land- their daily activities, livelihoods and community living. This also reflects a sense of flexibility associated with how people use these landscapes. These landscapes blend into their lifestyle and the visitors engage with the landscapes through the daily activities of people. The motor shed within the polder parks can act as a multipurpose structure around which community life is centred.

Petti means a box and para a cylindrical measuring vessel. These are the two main components of this indigenous de-watering mechanism a submerged vessel (para) and a rectangular box above the water and they are run by an electric motor. The fan inside the para is connected by a belt to a motor fixed inside the pump house. The water that is sucked in through the vessel flows out of the box whereby the contraption can be used to pump water from low lying areas into the backwaters. Fishes, that are trapped in this water, are caught using a net attached to the box, transforming this humble native engineering tool into a multi-utility technical device. These kind of indigenous systems should be made visible to the visitors. This will add to their recreation, further adding to the experiential quality of these landscapes



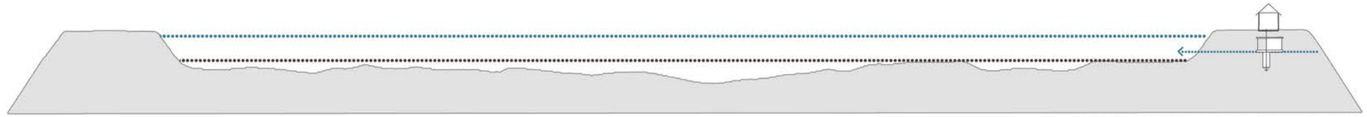
UNDISTURBED

FLOOD

DRAIN

MANAGING SPACES

Since they are dynamic these spaces require explicit management. The design calendar would be a useful tool. It will show the spatial qualities, biodiversity, operations and the decisions to be taken .

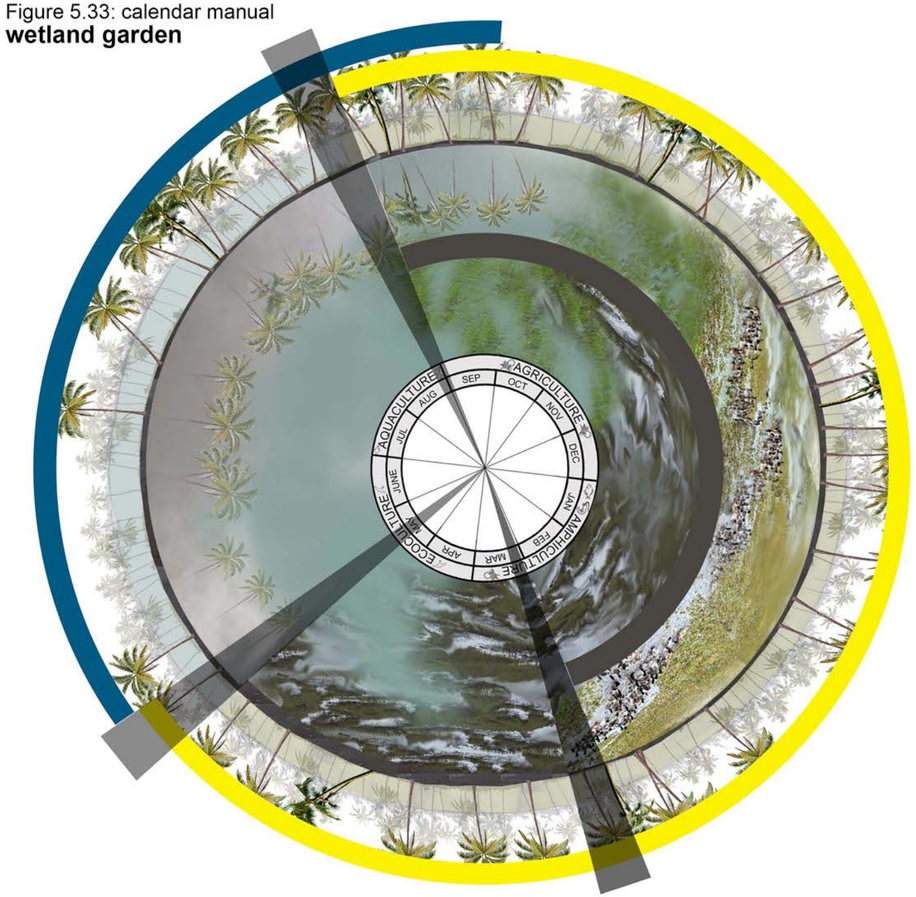


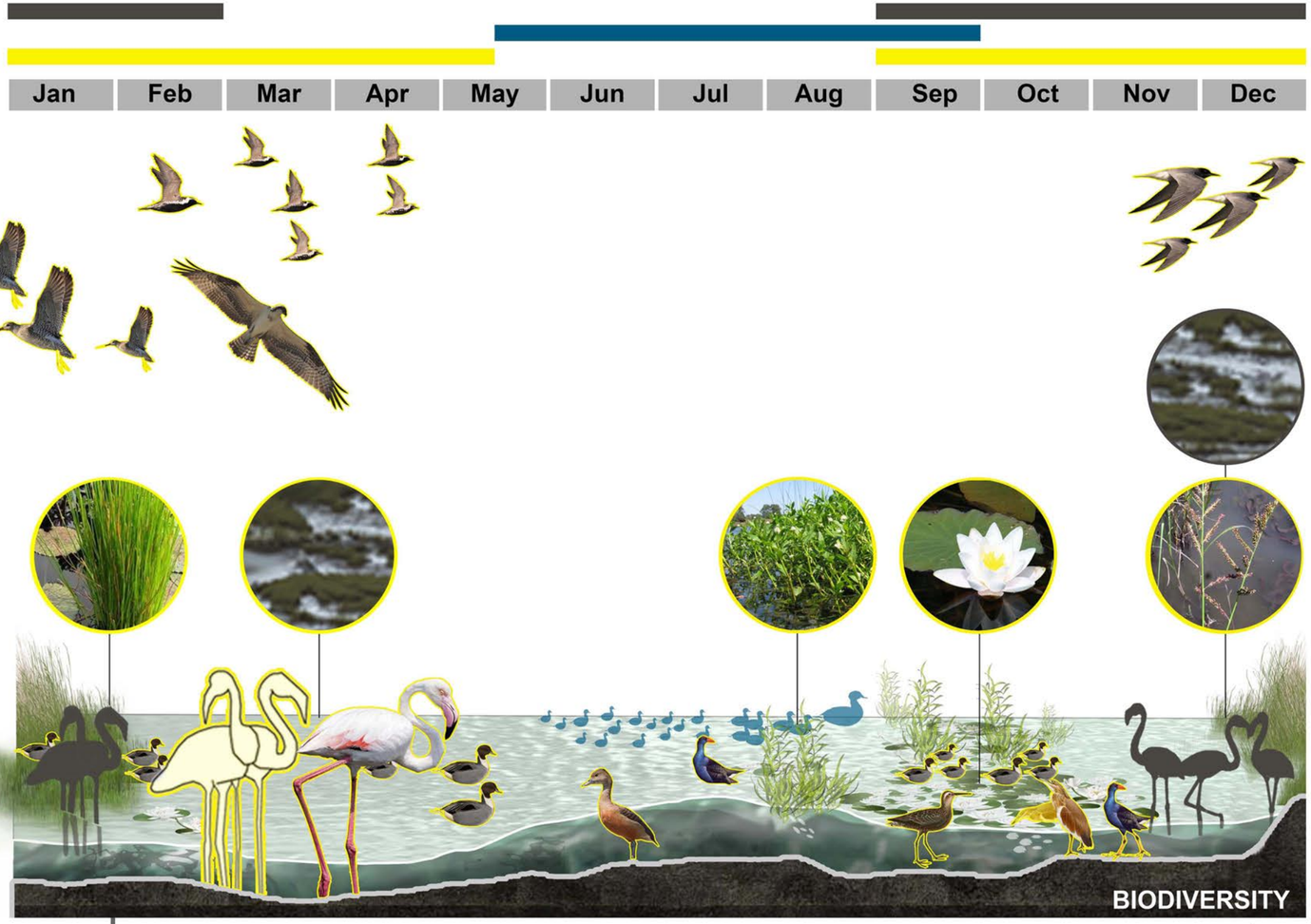
POSSIBLE DECISIONS

DRAIN by operation of the dewatering motor pump and
FLOOD by opening the sluice gate

CALENDER

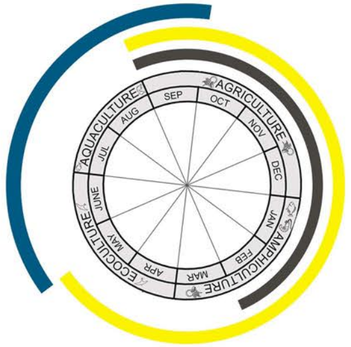
Figure 5.33: calendar manual
wetland garden





SPATIAL QUALITIES

PADDY FIELDS



UNDISTURBED

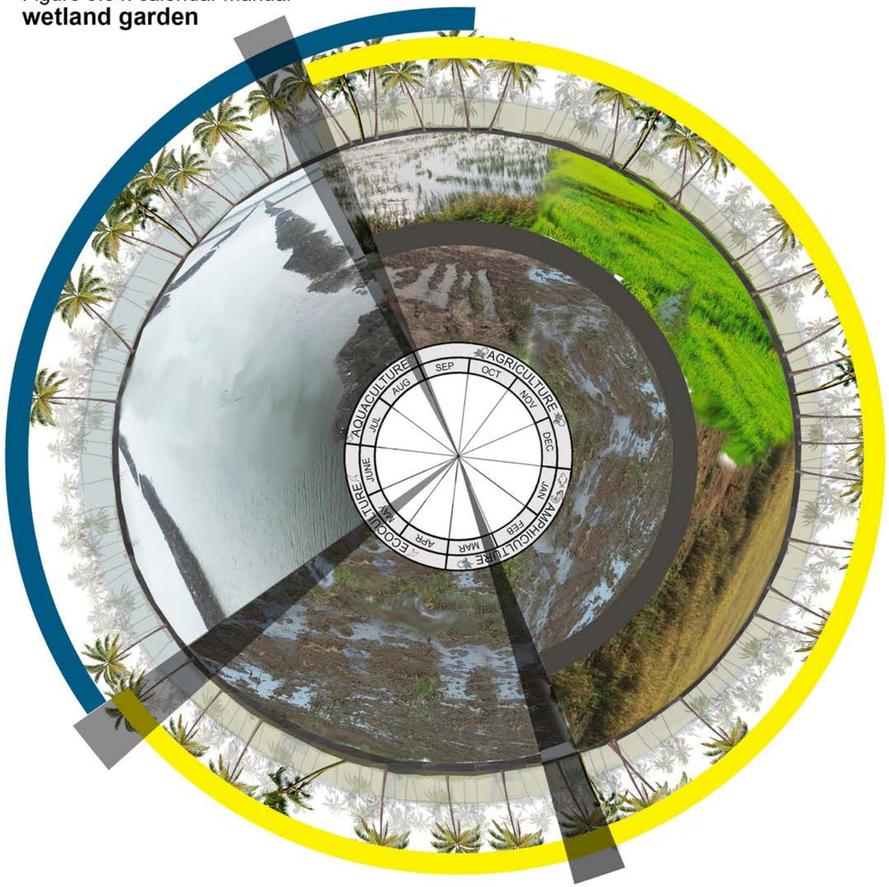
FLOOD

DRAIN

CALENDER

Figure 5.34: calendar manual

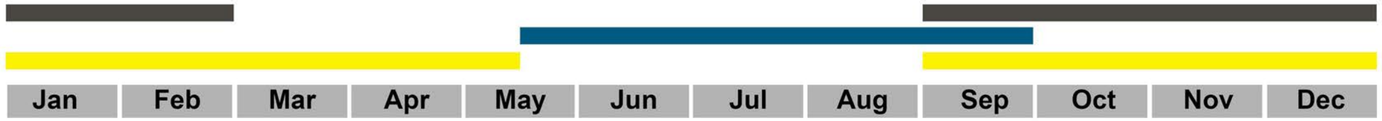
wetland garden



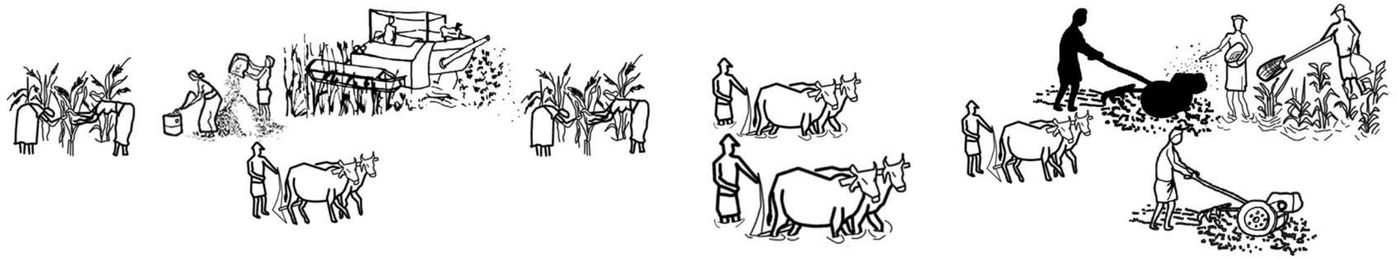
SPATIAL QUALITIES

POSSIBLE DECISIONS

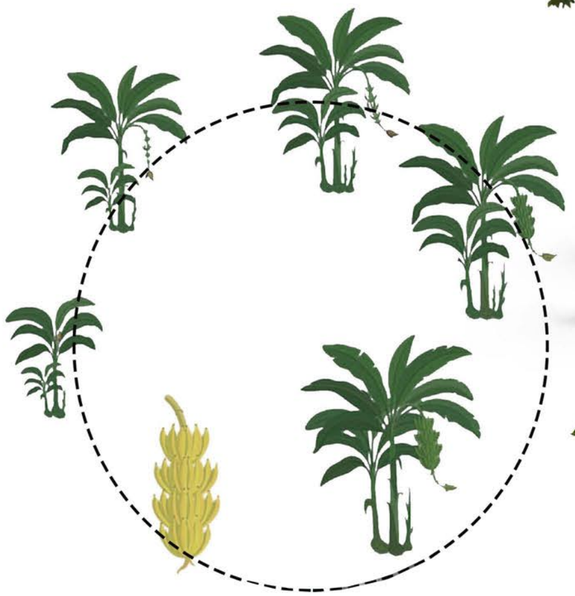
DRAIN by operation of the dewatering motor pump and
FLOOD by opening the sluice gate



SALT BARRIER



5.4.3 **RAISED FIELDS**



The raised fields are obtained by elevating the drier parts of paddy fields which and adjoining areas will be lowered using the cut and fill method to make it suitable for agricultural operations. These fields will remain dry even during monsoon as they are above the high tide water level.

“You can't solve your problems by using the same thinking that got you into those problems in the first place. ”

Albert Einstein

6. THE AMPHIBIOUS APPROACH

Lens	Critical Information	Methods	Scale	Questions Answered
Volatility	Biography	Landscape biographical and historical drawings	Regional, local	1. What are the most critical problems faced by the delta and its inhabitants that need to be tackled? 2. What are the extreme case scenarios the design needs to address?
Hydro-sociality	Stories, Experiences	Soft Atlas, Literature, Oral Narratives	Regional	1. What is the role/significance/ meaning of land and water to the people? 2. How does the society organize themselves to manage natural resources? 3. How does the natural resources respond to man-made processes? 4. How can you reconnect people with nature?
Rhythm	Biodiversity, Climate, Social Activities and Events	Analytical Sections depicting time-based characters	Regional	1. What temporal patterns in the landscape are critical to the identity of the delta? 2. What is the pulsating temporality behind the relationship between man and water?
Wetness	Topography, Hydrology	Experimental mapping, modelling, satellite imagery analysis	All, more prominent in local	1. What is the micro-topography of this low-lying landscape? 2. What are the site-specific processes that are key variables in the topographical definition of the delta?

Table 6.1: lens approach

takeaway from lens approach

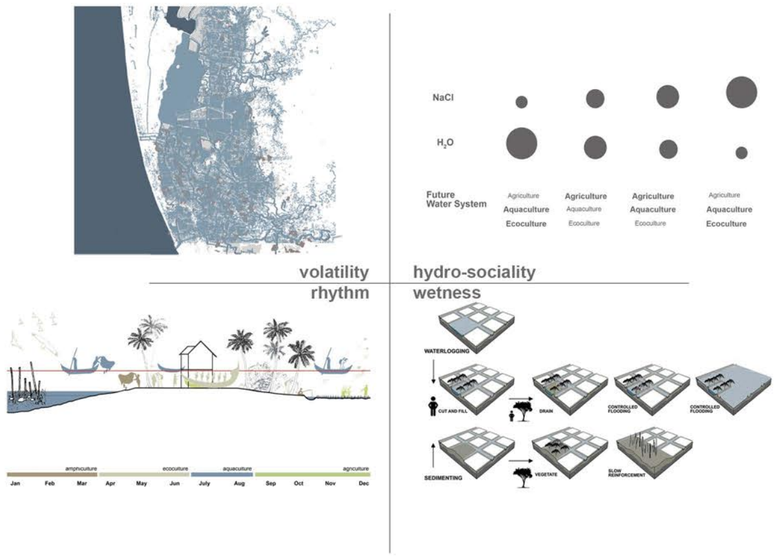


Figure 6.2: lens approach

design principles derived from lens approach

6.1 SCIENTIFIC RELEVANCE OF METHODOLOGY

The four-lens approach: A new analytical approach is proposed to the study and design the life in delta: Volatility, Hydro-sociality, Rhythm and Wetness. Table 6.1 describes comprehensively prime facets about the lenses when applied in the field of landscape architecture derived through a research with design and design with research approach.

To begin with analysis of the volatility of the delta will delineate the anthropocentric activities that shaped the delta. A critical reflection of these changes would explore the hydro-social relations manifested in these processes. On identifying the relationship between the natural and social processes there exists a need to understand the recurring patterns within the spatiotemporal extent of these processes. Ultimately, the design principles arrived from these lenses are:
1. Extreme case scenarios 2. Relationship between man and water 3. Temporality in the identified relationship 4. Site-specific physical processes shaping landforms respectively as shown in figure 6.1. These principles will form the basis of an adaptive design framework for a flexible landscape that will be guided by the dynamics specific to the particular delta, in this case the Kuttanad delta. The lens also puts forward dedicated vocabulary for elucidating the amphibious approach. They are:

New Spatial Vocabulary: The wetness analysis gives rise to the new spatial vocabulary of Kuttanad. These typologies are based on the new fluid geographical or amphibious approach this project embraces. It was done on an experimental basis through mapping and modelling.

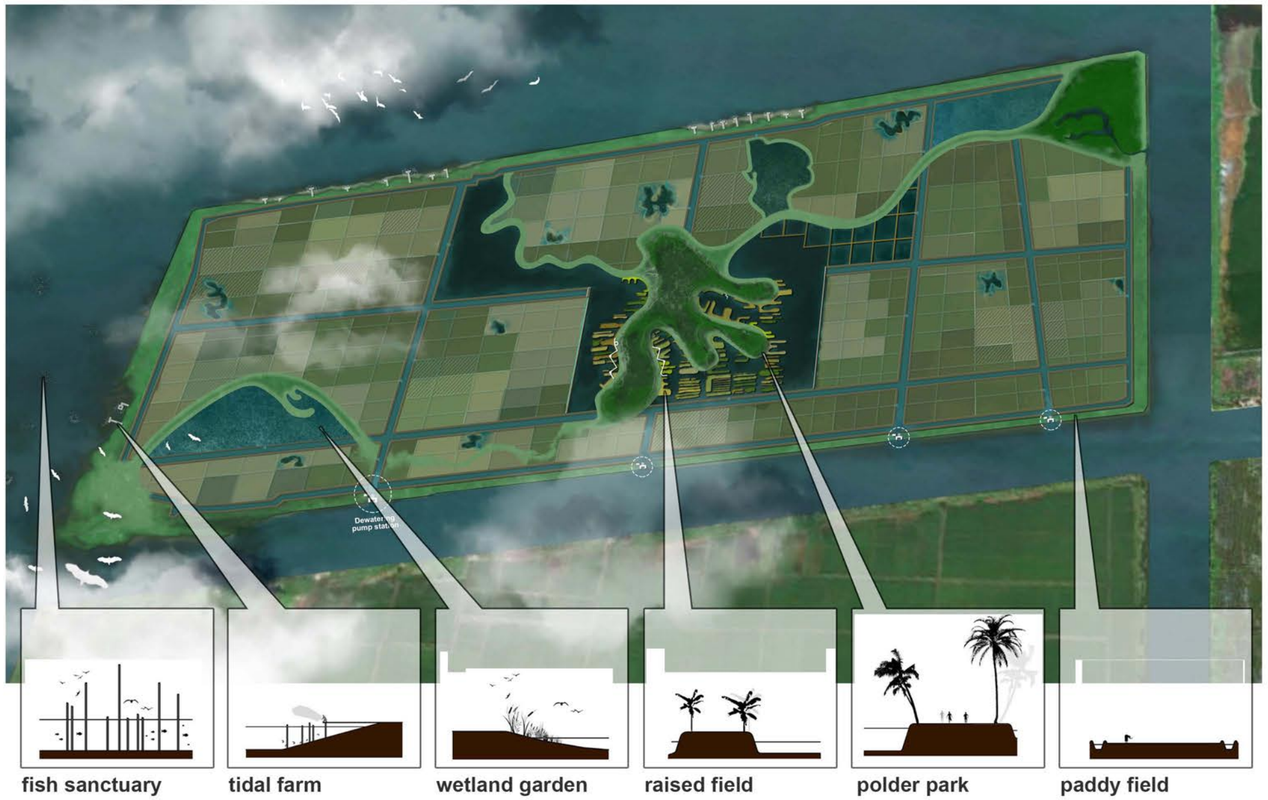
Wetness Gradients: The new spatial vocabulary was useful to classify the landscapes based on differing degrees of wetness and dryness.

Water Calendar: Water calendar had segregated zones for decision making and information. By varying the decisions and operations based on input conditions like water and salinity levels the mutual effect on other conditions like the biodiversity and materialization of the landscape could also be read.

Amphibious Landscapes Matrix: The different strategies for dealing with the wetness gradients resulted in a matrix of amphibious qualities. These qualities were formulated after testing the design principles.

Overall, the lens approach is very effective to understand the amphibious character of the landscape and can be used as an alternative to terrestrial centric approaches to analyse and design life in deltas in the field of landscape architecture.

6.2 **DERIVING AN AMPHIBIOUS SPATIAL VOCABULARY**



proposed typologies

existing conditions

Figure 6.3: reflection
amphibious typologies

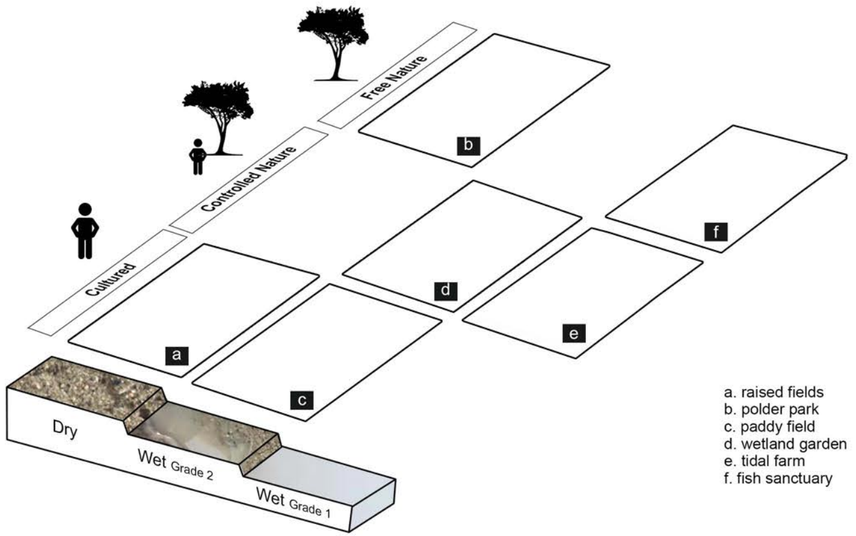


Figure 6.4: combining spatial typologies and maintenance strategies
matrix of amphibious typologies

The new approach puts forward a rethinking for categorizing spatial typologies, i.e. to attribute wetness gradients to the existing typologies. This will be a more useful way of classification and accordingly these qualities maybe transformed into amphibious structures as shown in figure 6.4. By attributing wetness gradients to management strategies as shown in figure 6.5 a matrix for amphibious structures maybe devised. This matrix is very specific to the Kuttanad deltaic landscape but very generic to any location within the delta and can act as a tool for slow landscape transformation of the rest of the Kayalnilams. These qualities will add to the diversity of the site showcasing which is otherwise a mono-functional landscape practicing paddy farming.

6.3. CAPACITY BUILDING

PARTICIPATORY URBANSM

As the proposed amphibious qualities are allowed to evolve over time, the management of these qualities will strengthen the community ties, gradually, another significant addendum envisaged through slow landscape architectural transformation. Here, the stakeholders are the government, schools and higher education facilities and the inhabitants. While the former two merely acts as the facilitators, it is the inhabitants who ultimately carry out the transformation. All these qualities are constructed and maintained by the local inhabitants as shown in figure 6.5. They are also part of the ongoing research and policy making through community appraisal strategies. These appraisal strategies include participatory resource mapping, water quality monitoring, resource condition mapping, analysis of utilization patterns etc. as shown in figure 6.5. The government will set this in motion by organizing regular stakeholder meetings, offering training programmes which can be conducted in the polder parks. The polder park here acts as a space where communities can interact. The inhabitants will use their indigenous knowledge to evaluate the health of the proposed amphibious qualities. For example, by observing the biodiversity near fish sanctuaries some information may be arrived at regarding the quality of water. The fish sanctuaries here act as a bio-indicator.

Ultimately, this will feed the loop of design and research, a design by practice methodology. The findings from the appraisals can be employed to update the adaptive design calendar and make it more scientific and user friendly. The schools and education facilities will systematically employ students to be a part of this process through educational programmes and awareness campaigns. Nature education and skill development regarding maintenance of the proposed amphibious qualities will be part of their curriculum. Hence, this participatory urbanism will empower the inhabitants by instilling a sense of ownership and belonging with strong community values.

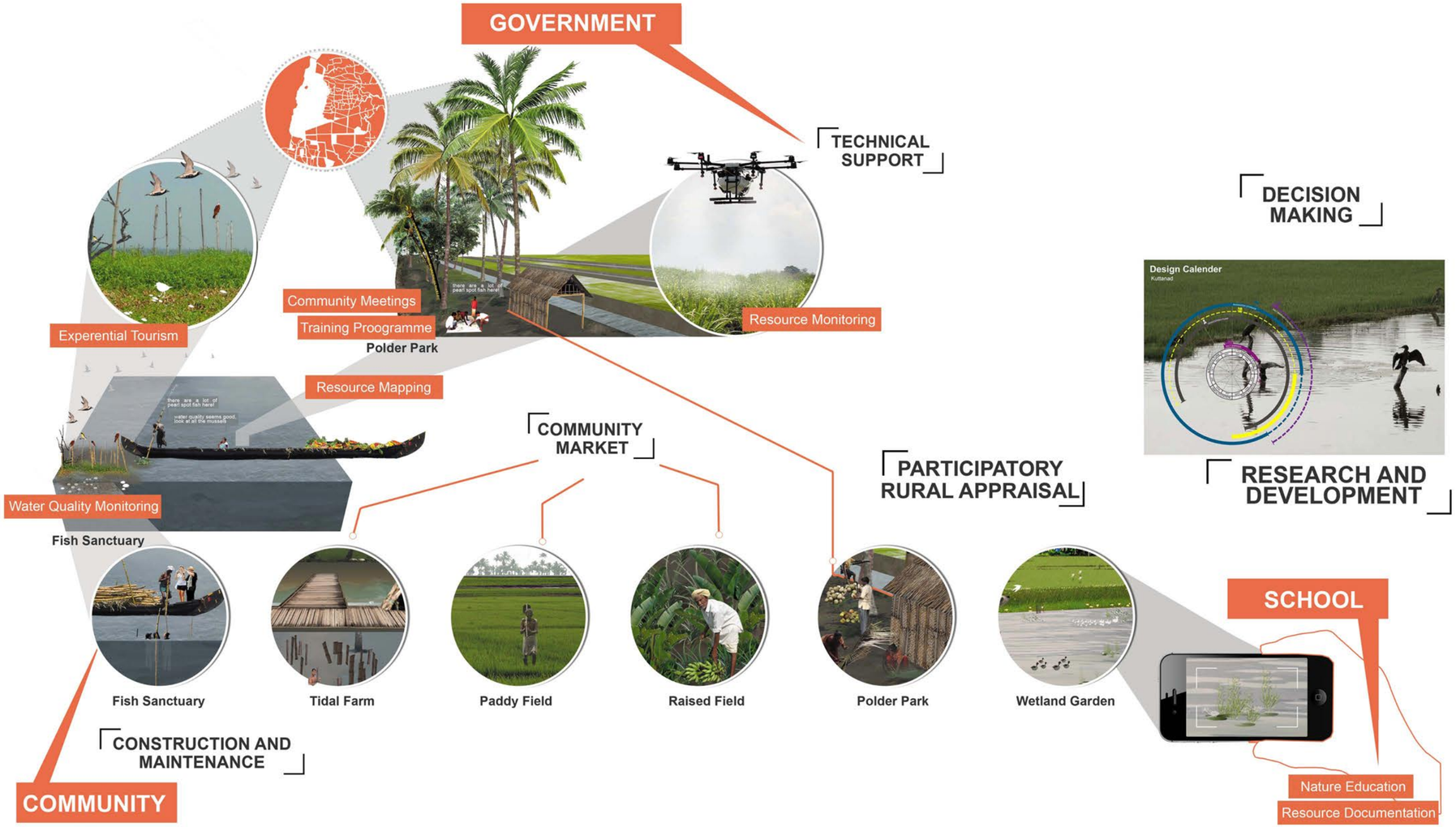


Figure 6.5: reflection
participatory urbanism

Figure 6.6: critical reflection
value comparison analysis

6.4 **VALUE ANALYSIS**

Although all the proposed typologies add to the spatial diversity of this landscape along with being amphibious it is important to understand the benefit of these interventions. While the paddy fields and polder parks were existing typologies, the other four are newly introduced. The newly proposed typologies were analysed critically to evaluate their performances and delineate any shortcomings if any to feed into the design with research and research with design loop through a value analysis diagram. Values were analysed under four themes: ecological values, hydrological values, social values and economic values. The main values to be checked for were flood resilience and economic outcome as entailed from the design question. All the typologies fared well under the flood resilience category, with the wetland gardens being the most effective for the same. However, when it comes to economic values, wetland gardens and fish sanctuaries showed nil value although they were very high on ecological values. On the other hand, the paddy fields, raised fields and tidal farms showed highest value under this category.

Among these three typologies, the paddy farm and tidal farms were more valuable as they had more social values as well. Though paddy fields are the strongest identity of this landscape when it comes to ecological values it was not adding any. On the other hand, the tidal farms were very high on ecological values as well. This means that the tidal farms which is a newly introduced typology maybe deemed as more valuable in the future especially when it comes to sea level rise in a deltaic context, where water will act as the new ground. Ultimately, these amphibious structures have been proved to be very valuable with multiple advantages which will add to the quality of life and space in this delta, which was the main intention behind the research question.

“How to create a flexible landscape by redefining the relationship between land and water in order to improve the quality of life and space in a Delta?”

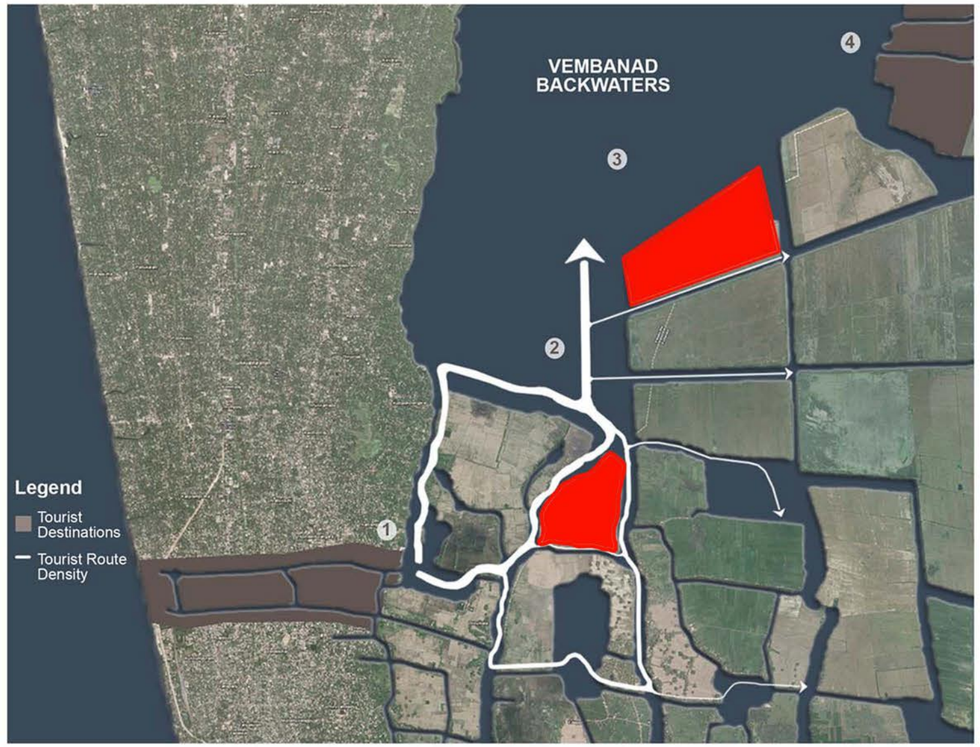


Figure 6.7:zoom in site
choosing new site to test the design feedback

6.5. GENERALIZING RESULTS

6.5.1. DESIGN FEEDBACK LOOP

The proposed four-lens approach can be applied to any other real time scenario with similar challenges, especially deltas, in order to create a flexible landscape. Through the research by design and design by research methodology, six typologies of amphibious qualities were devised. These spatial qualities are specific to the deltaic landscape of Kuttanad but at the same time are generic to any site within this delta. A critical reflection of the performance of these proposed qualities was established through a value analysis. The main values to be checked for based on the design question were flood resilience and economic potential. While all the qualities fared well in terms of flood resilience, the wetland gardens and fish sanctuaries fell short on economic values. But the fish sanctuaries facilitate aquatic diversity and increased number of species. Hence, it indirectly contributes to economy by enhancing the availability of aquatic species. On the other hand, the wetland garden does not add to the economy in any way. **Taking this as an analytical reflection in the design feedback loop for a design with research and research with design methodology another test location was identified along the proposed route for tourists as shown in figure 6.8 to explore the economic potential of wetland gardens.**

Different types of possible economic activities

1. **Floating gardens**
2. **Fish farms**

The two main economic activities characteristic to this delta is agriculture and aquaculture. Floating agriculture is a relatively new practice for the inhabitants and require more knowledge and experience while maintaining. It could probably be implemented in real time scenario to check for its feasibility. Correspondingly what best fits within a wetland garden will be fish farms because they have an inherent potential to trap fishes entering the polder during high tides and the inhabitants are familiar with aquaculture

6.5.2. **DESIGN PROCESS**

Step1. Analysing the wetness gradients of the selected Kayalnilam

To begin with the satellite image was investigated to identify patterns of wetness and dryness. These patterns were compared to that of the wetness matrix as categorized based on the sandbox experiment from chapter 4; figure 4.20. This approach is used for analysing the micro-topography or hidden terrain of this Kayalnilam.

Figure 6.8: identified Kayalnilam
satellite imagery analysis

Source
Available at https://www.google.com/earth/
Accessed in July 2020

Step2. Delineating areas suitable for a wetland garden

From the research through design process in the first test location the wetland garden is defined as a spatial quality created by applying the cut and fill strategy to wet degree 1 patterns.

Step 3. Finding a location closer to a dewatering motor station.

Adding to this condition of wetness, if aquaculture is to be made economically viable there needs to be a tidal inlet close to the wetland garden to ensure that there is enough availability of fishes The area shown in figure 6.6 is close to the dewatering motor station and hence is suitable for a wetland garden.

Step 4. Consolidation of Patterns of Wet Degree 1 in the identified area

The identified patterns should be consolidated with other similar patterns to make more room for water.

Figure 6.9: identified zoom in site
consolidating patterns of wetness

Step 5. Cut and fill to create a wetland garden lined by a polder park

Step 6. Installing a filter that traps fishes during high tides near the inlet at the dewatering pump station so that all the incoming aquatic species can be directed to the nearby wetland gardens

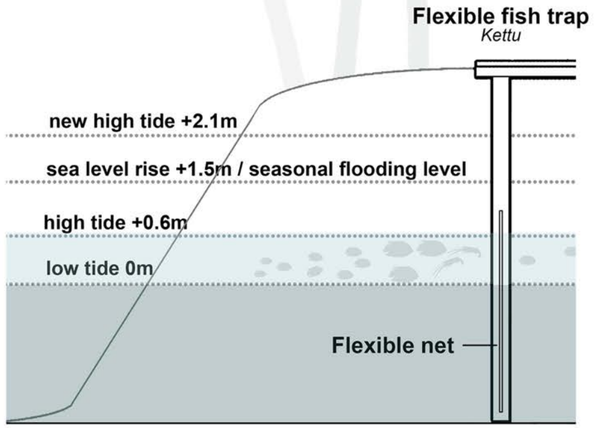


Figure 6.10: design exploration as a reflection
proposed wetland garden based on design feedback loop

Step 7. Use of Water Calendar to manage

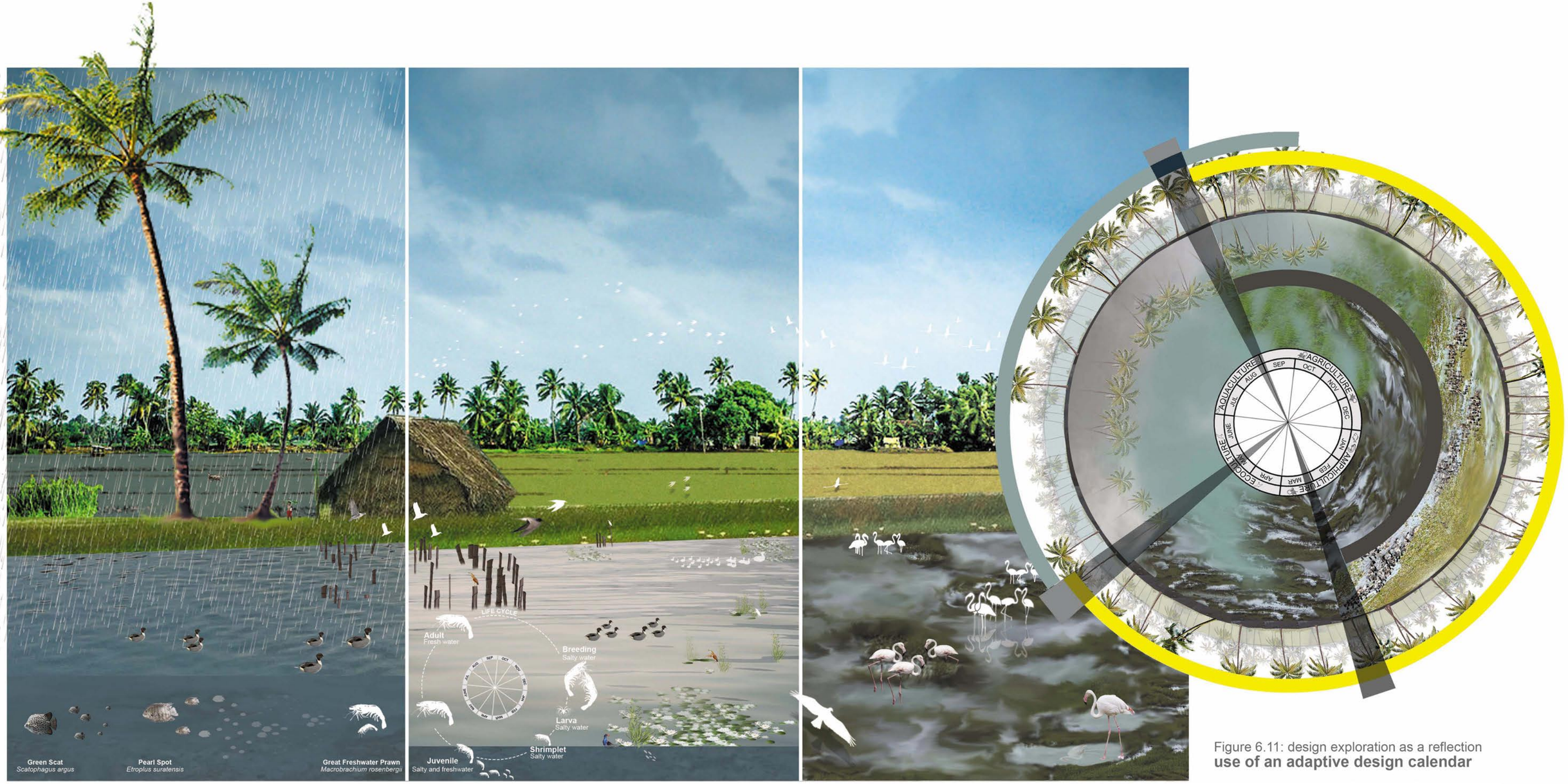


Figure 6.11: design exploration as a reflection
use of an adaptive design calendar

The adaptive design calendar is designed using results from the test locations. The different strategies to be taken are differ according to the scale of magnitude and also depending the type of amphibious structure

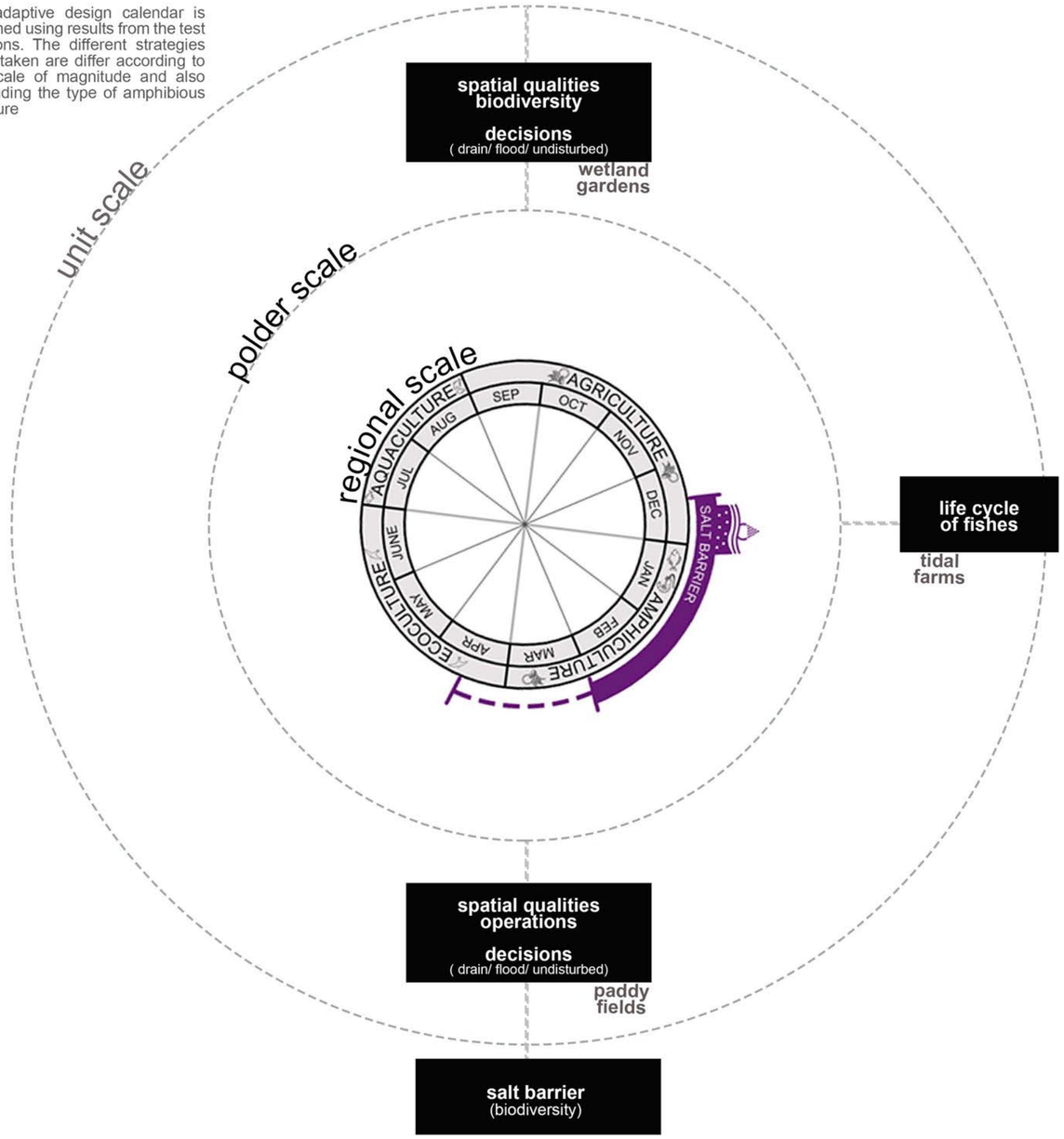
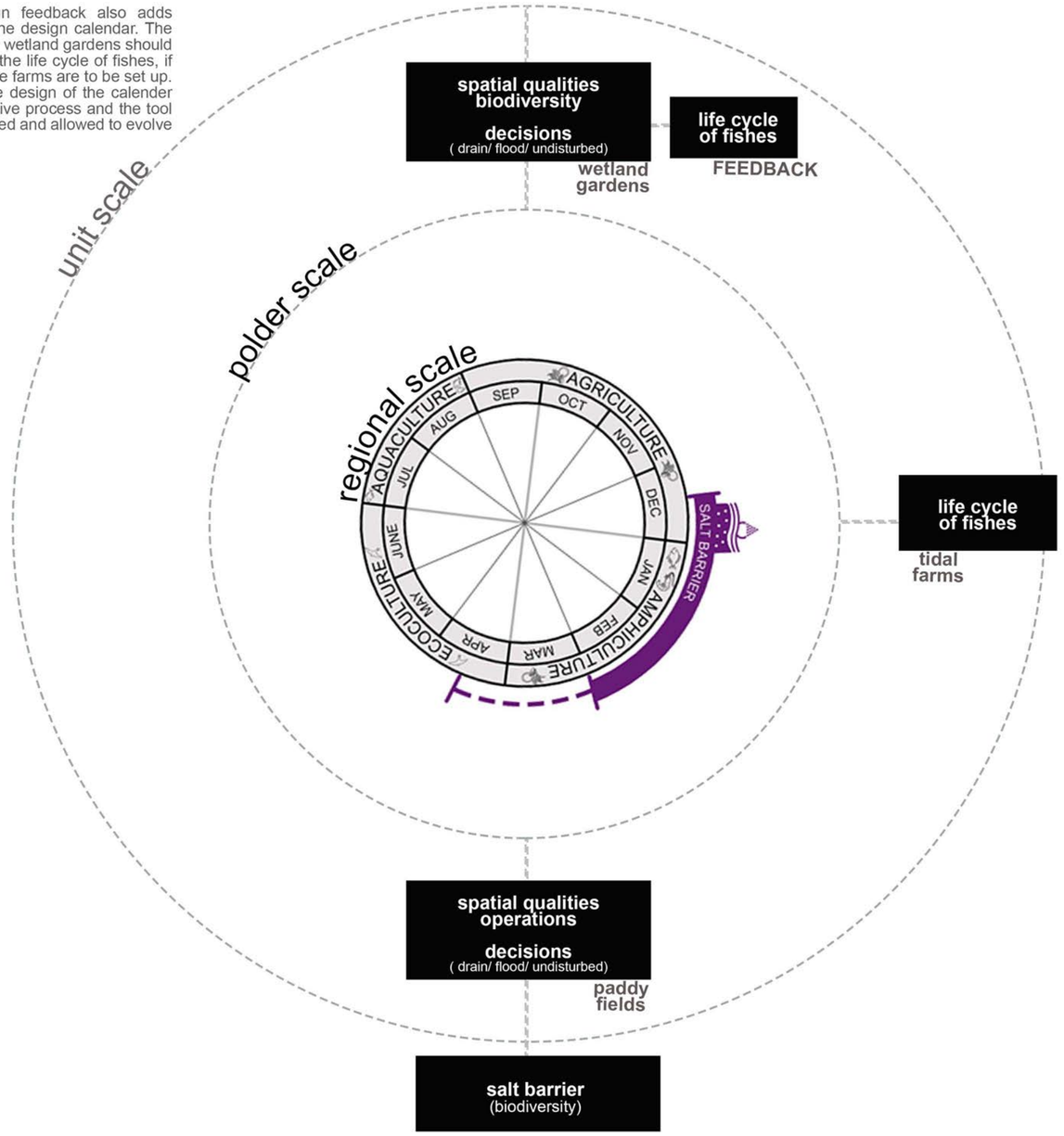


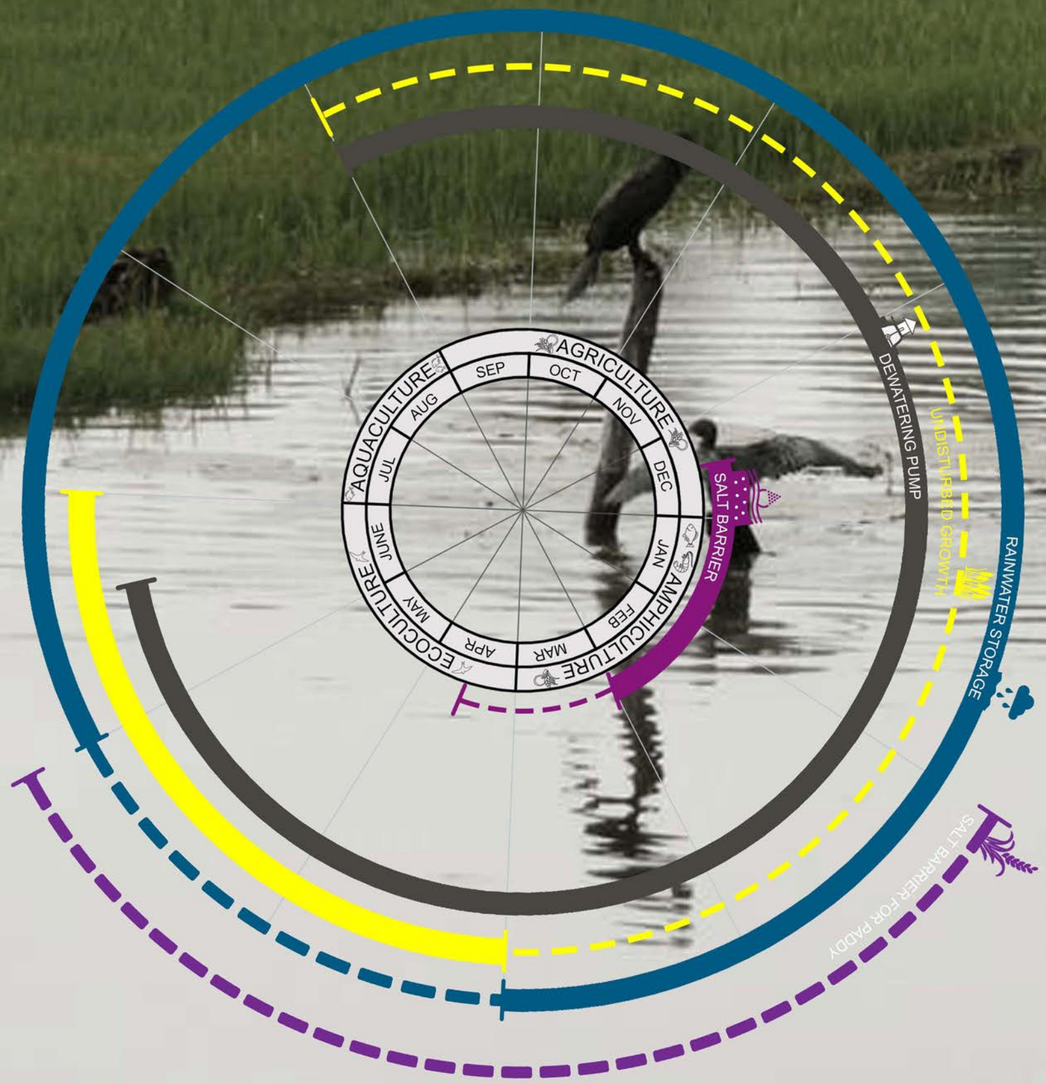
Figure 6.11: design exploration as a reflection
proposed zoning of an adaptive design calendar

The design feedback also adds layers to the design calendar. The manual for wetland gardens should also have the life cycle of fishes, if aquaculture farms are to be set up. Hence, the design of the calender is an iterative process and the tool will be tested and allowed to evolve over time.



Design Calender

Kuttanad



“Landscape as an object” to “Landscape as a situation.”

Author

7. A NEW PARADIGM

“Landscape as an object” to “Landscape as a situation.”

Author

7.CONCLUSION

In totality, the study brings to the foreground, a radical departure from the tenets of classical approaches in geomorphology, geography as well as landscape architecture that deemed land and water as fixed objects confined within well-defined boundaries. On the contrary, land and water are different materializations or physical forms of a continuum of matter alternating between varying degrees of wetness and dryness. This concept is more illustrative when it comes to amphibious landscapes where land and water are objects continually in transition, personifying a tangible image of a given situation. This quintessentially points to a shift in theoretical foundations: from “landscape as an object” to “landscape as a situation”.

This paradigm shift should also be reflected in the practice of landscape architecture, where the design proposition put forward by the landscape architect would essay a process rather than a fixed plan. This design will be based on a logic with a certain degree of anticipated speculation substantiated by both data and a systematic understanding of the site context from the four-lens approach. While the lens of wetness encapsulates the spatial dimensions, the temporal dimensions can be derived from the lens of rhythm. Also, landscape architects conventionally relies on two-dimensional drawings for translating an architectonic design on site. As a matter of fact, these drawings are simply for the purpose of visual communication of three-dimensional qualities and often disregard the dimension of time. The adaptive design calendar or water calendar is a very site-specific tool that can be used for both visual communication and decision making regarding the function, quality and diversity of space and life in a flexible landscape operating within the spatio-temporal context of any deltaic region. Ultimately, it will guide to gradually build a complex narrative of how humans and nature exchange roles between being makers and takers of the landscape over time. On the other hand, the role of the landscape architect is to facilitate this narrative by envisioning a slow landscape architectonic transformation.

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