





egulate water. Reduces the flood in the historical center by managing the

The porous parl

water on site.

in a safe area





munities.









Catchment elements

Storage elements



the course of a stream



Connecting the system



Wet pond, retention basin. Located in Rain garden, located alow the highways Water feature. Located in plazas









The project is base on create a porous landscape. Pore: Is a small opening in a surface that let liquids to go trough. To pore is to flow continously and rapidly from one site to the other. That is how the green and blue systems in the city should work, in a fluid and dynamic relation, with openings that allow the interaction between ecosystems, landscapes and users. The porous system in the city works as a space composed of smaller elements that work toghether to create a bigger object, and at the same time interact to each other in an addaptative landscape.

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Contractor Supervision in which the restored

Soccer field / Dry basin Rugby court / Dry basin

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As Naoto Fukusawa says "Great design is a multi-layered relationship be-tween human life and its environment." The project recognizes the need of creating spaces not only for humans but also for animals, spaces that un-derstand and highlight the natural working of the world. The porous park is designed as a connector element, part of a bigger network that integrates different users in the same place. Gives space for water that fertilizes the soil and allows the growing of vegetation. Frutal trees and water are an attractor for different bird species, the project work as a stepping stone for them, a space to eat, to rest, and to be between the Sierra Nevada de Santa Marta and the sea. Shadow trees and topography that protect from the strong wind create a

comfortable space for people to practice sports or to enjoy a man-made

(midraterine)

The second second

nature in the middle of the city.

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Tennis court / Dry basin



The planting Strategy is divided in 3 different 1. Dry zone: Pedestrian ecotone, access plazas 2. Shadow zone: Spaces inbetween 3. Wet zone: Filtrating terraces and aquatics





c with a max register of 41 c. It is necessary to introduce native trees with high shadow production to provide climatic comfort for people, an promote all-day func-tion of the park.













System capacity, Modified Rational Method















THE POROUS LANDSCAPE

A man-made landscape with porous qualities that create multipurpose spaces to contribute to relieving the storm flood in Santa Marta, Colombia







Colombia, South America

Sierra Nevada de Santa Marta SNSM

Santa Marta, Manzanares floodplain

The project is located in Santa Marta, Colombia by the foothills of Sierra Nevada of Santa Marta, the heist coastal mountain in the world, goes from 0 m to 5.000 m above sea level, and is the source of 36 rivers.

The first cartography of the city is from 1525, where we can see the relationship between land, ocean, river, and its delta. As the city was growing and developing, the space for water got reduced, reclaiming land and modifying the natural curse of the river. In the pre-Columbian time, native communities developed cities high up in the mountain, their landscape interventions were based on terracing created with stone and cover by porous surfaces. As the city was growing on the floodplain, the course of the river was modified, the space of water got reduced, spaces occupied before by water, vegetation, and other species are now the location of constructed elements with non-porous materials. The city has a disconnection between the green and blue structures.

City growing and flooding

5th century b.C.

Pre-Columbian Taironas, native community developed cities in the SNSM, connected with stone paths. Society based on agriculture and fishing.

1525

First city founded in South America, next to Manzanares river by the flood plain of Sierra Nevada de Santa Marta.

1793

City expansion, change the course of the river and reducing space for water.

1970

First register event of flood in the city doe to Manzanares river.

Last 5 years 62 Flood events register in Santa Marta.





Weather data Santa Marta



Two rivers cross by the city, Gaira and Manzanares river. Santa Marta is located mainly in the flood plain of Manzanares river.

Santa Marta is a city of contras characterized by a very dry weather during the first months of the year and a heavy monsoon season with the high peak on October when the city suffers of flooding events. Stormfloods represent the 65 percent of risk events every year.

The flood in SM is mainly on the city center, is shallow and extensive, with a low speed in comparison to other cities in the country.

Manzanares river watershead



The city and its relation with stormwater

Centralized system

Decentralized system



Currently, the city manages stormwater by a pipe system, it is centralized, does not allow to increase its capacity. Centralized systems focus on getting rid of water as soon as possible.

The project objective is to connect the blue and green structures in Santa Marta to use stormwater as a creator of new dynamics. By transforming the city into a sponge, with a decentralized system. Stormwater is managed locally on-site, creating new recreational areas connecting the blue and green structure with a porous system that contributes to relieving the flood, gives identity, and creates new ecosystems not only use for humans but also for other species.



Flooding areas

The areas most affected by storm floods are the city center and along the Manzanares river. On the diagram is shown 100 Tr flood events. The project is designed to passively absorb, clean, and use rainwater, allowing the natural flow of the water through permeable surfaces, stoping the water before it arrives at the most affected areas

City intervention steps

1. Create a flooding buffer area (relocate illegal housing at safe areas) and give space to the river to grow during monsoon season in a safe area

2. Recover all the tributaries. Give space to the natural streams on the surface. Make visible the natural working of the water 3. Insert wet basins to filter and storage storm water and dry basins to increase system capacity at extreme flooding events. 4. Porous system based on runoff reduction elements incorporated on public spaces that work to relieve the flood in the city, creates identity, new ecosystems and integrates comunities.

Toolbox of runoff reduction elements

A project by itself wonts solve the flood problems in the city, but a porous city system will help to relieve the flood in the most critical areas.

The system needs different elements to work, located across the city are catchment elements, connecting elements, and basins, these elements are interconnected and work together to allow control floods on public spaces in spread areas.

They work together to transform the city into a sponge, a permeable and porous city that wors down the principle of a decentralized system.

Catchment elements

Porous pavement with detention tank

Storage elements

Connecting the system

The porous park

The park integrates into the porous city network, its objective is to be a multipurpose space, to create recreational spaces, and at the same time to regulate water. Reduces the flood in the historical center by managing the water on site.

The inflow comes from the stream running from the hill at the east, the water flows through terraces with native submerged aquatics and emerging plants from the wet ground that clean the water before it arrives at the wet basin.

In moments of high floods, the system increases its flooding capacity with a combination of dry and wet basins.

Dry basins work as sports fields in dry conditions, in addition, 80% of the park is located 0.20 m lower than the pedestrian ecotone, which allows flooding the whole area in an extreme flood event. A pedestrian bridge connects the ecotone and allows the normal flow of people, even when the whole park is under an extreme flood condition.

Flood 100 Tr

Topography

Slow movement network

Concept of the project _ Porosity

The project is base on create a porous landscape.

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That is how the green and blue systems in the city should work, in a fluid and dynamic relation, with openings that allow the interaction between ecosystems, landscapes and users.

The porous system in the city works as a space composed of smaller elements that work toghether to create a bigger object, and at the same time interact to each other in an addaptative landscape.

Who, user of the project

As Naoto Fukusawa says "Great design is a multi-layered relationship between human life and its environment." The project recognizes the need of creating spaces not only for humans but also for animals, spaces that understand and highlight the natural working of the world.

The porous park is designed as a connector element, part of a bigger network that integrates different users in the same place. Gives space for water that fertilizes the soil and allows the growing of vegetation. Frutal trees and water are an attractor for different bird species, the project work as a stepping stone for them, a space to eat, to rest, and to be between the Sierra Nevada de Santa Marta and the sea. Shadow trees and topography that protect from the strong wind create a comfortable space for people to practice sports or to enjoy a man-made nature in the middle of the city.

с.

Contraction of the local distance 100

THE POROUS PARK

Runoff reduction elements and water bodies
Porous ground
Contourlines 20 cm
Microtopography
Stream

N

1:1.000

Material Palette

Pavers 75% density with pebbles

Pavers 75% density with grass

Tree bark

Sand

The landscape seasonality

Flooding on site

Flooding in an adaptive landscape

System capacity, Modified Rational Method

q max = 14,19 m3/ s

The planting Strategy is divided in 3 different zones:

1. Dry zone: Pedestrian ecotone, access plazas

2. Shadow zone: Spaces inbetween

3. Wet zone: Filtrating terraces and aquatics

The location of the planting is defined by a series of grids, that look for a geometrical connection, relation, and tension with the urban fabric, the natural flow of the people, and the natural flow of the water.

At access plazas, the vegetation continues with the diagonality connecting with the principal people flow. At the border, the planting is related to the immediate context. On the east side, the vegetation recognizes the flow of the water and makes it evident with the strips of vegetation that lets water go in between.

Planting Steategy Access plazas- Dry zone

The ecotone planting is characterized by 3 layers of vegetation. Tall trees, medium-sized trees, and low vegetation. The access plazas are a combination of palm trees that highlight the desertic zonobiome that surrounds the area, give a clear path to follow, and are combined with fruit trees that attract different bird species.

The average temperature in Santa Marta is 31

It is necessary to introduce native trees with high shadow production to provide climatic comfort for people, an promote all-day func-

c with a max register of 41 c.

tion of the park.

gerascanthus Hight: 10m Wide: 6m

* Native species

Hight: 15-25m Wide: 30m

Planting Steategy Wet zone

• Step 1. Emerging plants of wet ground

* Eichhornia

crassipes

* Eichhornia

azurea

*Pistia

stratiotes

*Silvina

minima

Species attracted by the fruit trees, the water, and the birds island

Shaded spaces thought native planting, protect people from the heavy tropical sun and attract endemic bird species

