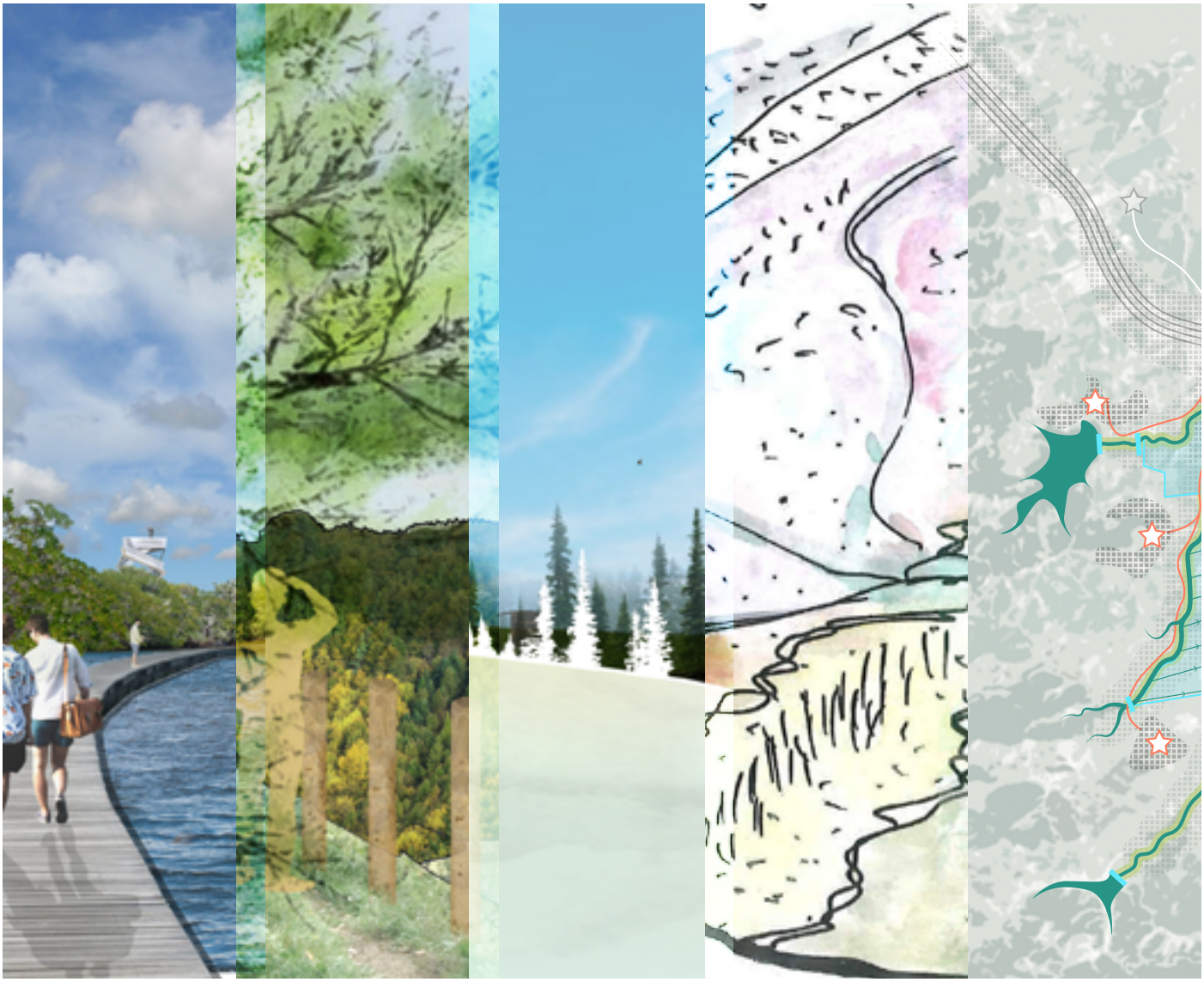
Portfolio

Iris van Driel

BSc Architecture
MSc landscape Architecture



Preface

This portfolio is a summary of the projects that I did during my master Landscape Architecture at Delft University of Technology Faculty of Architecture and the Built Environment. It is a diverse collection of individual design projects, multidisciplinary group work and my graduation thesis, but does not include all the work done. More projects and mentor recommendations are available upon request.

Index

Master thesis

I Biscayne Bay: Turn the tide 5

Projects

II The Curfs Quarry 11

III The Dune 13

IV Landscape components Green and Blue 15

V Limuthi Re-cycle Valley 17

Turn the tide:

"To completely change the direction of something"

Cambridge dictionary of American idioms (2003)

I

Biscayne Bay: Turn the tide

An integrated landscape approach for coastal restoration in Biscayne Bay through spatial and ecological interventions

Project type · Graduation thesis

Date · 2019

Location · Biscayne Bay, Florida USA

Mentors · Dr.ing. Steffen Nijhuis & Yuka Yoshida

Keywords · mangrove restoration, South Florida, Biscayne Bay, landscape architecture, spatial design, flood protection, landscape ecology, social reconnection, design research, design with nature.

The coastline of South Florida has undergone a drastic change in the last century and this has had a major impact on flood safety and natural resources of its inhabitants. Natural coastlines supporting mangrove and wetland have been transformed into seawalls with buildings. It is estimated that in the last 100 years, 40 percent of the mangrove coast and significant parts of wetland, pine forest and sea grass have disappeared.

Mangrove forests stand out to be a future-oriented way of natural coastal defense for South Florida. Although they mainly appear in calm tropical waters, they can withstand and recover from tropical storms. Their unique growth habit with a characteristic root system and branching forms a robust forest, that functions as a natural coastal defense. Also, marine life is dependent on the nursery grounds provided by the root system of the trees and maintaining a healthy fish stock.

We can learn from the past that this forest provides the land with a natural levee and protect against flooding. Also, this natural system has potential to adapt to the consequences of climate change that highly urbanized areas like Miami are already facing and which will increase rapidly in the future.

This research identifies and explores design strategies and principles for the mangrove landscape of Biscayne Bay in order to reduce the flood risk of Miami Metropolitan Area, as well as provides aesthetic, ecological and functional qualities that contributes to the identity and resilience of this coastal region. This is done through design-related-research, that divides this research in two domains. Design research, which consist of a system analysis and examination of best practices and research by design, which involves design experiments.

The result is a layered landscape strategy that contributes to the harmony of the natural coastal landscape of Biscayne Bay and thereby restores its functions. The systematic strategy is converted into a spatial design, applying principles gathered from best practices. This landscape architectural design adds an extra dimension to the mangrove landscape that will invite the residents of the Miami Metropolitan Area to experience through exposure to changes and value its aesthetic and ecological qualities and protective functions.

In collaboration with:

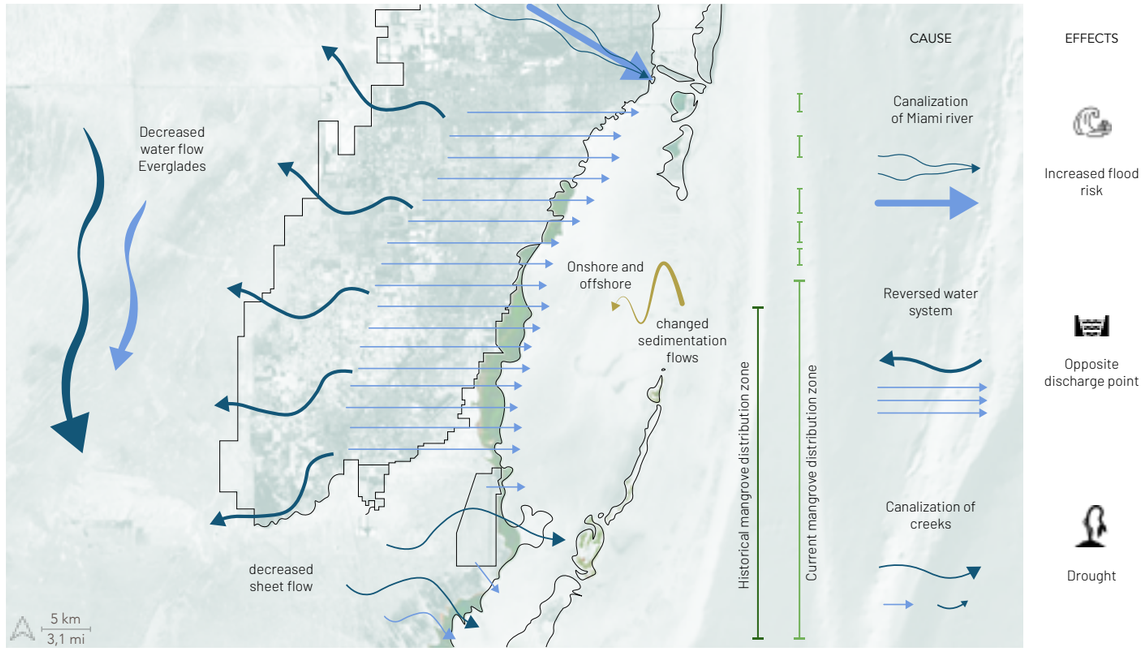


Figure 1. Structure map Biscayne Bay

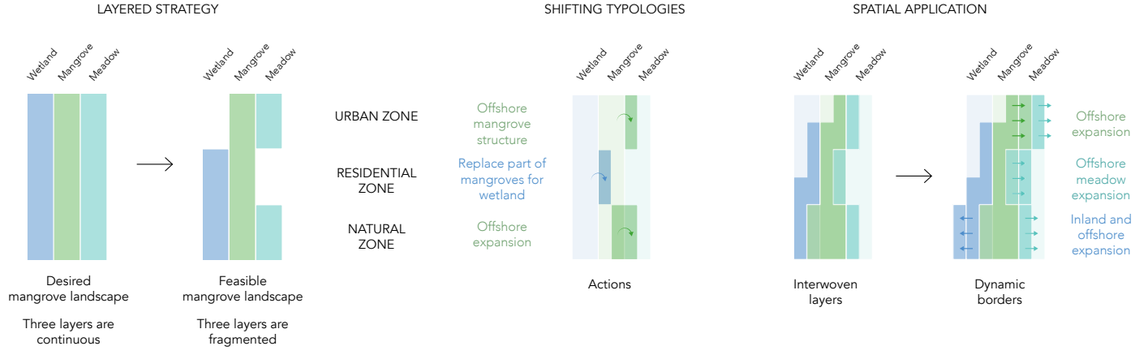


Figure 2. Design strategy

THE MANGROVE LANDSCAPE

The desired coastline for Biscayne Bay is a continuous mangrove landscape, consisting of three layers: wetland, mangrove forest and sea grass meadow. In the current situation, the interrelation between the layers is interrupted by the spatial limitations of the built environment and the canalized water system. Mangroves along the coast are depleted and fragmented, but fig 1. also shows that the distribution area has increased because of the new growth opportunities due to reversing water flows on the ridge. Based on these challenges and opportunities, a feasible situation has been outlined.

This is a fragmented but continuous mangrove landscape, which contains at least one of the three layers. These existing layers and fragments offer the opportunity to restore the desired landscape. The strategy is therefore to preserve, restore and reintroduce the layers in a design for a continuous mangrove landscape with dynamic borders to enable expansion. If there is no space for one of the typologies in the original zone, which is defined by the topography of the landscape, it can be shifted to an adjacent zone and be interwoven with its context. Three zones are identified to develop an specific approach and design.

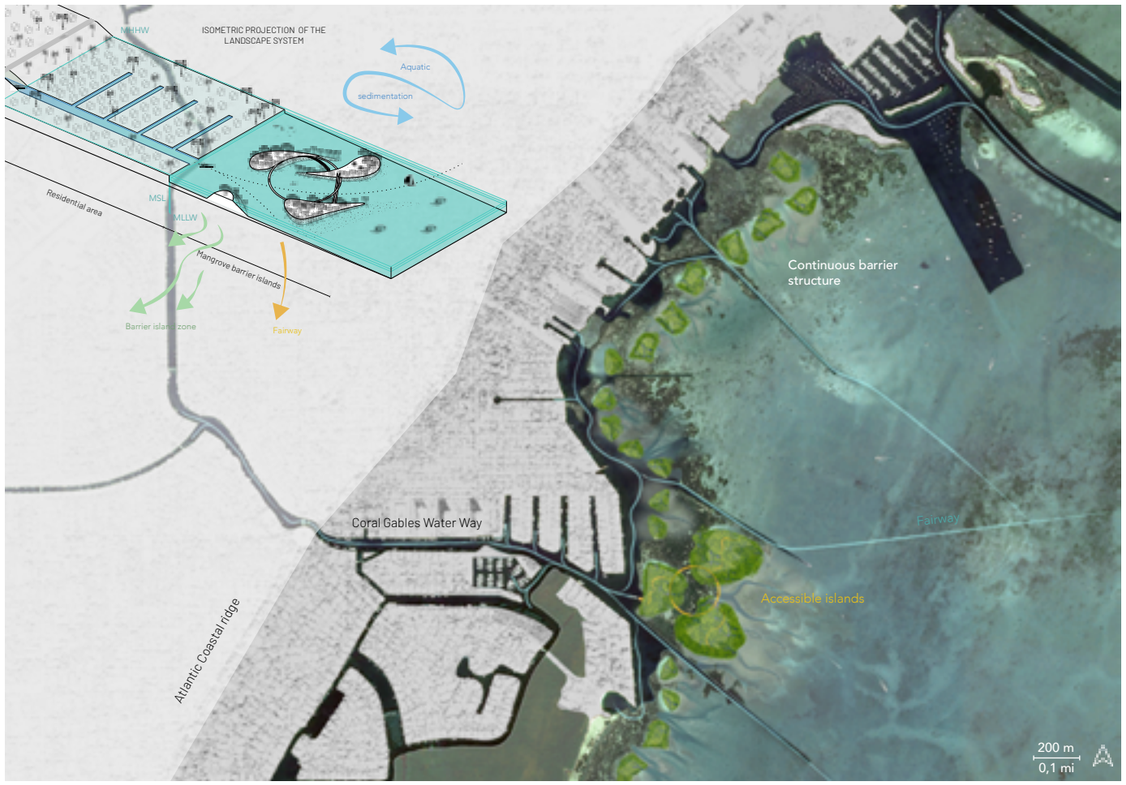
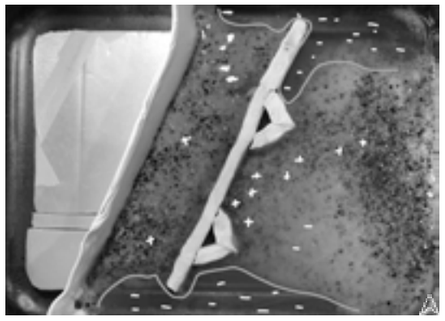


Figure 3 (above). Map of the barrier island structure
Figure 4 (below). Sedimentation experiment



SEDIMENTATION DEVELOPMENT

MANGROVE DEVELOPMENT

MANGROVE BARRIER ISLANDS

In the most northern part of the bay, the mangrove landscape barely exist anymore. Apart from a few small mangrove fragments and depleted meadow, there is no place for the landscape in this urbanized area. Shifting typologies of the mangrove landscape, forms the basis for the concept of this area. An island chain off the coast of Coral Gables offer space for the mangrove forest. This barrier structure can substantially lower the water level and the impact of waves of storm surges. The mangroves improve and hold sedimentation, but also add spatial quality and aesthetic value to the area.
The shape of the islands is based on a sedimentation experiment (fig. 4) and the pattern is defined by the bay's current and the topography and topology of the sea floor. The islands are situated in existing fairways or on the mudflat, to spare the sea grass meadow that supplies the islands with sediments so they can expand. Some of the island in front of the Coral Gables Waterway are bigger and accessible by boat. They mark and protect this historical waterway and are interconnected by a circular bridge which forms a calm zone for kayaking and fishing. The area between the shore is sheltered by the barriers islands and supports larger water based recreation.

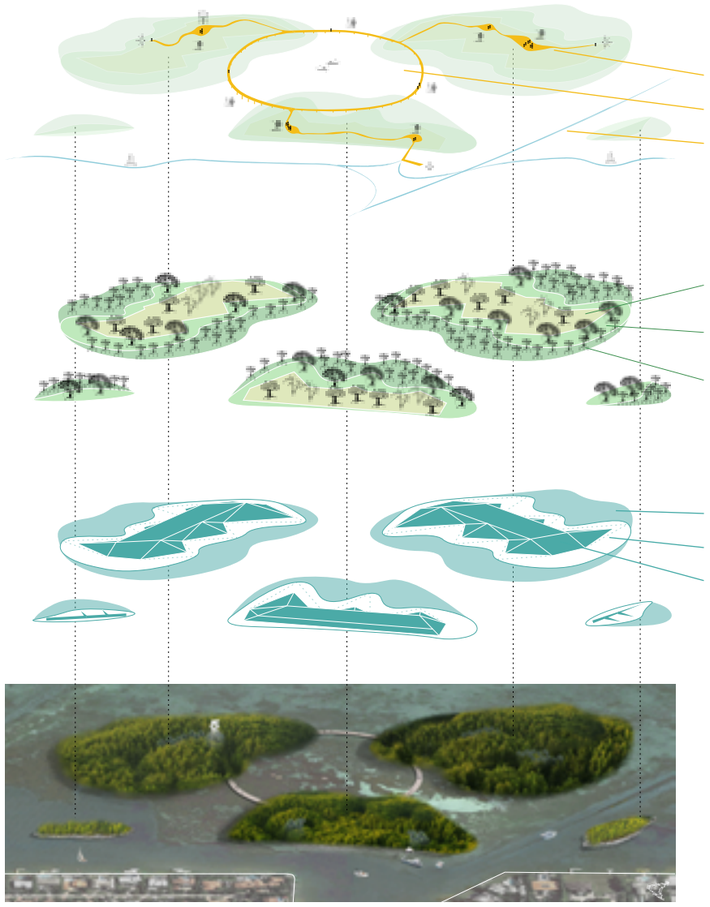


Figure 5. Exploded view of accessible islands

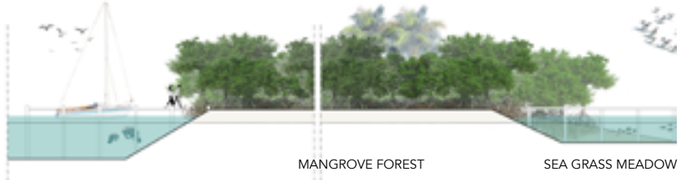
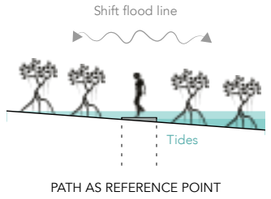


Figure 6. Section of accessible barrier island



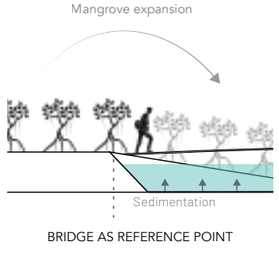


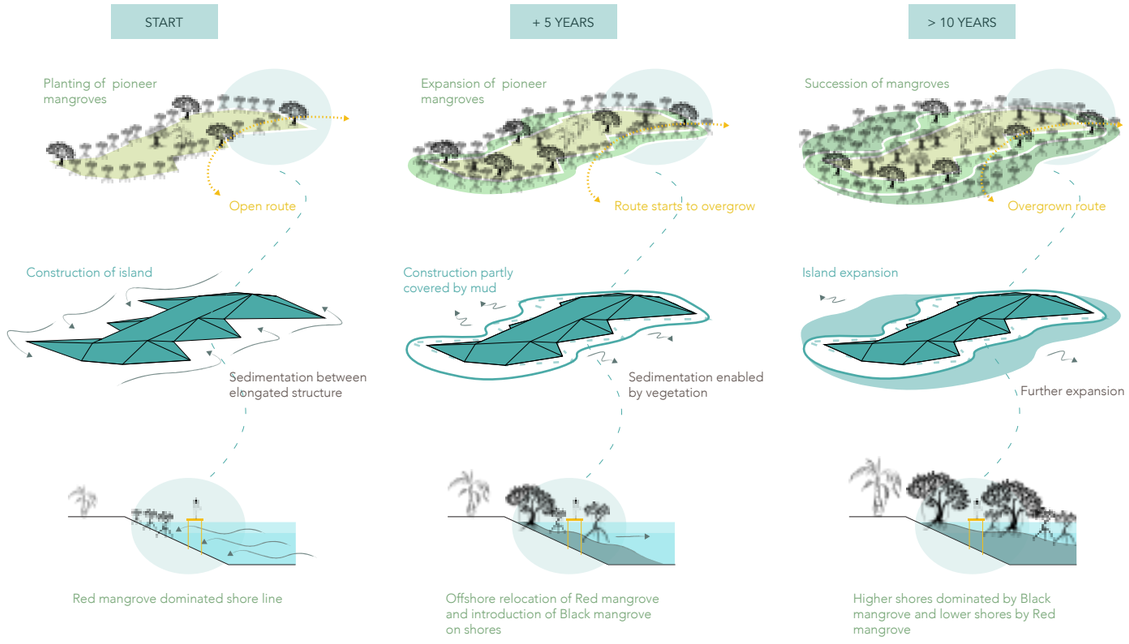
Figure 7. Visualization of change

ACCESSIBLE ISLANDS
All islands are built up from a basalt rock structure. Their specific shape enables sedimentation and supports mangrove expansion. Not only sedimentation, but also peat formation between the mangroves root system will cause growth of the islands. The bigger accessible islands have a wider base that allows elements of the program, such as the routing, picnic places and a observation tower. This higher middle zone is mostly dry and vegetated by native tropical hardwood. Around it is a inter tidal zone that, dependent on the water depth, dominated by different mangrove types.
The islands offer a new experience for the residents and local tourists in the northern part of the bay. The shape of the islands and their vegetation is constantly changing due to sedimentation and erosion. This form of diachronic change allows the user to experience the most important processes of the mangrove landscape. Paths and the circular bridge are a reference point to observe the development of the islands over time. Experiencing retreat and expansion of the vegetation, but also deviating high water levels, will make the user aware of the function of the mangrove landscape and value its role as a coastal defense system.

Boat ride to the accessible mangrove islands

Walk towards the other islands

Figure 8 (above). Impressions
Figure 9 (below). Development of the islands



DEVELOPMENT AROUND THE RING
The scheme above illustrates the development of an accessible island. In the beginning, the base is constructed in the water and planted with different mangrove types. The ring shaped route goes mainly through the open water and along the island, but at one point is goes ashore on one of the elongated shapes, to allow users to enter the island. In the following years sedimentation will occur and the mangrove trees start to expand. Red Mangroves move seaward and the Black Mangrove strip increases on the higher shores. The relocation of the forest changes the experience of the route, which will partly overgrow close to the slopes of the islands. After a decade, the slopes of the islands will be more elongated by sedimentation and peat formation. The circular route will become mainly overgrown and only in the middle between two islands be open to the bay. Eventually, several islands can expand towards each other and form one bigger islands. Though, the expansion is not based on stable rock or solid ground and could be washed away during a heavy storm. The base of the island would continue to exist and the process of expansion can start again from the beginning.

Figure 1. Objectives

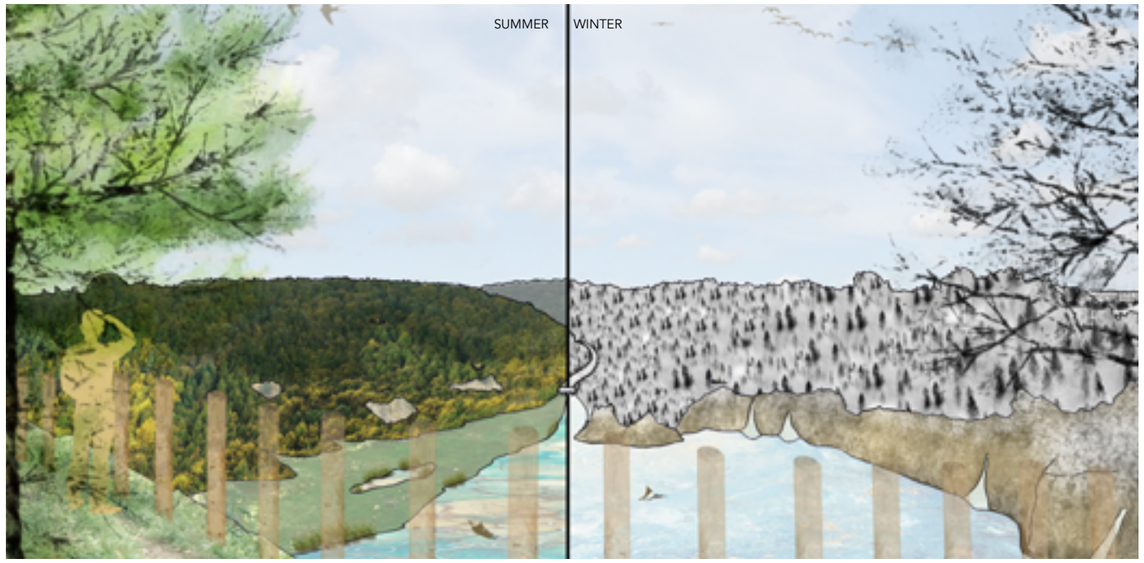


Figure 2. Seasonal impressions quarry

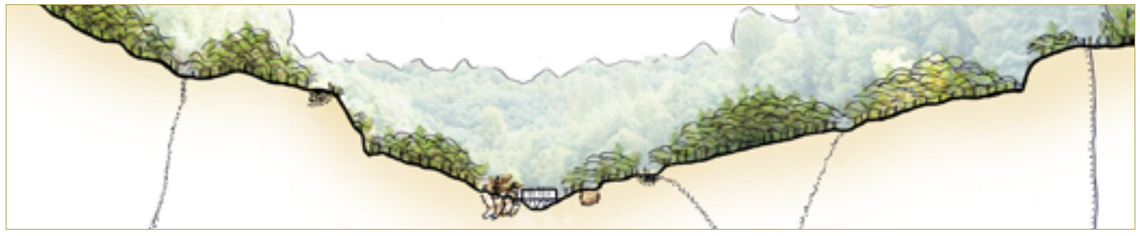
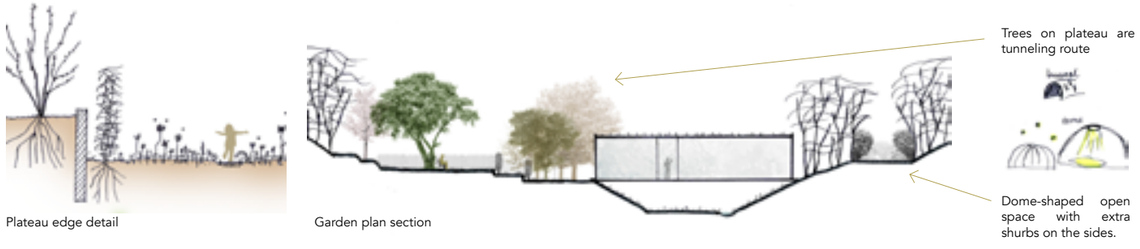


Figure 3 (above). Section of the valley
Figure 4 (below). Development of water buffer

now | +4 years: 2021 | +20 years: 2037 | +100 years: 2117



Plateau edge detail | Garden plan section

Figure 5. Details of villa and garden

II

The Curfs Quarry

Redevelopment of an abandoned limestone mine through a landscape architectural design with recreational purposes.

Project type · design project

Date · 2017

Location · Curfs Quarry, Limburg, The Netherlands

Mentors · Ir. Joost Emmerik & D. Piccinini

Keywords · quarry design, quarry redevelopment, recreational landscape, garden design, ecological design, landscape architecture, drought, flooding.

In the province of Limburg, many abandoned quarries can be found. They were used for mining raw materials like sand, limestone and gravel. Now that many mines are closing because of stricter regulation, a new purpose for these sites must be found. A commonly used destination is recreation and restoring ecological values. The Curfs quarry has been given a recreational function since its closure in 2009, but there has never been a plan for this implementing this to the site. The assignment of this project is to do this through a landscape architectural design for the quarry as a whole with recreational purposes and providing a living space for the forester and his family in this location.

The starting point for the design is to positively contribute to Limburg's climate related problems, such a air pollution and drought. Also, to restore the ecological values by protecting unique species that remained living there despite devastating years of mining. As well as, creating an attractive and unique recreational space for local residents. The principle used is creating a water buffer within the quarry which is subjected to seasonal changes that enable different types of recreation. Therefore the bottom of the quarry needs to be excavated and dammed of, so that water can be retained. The surplus land is used to narrow the adjacent valley, so that the house for the forester can be supported as a bridge between the two slopes. This marks the location where the water level is managed by a lock and can be used in events of drought for the surrounding agricultural land.

The recreational routing goes around the quarry and follows the highest elevations, which gives the best overview. Only at the opening of the excavation, the trails go down in the valley towards the villa and gardens of the forester. The principle used here is creating the desire to go down in the quarry, but not knowing when and where you can. This will invite the visitor to be guided around by the trails and eventually find a way to enter the quarry, when the amount of water allows them to. Another important principle is to experience the development, which will make visitors return to see the quarry change over time. The main changes that can be observed are the reforestation of the largest slope and the development of the water buffer. Seasonal differences, which are more divergent in this part of the country, enhance the changing effect of the water buffer.

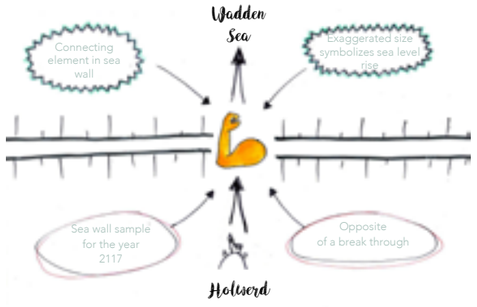


Figure 1. Vision for Holwerd

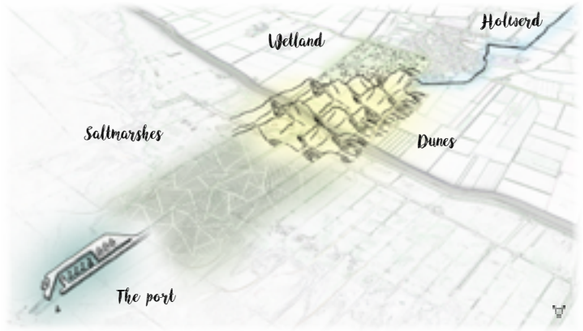


Figure 2. Concept of The Dune

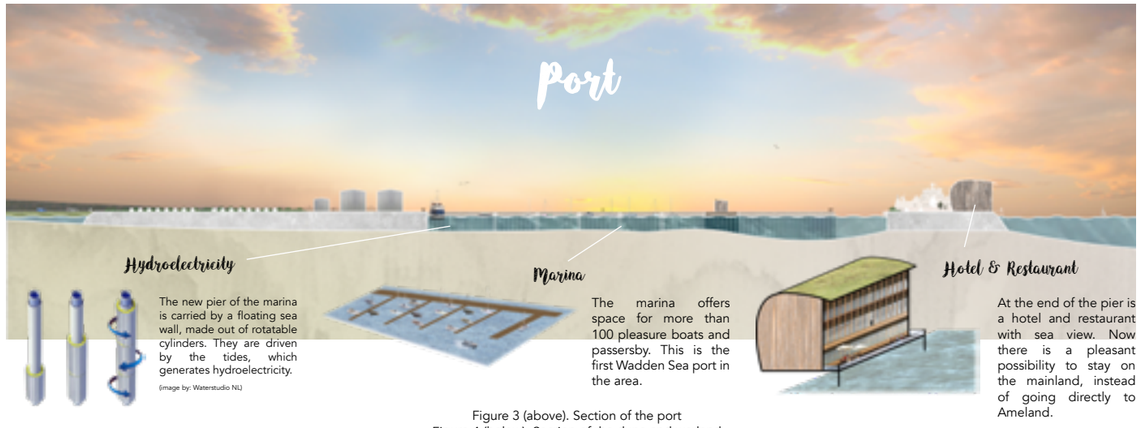
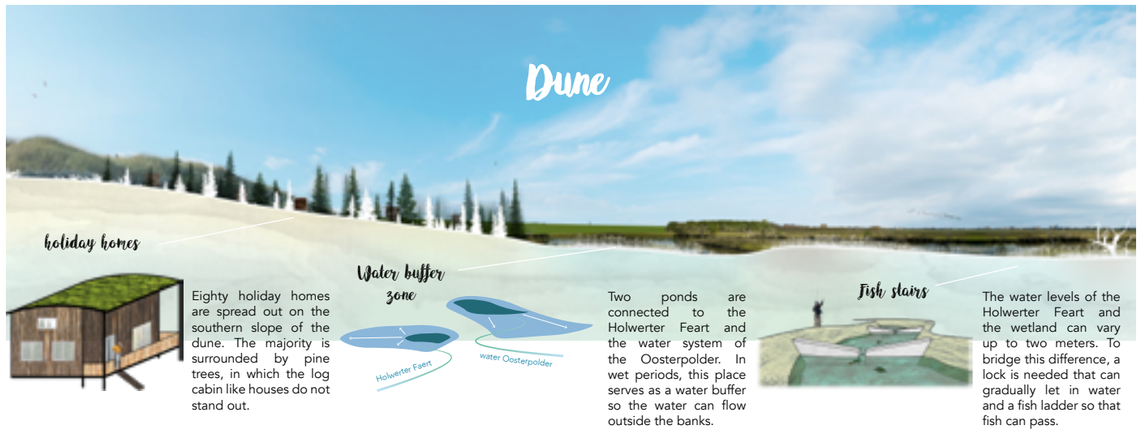


Figure 3 (above). Section of the port
Figure 4 (below). Section of the dune and wetland



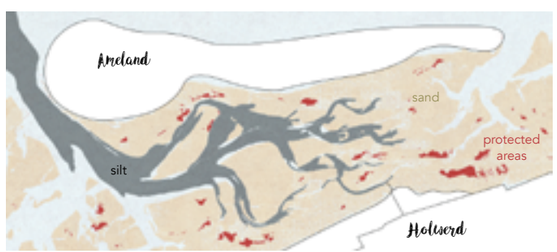


Figure 5. Soil map Wadden Sea for silt and sand sources

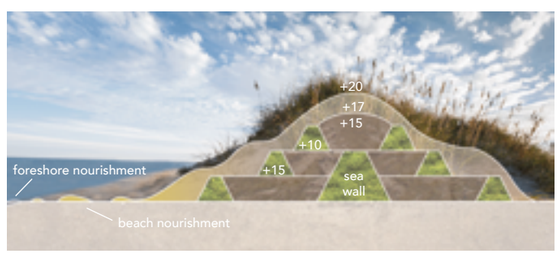


Figure 6. Construction principle and heights (m) of the new dune

III

The Dune

Adding ecological and recreational value to the Frisian Wadden Sea coast, by a coastal defense sample for the year of 2117.

Project type · design project

Date · 2017

Location · Holwerd, Friesland, The Netherlands

Mentors · Ir.PhD. Nico Tillie & Berrie van Elderen

Keywords · coastal defense, sea level rise, wetland introduction, dune landscape, salt marshes, landscape architecture, spatial design, flood protection, landscape ecology, social reconnection, design with nature.

Holwerd needs attention. All passersby on their way to Wadden Island Ameland rush past this Frisian village, without even taking a look. The Dune will make a difference. This enormous mount of sand frames a new world between Holwerd and the Wadden Sea. It is the opposite of the residents' initiative, the break through, which is not climate proof. With a height up to 25 meters, this coastal defense is ready for the expected sea level rise of the year 2117.

The concept is illustrated in figure 1 and 2 on the left. In yellow, the dune as the main element, which lies both inside and outside the sea wall. It is connected to the existing salt marsh marked dark green and the new wetlands north of the village. The existing canal, the Holwerter Feart, is now connected to this new swampy ecology. As a counterpart to the improvements inside the sea wall, on the other side of the seawall the ferry pier has been transformed to a port.

In the port, there is room for pleasure boats and a hotel with restaurant. In addition, this is the place where sustainable tidal energy is generated and a business park with a quay can be found. The dune offers space to 80 holiday homes and 30 new houses. The adjacent wetland has trails which are connected to the salt marsh and is together with dune home to a new ecology.

As shown in figure 5, sand and silt can be found locally between Ameland and Holwerd. The Wadden Sea has many sandbanks, but not every bank can be excavated. In certain places, mussel beds attach with high ecological value. They filter the turbid water of the Wadden Sea, improving the habitat of different fish species. Silt comes from dredging the fairways. It is a residual product that can be reused for the dune. For example, 365 days a year the fairway between Holwerd and Ameland is dredged for the ferry. The silt is being dropped further, but within moments two-thirds of the silt is deposited back in the fairway by the current. Using the silt on land could solve this problem.

Finally, the entire construction of clay basins is covered with sand. Vegetation as European Beach grass largely prevents the sand from blowing away inland. Nevertheless, the dune will be subject to erosion and a sand supply is required. This can be done in two ways, shown in figure 6. Firstly by beach nourishment, where sand is deposited on land. The wind blows the sand towards the dune. Secondly, foreshore nourishment, in which sand is applied in the shallow bank just in front of the dune. The current settles the sand on land and there it is blown up by the wind, like the beach nourishment method.

THE NORTH SIDE

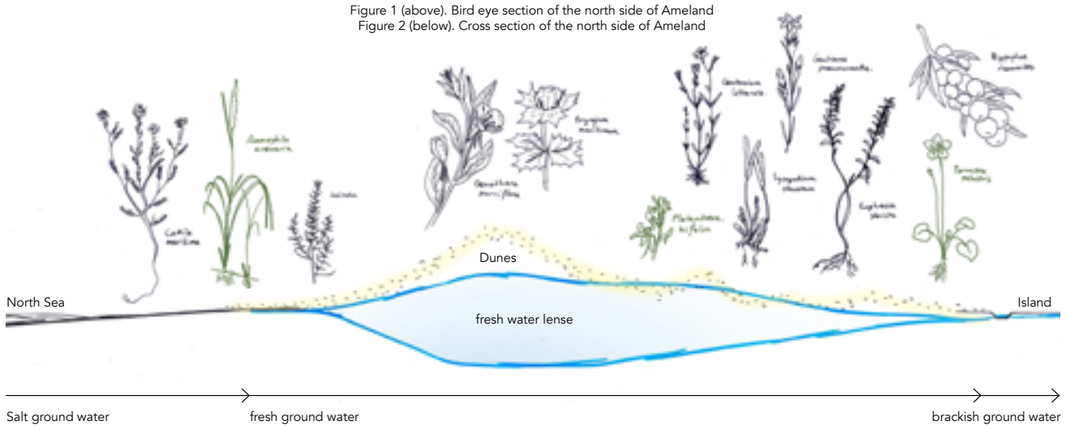


Figure 1 (above). Bird eye section of the north side of Ameland
Figure 2 (below). Cross section of the north side of Ameland

FEUGELPÔLLE

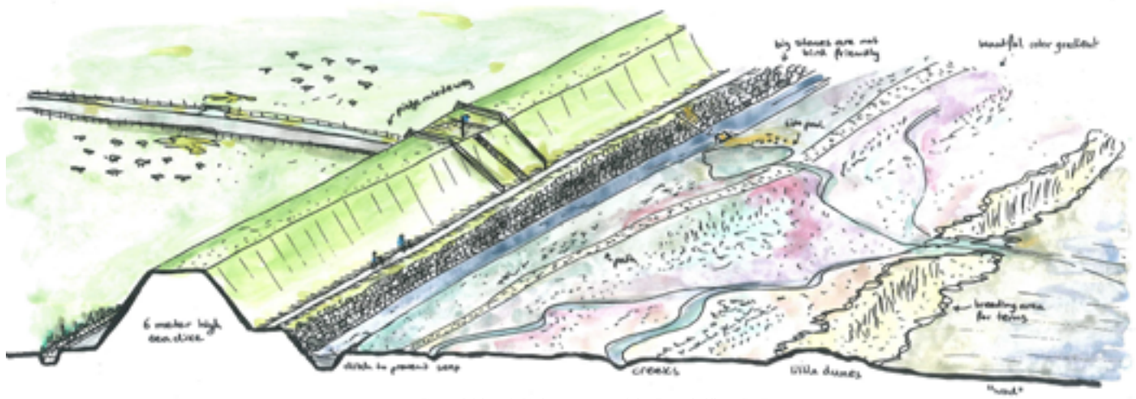


Figure 3 (above). Bird eye section of the Feugelpôlle
Figure 4 (below). Left: food cycle. Right: sea birds

IV

Landscape components Green and Blue

Ecological exploration of the Wadden island Ameland, including flora, fauna and water systems.

Project type · Ecological research

Date · 2017

Location · Wadden Sea, The Netherlands

Mentors · Ir.PhD. Nico Tillie & Ir. Frits van Loon

Keywords · salt marshes, sand dunes, wetlands, tidal influence, Wadden islands, Wadden sea, coastal gradient,

Ameland is one of the Wadden Islands, an archipelago in the North Sea along The Netherlands, Germany and Denmark. It is a unique inter tidal area with an extensive flora and fauna. The mudflats between the islands and the mainland come dry twice a day and supply food for many coastal birds. Therefore, it is an important stop for migrating birds between Africa and Europe.

On top of the left page, the north side of the island is illustrated in bird eye view and cross section. Here are the dunes which protect both the island and the fragile Wadden Sea. Up till 24 meters high, they are one of the highest dunes of the entire Wadden area. Fresh water is hidden beneath these enormous sand hills, which sometimes pop ups in the dune valley as ponds. Specific plant- and animal life can be found here, like orchids (Platanthera bifolia) and roe deer (Capreolus capreolus). The sea side of the dune is very rough. Sea and wind constantly distort the dunes and during storms lots of sand can be replaced. Here, only tough grass species can grow, like European Beach grass (Ammophilia arenaria). This plant grows in linear clusters that keep the dune sand in place. Without this plant, the sand wouldn't stay and dunes are unable to be formed. Behind the dunes, there is a zone with larger shrubs and pine trees. Sand which is blown over the dunes is captured here by the vegetation and it forms the transition between the dunes and the farmland.

On the other side of the island, a different ecology can be found. A 6 meter high sea wall protect the island here. This long green barrier reveals nothing from what is happening on the other side. Here is a unique project going on: The Feugelpôlle. It is a so-called natural climate buffer, which takes climate change in account and functions as a precaution. On this location, the perfect breeding conditions for sea birds are reconstructed. Due to human interventions at sea and on shore they disappeared. Birds like the Arctic Tern (Sterna paradisaea) need higher ground (pôlle) as close to the sea as possible. Here they can find enough food for their chicks, which can stay safe and dry in their nests. During low tide the birds can find shellfish, worms and small crustaceans on the mudflats and during high tide they can feed on insects that are found on the saltmarshes. A version of the food cycle is showed on the left, showing to short chain that could take place in this one location. The sand-shell mix functions as this higher area for the birds. Both this area as the salt marsh are not connected to the sea wall, because of a ditch to prevent to land from seep during low tide, so the bird's chicks are safe from land predators.

The outcome of this research was used for the design project described in the previous chapter: the Dune.

Concept

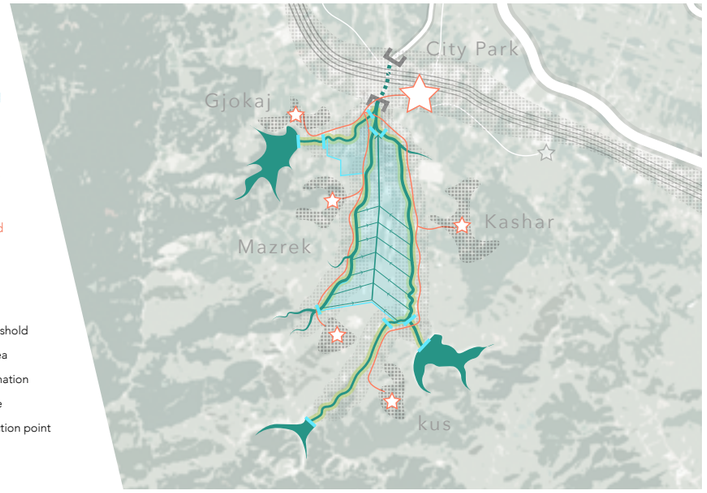
Blue: Limuthi river is divided in a water system of three levels to control the discharge in rainy and dry periods

Green: The cross section of the riverbank is interrupted by a horizontal planting plane that cleans the water and reduces the water speed.

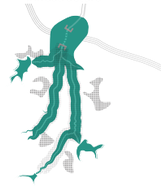
Red: Every village has a waste deposit place, which is connected by a bicycle network to the central collection point.

Legend

- lock with water threshold
- controlled flood area
- river bank transformation
- waste deposit place
- central waste collection point
- bicycle route



Flood risk settlements and infrastructure



Flood risk agriculture

Figure 1. Concept map (middle) and current flood situation (right)

Strategy

Residents

Participation in waste project and farmers cooperate in new water system

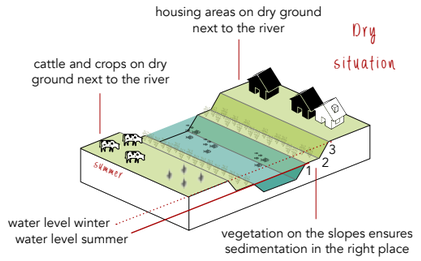
Ecovolis

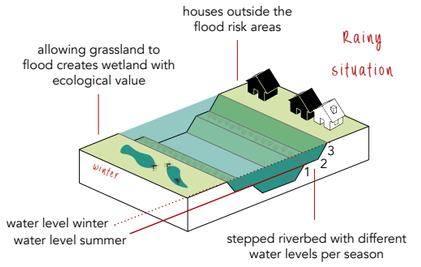
Independent waste awareness and collection project, based on rewards

Municipality

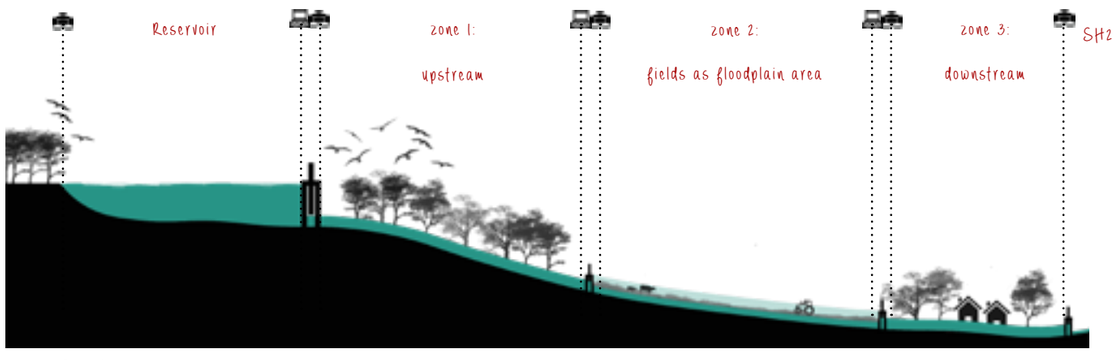
Improvement of water system and riverbanks. Registers and regulates land use

Flood protection





Water level control



Reservoir lock + threshold

River lock + threshold

Figure 2. Schematic longitudinal section of the river

V

Limuthi Re-cycle Valley

Interdisciplinary solutions for flooding, waste disposal and aesthetic degradation for the valley of Limuthi in Albania.

Project type · Interdisciplinary design project with multidisciplinary preparatory work

Date · 2018

Location · Limuthi, Albania

Mentor · Dr. Fransje Hooimeijer

Keywords · multidisciplinary approach, interdisciplinary design solutions, flood protection, waste problems, land degradation, resident participation, landscape ecology.

The inland of Albania is completely surrounded by mountains, from where rivers flow to the coast. Most of these are artificially guided through the wide valleys towards the Adriatic Sea. In the dry season the cities and agricultural areas benefit from this extensive water network. In addition, countless lakes and valleys have been dammed to supply the land with hydropower. This intensive use of the water network creates bottlenecks, such as in the Limuthi valley. Here, several rivers merge and the infrastructure density is high. The Limuthi river flows gently through the farmland of this valley in the outskirts of Tirana. This agricultural landscape is both drained and supplied by water from the river which is sourced by three basins up in the hills. Only in winter, the discharge of the river changes into unforeseeable amounts of water and the valley floods. After the annual floodings, the farmers have to they restore the damage to their homes and fields and that causes economical damage. Besides that, it is also dangerous when this small stream changes into a wild river with almost 30 times the amount of water compare its average discharge.

The challenge in the Limuthi valley is to control the river, both in rainy and dry season. The narrowed river bed, which is mainly caused by cultivating land for agriculture, needs to be widened and protected against erosion. This is the only way to guarantee a safe living environment and allow agriculture. Also, a social environmental problem occurs: trash bags, construction materials causing major blockades in the river, which increases natural sedimentation and result in a obstruction of the water flow. Besides not having a garbage system, the local residents also lacking awareness. People do not know why floods reoccur every year and what they can do to prevent this. These two major challenges are interrelated and need to be approached at the same time, because a technical design for the river could only work with support of the local community.

The design principles derived from multidisciplinary preparatory work are to create a regulated water system, by water control elements such a locks and thresholds. Also, change the dimensions of the river to deal with under capacity, by widening the river bed. To prevent erosion and pollution of the river, planting is used for purification and to strengthen the river banks. And to deal with congestion and pollution, a structure for collecting waste with an associated infrastructure is introduced.

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