Landscape in Production. The Lanzarote's Case

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Abstract

I investigated the landscape project as a response to a model of tourism attentive to the sustainable development of the territory. I worked on the island of Lanzarote, in a particular context, characterized by an arid landscape, rich in natural and cultural beauty but poor in resources, especially water. Through a multidisciplinary approach I produced design scenarios of landscaping and architectural recycling along the route connecting El Golfo to Caleta de Famara. The architecture, synthesis of a deep knowledge of the place, represent an "oasis" in the desert of lava fields and it is a metaphor to a landscape in and of production. The elements of the architecture compose a device to generate water, through principles of idrogenesi, exploiting the condensation of air humidity during the night. With the project I tried to turn the limits of an arid territory into strengths to get a succession of positive effects on a large scale, enhancing the natural and cultural heritage of the island.

Keywords: Aridscape, Idrogenesi, Architecture

1. Introduction

The thesis builds on the International Workshop *CANARIAS: [7X1000] MILLAS. HACIA OTRA REALIDAD. TOUR & TOURISM: ITINERARIOS, DERROTEROS Y DESVÍOS*.

The workshop was organized by the Observatory of the Landscape Biennial of the Canaries, with the support of the *Gobierno de Canarias.*

The theme of the workshop is the landscape project as a response to a model of tourism attentive to the sustainable development of the territory, to the protection and enhancement of its natural and cultural heritage. The title refers to the role of the travel experience as direct observation, perception and understanding of a place.
The context is that of the Canarian, 28 ° parallel north of the Tropic of Cancer, crossing place in international shipping routes. In particular the island of Lanzarote, the northernmost and eastern therefore closer to the African continent (the Sahara desert), an island characterized by a stunning landscape, made of contrasts. [Pic. 1]

On the 7 islands have been identified 61 routes that have in common the diversity.

With the research group of the University of Trento DICAM I worked on the island of Lanzarote, in particular to the project of the route LZ 5, which connects *El Golfo* to *Caleta de Famara*. [Pic. 2]

Through an interdisciplinary approach I produced design scenarios of rediscovery.
I organized the work in four parts: the first, cognitive, in which I analyzed the relationship between nature and artifice, and that brought me to the elaboration of the design concept; the second, of projecting, so I investigated the binomial architecture-landscape; the third and fourth parts of depth, respectively of environmental issues and water.

I defined the goals of the project:

- To Interpret the route as a journey of discovery of the island of Lanzarote;
- To Disassemble and reassemble the elements of the site to identify possible points of project;
- To Identify the limitations and weaknesses of an arid territory to turn them into strengths and resources to valorize the natural and cultural heritage;
- To Address the tourism toward a model attentive to the sustainable development of the place.

2. Background

I have examined the issue of the relationship that exists between landscape and tourism in a mutual process of generation and transformation, from early exploration trips to the boom of tourism as a mass phenomenon, from the myth of the paradise island to the paradox of thematic environments. For an island with limited resources, tourist activity is a great opportunity and at the same time a risk.

In opposition to this direction, interventions by the local artist César Manrique represent "deviations", a change of trend to which today also refers to the new PIOT (*Plan de Ordenación Territorial Insular de Lanzarote*).

Than followed a survey of the island on a regional scale by breaking down the four primordial elements that characterize it.

The fire, so its volcanic origin. The formation of the volcanic landscape of *Timanfaya* lava has covered a quarter of the surface, leaving a wasteland for years that has been converted into wealth and today represents the greatest attraction.

The land, linked to the fire: geomorphology is the result of the alternation of phases in the time of addition-stratification and subtraction-erosion, combined action of man, has left a mosaic of natural and cultural landscapes of significant value.

The special climatic conditions, then the wind (air) that besides being a constant companion, is the factor that makes life possible on the island, carrying moisture from the Atlantic Ocean to the inside dry.

Water: its absence has led more people to develop a real culture of water representing a character identitarian of the island. It was interesting to investigate the significance of the three meanings of the term Spanish culture:

· as history and culture, or as a set of hydraulic techniques implemented by the inhabitants in time for the difficult water supply;
· as agricultural treatment that receives the water before being used: in fact, the water is collected, stored and purified, and then consumed;
· as worship, veneration that this element had especially in Aboriginal society.

The agricultural landscape and rural architecture as a synthesis of these elements

Later I focused on the route, the subject of the thesis work.

The route begins and ends on the coast, linking *El Golfo* to *Caleta de Famara*, crossing the island from south-west to north for 40 kilometers.

Along the way I studied the variation of the geomorphological elements, the elements of light and temperature, wind, precipitation and soil porosity.

The route crosses three arid landscapes: *Salinas de Janubio* (salt desert), de *Campos de Timanfaya lava* (lava desert), *Corridor del Jable* (sand desert). It connects two natural parks: *Parque Natural de Los Volcanes*, *Parque Natural del Archipelago Chinijo*.

Along the route, within the scenario of slow mobility, I have identified a number of points of tension in places by particular characteristics or areas of discontinuity landscape, generating flows and representing points of attraction, staging points: oasis. [Pic. 3]

The oasis is the figure of a landscape in production. Depending on the context in which it appears, the production change because they change the elements, materials and forms, and also changes what is produced. The oasis is a metaphor of landscape architecture imagined as in production.

oasis = arid landscape - [water + vegetation + architecture]

3. Tools

The particular morphology of the place led me to control the relationship with the ground through the construction of a model of the terrain of the island. The base material is constituted by the topographic map with the level curves of the island, integrated with the curves of the seabed. I availed of GIS as a tool for reading and returning the model, in particular, I have chosen to work with open source software, GRASS interface QuantumGIS, thanks to which I modeled precisely the DTM island.

The profiles (transverse and longitudinal, produced by cutting the model in two directions at a constant distance of one kilometer) allowed me to work in section because I believed it was the best way to understand the relationship with the ground. [Pic. 4]The model helped me to control architectural questions I posed: the relationship with the land and with the elements of the landscape.

I wanted to explore the theme of the production of the water that is an essential part of the project.
The irregular nature of rainfall, the lack of resources in the subsoil, in addition to the desire to generate water sustainably reinventing traditional techniques of Aboriginal society, they pushed me to explore solutions for water supply based on the principles of idrogenesi.

I then proceeded with the sizing of the elements: they assumed that the size of the oasis is the balance between tourist numbers and capacity of local resources.

To define the "catchment area", I referred to the tourist information collected in the statistical yearbook of Lanzarote and the forecast contained in the new management plan for the island territory, in particular those relating to the turnout CACT: *Centros de Arte, Cultura y Turismo* promoted by local artist César Manrique (as "oasis" of cultural tourism in an island threatened by becoming a destination for mass tourism of *"sol y playa"*).So the affluence per day could be between 100 and 200 people, spread throughout the day, in an opening turn of 10 hours. [Pic. 5]

I subsequently evaluated two possible scenarios "collection". The idea was to take advantage of two natural phenomena of condensation of the island. Being small quantities of water I have foreseen the need to install a collection surface in considerable dimensions, but at the same time, simple purification systems and modest conduct systems, if possible by gravity.

The first scenario uses the temperature differential, or the condensation of air humidity during the night. This phenomenon, called *rocío*, is typical of the island, especially prevalent in the central part of the territory where the surface is covered with pyroclastic material. This resource of water, modest but steady throughout the year, allows the presence of vegetation on the island and it is fully used in agriculture: farmers have realized that the volcanic ash (*picón*), and the sand, capture and hold the night "dew" and release it slowly, allowing the plant to survive.

For the calculation of the amount of water obtainable I used the values reported in the literature, according to these, in fact, covered surfaces of pyroclastic material or sand condense 11-13 mm / year, while bare surfaces of dark color (preferably metal), condense 33 mm / year, or 0.1 l / (m^2 · day).
From the latter, assuming that each person needs about 5 liters of water, I got:

200 people · 5 l = 1000 l/day

1000 l/day : 0.1 l/(m^2· day) = 10000 m^2 of collected surface

After a search of forms and sizes the most common on the island, I chose to use a pure geometric figure, the golden rectangle, size:

130 x 80 meters, otherwise a surface of 10400 square meters. I also adopted two measures. The first, to divide the large surface area of the tray into parts of smaller dimensions to reduce the path of the droplets of condensation from the extremes of the tray furthest to the spout of the conduct. This allows me to reduce evaporation and especially to avoid possible contamination of water by pollutants. The modules that make up the tray are not constant but they vary depending on the mesh of the frames of the structure. The second, prepare each tray of a filter in such a way that the water already treated arrives to the storage tank where it must remain a short time (a few hours) before being consumed. I planned to use the filter "natural" that work for stratification of local materials: the water is filtered by passing through layers of gravel in succession of coarse, medium and fine, and volcanic ash or sand, then again gravel coarse or maybe a piece of stone *destiladera* traditionally used as a purification system and cooling water.

Through the second scenario, I evaluated the ability to capture the moisture carried by the wind, which blows from the sea towards the interior. This phenomenon is observed more in coastal areas or in the northern part of the island, especially on top of the relief of *Famara*.

So from the average values of humidity, temperature, atmospheric pressure and wind speed I have proceeds the amount of water that may condense into a square meter of fabric.

The average values [Pic. 6] of temperature, humidity and atmospheric pressure combine to determine the value of the mass of dry air. From the table [Pic. 7] I got a value of:

$m_{as} = 2.38\ Kg_{as}$

From the psychrometric diagram [Pic. 8] on the other hand results a value of specific humidity:

$x = 0.01\ Kg_v / Kg_{as}$

By definition, x is the ratio between the steam mass and the mass of dry air present in the same volume of moist air. From the inverse formula, the steam mass results:

$m_v = m_{as} \cdot x = 2.38 \cdot 0.01 = 0.02\ Kg_v = 20\ gr_v$

The amount of water that actually can condense is reduced to about half of the mass of water vapor. In this case in a cubic meter of air, there are 20 grams of water vapor, of which it can condense only 10 grams, or 10 ml.
Then I proceeded with the calculation of the flow rate resulting from the product between the wind speed and the surface of the fabric:

$Q = 6 \cdot 1 = 6\ m^3/s$

Each cubic meter of air contains 10 ml of water for which hypothetically every second condense:

$Q = 6 \cdot 10 = 60\ ml / (m^2 \cdot s)$

To this result I applied reductions due to other factors. The first is that the evaporation in Lanzarote is very high. During the day nearly 96%, while during the night is less. Having no reliable information about it I assumed that at night the evaporation coefficient is 60%.This means that on 60 ml, 36 evaporate and 24 are left.Finally, we need to consider the ability of the fabric to retain the liquid. The amount of water that can pick up the fabric depends on the type of fabric, and then by its hygroscopic coefficient. As you can see from the graph [Pic. 9], with a value of 65% humidity, the coefficient varies from 5% for synthetic fibers to 15% natural fibers, in particularwool. With the intention to install a synthetic fabric I hired a low hygroscopic coefficient of 5%. Of the remaining 24, the fabric can hold only 1.2 ml.

The flow rate the final results to be of 1.2 ml / ($m^2 \cdot s$), or about 26 l / ($m^2 \cdot day$).

In this case the water is filtered down by gravity through the fabric.

Finally I prepared the elements of storage.

I chose to install two tanks different: this allows me to ensure a simultaneous operation or at different times of the system, depending on the climatic conditions of the area where it is located. The first tank, the smallest, is used to store and keep the water clean of the horizontal fabrics that arrives already purified, and which must rest only a few hours before being consumed (drank). The second, larger, stores the water from vertical fabrics. This second tank is oversized in order to accommodate the excess water coming from the first tank in the cases of any favorable situations of high humidity compared to the average values taken into account, or to store a certain amount of water (reserve) to be allocated, for example, for agriculture in periods of severe drought.

4. Project

I studied one of the possible points of project I had spotted along the way and I have defined an architecture for the desert of lava fields, at the limit of the Natural Park of *Timanfaya* Volcanoes.

The architecture fits in the itinerary at a point marked as a place intersection of North-South, East-West and identifies a point geometrically defined in a complex morphology. [Pic. 10] The architecture sets within the context artificially, but not in an impacting way. From the composition of small modules, it reaches the territorial dimension to face the scale of the landscape and the monumentality of its forms. Through the arrangement of the elements of architecture I worked with local materials: light, wind and water. [Pic. 11]

The architecture is a device for the "ability to see" the landscape.

Through architecture the outer space is defined and limited, the singular points of the place are framed and exalted. [Pic. 12]

The architecture is composed and defined by three elements:

- The structure, a "three-dimensional lattice with variable density." It consists of a mesh of frames which thickens following a spiral movement (from the division of the golden rectangle) giving to the architecture a dynamic ever-changing, evocation of the succession of landscapes / scenery of the island;
- The voids, cavities usable in succession, of different shape and size, projected on the landscape. I proposed a system permeable that facilitates dialogue between inside and outside; the gaps leave the landscape enters the structure and allowed the view to see the bait around. The result is an osmotic process between architecture and environment;
- The artificial soil that receives a free program of activities related to the perception of the landscape and its elements. [Pic. 13]

The house is attached to the ground on time to preserve it. The relationship between the natural soil and new artificial soil is clear but delicate.[Pic. 14]

For this architecture transparent and light I chose steel because it is a material that allows for minimum sections, an extra on-site assembly, harness the prefabrication and recycling opportunities.

I thought of a material, steel, mutable and changing, which could fit in harmony with the place, to return it without trying to imitate him, through the colors of the landscape and the colors of architecture, interior and exterior, interpenetrate each other. [Pic. 15]

The architecture is a device for generating water.
The emblematic elements of the project are the fabrics.

Surfaces / tissues horizontal and vertical composing a transparent landscape (almost evanescent) as opposed to the plasticity of the lava fields abstracting the place, they produce a space shaded refreshment in the desert of the lava fields.

The trays, arranged at different heights, allow the use of the architecture and create cuts of light within the space of shadow. They seem suspended and give to the architecture an appearance of lightness. Vertical surfaces create geometries and abstractions of textures that characterize the soil of Lanzarote.

The fabrics, some fixed and other movable, give voice and image to the movement of the wind, and recall invisible presences. As well as some devices of traditional techniques represent actual Landmark and originate cultural landscapes of significant value and charm, the same way the architecture is composed of surfaces, lines and points that make visible the presence of water.

The horizontal trays are used to collect the condensation of air humidity during the night. The vertical fabrics instead try to capture the moisture carried by the wind. [Pic. 16]

In brief, the elements of the architecture provided are: surfaces (vertical and horizontal) for collecting, volumes for the purification and storage and consumption points. These figures summarize the process that water gets in the tradition of Lanzarote before being consumed. [Pic. 17]

5. Conclusion

The work relies on a multi-scale and multi-disciplinary approach, with which I tried to reuse and enhance a route, a summary of the binomial nature-artifice, so far shared spontaneously by locals and tourists. Through spatial analysis, accurate insights, field investigations, I looked for a knowledge of the place, which allowed me to imagine an architecture in which it is possible to recognize the telling of the journey made.

The architecture is a real device: to perceive the landscape and character of the place, to produce an area of shade, a nice stop in the desert of lava fields, but especially to generate water.
The architecture is a new landscape of and in production, and through its entirety and its elements, it invites you to embark on a journey of discovery of the island of Lanzarote.

In response to the proposed objectives I can conclude that:

· Through the project I tried to enhance the natural and cultural heritage of Lanzarote and to guide tourism towards a model careful and sensitive to the fragile ecosystem of the area;
· I tried to turn the limits of an arid landscape into strengths to get a succession of positive effects on a large scale;

· Through the digital terrain model of the island I could analyze the particular geomorphology of the area and instantly see the inclusion of architecture in the context;
· The analytical process has contributed to the sizing of the oasis and the definition of its elements.

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<http://www.grafcan.es/>
(contains the most complete and updated map material of the Canary Islands)
<http://grass.osgeo.org/>
(software open source GRASS's website)
<http://www.qgis.org/>
(software opensource Quantum GIS's website)

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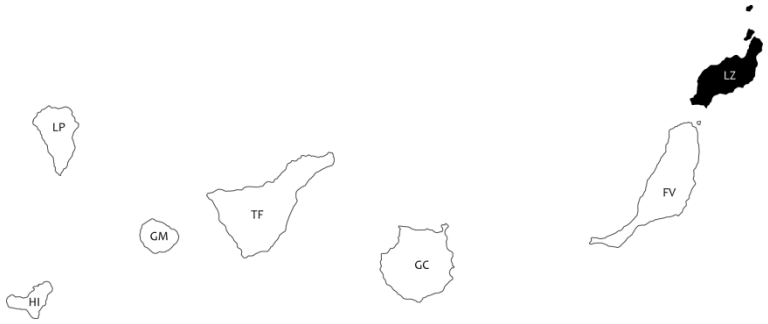
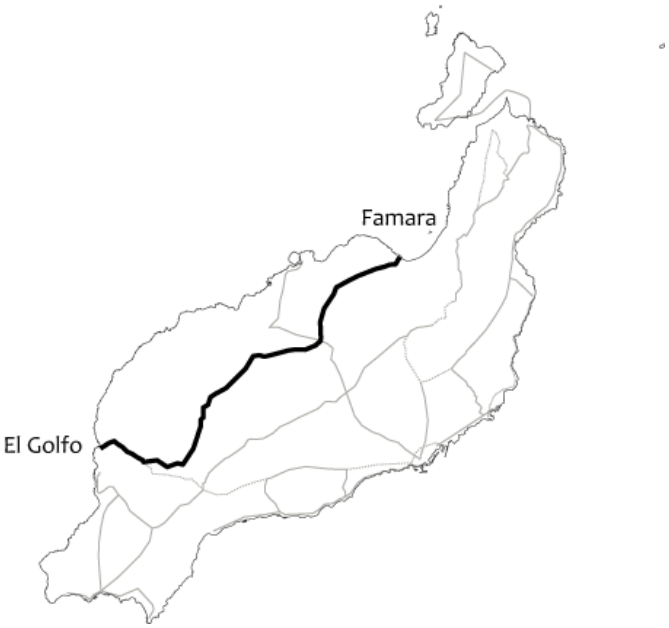
Architect Luca Zecchin.

Pic. 1: Arcipelago Canario

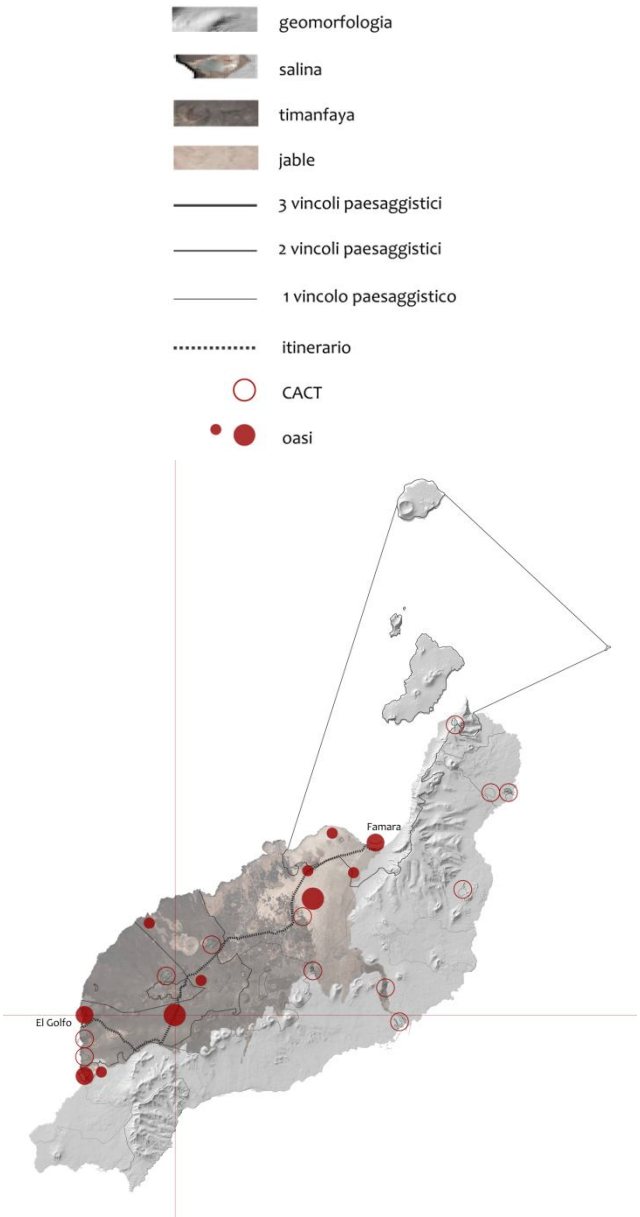
HI: El Hierro
LP: La Palma
GM: La Gomera
TF: Tenerife
GC: Gran Canaria
FV: Fuerteventura
LZ: Lanzarote



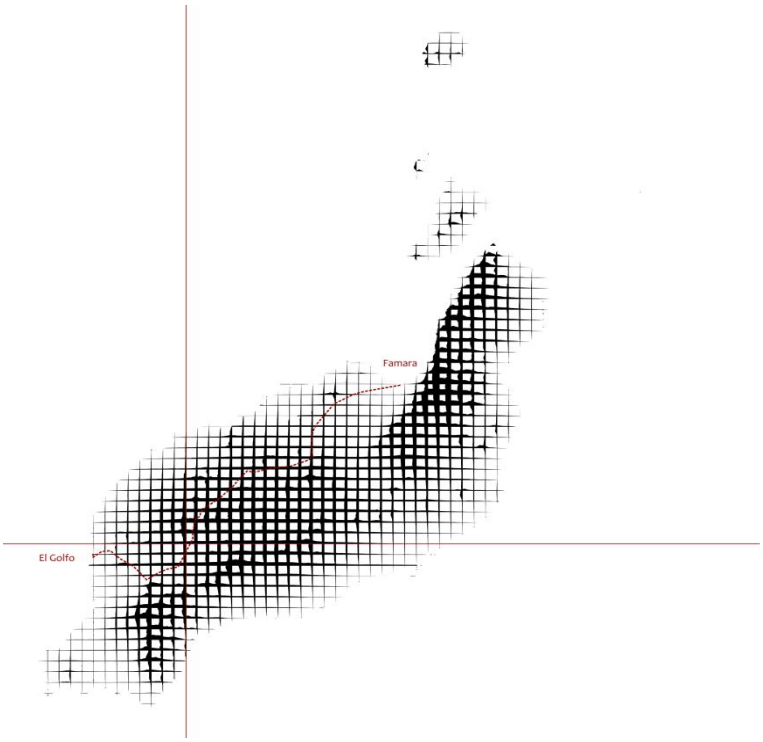
Pic. 2: Island of Lanzarote. Itinerary LZ_5: *El Golfo – Caleta de Famara*



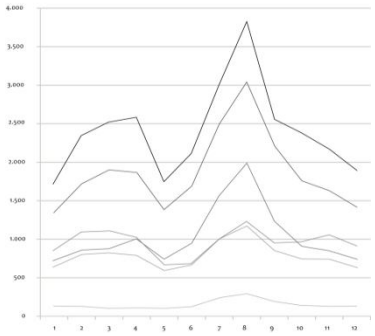
Pic. 3: Project Concept



Pic. 4: Profiles (from DTM)



Pic. 5: Tourist Numbers



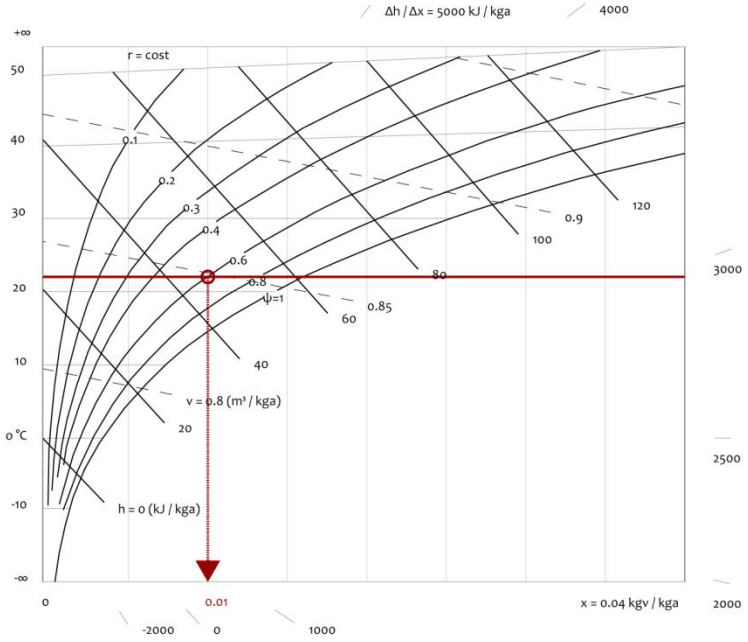
Pic. 6: Meteorological Data

METEOROLOGICAL DATA OF LANZAROTE (AVERAGE VALUES)	
Relative Humidity	**65 %**
Temperature	**22 °C**
Wind Speed	**6 m/s**
Atmospheric Pressure	**1020 hPa = 1.02 bar**

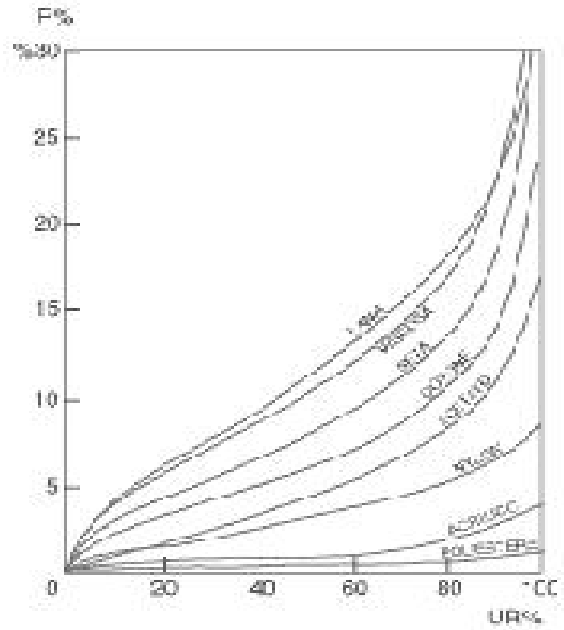
Pic. 7: Gauge Pressure

	Gauge Pressure (bar)					
T (°C)	0	0.5	1	1.5	2	2.5
0	1.293	1.931	2.569	3.207	3.845	4.483
10	1.247	1.863	2.478	3.094	3.709	4.325
20	1.205	1.799	2.394	2.988	3.583	4.177
30	1.165	1.740	2.315	2.890	3.465	4.040
40	1.128	1.684	2.241	2.798	3.354	3.911
50	1.093	1.632	2.172	2.711	3.250	3.790

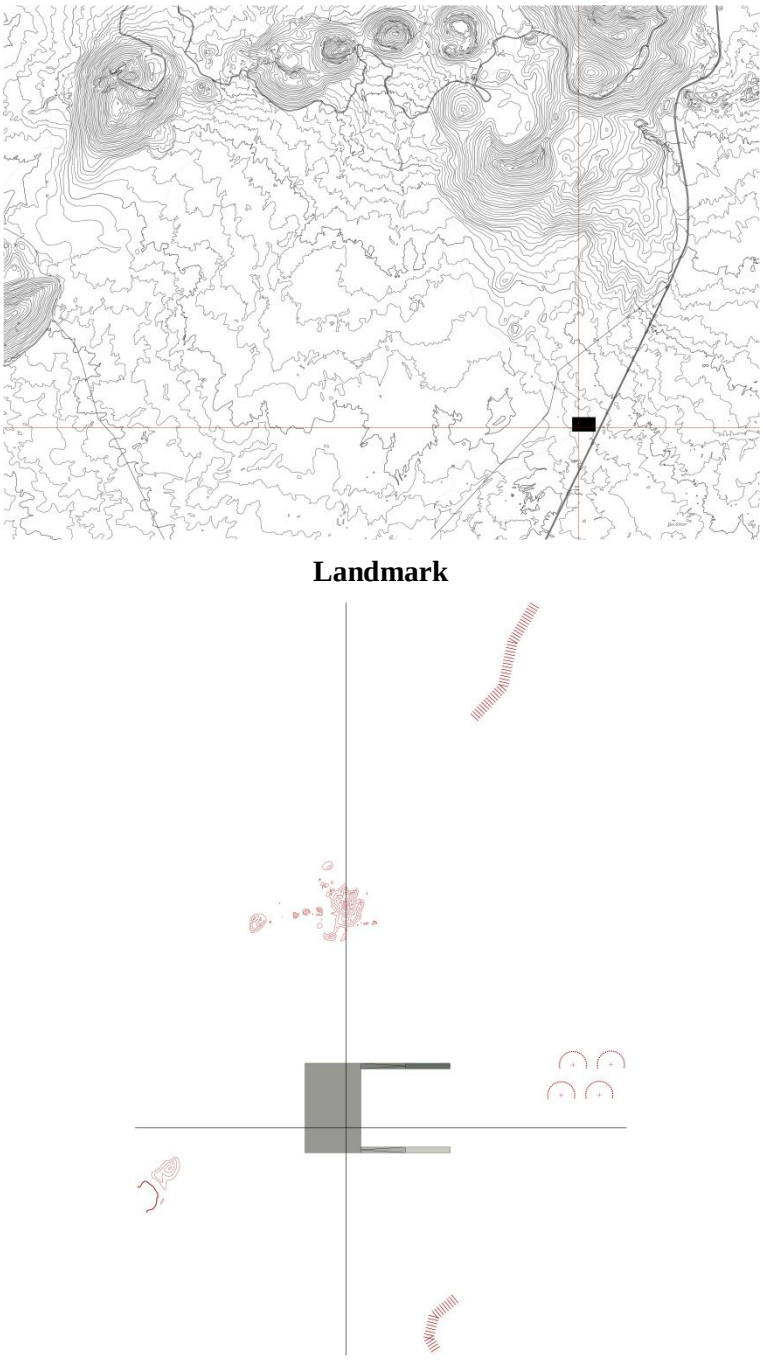
Pic. 8: Psychometric Diagram



Pic. 9: Absorption Isotherms of Some Textile Fibers

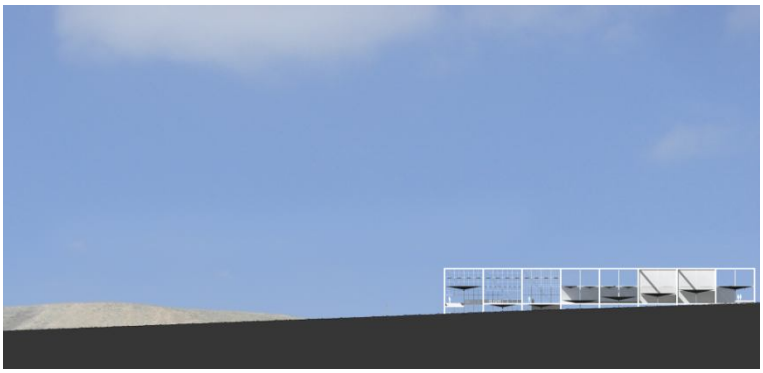


Pic. 10: The Architecture Identifies a Point Geometrically Defined in a Complex MorphologyPlanimetry

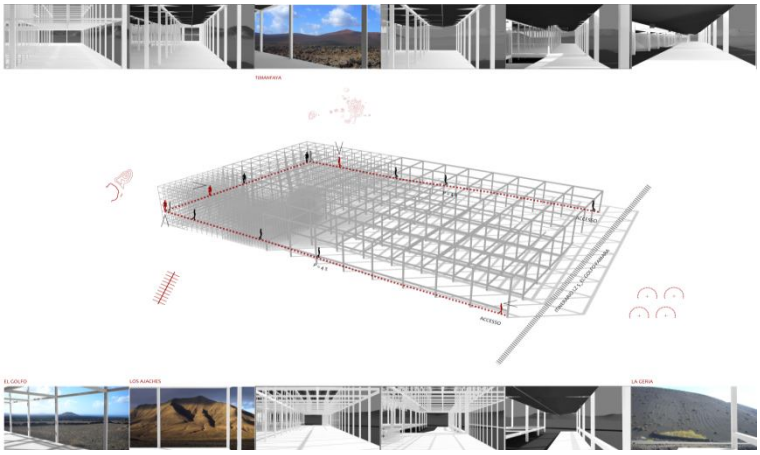


Pic. 11: The geometric lines of the architecture draw a new horizon, measure the landscape and scales the elements.
LongitudinalSection

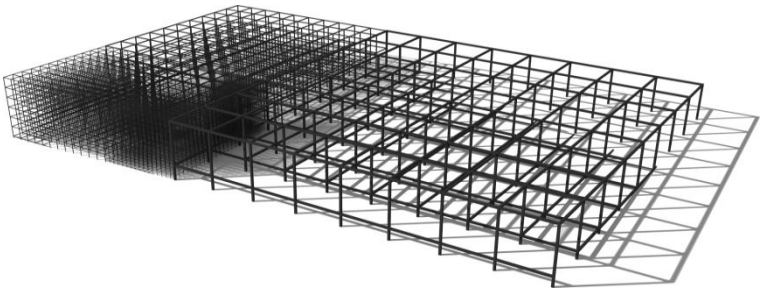
Cross Section



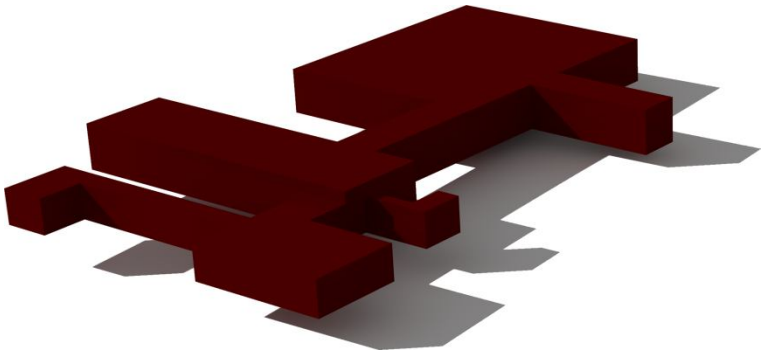
Pic. 12: Through the Architecture



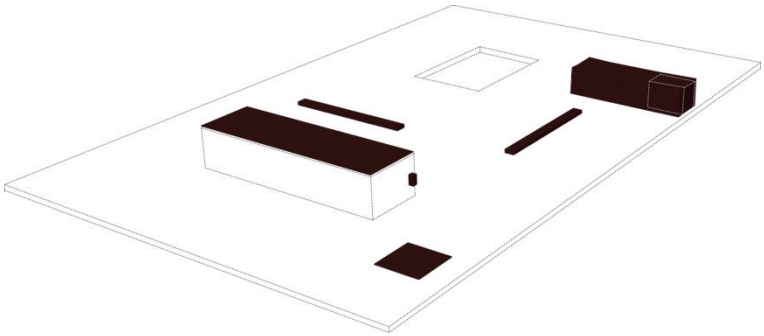
Pic. 13: Architecture's Elements:
The Three-Dimensional Structure with Variable Density



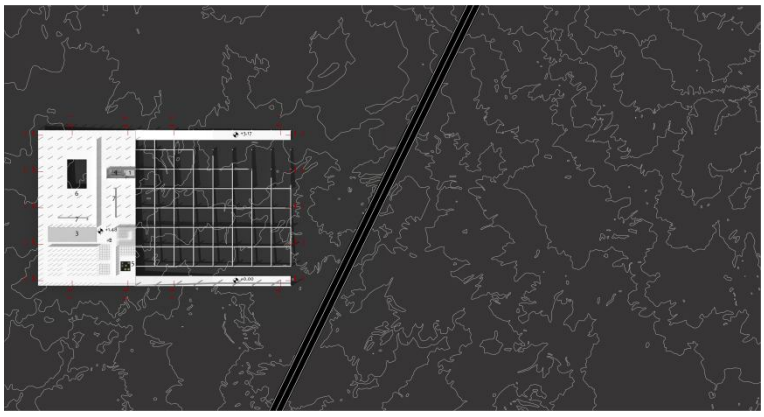
The Gaps



The ArtificialSoil

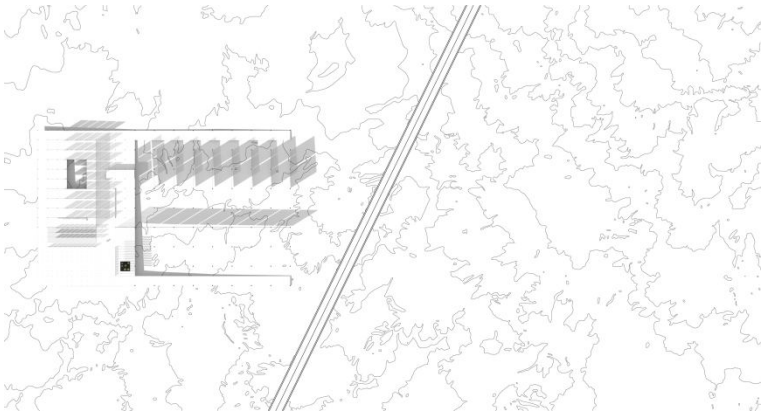


Pic. 14: Clear but Delicate Relationship between Natural soil and Artificial soil Ground Floor

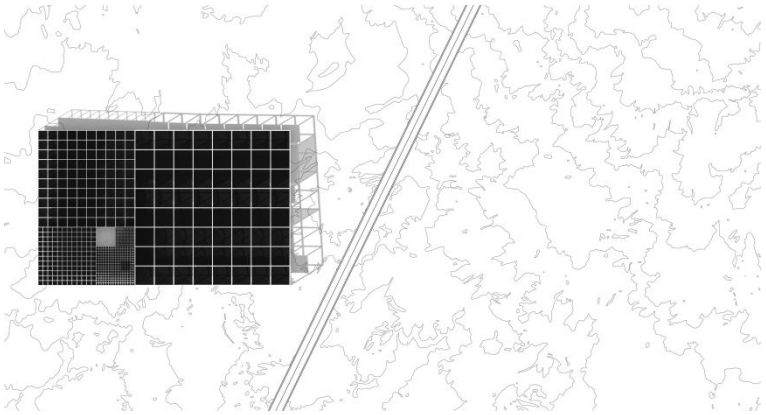


Pic. 15: Project Materials and Colors of the Landscape, Endless Shades

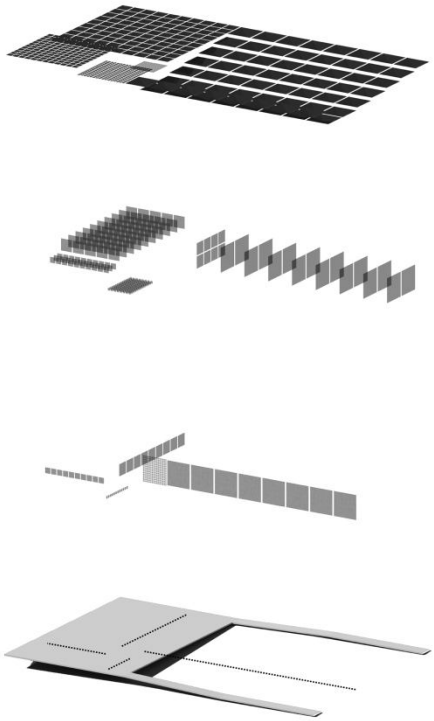
Pic. 16: The Elements of the Architecture:
the Curtains: Horizontal Trays, Vertical Fabrics, Movable, and fixed.
Floor at + 2.70 m



Coverage



Three-DimensionalView



Pic. 17: The Water's Process

SCENARIO 1
(temperature differential)
0.1 l / m^2condensation (*rocío*)
10400 m^2 trays
Q_{in} = 1040 l / day
3.324 m^3 filter
gravel and volcanic ash or sand
90 ml tube Ø = 1” - 1/2”
tank 1
(treated water)
V_c = 2.2 m^3
V_{eff} = 30 m^3
Q_{out} = 200 liters / day:
water for drinking
= 1 (+4) liters / person x day

~ 1000 glasses of water
SCENARIO 2
(wind)
1 m^3 air = 20 gr water vapor
1 m^3 air = 10 ml condensation
1 m^2 fabric = 26 liters / day
1025 m^2 vertical fabric
Q_{in} = 26650 l / day
215 ml tube Ø = 1”
tank 2
(untreated water)
V_c = 53.2 m^3
V_{eff} = 100 m^3
Q_{out} = 16000 liters / day:
pool
(187.5 m^2) = 15000 l / day
WC
(5 l / p x day) = 1000 l / day
agriculture and vegetation