PROTEAN LIVING
ADAPTING TO THE CLIMATE CRISIS

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ABSTRACT

The timescales of the Earth's climatic processes are slow. Even in the best-case scenario, if we cut down all carbon emissions by 2050, we are still looking at 1.5oC of warming. Presently, at 1oC of warming, and 415 ppm of carbon [1], these impacts are already catastrophic. As these numbers translate into real life climatic disasters, people across the globe are in search of safer lands and better opportunities. However, not all communities have the same capacity to move away, and those in fragile areas, who have had minimal contributions to this problem, and are living in poverty are most vulnerable to the impact of these changes. We need to bring to realisation, a world where everyone has the ability to combat this crisis.

The objective of this dissertation is to study the impact of the changing climatic patterns on the people on the frontlines in India, specifically the coasts. The study also looks at adaptation tactics across a wide spectrum- from indigenous techniques to modern technology. It also explores methods of polyvalent adaptation, including the scope of migration as a strategy. The dissertation assesses the scope of the built interventions in adapting to the crisis.

To face the greatest threat of our generation, we have to learn to adapt. Today, there is a need for new infrastructure with the ability to adapt to this new normal, to be designed and constructed. The framework for this infrastructure has to be polyvalent, in meeting current needs and building capacity to tackle future events. The dissertation proposes the use of anticipatory design strategies that are regenerative, and pliable and amphibious architecture that engages with the environment.

INTRODUCTION

Human beings are the only species to have existed for such a short period on earth and altered it so significantly. The early human beings knew to live symbiotically, but that relationship soon morphed into one of discord as the anthropocene progressed. The human impact is so much that we have managed to alter the earth's atmosphere. The Inter-Governmental Panel for Climate Change warns us of the precarious effects of allowing an increase of the global temperature by even 1.5°C above the pre-industrial levels (Masson-Delmotte et al., 2018). Even at 1 °C rise, we are experiencing the impacts of climate change. From increases in global average air and sea temperatures, the widespread melting of ice and the permafrost, the intensification and high variability of extreme weather events, rainfall anomalies, desertification, the acidification of the oceans, and the rising average global sea levels. We have changed the environment so much that we have set a mass extinction into motion. A World Bank report estimates that climate change will transform more than 143 million people into 'climate migrants' escaping crop failure, water scarcity, and sea-level rise by 2050 (Rigaud et al., 2018). Even if we manage to limit the global average temperature rise to 1.5 °C, we will still have to deal with the irregularities it will cause.

NEED FOR STUDY

Elasticity (noun) : the ability of an object or material to resume its normal shape after being stretched or compressed.

Everything has an elastic limit. When pushed too far, that limit is reached, after which the onset of permanent alteration begins. This is known as a tipping point in the climate system. The catastrophic onset of life-altering events has already begun.

Whether we look at small island nations such as Kiribati or larger deltaic areas such as the Sundarbans, we see the plight of their inhabitants- losing houses and sources of livelihood, living on the edge of poverty. What is often found in common amongst these climatic hotspots is that they are the early sufferers of this human-induced disaster despite having a minuscule contribution to the cause of the crisis. The impacts of this climate emergency are going to exacerbate existing vulnerabilities and marginalise the marginalized.

In cities, we see gross mismanagement of resources. From building insensitivity over natural catchments to ill-planned infrastructure of cities. All of this has a cumulative impact on the overall resiliency of the city and its surrounding areas. The further construction of 'fortress-like' projects that keep natural disasters and environmental changes at bay temporarily instead of integrating them into the infrastructural fabric is doing more harm than good. In order to face the greatest threat of our century, it is essential to adapt to change.

AIM

The aim is to integrate the emerging environmental, social, and economic challenges into future resilience planning. The intention is to re-imagine living in a new normal of increased natural calamities, food shortage and water crisis through anticipatory methods that are humane and endurable, and to create alternative methods of sustenance.

HYPOTHESIS

The current efforts toward global climate action do not look promising. In order to survive the inevitable: higher temperatures, droughts, rising seas, fiercer storms, more unpredictable rainfall, and more acidic oceans, we need to design a climatically adapted society- where instead of resisting change, we Anticipate and Adapt.

METHODOLOGY

The initial background study was conducted using existing research papers and data online to understand the climatic hotspots of India and their geographical and climatic timeline. Following this, live case studies were carried out at identified sites: 5 coastal settlements in 24 South paraganas in West Bengal, including Bakkhali and Beguakhali and Devbag in Maharashtra. To carry out the study, at least 10 residents were personally interviewed in each village. The aim of the survey was to understand the socio-cultural and economic practices of the communities and the direct and indirect distresses caused due to the climate crisis. In 24 South paraganas, this also involved mapping the impact of previous cyclones and understanding the subsequent adaptation techniques. In Devbag, the first study focused on understanding the social and economic fabric of the village. All the live case studies pointed towards a grave problem of water. During this period, existing impacts of environmental and anthropogenic changes on communities using available data and satellite images were mapped out. Local, traditional methods of combating natural adversities and understanding the ecosystem's regenerative processes were also studied.

Online case studies were carried out to study various techniques of adaptation which included nature-based solutions such as wetland restoration, Sponge Cities, CALTROPe and soft infrastructure; infrastructure solutions such as Climate Tile, POP-UP: All-purpose flood shelter; investigation of native techniques which was done through live case studies; and exploration of migration as a design strategy through existing projects.

All these studies concluded that Devbag, Maharashtra would be an ideal pilot village as it represented many coastal villages in India. In that, the village, like many in India, has turned its economic base away from fishing towards tourism. It is a peninsular sand-spit of a gradual ever-changing nature. Devbag is situated on a 3.5 km long extended piece of land that projects from Tarkarli. The peninsular land lies between the mouth of the Karli river and the Arabian sea. The village is at an approximate elevation of 5 metres above the mean sea level. This means that it is susceptible to rising sea levels. Along with that Devbag has seen a steep rise in the number of environmental events and the destruction that ensues.

Field visits were carried out that focused on identifying potential sites for intervention through interviews and consultation with the residents, local experts and local bodies. These site visits revealed more information about the polluted groundwater table, and a gradually receding coastline. Factors that were studied included topography, historical landform changes, salinity of soil, sea level rise as per the IPCC SR6, mapping of existing infrastructure, wind analysis and impact of previous environmental events. All of these factors led to the generation of a vulnerability mapping that identified 3 sites on the village.

DISCUSSION

The climate breakdown is a process whose outcome is unknown. This situation has no precedence. Adaptation therefore has to be polyvalent. Durability and functionality of structures need to be reassessed, especially their purpose and reaction with the environment. People on the coasts have a better grasping of water than anyone else. Interactions with water ar[illegible]

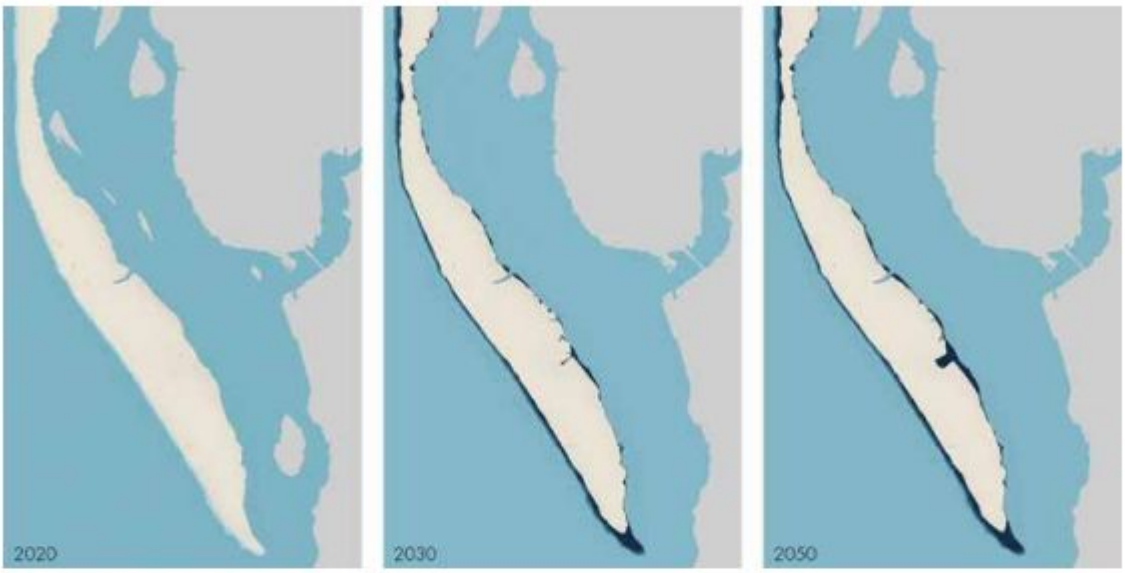


Figure 1- Mapping of sea level rise as per the IPCC SR6

Figure 2- Infrastructure mapping of Devbag (by Author on the base of Googel maps)

Figure 3- Mapping of soil salinity (Source: Pisolkar (2008)

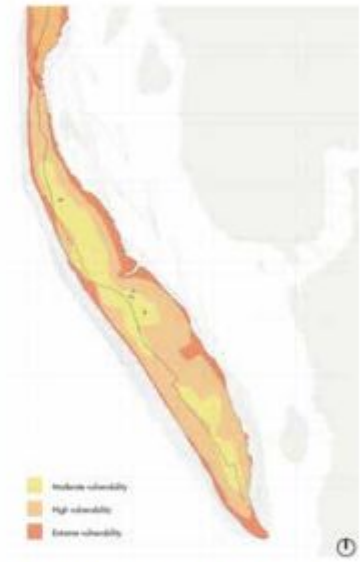


Figure 4- Vulnerability mapping (by Author on base map by Pisolkar (2008)

tegrated into their socio-cultural and economic fabric. For the viability of any design proposal in this context, it is crucial to understand and interact with water. An important outcome of all case studies was the interdependency between the two types of water- fresh and salt. The salt water provides the residents of Devbag with their livelihood while the fresh water enables their survival .Where there is too much water, there is also very little water. The design proposal harnesses this to suggest small scale interventions that are woven into the ever-changing nature of the village and the water. The proposal looks at protean living. It incorporates the ideas of regenerative systems, the pliability of structures and amphibious building to propose a design that modifies and enhances existing public infrastructure in the village to make it resilient, for it to act as a shelter when disaster strikes, and to function as a refuge when the time for migration comes.

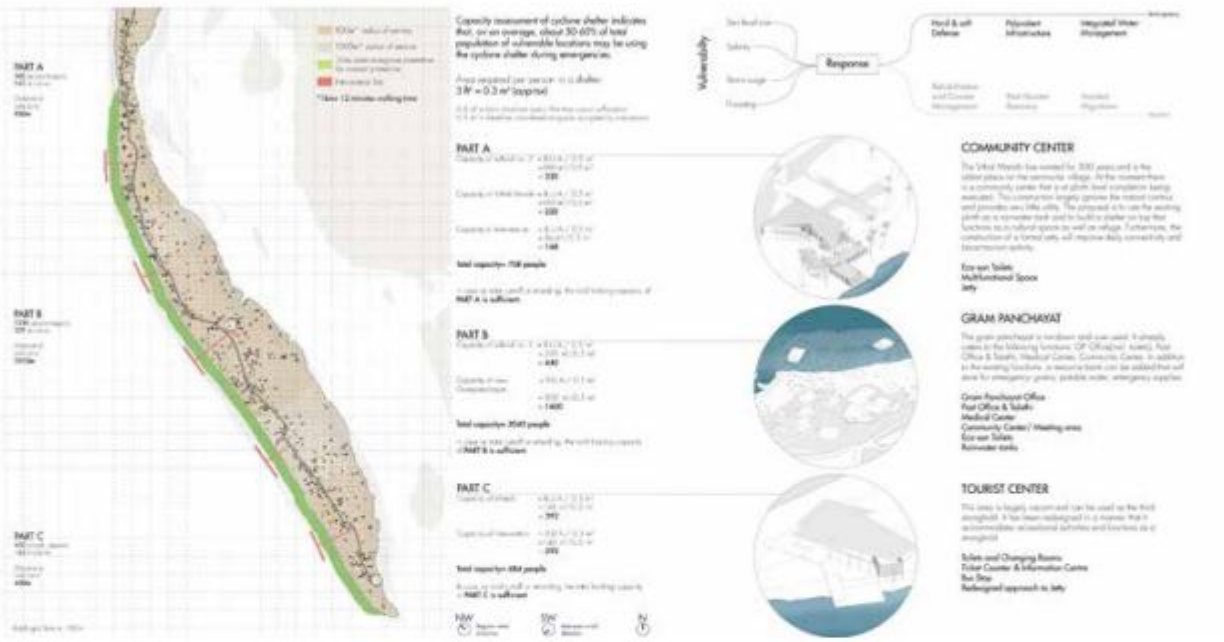
Regenerative systems are systems that not only help with adaptation to the climatic changes, while reducing impacts; they also try to mitigate the issues. A classic example of this is wetlands barriers. Pliability of structures refers to the flexibility of both structures and of the people. It heavily emphasises on the concept of going with the flow. For structures, it implies that the architecture has to be flexible. It needs to allow for the forces of nature to mould it. For adaptation it means that migration has to be looked at through a different

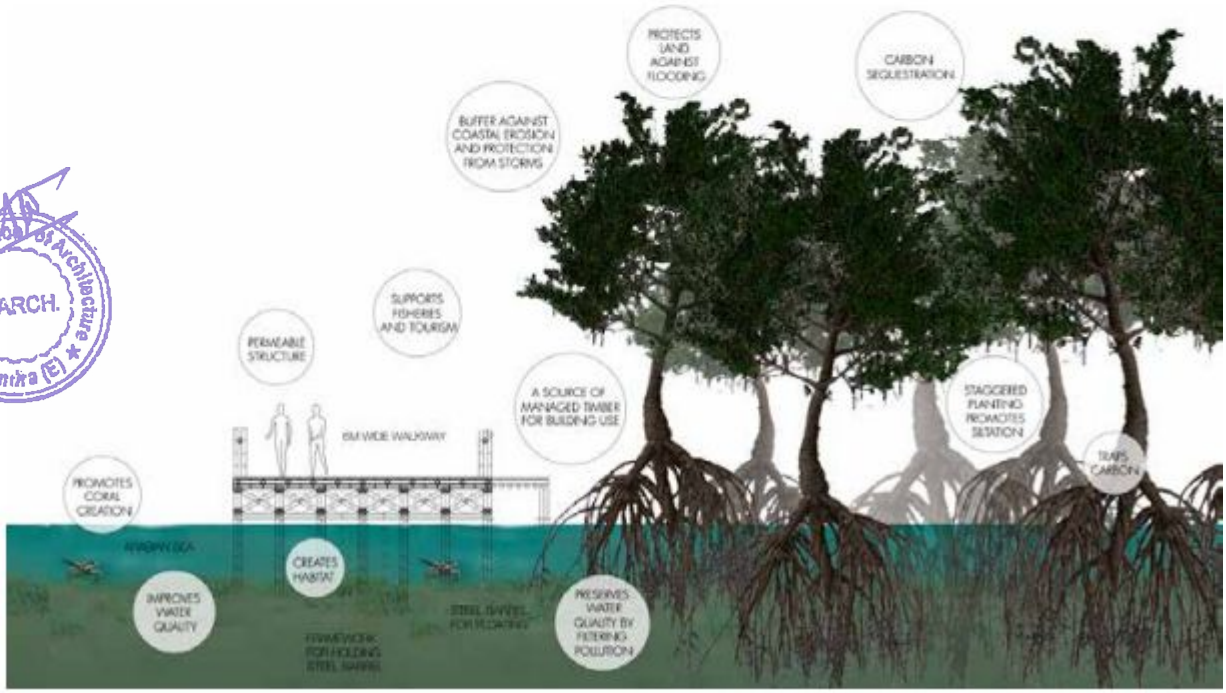
lens. Seasonal migrations should be encouraged and looked at from a new perspective. Amphibious nature refers to the ability to live on both land and water. In the context of climate adaptation, it refers to architecture's ability to engage with water.

While viewing adaptation through the lens of the built environment, anticipatory design strategies are more pivotal than reactive design strategies.

RECOMMENDATIONS

The design draws on the knowledge of socio-logical, economic, cultural and traditional systems of Devbag which are deeply rooted in the concept of 'living with water'. It assumes - on the basis of previous studies - that the peninsula will eventually disappear and makes recommendations for this process. The design proposes a network of soft and hard infrastructure that will provide support for, and navigate through this process of





Top: Figure 5- Design proposal for Devbag (Source: Author)
Bottom: Figure 6- Proposed wetland barrier and walkway as a method of regenerative adaptation (Source: Author)

change. The design will be such that is functions in three main scenarios:

❶ Predicted changes
❷ Natural disasters such as cyclonic events
❸ Once-in-a hundred-year event which will lead to migration

The proposal is to modify and enhance existing public infrastructure in the village to make it resilient, for it to act as a shelter when disaster strikes, and to function as a refuge when the time for migration comes. The program is to meet the present needs of coastal communities and increase their resource independence, especially with regards to potable water. It also addresses issues of increasing tourism, which has become a part of daily lives, such that it does not catalyze ecological damage. The new infrastructure enhances the existing quality of life in aspects of health care, social and cultural gatherings and economic activities.

Top to Bottom: View of the community centre on part A; View of the gram panchayat at part B; View of the tourist centre at part C (Source: Author)

As a part of the overall resilience of the village, the design proposal is a wetland barrier that integrates the functions of coastal defenses and public space. This barrier will span the entire western coast of the village, i.e., 3.5 km stretch with intermittent pockets of an amphibious walkway that gives access to the Arabian Sea. This walkway will function as a promenade for the locals and tourists and as a boat anchor for the local fishermen.

The wetland is rooted in the idea of regenerative systems. They will react to the challenges of the changes in the environment and minimize them. This will function as a carbon sequestration system, and absorb carbon. It will promote coral growth and provide a habitat for fish along with improving water quality. This will in turn promote self-sustenance both ecologically and economically.

The village is divided into three parts of 10-12 minutes of walking distance from the 3 sites. These sites have public structures situated at the highest ground in that region that will act as evacuation points. In part A, the program proposes a community centre near the Vithal Mandir and school no 2, in part B, there is a proposal of a new polyvalent gram panchayat and in part C, the proposal is to build a tourist centre and a jetty.

All architectural interventions in the proposal engage with both seawater and fresh water. The modifications to the existing built infrastructure include creation of water reservoirs to store water harvested from the monsoons. All three structures are made such that they rise and fall with the tidal frequency of the river and the sea. They are designed keeping in mind the wind velocities and directions. All roofs are designed aerodynamically, ensuring minimal impact of the stability and security of the structure. Around these structures, it is recommended to explore the process of phyto-remediation which entails planting shrubs and plants of variety that extract soil from the water and improve the groundwater table. The structures will be made out of locally sourced materials that will disintegrate alongside the landform.

CONCLUSION

The climate crisis is the greatest challenge of our generation. It will exacerbate existing inequalities and create new ones. Architecture can no longer function in isolation and disregard the environment. The biggest problem with designing in isolation, is the creation of hard infrastructure such as embankments, is that they disrupt the existing delta and their smooth concrete surfaces are detrimental to the natural processes of siltation and erosion of landforms. All and any design strategies therefore need to be woven into the landscape. In order for us to combat and overcome the crisis, we need to look at inclusive design that penetrates through different strata and provides a fair chance at survival to all.

Endnotes

[1] The Mauna Loa Observatory in Hawaii, which has tracked atmospheric CO2 levels since the late 1950s, on May 11, 2019 detected 415.56 ppm of CO2.

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