

BIODIVER-CITY

SPREADING AND SHARING SPACE IN A CITY CONTEXT



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BIODIVER-CITY

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VALENTINA MENA & LAUREEN PUTZOLU

ABSTRACT

Contemporary societies are facing an important ecologic issue that concerns biodiversity loss, especially in an urban context. Indeed there is a clear relation between the species decrease and the urban expansion according to the fact that cities development and human activities have an important impact on biodiversity and are the main cause of its loss. How can we use architecture and the city as an opportunity to enhance biodiversity?

In this way, “Biodiver-City” explores the possibility to combine a shared-space for people and biodiversity to coexist together in a built environment. The project aims to propose a new (eco)system for the nature in a dense urban context, that will be advantageous for biodiversity and human well being.

The city of Barcelona in Spain is a good example of an European dense city disconnected from its environment even with a great potential of natural features as Colserolla mountain range, the Mediterranean sea and two rivers. The process to develop this project was to analyze precisely the biodiversity and urbanisation features in the city in order to define tools that could be implemented in the design, taking in consideration fauna, flora and human needs. In order to preserve and enhance biodiversity in the city, the project is developed on three different but interconnected scales - regional, local and site. The proposal acts as a catalyst of a new sequenced system that spread biodiversity in the city through green corridors.

“Biodiver-City” proposes various programs, leaded by a pedagogic aim in order to teach people the importance of biodiversity. The project enables people to experiment a new way of living with nature in a city context, interacting with biodiversity through its space design and materiality.

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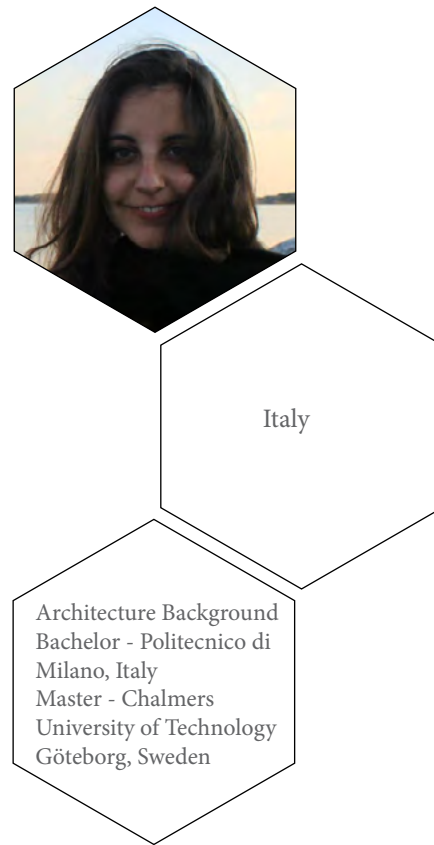
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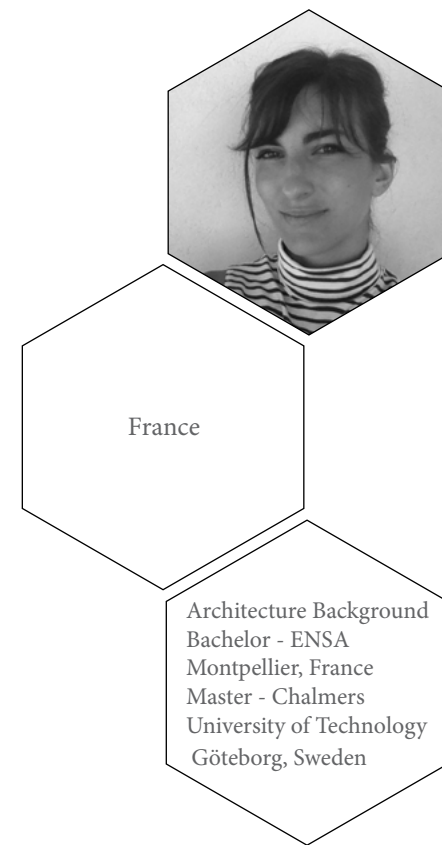
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REFERENCES

PRESENTATION



VALENTINA MENA



LAUREEN PUTZOLU

BACKGROUNDS

Biodiversity: The variety of different types of life found on earth. It is a measure of the variety of organisms present in different ecosystems. This can refer to genetic variation, ecosystem variation or species variation (number of species) within an area, biome or planet. (1)

Nowadays, one of the most important challenge concerning the sustainable development concerns the biodiversity loss. Indeed, as a result of several factors caused by human activities such as land use change, climate change and overexploitation resources for example, the biodiversity is truly threatened.

What are the consequences of this loss?

Biodiversity is fundamental for the regulation of the earth system and as well for human well being. The loss of biodiversity affects ecosystem stability.

Ecosystem: Community of living organisms (plants, animals and microbes) in conjunction with non living components of their environment (air, water and mineral soil), interacting as a system. (2)

Biodiversity is important for ecosystem functioning, since it provides us a lot of free services as oxygen, water, food and medicines.

Indeed, biodiversity is essential for humans to survive and stay healthy.

As architects, what can we do to preserve and enhance biodiversity?

How could we rely architecture and nature?

MOTIVATION

Studying at Chalmers University of Technology, we have developed during those two years of master programme a sustainable approach towards architecture and urban design that we wanted to apply for our master thesis project.

Concerned and truly interested by the biodiversity challenge, our wish was to experiment a new way of thinking architecture and urban design through this topic.

We believe that architects can play an important role in the evolution of our cities by integrating biodiversity in their buildings and urban planning design.

Considering our master thesis work as a step between the studies and the professional life, we wanted to experiment a project that rely to an innovative thinking of architecture by using biodiversity as an opportunity according to today's challenges.

As a result, we want to link biodiversity and architecture as a main system that can be beneficial both for humans and nature.

The project is an exploration of how architecture and the city can integrate biodiversity by understanding the ecological systems and the nature principles in order to apply them to buildings.

INTRODUCTION

Nowadays, we are facing an important ecologic issue that concerns biodiversity loss around the world. At the same time, our cities don't stop growing and expand, resulting in the fact that urbanisation is a main aspect of societies today.

Cities development and human activities had and still have an important impact on biodiversity and are one of the main reasons of species loss. In today's challenge of cities evolution, we wonder how we could rely human and nature in a city context.

How the architecture and the city can be an opportunity to enhance biodiversity?

From theory and analysis, the master thesis is developing a project that could evolve in a city context.

Chapter 1_ Strategy

Chapter 2_ Analysis

Chapter 3_ Project

Chapter 4_ Development strategy

Chapter 5_ Conclusions & Reflections

STRATEGY

WHAT IS HAPPENING ?

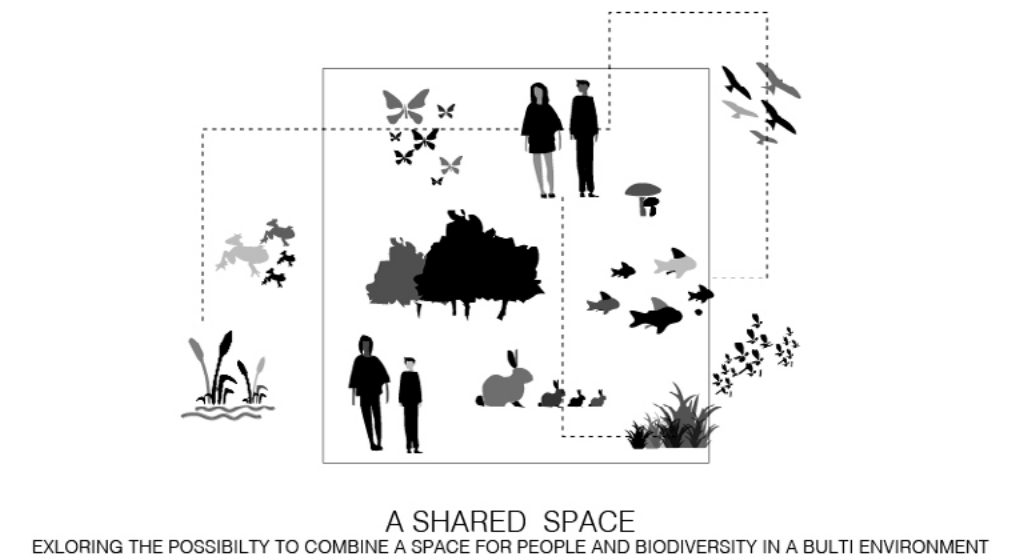
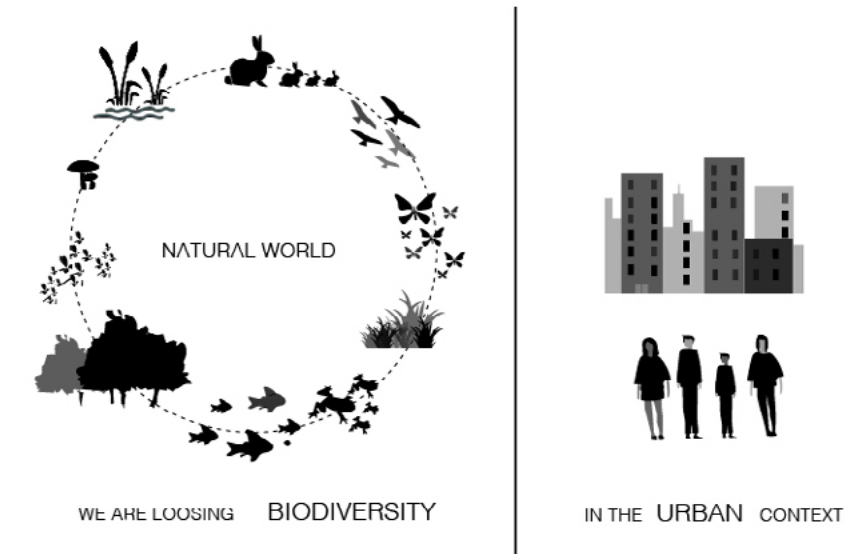
We are losing biodiversity in an urban context. In other words, we are facing an important disconnection between the city and the biodiversity, and consequently between humans and biodiversity. Indeed, cities have grown really fast during the last century without taking care of the biodiversity and their needs, that is why we are living currently in cities disconnected from our environment.

SHARED-SPACE

According to the fact that biodiversity is mainly affected by urbanisation, the intention of our proposal is to use architecture and the city as an opportunity to gather together human and biodiversity. Our strategy is to develop a shared-space for people and biodiversity where they could coexist together in a urban dense environment. In this way, the project aims to propose a new ecosystem for nature in the city by experimenting how we can reintegrate biodiversity in building and urban planning, either on new projects and actual cities that have been mostly designed for humans.

Nevertheless, it is really important that people become aware of the society challenge concerning the biodiversity loss. This is the reason why our project is guided by a pedagogic aim, in order to teach people how biodiversity is important for their own well-being and how it could be integrated in our cities.

The idea is that people learn about biodiversity in this shared-space, experimenting how we can co-exist with nature and learn to respect it and preserve it as well. Our proposal aspires to let people experiment by themselves this new way of living.



FACTS

It is important to understand properly the relation between biodiversity and urbanisation. The decrease of biodiversity and the increase of urbanisation are clearly related.

Indeed, urbanisation, which can refer to the physical growth of urban areas as a result of global change, began during the industrial revolution when workers had moved towards manufacturing hubs in cities to obtain jobs. (3)

According to the graphic (left page), the rate of population living in cities has increased mainly at the beginning of the XXth century as the biodiversity starts its important decline.

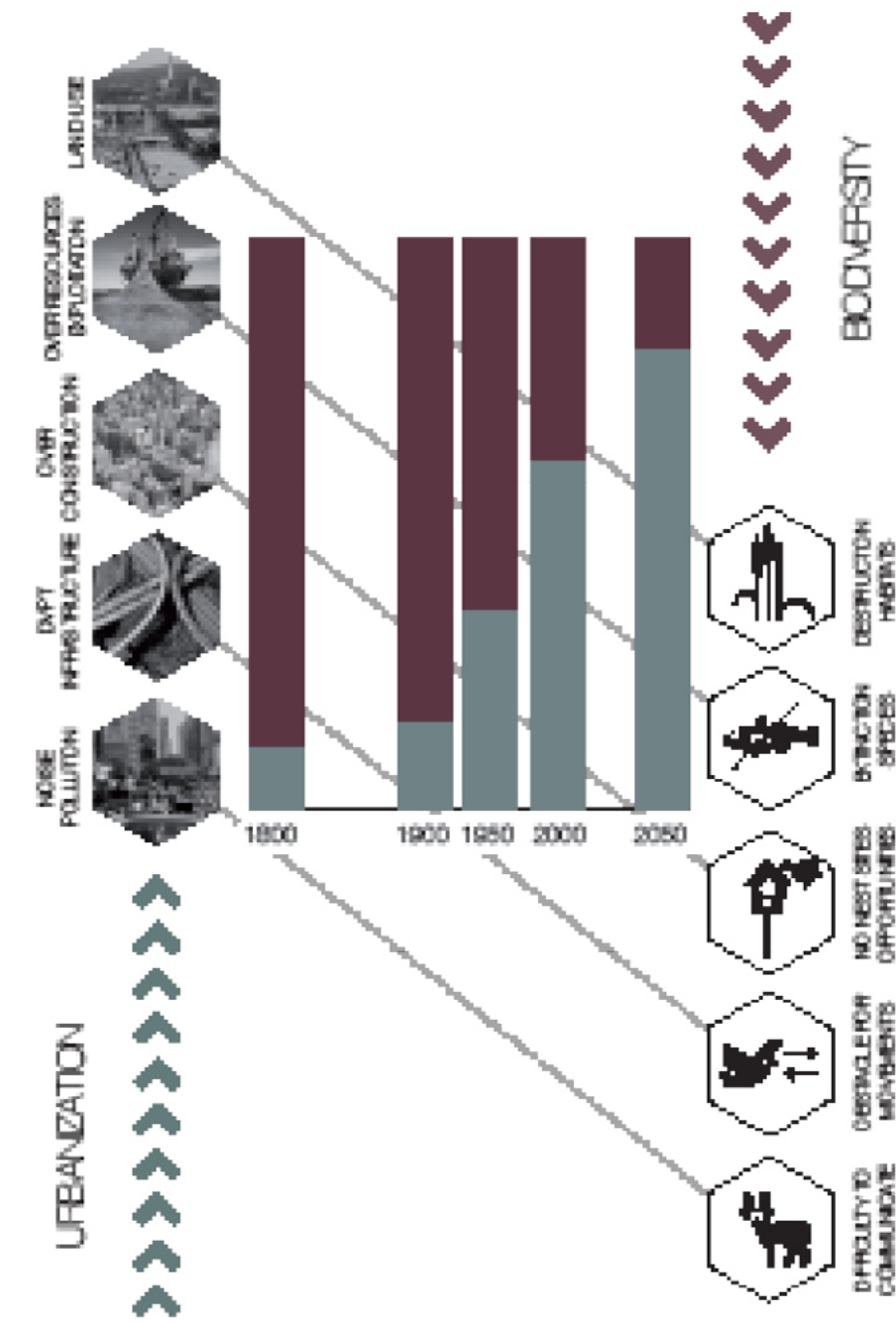
The expansion of urbanization had several consequences on biodiversity, inducing it loss.

For example, land uses for human activities have increased with the urbanisation and had consequently destroyed a lot of natural habitats as wetlands, rivers and forests. In this way, it is limiting areas where the biodiversity could develop.

Moreover, we had considered for a long time that the natural resources were inexhaustible. Indeed, the over exploitation of resources induced extinction of species as happened with the large scale industrial fisheries.

Due to the growth of cities and population, the over construction and the development of infrastructures had affected habitats and nest sites for the biodiversity, creating at the same time obstacles for the fauna to move through the city.

Finally, the noise pollution occurring in dense cities produces stress for the fauna since it is more difficult for them to communicate.



WHY BIODIVERSITY MATTERS?

Biodiversity is fundamental for the regulation of the earth system and as well for human well being. Indeed, biodiversity provides us:

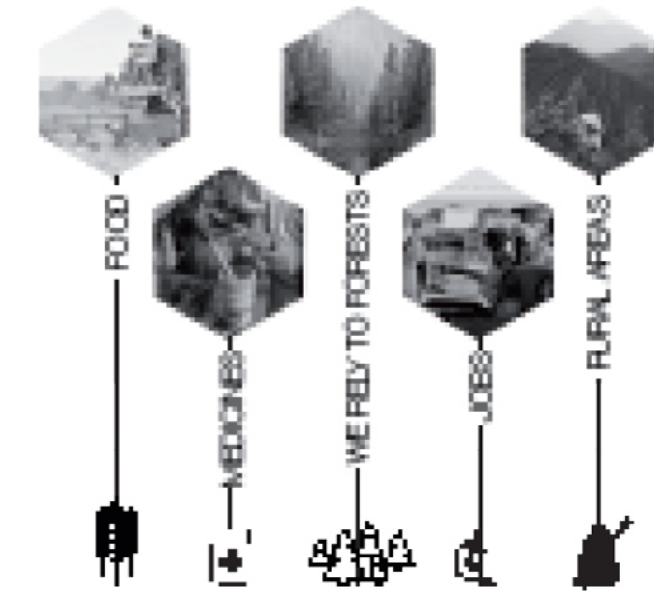
FOOD: Biodiversity is important concerning the diversity of functions that it proposed in order to develop food, micro-organisms in the soil, nutrients for plants. Indeed, humans consume 7000 plants species as food and 70% of the world's poor live in rural areas and depend directly on biodiversity for their survival.

MEDICINES: Indeed, half of synthetic medicines to cure illness have a natural origin.

WATER: Living species regulates the flows of fresh water, the flows of carbon, nitrogen and phosphorus. Moreover, the fauna is purifying the water that we can use afterwards.

OXYGEN: Oxygen is produced during the process of photosynthesis and released mostly by plants. Nevertheless, it can also be found in water, rocks and minerals. Indeed, biodiversity is fundamental concerning the quality of the air that we breathe.

JOBS: Biodiversity is also really related to jobs. Indeed, a lot of people like farmers and fisherman for example depend on biodiversity for their economical survival.



Humans consume 7000 plant species as food



1/2 of synthetic drugs have a natural origin, including 10 of the 25 highest selling drugs in the U.S.



1.5 billion of the world's 7 billion people rely in forests for their livelihoods



Losing biodiversity costs jobs



70% of the world's poor live in rural areas and depend directly on biodiversity for their survival and well-being

REFERENCES

TURN GREY BRITAIN GREEN, London - England, Cody dock ^(a)

Green the city - Wildlife corridors - Abandoned area

PASSEIG SANT JOAN, Barcelona - Spain, Lola Domenech ^(b)

Pathway - Green - Stripes

HIGH LINE, New York - USA, Diller Scofidio + Renfro ^(c)

Pathway - City - Interaction - Human - Biodiversity

BIODIVERSITY, research project - Ljibers Architects ^(d)

City - Biodiversity

TOWER OF BIODIVERSITY, Paris - France, E. Francois Architectes ^(e)

Building - City - Spread biodiversity - Native species

PRIMARY SCHOOL, Paris - France, Chartier Dalix Architectes ^(f)

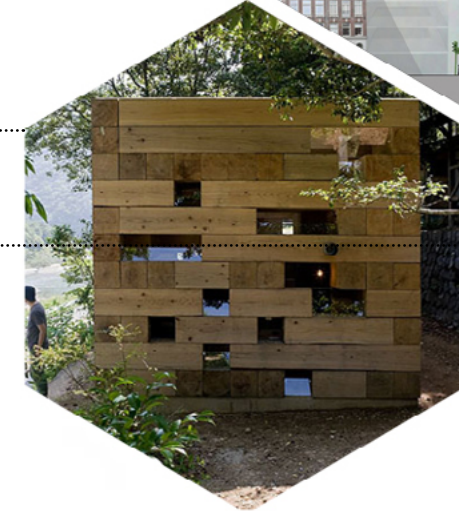
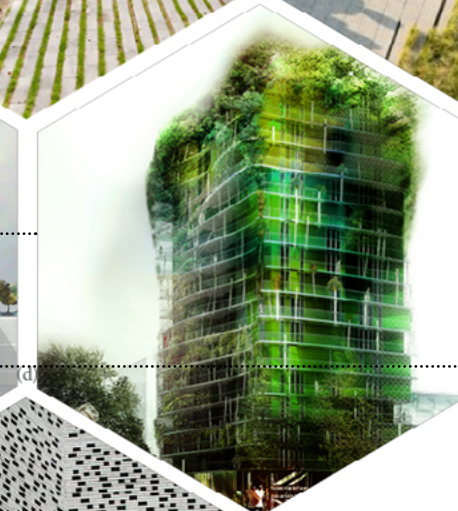
Teaching - Habitats - Biodiversity - City

TETRIS HOUSE, Kumakura - Japan, Sou fujimoto Architects ^(g)

Materiality - Openings - Interaction

KOLUMBA MUSEUM, Kolumba - Germany, Peter Zumthor ^(h)

Materiality - Habitat opportunities - Tectonic





(i) Final vision, Rendering. Primary School for Sciences and Biodiversity by Chartier Dalix Architects



(l) Cody dock, view on the plants <http://www.bbc.com/news/science-environment-32254701>

CASE STUDY

Primary school, Paris - Chartier dalix architects

BIODIVERSITY - TEACHING - MATERIALITY - CITY

The architects Chartier Dalix have designed an innovative primary school and public gymnasium in Boulogne Billancourt, city situated near Paris. The building proposes a new environment in a dense urban context that aims to enhance biodiversity. Indeed, this new landscape, designed as a topography, offers several opportunities for fauna and flora.

The mineral walls, made from prefabricated concrete blocks provide new habitats for vegetation, wildlife and different native species. (4) The roof is designed as a big garden, with areas for mesophilous plants, shrub land and woodland island.

This living landscape give a fundamental opportunity to teach to children the importance of biodiversity and showing that urban context and biodiversity can work together.



(j) View of the facade © cyrille weiner



(k) Detail wall © david foessel

CASE STUDY

Turn grey britain green, London - England, Cody dock

GREEN THE CITY - WILDLIFE CORRIDORS - ABANDONED AREA

Cody Dock, situated in east London, has been for a long time an industrial area of gas and chemical companies. During the past 25 years, it was abandoned.

A group of volunteers and local businesses had the project to "turn the area green" in order to improve the quality of the site and recover the access to the water.

Moreover, greening Cody Dock had the effect of reintroducing biodiversity in the area by putting reed beds in the water in order to clean it for example.

According to Al Cree, volunteer, "when we first go here, the site was desolate, there was no green and hardly anyone came here. Lately, more wildlife is coming into the area and people can see it".

This "catalyst" project aims to be developed in all London surroundings by turning 6000 grey spaces green. The idea is to develop wildlife corridors that could help the biodiversity to be enhanced in old abandoned areas. (5)



(m) Cody Dock, view on the industrial area, <http://www.bbc.com/news/science-environment-32254701>

METHOD

METHOD PROCESS

STRATEGY - ANALYSIS - TOOLS - PROJECT - LONG-TERM

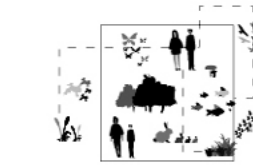
In order to achieve the master thesis project, we followed a method that can be divided in 3 main parts: Defining a project strategy, working on an analysis to develop afterwards a design.

#1 More precisely, we first had made researches concerning the biodiversity loss issue to be able to define a strategy for our project that could answer our problematic.

#2 Then we had developed a precise analysis divided in two parts that are complementary. Concerning the first part, we worked principally on maps and diagrams although the second part is the result of the study on site where we had the occasion to have several meetings that enriched our analysis.

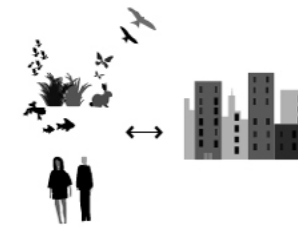
#3 Lately, from these two analyses, we defined tools that will be implemented in the design.

Then, we had developed the project by implementing these tools, following a main design concept. The aim of this project dealing with biodiversity is that it has to evolve and be adapted in the long term. In this way, we defined a long-term strategy for the project, aiming at improving the results along the years concerning the biodiversity enhancement in a dense urban context.



I. Definition of the strategy : Shared-space
 II. Research about the topic : Biodiversity & Urbanisation
 III. Prototype
 IV. 3 scales project
 V. Choice of the city

STRATEGY



I. REGIONAL ANALYSIS
 Biotopes, water, topography, infrastructures >>> Green corridors
 Fauna & Flora >>> Ecosystem interdependencies

II. LOCAL ANALYSIS
 Programs, Besos river, chemical datas

III. SITE ANALYSIS
 Programs, biotopes, urban plan

BARCELONA STUDY TRIP
 One month on site

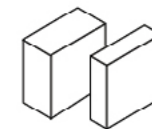
MEETINGS
 Orthinologist
 Biologist
 Landscape architect
 Municipalities
 Master thesis students

ANALYSIS



DEFINITION OF TOOLS TO DESIGN

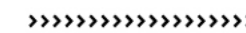
DESIGN



I. IMPLEMENTATION OF THE TOOLS
 Regional scale | Building scale

II. PROJECT DEVELOPMENT
 Concept
 Grid of the project
 Plans - Sections - Facades
 Construction detail - Materiality
 Models

LONG TERM STRATEGY



III. ADAPTIVE MANAGEMENT STRATEGY
 Testing ideas strategy
 Biologists on site
 Dynamic modules

RESEARCH FOR DESIGN

PROTOTYPE

CITY - RIVER - BUILDING

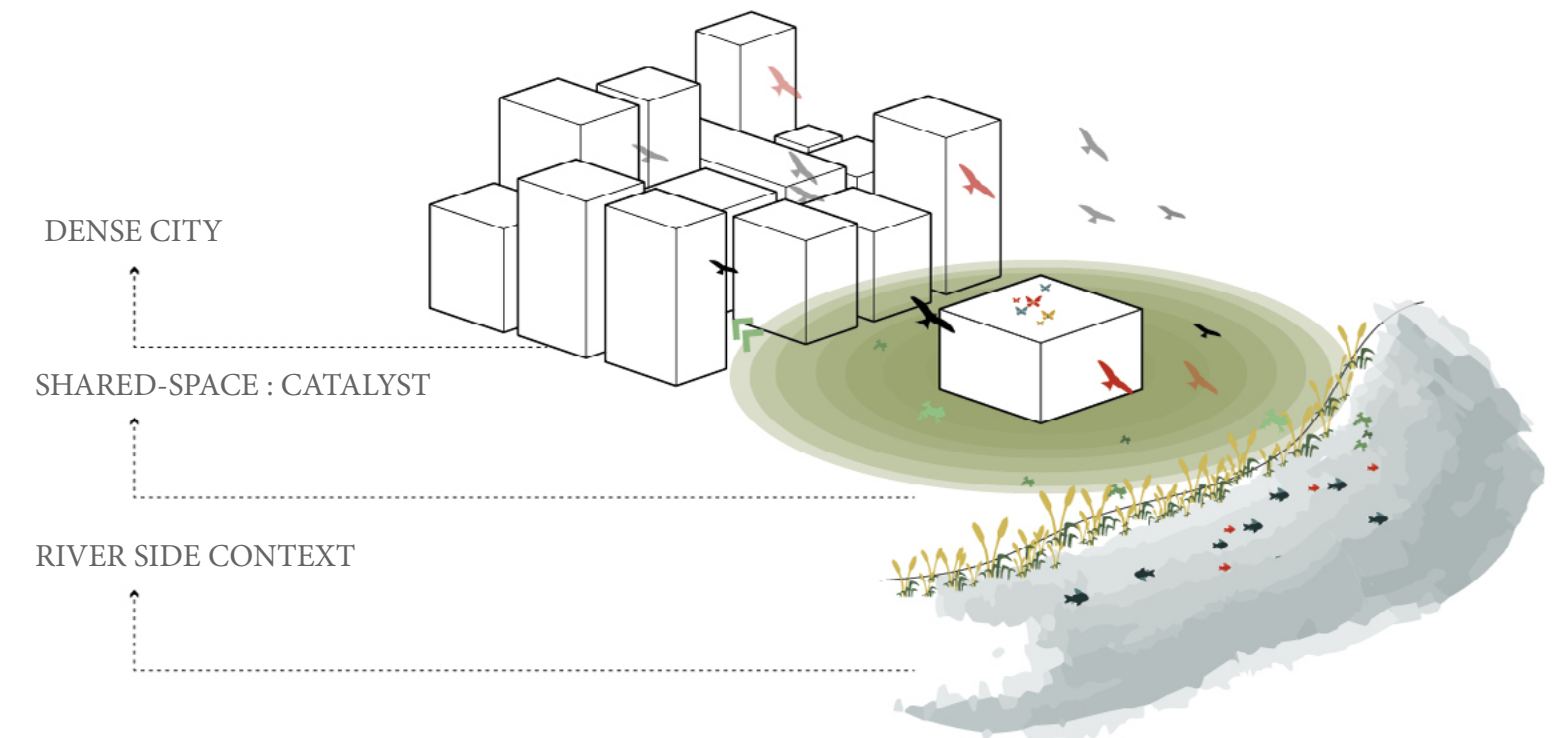
In the project process, it was important to define a prototype that could help us to implement the strategy of the shared-space.

#1 CITY - Since our project is dealing principally with the idea that the urban context should be an opportunity to enhance biodiversity, our strategy has to be implemented in a dense city.

#2 RIVER - Secondly, one of the main features of European dense cities is the river that is crossing the urban context. The river can be a really good opportunity to enhance biodiversity since it is a natural corridor that is already connected to the city and people.

#3 BUILDING - For our architecture's Master Thesis final project, we wanted to develop a building. According to the strategy, the building will be the shared-space.

In our prototype, the building is placed in between the city dense context and the river, acting as a catalyst that spreads biodiversity.



3 SCALES

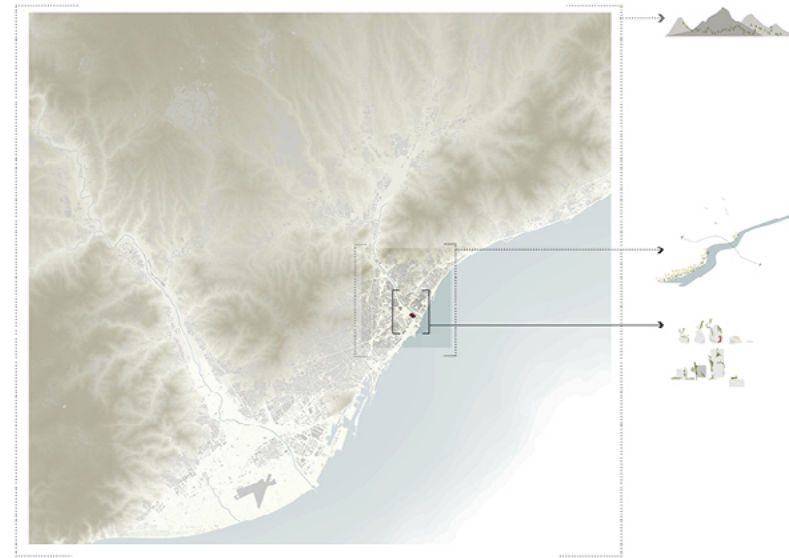
REGIONAL - LOCAL - SITE

In order to enhance biodiversity in a city context, it is important to work at different scales that correspond to the prototype. In this way, the project will be developed at three scales that are interconnected creating a real opportunity to spread biodiversity through the different actions:

#1 REGIONAL SCALE – Development of green corridors through the city that enable the biodiversity to move through the biotopes, greening the city at the same time for the well being of humans.

#2 LOCAL SCALE – Zooming in a local scale by naturalising the river edge. Indeed, the goal is to implement plants that could help to purify the quality of the river and surroundings. At the same time, it can be an opportunity to rely humans with the river side.

#3 SITE SCALE – Zooming in the building scale by developing the shared-space for humans and biodiversity that will act as a catalyst.



IMPLEMENTATION IN BARCELONA

WHY BARCELONA?

DENSE CITY - NATURAL LIMITS - PLAN BIODIVERSITY 2020

After having defined the strategy of the project and the prototype, we had to implement it in a city that was dealing with the dense urbanity and river features.

We selected Barcelona since this city was in accordance with several points of our prototype:

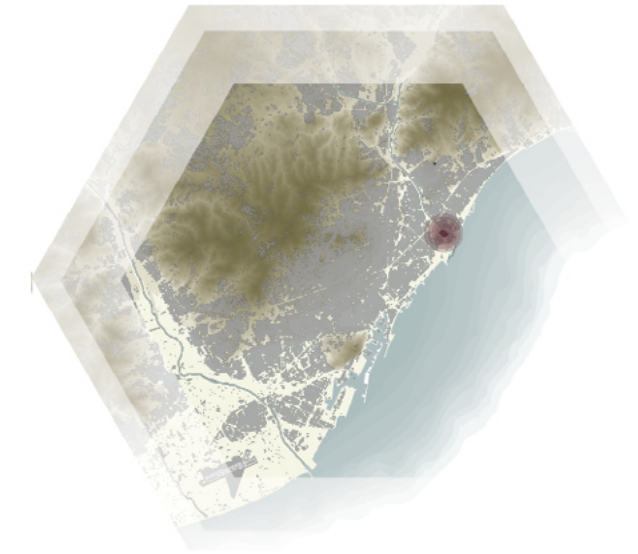
First of all, Barcelona, situated in Spain, is a really dense city. Indeed, it is the second biggest city in Spain, with a population of 1,6 million of inhabitants.

In consequence of this important density, Barcelona is mostly polluted according to the air, water and noise quality principally.

Secondly, the city is characterised by natural limits that are interesting and good opportunity for biodiversity enhancement. Barcelona is surrounded by the Mediterranean sea side, the Collserola mountain range on the west side and the two rivers Besos and Llobregat. These strong natural limits are shaping the city, limiting the expansion of the city to the detriment of the green areas.

Moreover, the Mediterranean features of the city, considering the climate, the culture and the rich historical and architectural patrimony were interesting to take in consideration for our project.

Finally, we found out that the city of Barcelona was developing a plan for biodiversity for 2020 in order to preserve and enhance its natural patrimony. In this way, it was a really good opportunity for us to work on this Master thesis project in relation with this plan for the future.



PLAN FOR BIODIVERSITY 2020

STRATEGIES - GREEN INFRASTRUCTURE -PRESERVING

The plan for biodiversity 2020 has been defined by the municipality of Barcelona in order to green the city. It has been set up in accordance with European Union Strategy for the Biodiversity 2020. (6)

This plan aims to define strategies, actions and directive lines that can help to preserve the natural ecosystems, the fauna and the flora, and as well to develop ecological infrastructures. (7) Basically, the main goal is to improve the quality of the city by relying biodiversity with the urban context.

Indeed, why Barcelona needs a plan for biodiversity?

Barcelona is rich in its natural patrimony, according to the natural features that has to be preserved. Moreover, the green in the city offers ecological, environmental and social qualities that have to be developed. (8)

The fauna and flora can provide a lot of benefits to the inhabitants, but they are facing a lot of pressure and stress in Barcelona that make difficult their survival.

What can Barcelona improve?

Barcelona wants to develop a new city model, based on sustainability that aims to reconnect urban nature with the population through some main lines:

- Preserve habitats and species by improving the habitat quality for the species (soil quality, permeability and water presence) and the biological quality (habitat and species wealth, enhancement of the fauna and flora)
- Improve the urban pressure by working on the environmental quality (acoustic comfort, climatic comfort and air quality) and the sensory quality (sound quality and visual quality)
- Participation and interaction with the population by developing a cultural interest (identity of the city, historical and artistic interests, educational and pedagogic aim)(9)

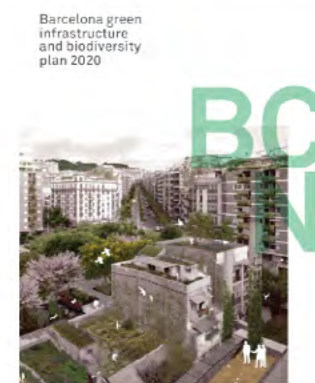
What are the main strategies?

The main strategies to develop the green connectivity and the city natural qualification are

- The development of green corridors to connect the different biotopes. The green corridors are opportunities to create attractive habitats for the fauna and improve the environmental and social quality of the city.
- Preserve and improve the natural patrimony of the city in order to decrease the biodiversity loss.
- Achieve the maximum of green superficies by developing its connectivity.
- Improve the value of green and biodiversity for the people and their knowledge about it. (10)



(n) The green network of Barcelona, poster 20, p33



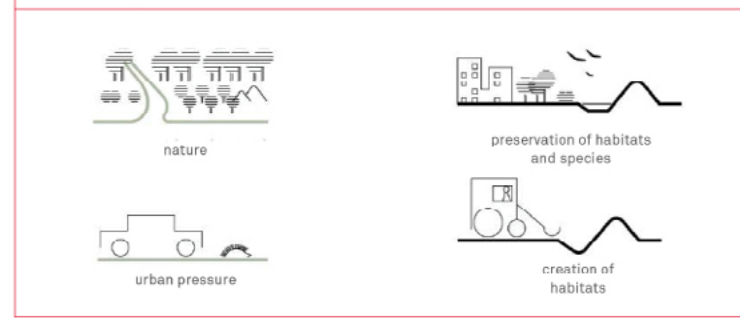
(o) Cover of Barcelona plan for Biodiversity

ANALYSIS

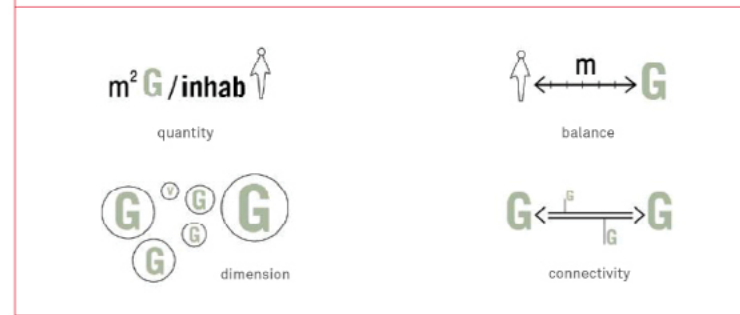
« Barcelona green infrastructures and Biodiversity Plan envisages Barcelona in 2050 as a city where nature and urbanity interact and enhance one another» (11)

The plan for biodiversity 2020 makes a deep analysis of the actual general condition of the biodiversity in Barcelona, including biotopes, ecosystems and green corridors.

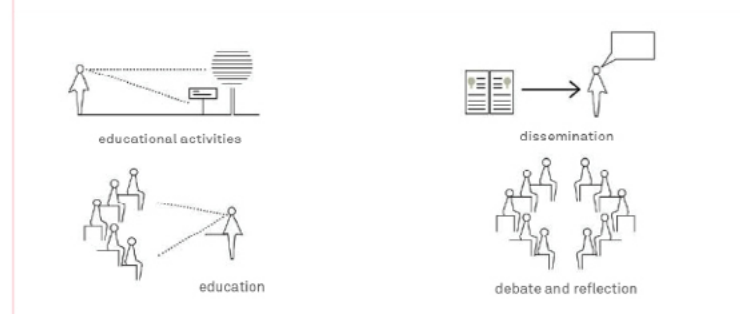
NATURAL HERITAGE



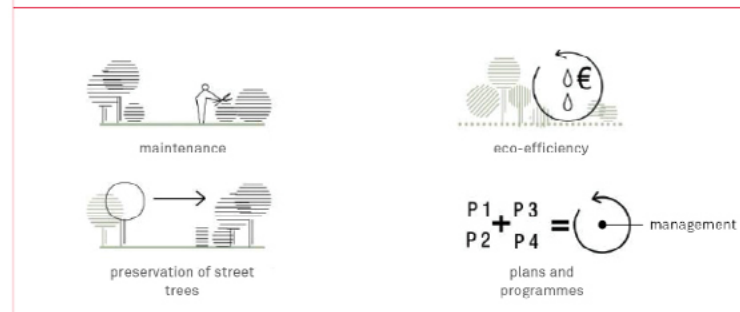
TERRITORY



COMMUNICATION AND EDUCATION



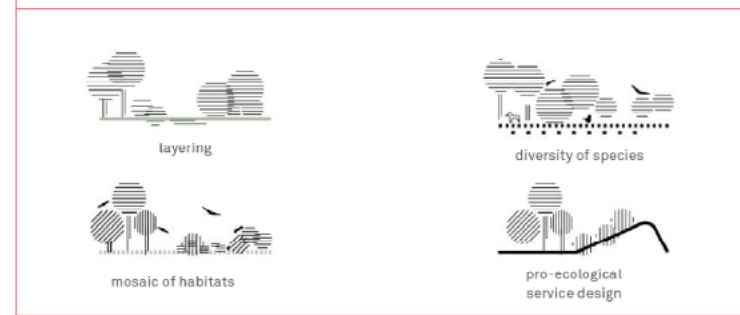
MANAGEMENT MAINTENANCE



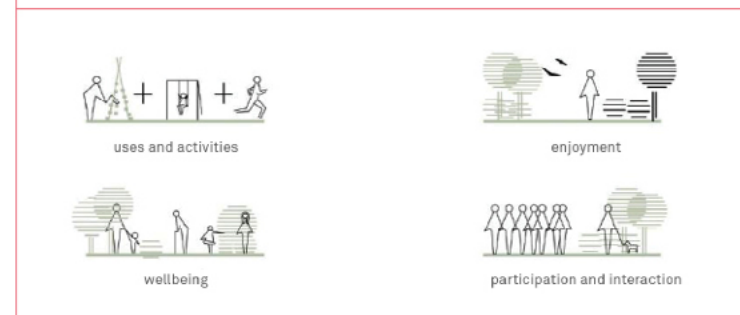
MAIN STRATEGIES TO IMPROVE THE CITY

These diagrams are defining the kind of biodiversity and green infrastructure that the city of Barcelona wants to develop and improve. These directive lines and strategies rely to the development of green infrastructures that could act as a new green network. As well, putting the emphasis on biodiversity matters and using every urban spots as opportunities to define new places for fauna and flora.

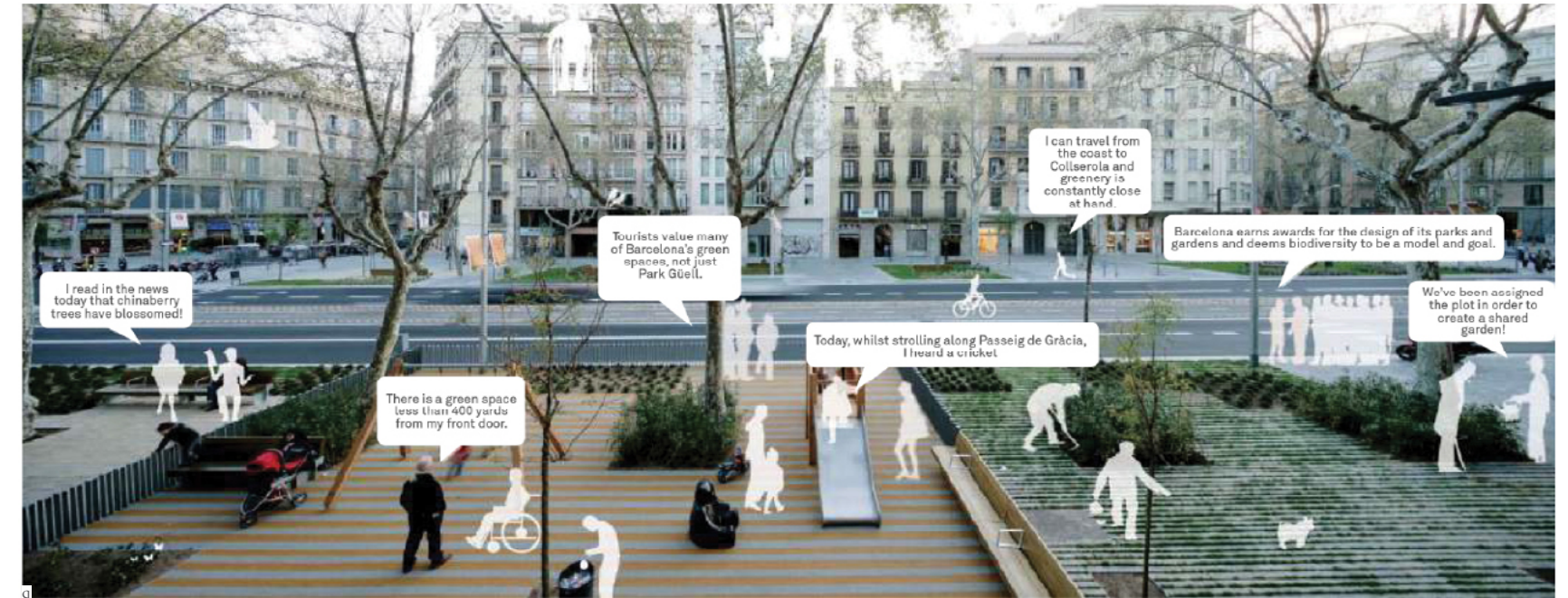
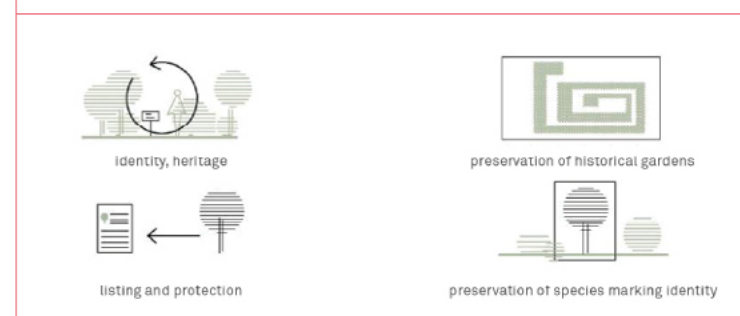
STRUCTURE AND ECOLOGICAL SERVICES



QUALITY OF LIFE



CULTURAL HERITAGE



Barcelona green infrastructure and Biodiversity plan 2020, Ajuntament de Barcelona, pdf version, poster 21, p64



Barcelona green infrastructure and Biodiversity plan 2020, Ajuntament de Barcelona, pdf version, poster 30, p75



Barcelona green infrastructure and Biodiversity plan 2020, Ajuntament de Barcelona, pdf version, poster 28, p73



Barcelona green infrastructure and Biodiversity plan 2020, Ajuntament de Barcelona, pdf version, poster 29, p74

VISION FOR THE FUTURE BARCELONA

- (q). City vision for 2050: Barcelona, a city where nature and the urbanity converge and enhance one another. How Barcelona could look like as a city that enhanced the biodiversity?
- (r). Nature is a garden and gardens are nature. Preserve and design more gardens in the city since they are good biotopes for the biodiversity.
- (s). From passive platforms to dynamic and vital spaces. How the biodiversity can be integrated in pathways and resting spots?
- (t). New forms of urban green spaces, within reach and productive? Using roofs, balconies, walls to enhance biodiversity.

(p) Barcelona green infrastructure and Biodiversity plan 2020, Ajuntament de Barcelona, pdf version, 2.4, Key concepts of the diagnosis, Medi Ambient I serveis urbans, p60

MEETINGS IN BARCELONA: REPORT

BIOLOGIST - ARCHITECTS - MUNICIPALITIES

In order to rely our master thesis project with the Plan for Biodiversity 2020, it was essential to go to Barcelona for a period long enough that could enable us to meet the important actors that are dealing with urbanisation and biodiversity and to visit properly the site.

By spending the entire month of February in Barcelona, we had the occasion to enrich our project thanks to several meetings with people that are acting in a different ways for the preservation and the enhancement of the biodiversity in Barcelona.

Antonio Gomez, Biologist and coordinator of the Master of Biodiversity in the Faculty of Biology in Barcelona: We had the occasion to meet Mr Gomez several times, enable us to discuss about the strategy and to adapt it according to his feedbacks. Moreover, he provides us a lot of documentations concerning the biodiversity in Barcelona that enrich our knowledges and analysis.

Jaume & Alexis, master thesis' student in the Master of Biodiversity in the Faculty of Biology in Barcelona: Mr Gomez put us in relation with his two students so that they could collaborate with us on the project, principally on the strategy. They gave us relevant and fundamental advices along the process concerning the interaction between human and biodiversity by expressing mostly their knowledges on biodiversity. As well, they provided us interesting references concerning ecological environment theories.

Xavier Ferrer, ornithologist working at the Faculty of Biology in Barcelona: Specialist of birds and their needs, the meeting with Mr Ferrer was really useful. Indeed, he guided us towards the species of birds that could interact with our building and help us to understand their needs, their feeding system, their relation to human and their habitat. We discussed mostly about the integration of biodiversity on our project, in order to know how it could work in the reality.



Maria José Chesa Marro, director of planification and innovation, water cycle department in the municipality of Barcelona: Mrs Chesa Marro explained us in detail the water management of the city and gave us at the same time a lot of information and maps concerning the different water nets in Barcelona. Indeed, the aim of this department is to manage and optimize the provision of water cycle services, towards a sustainable city. Mrs Chesa Marro presented us the main strategies that she would like to implement in the city. In one hand, the idea is to develop green walls and roofs in the city, promoting new green spaces in the city by using the water management. In an other hand, there is a really interesting plan already implemented that deals with projects concerning the public and ornamental fountains in the city. Indeed, the municipality already starts to clean the ornamental fountains with natural products, allowing the biodiversity to use these fountains presents in Barcelona as a habitat. It is a really good opportunity to enhance biodiversity in the city, while preserving the rich patrimony of the city. This meeting was really interesting to understand the opportunity to use these fountains in our project.

Denia Beliver, working in the technical department of Medi Ambient in the municipality of Sant Adria del Besos: Working principally with environmental challenges in the city next to Barcelona, where the Besos river takes part, Mrs Beliver provided us an important amount of documents.

She gave us interesting reports concerning the quality of the water of the river, the quality of the air and as well on the sound quality of Sant Adria del Besos.

The report on the river water quality was really important to complete our analysis since we decided to implement the project next to Besos river. Moreover, it gave us information concerning the actual state of the biodiversity through accurate chemicals datas taking in consideration the physio chemical and biological qualities.

Thanks to information concerning the fauna and flora presence around Besos, we could complete our index.

Finally, we discussed with Mrs Beliver on our project, according to the pedagogic aim. She explained us that one of the plan of Sant Adria del Besos municipality was to develop pedagogic activities around Besos for the inhabitants. The aim is to reconnect people with biodiversity by teaching them and find a playful way to learn them the importance of biodiversity in an urban context. It was an interesting trail to follow concerning the program of our building.



Victor Tenez, landscape architect: M Tenez has been working with a lot of projects that deal with a river context. Most of them have been developed next to the Llobregat river, in the boundary of Barcelona. In this way, it was really interesting for us to discuss with him about the strategy and the process to follow to implement a project that deal with biodiversity next to a river, taking in consideration the features of Barcelona.

M Tenez explained us the importance of the testing ideas process when we work with nature and biodiversity. A “testing ideas” strategy aims to report the result of the project along the years, in order to see its value and be able to modify on site some elements if it is needed.

According to the fact that we want to work on a project that can inspires a new way of dealing with biodiversity in an urban context, it is important to take in consideration this strategy for our project development along the years.



Consorci del Besos, Sant Adria del Besos: We had to opportunity to present our project to the Consorci del Besos, that is an institution that deals with the management of the river and its surroundings, concerning local constructions, development of infrastructures. It has been constitute by the municipality of Barcelona in order to develop the area around the river.

We had a meeting with Jesus M. Canga Castano, manager of the department and Antoni Alarcon I Puerto, director of the Consorci.

They presented us the new urban plan that they are going to implement on an interesting site called La Catalana, situated next the river. Moreover, they presented us some projects dealing with the preservation and enhancement of the biodiversity that they would like to develop.

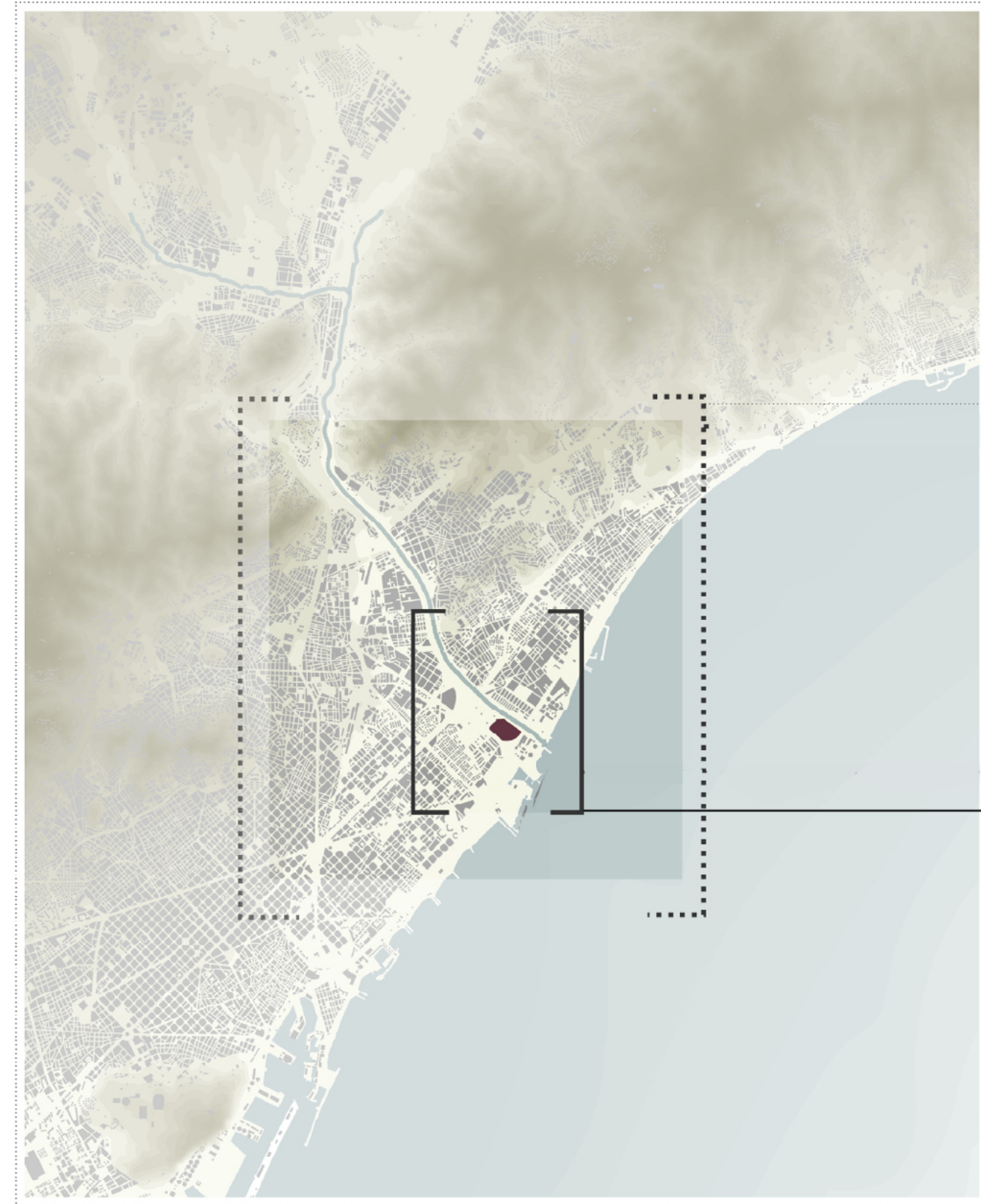
We discussed as well concerning strategies that we could incorporate in the design process to deal with the idea of green corridors and connection for human and biodiversity, by trying to find solutions as well for the flooding issues of the river.

ANALYSIS

ANALYSIS

WHAT IS IT?

The analysis aims to achieve useful results for the design process. The analysis is focused on the study of the biodiversity and the interaction with the human world, these two topics need to be studied in different zooms in order to have a whole vision of the situation. This is the reason why this part has been done in 3 different scales: regional, local and site. Developing the project in different zooms creates more possibilities to spread biodiversity in a larger area.



REGIONAL scale
-area 80x80 km
-study of the existing GREEN CORRIDORS, BIOTOPES, INTERDEPENDENCIES between FLORA AND FAUNA
-project: ENHANCING NEW GREEN CORRIDORS

LOCAL scale
-area 10x10 km
-studies of the human features in relation with the condition of the nature
-project: RENATURALIZATION of the delta of the river Besós in order to enhance the biodiversity in that area after years of industrial pollution actuated by the humans.

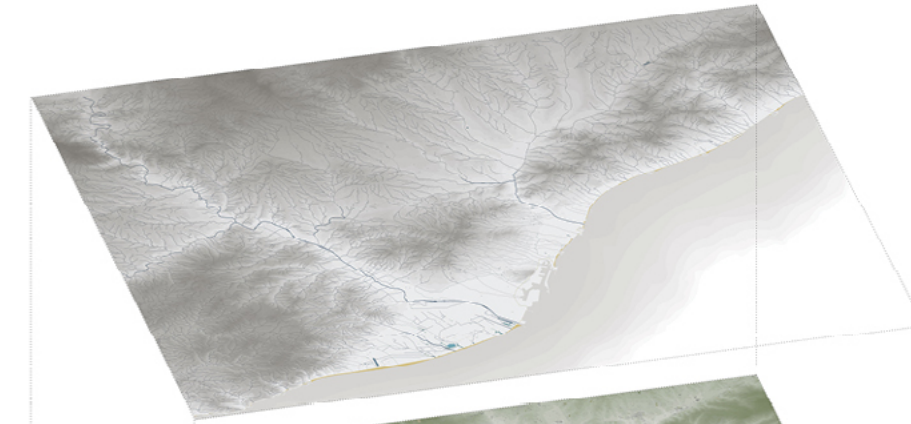
SITE scale
-area 1x1 km
-study of the historical, program biotopes and infrastructures
-project: PEDAGOGICAL CENTER on the side of the river Besós.

REGIONAL ANALYSIS

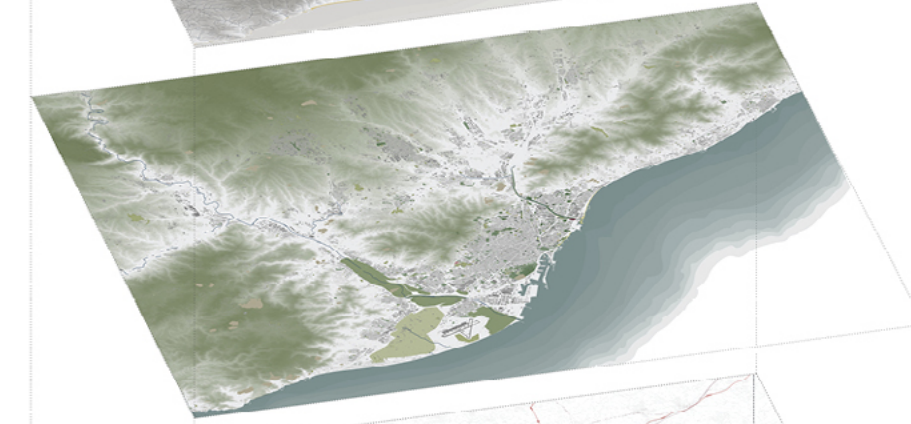
WHAT IS IT?

The regional analysis is aimed to know which are all the natural and human features in a territorial scale, an area of 100 by 100 km, studied in 1:100 000 scale. The main aim of the regional analysis is to understand which are the boundaries of the human factors and the natural world. All the elements are studied in an exploded axonometry that divides several main elements that have to be take in consideration.

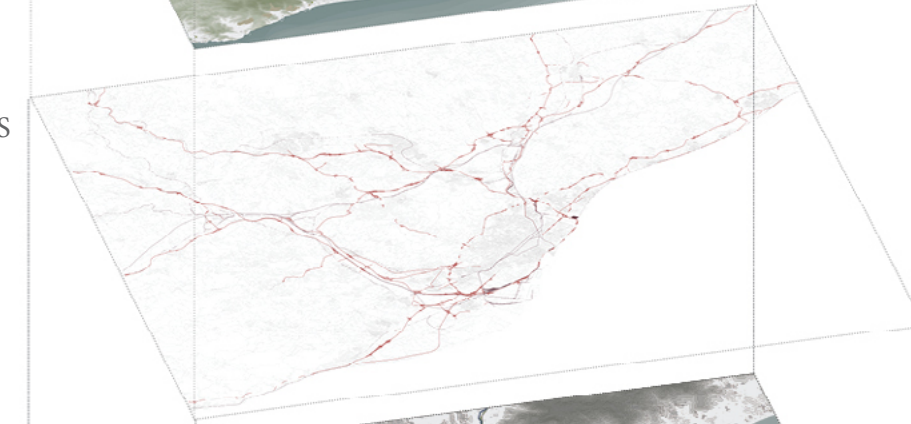
WATER and
TOPOGRAPHY



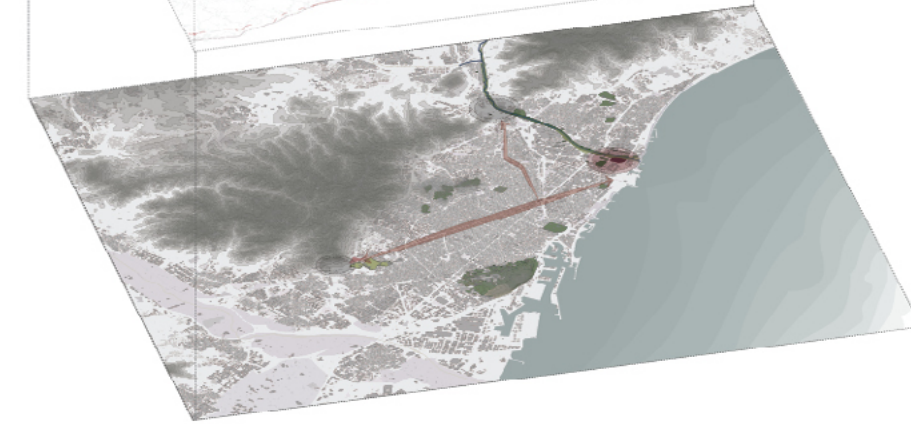
BIOTOPES



INFRASTRUCUTRES



ZOOM IN-
CONCLUSION

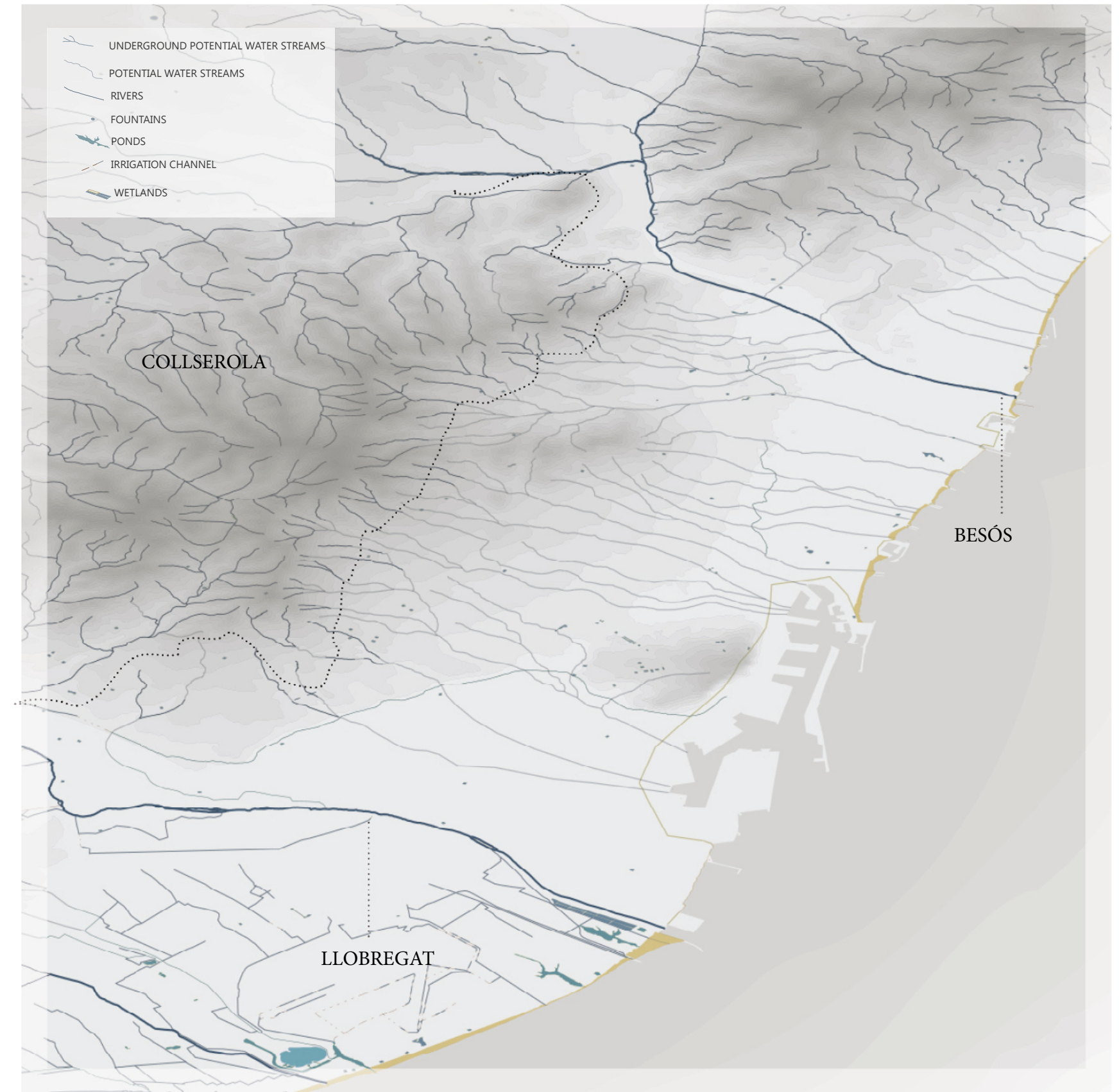


WATER and TOPOGRAPHY

LLOBREGAT and BESÓS, WATER SUPPLIES, COLLSEROLA

Since hydrology plays an important role in the development of biodiversity, the analysis at a regional scale defines which are the main water elements: the main two rivers of Barcelona, Besós and Llobregat, draw the east and west borders of the city. The other streams that flow from the range of Collserola are potential rivers, mostly dry during the year. Another presence of water is represented by the water supplies of the city: 1.643 drinking public fountains, 307 ornamental fountains, 21 groundwater network operating systems, 78 km of groundwater network and 3,4 km of regenerated water network ⁽¹²⁾.

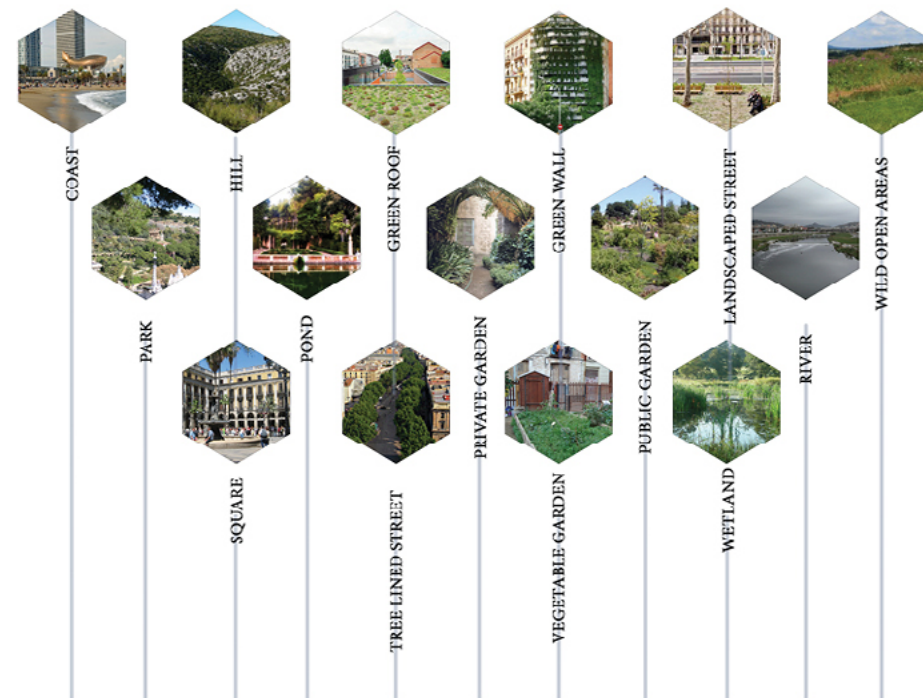
The city of Barcelona is also defined by the presence of the mountains: Parc Natural de la Serra de Collserola and Serralada de Marina.



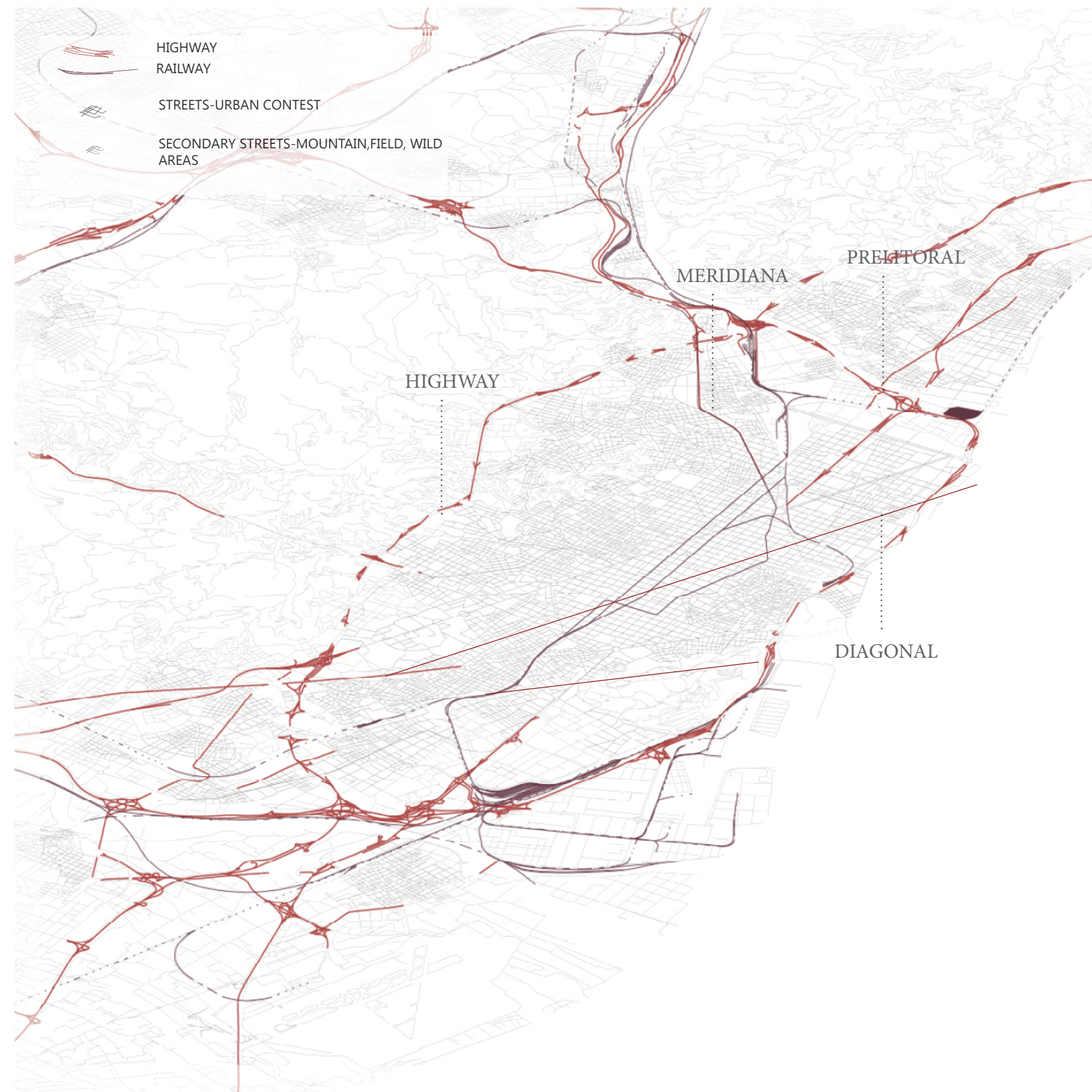
BIOTOPES

WHAT IS A BIOTOPE? GREEN SPACES OF BARCELONA

A BIOTOPE is an area of uniform environmental conditions providing a living place for a specific assemblage of plants and animals (13). The analysis at a regional scale takes in consideration the presence of biotopes since they are the basic habitats for the fauna. The region of Catalunya is rich in wide parks because of the presence of water, but the city itself boasts of small biotopes. Barcelona in fact contains sixty-eight municipal parks, of which twelve are historic parks, five are thematic (botanical) parks, forty-five are urban parks and six are forest parks (14). The range of the green areas goes from small parks to large recreation areas. The urban parks alone cover 10% of the city (549.7 ha or 1,358.3 acres) (15). The total park surface grows about 10 ha (25 acres) per year, (16) with a proportion of 6,6 square metres (195 sq ft) of park area per inhabitant (17). Barcelona counts many green spaces because of the consistent urbanistic plans made in the past centuries. From 1859 Cerdà, urbanist of the city, gave an important change to the morphology of the urbanism with the *Eixample* (18). In the strategy the 65% of the block is intended to be green space (in order to achieve the 250 ab/ha), even if in the end of the 19th century already the 70% of the blocks are let to the constructions. This urban strategy let the possibility of the growth of many small green spaces all around the city. In the years the trend of the biodiversity decreased because of the growth of the urbanization, a process that is interesting the entire world.



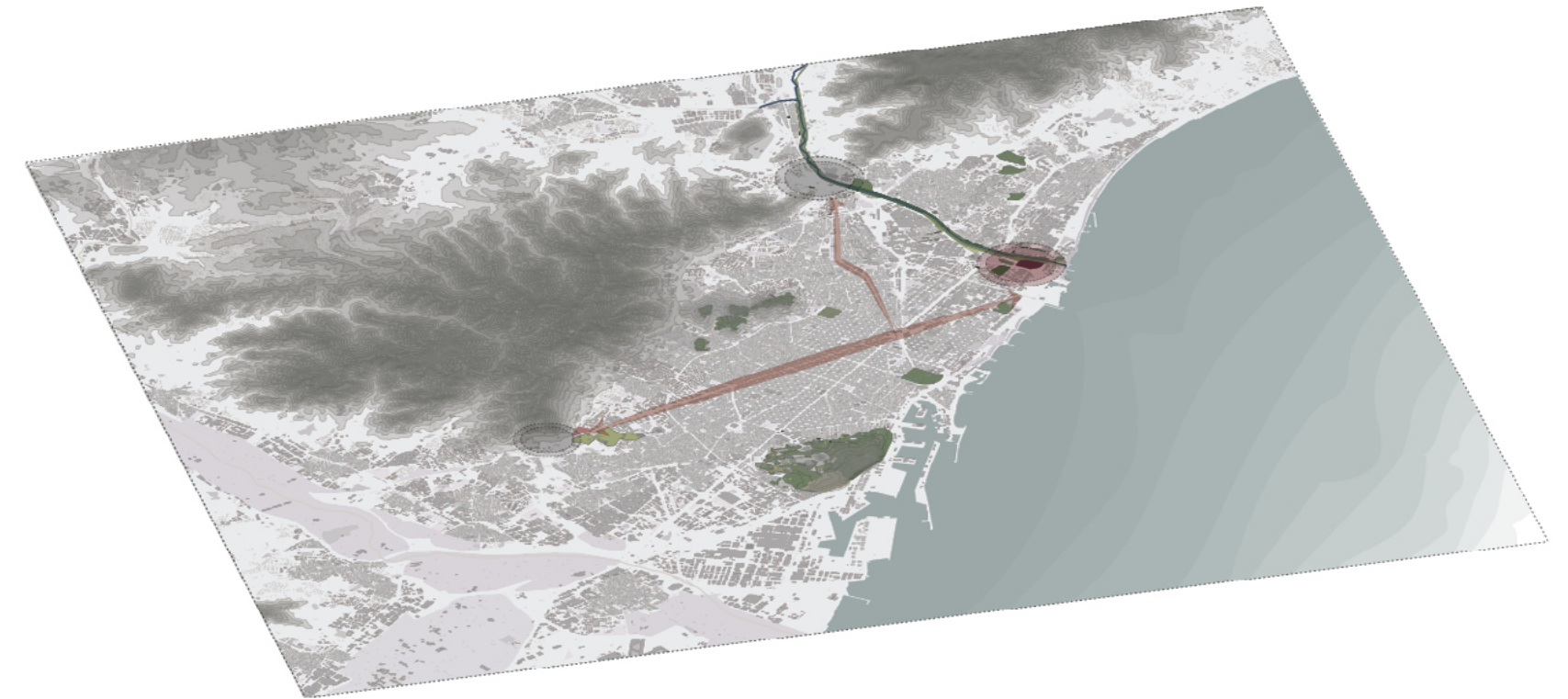
INFRASTRUCTURES



CONCLUSION: ZOOM IN BARCELONA

POINT OF INTEREST

From the regional analysis is possible to highlight the potential sites to implement the project. In order to implement a shared space it is important to chose a site that can be a point of connection between human corridors (infrastructures) and green corridors (rivers, mountains).



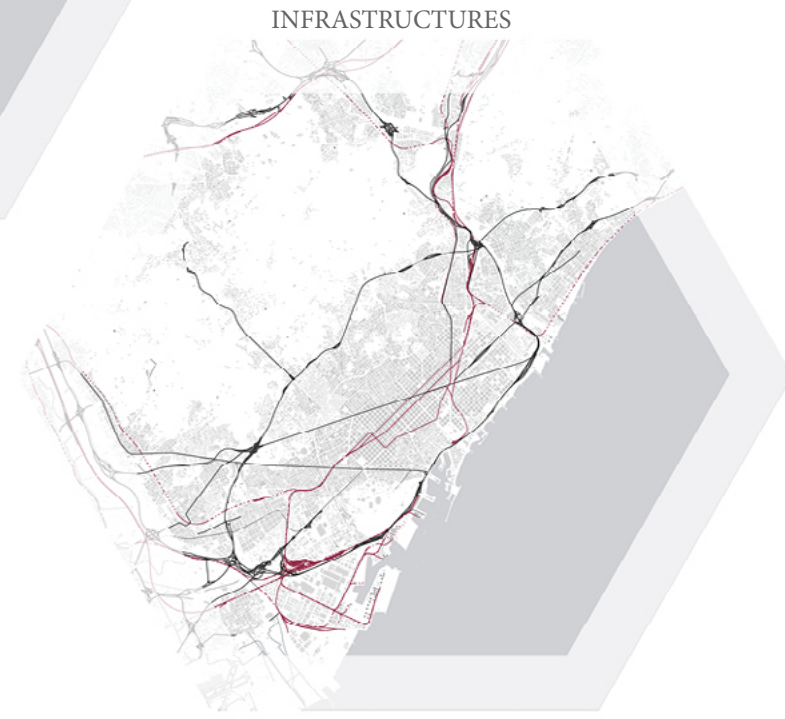
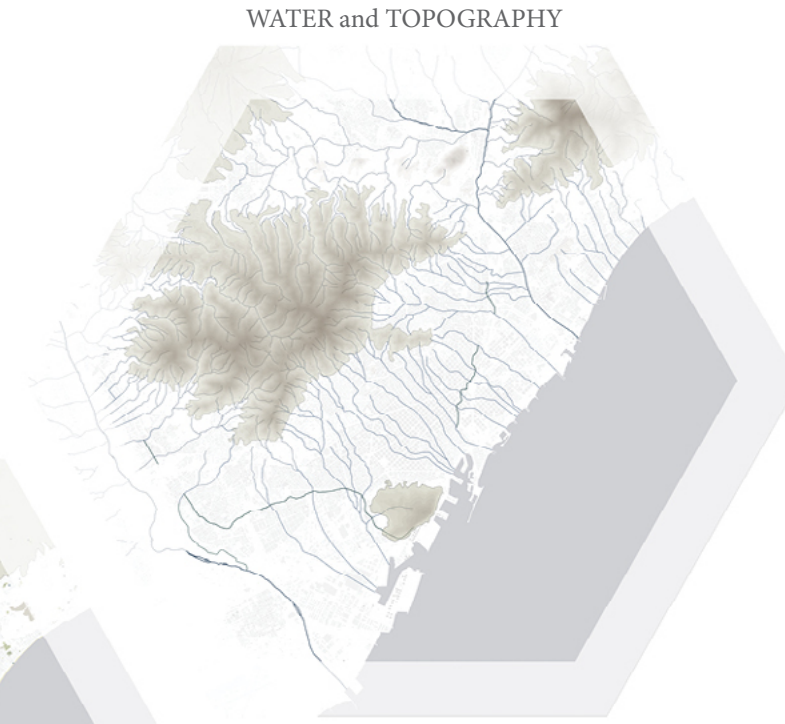
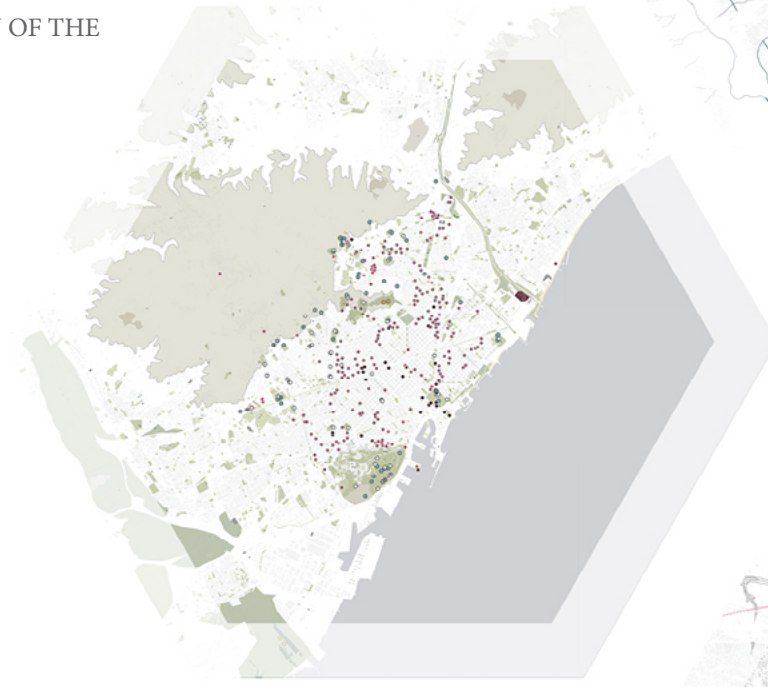
GREEN CORRIDORS

WHAT IS IT? FEATURES

The green corridors are stripes of land that provides sufficient habitat to support wildlife, allowing the movement of wildlife along it (20). The city of Barcelona sees the presence of many green corridors. In order to understand the movement of the animals we analyzed the main features that characterize the presence of the green corridors in Barcelona: infrastructures, point of reproduction of the fauna and water in relation with the topography.

POINT OF REPRODUCTION OF THE FAUNA

- TERRESTRIAL MAMMALS
 - BATS
 - REPTILES
 - AMPHIBIOUS
 - BUTTERFLIES
-
- BIRDS
 - Kestrel
 - Alpine Swift
 - Western Jackdown
 - Peregrin Falcon
 - Pale Swift



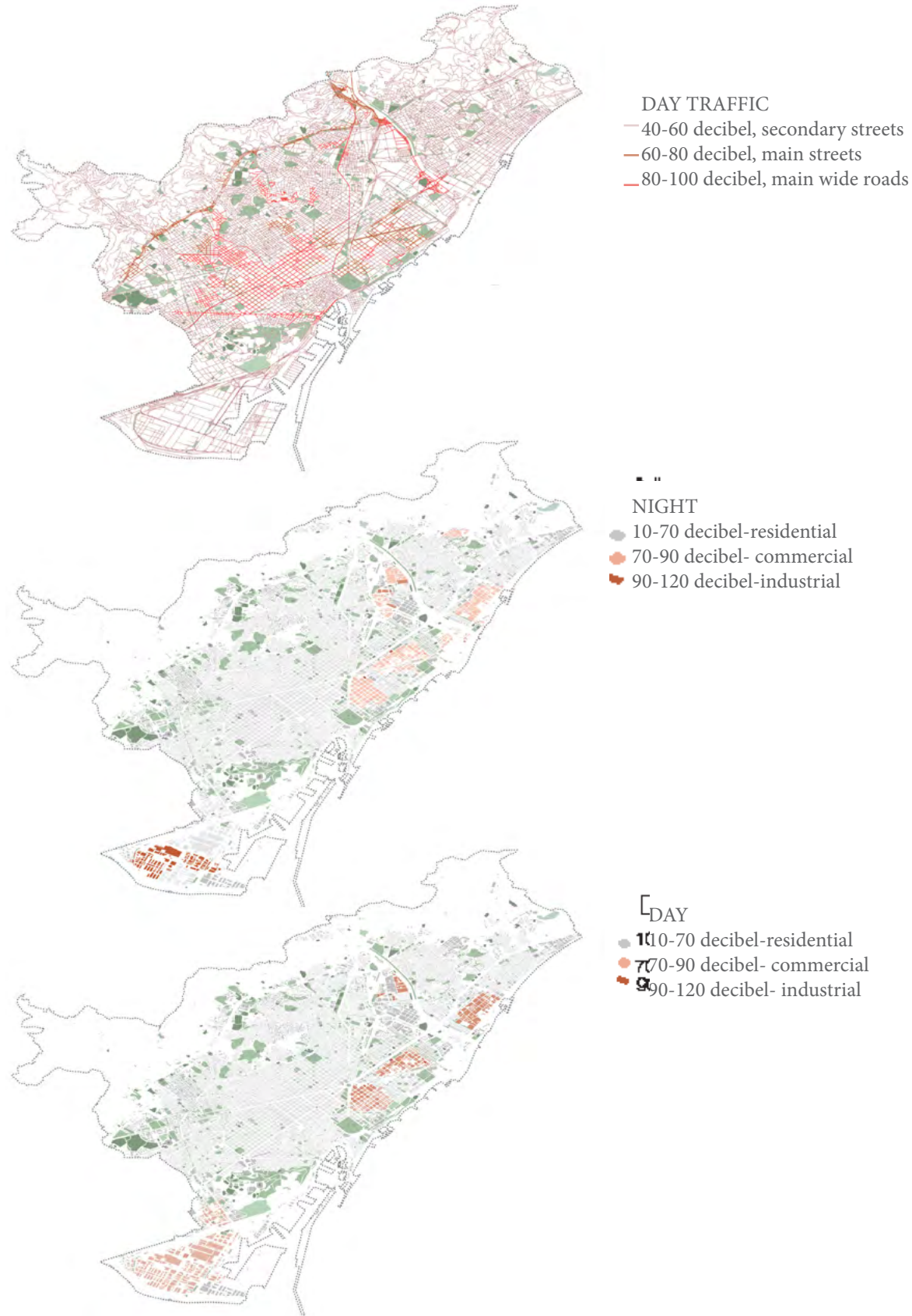
GREEN CORRIDOR OF BARCELONA



NOISE POLLUTION MAPS

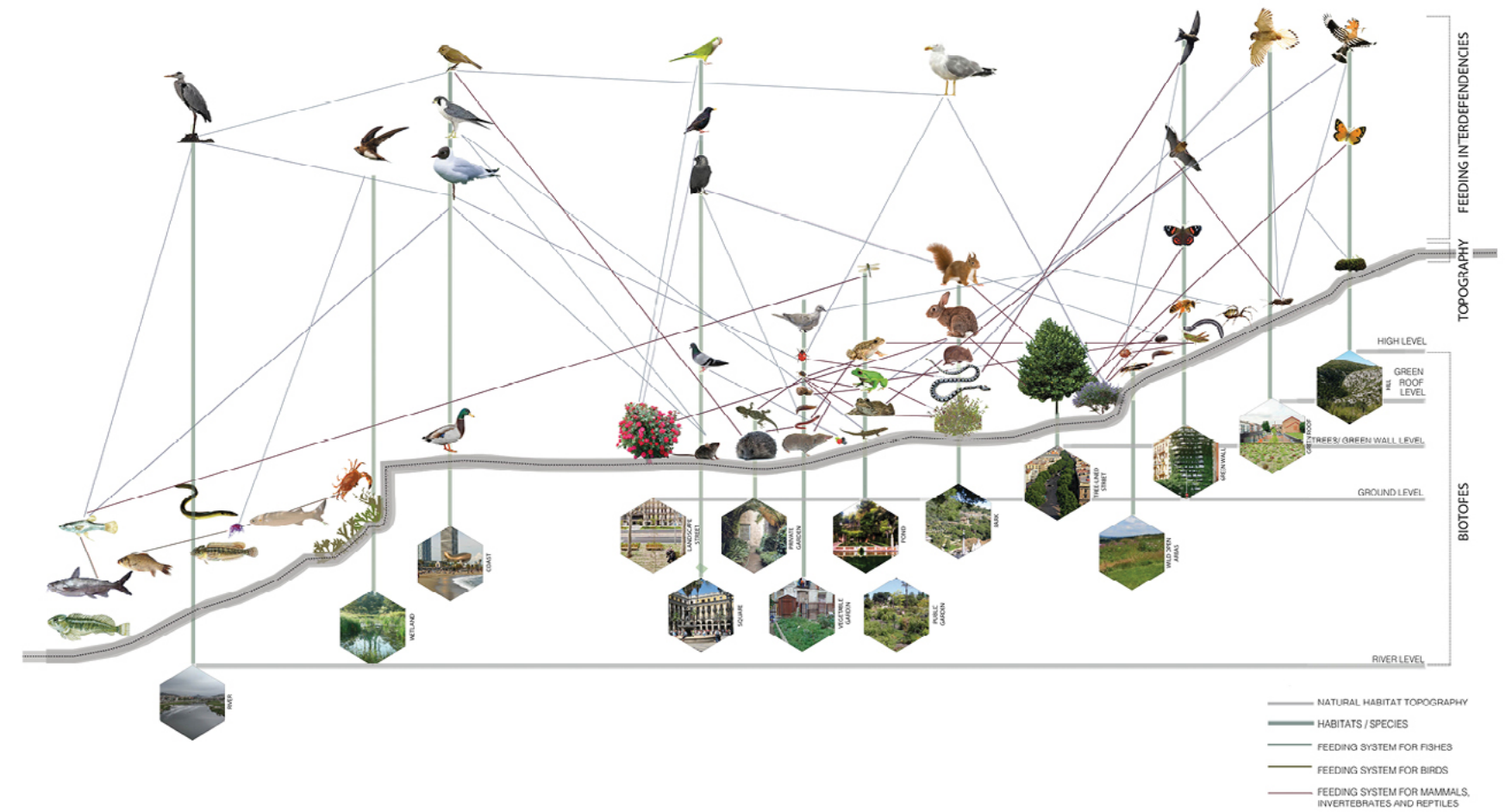
PROBLEMATICS

The noise pollution is an important problematic related to the decrease of biodiversity. The loud noises are an obstacle for the communication between the animals, disturbing them and isolating the biotopes.



ECOSYSTEM INTERDEPENDENCIES

Study of the relations between the fauna, its feeding systems, the habitats-biotopes and the altitude they use to live in.

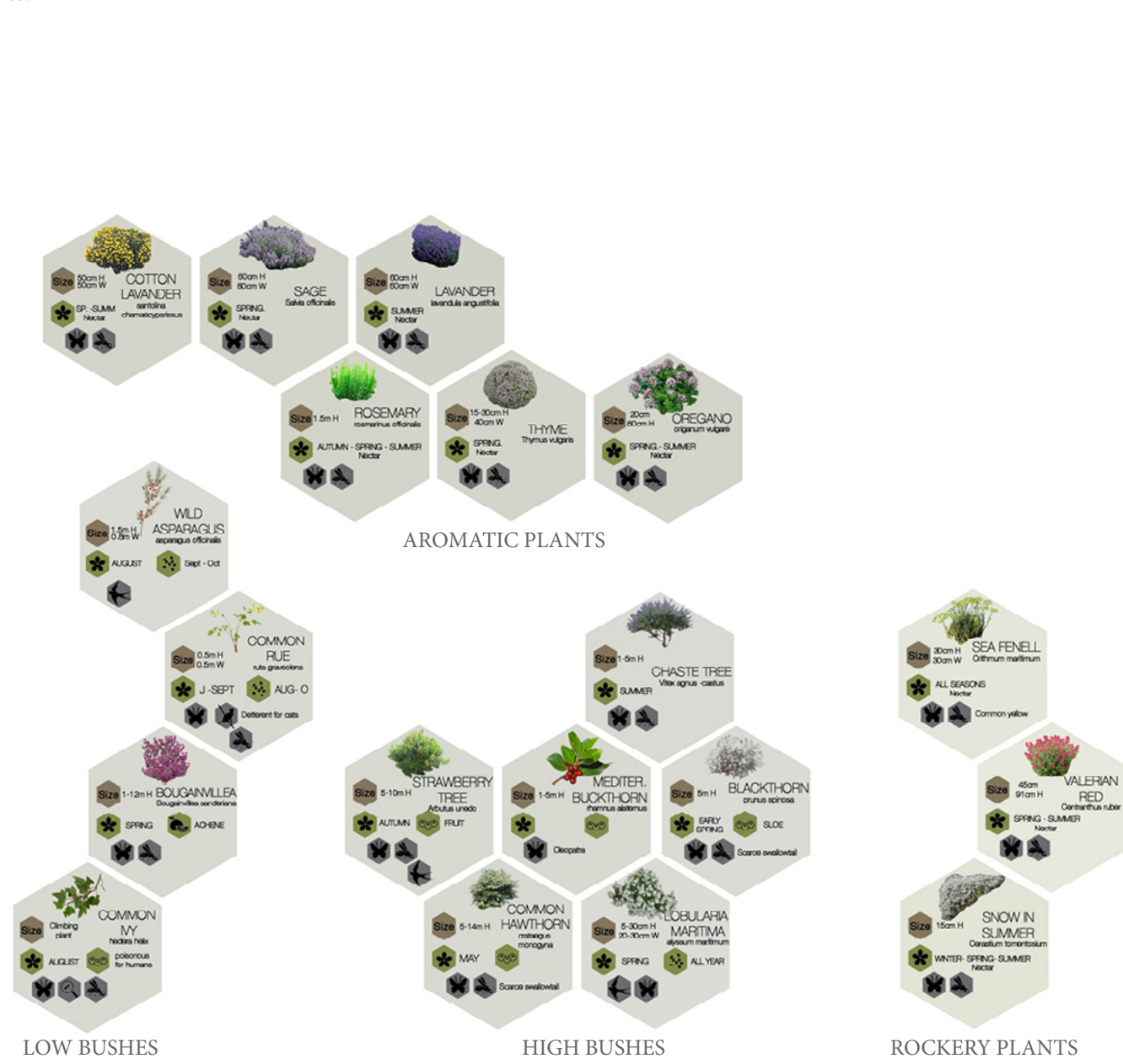


INDEX OF THE FLORA

FLORA OF BARCELONA

It is important to know which are the species of the flora. The species that we can find in Barcelona are adapted to the mediterranean climate.

Here is the index of the most common species and their main features.

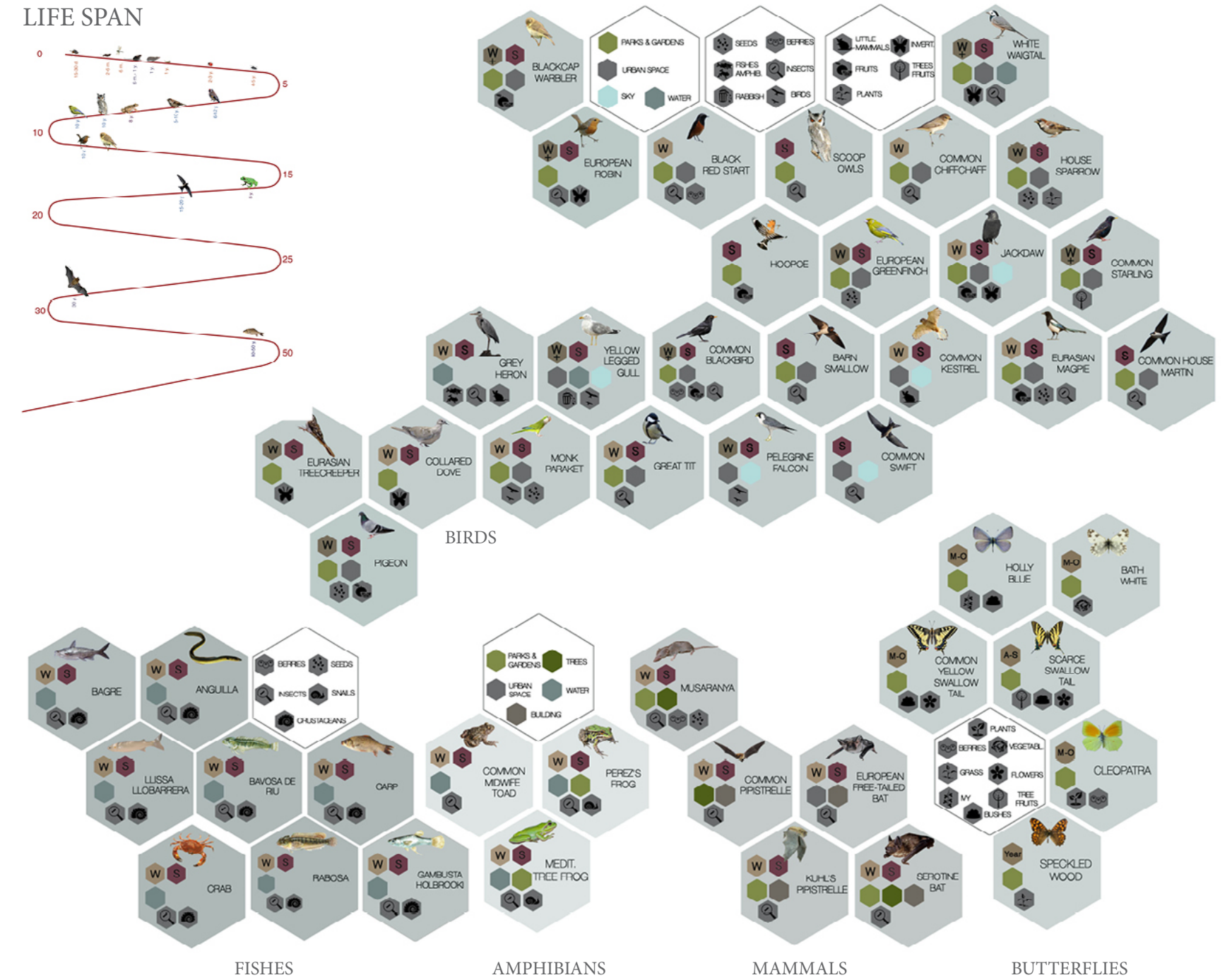
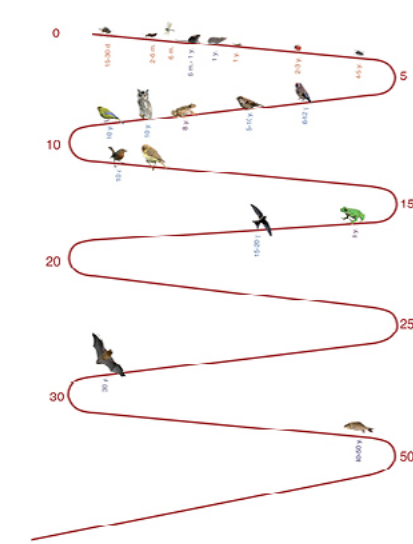


INDEX OF THE FAUNA

FAUNA OF BARCELONA

The fauna of Barcelona is really various. This catalogue gives the main informations (food, seasonability, habitat) regarding the most common species of the city (autochthonous and invasive).

LIFE SPAN



LOCAL ANALYSIS

THE RIVER BESÓS, RELATION WITH THE HUMAN FEATURES

The local analysis focus on the river Besós. This choice is related to the prototype developed in the beginning in which one of the prerequisite for the shared space was the presence of a river because of its relation with the biodiversity. The river Besós infact is a green corridor that connects the sea to the range of Collserola and it is also a strong element in the urban panorama since is one of the limit of the city of Barcelona. The decision to act in the sourrounding of this river is connected to the urban enviroment that grows around the edges, rather than Llobregat more characterized by agricultural parks. The Besós flows for the first 9 km from the sea to Collserola in a dense urban context that disappears gradually when the river gets close to the mountains. This natural element caused many problems in the past when in 1962 flooded, it destroyed many buildings and killed many people. The last kilometers of the river at that time were still shaped as a wild delta but the urbanization was growing with no limits and the industrialization was using its water, polluting it and destroying the original environment and also disturbing the fauna and flora, that with the time disappeared. After the flooding of 1962 the municipalities of Sant' Adrià del Besós (the town that occupies the delta of the river) and Barcelona decided to dig a channel of 110 meters of diamater with walls of 4 meters high in order to let the river flowing at 0 meter on the level of the sea and let the city on an upper level (4 m higher). With this intervention the cities prevented the flooding of the city but the biodiversity decreased because of the walls, an obstacle for the movement of the fauna. The other problem of Besós is the pollution, this is due to the presence of industries all along the first 9 km from the sea.

The analysis at a local scale will show which is the relation existing between human and the river itself and which are the conditions nowadays of the biodiversity in the sourrounding of the river Besós. The scale of intervention takes in consideration and area of 10 by 10 km.



(a) Besós flooding 1962-Archivio historico de l'Ajuntamnet de Barcelona



(b) Besós flooding 1962-Archivio historico de l'Ajuntamnet de Barcelona



(c) Upper part of the Besós,today-Pere López



(d) Park fluvial, today-Montse López



(e) Delta of the Besós, today-Montse López

RIVER BESÓS

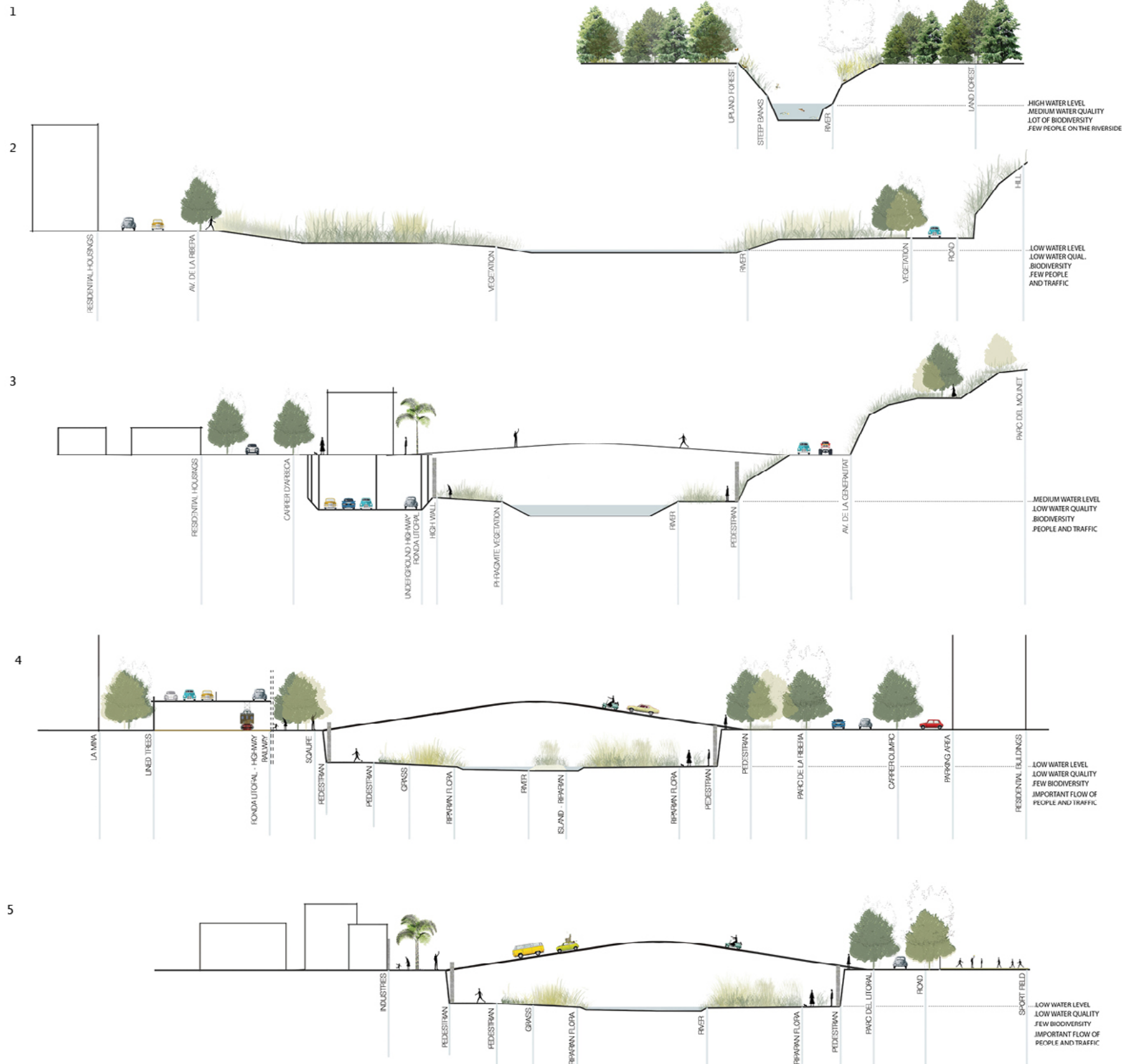
SECTIONS, AREAS

The river is characterized by different areas in the last kilometers of its flow. First is the delta (500 m) where riparian and mediterranean vegetation grows wildly. Despite the natural aspect of this part the last trench is still very polluted and in an abandoned state. This condition is not adapted for the growth of biodiversity.

The second area is the one of Parc Fluvial, a pedestrian and bicycle pathway all along the next 5 kilometers, the park has been built in 2000 in relation with all the new construction built in the 2004.

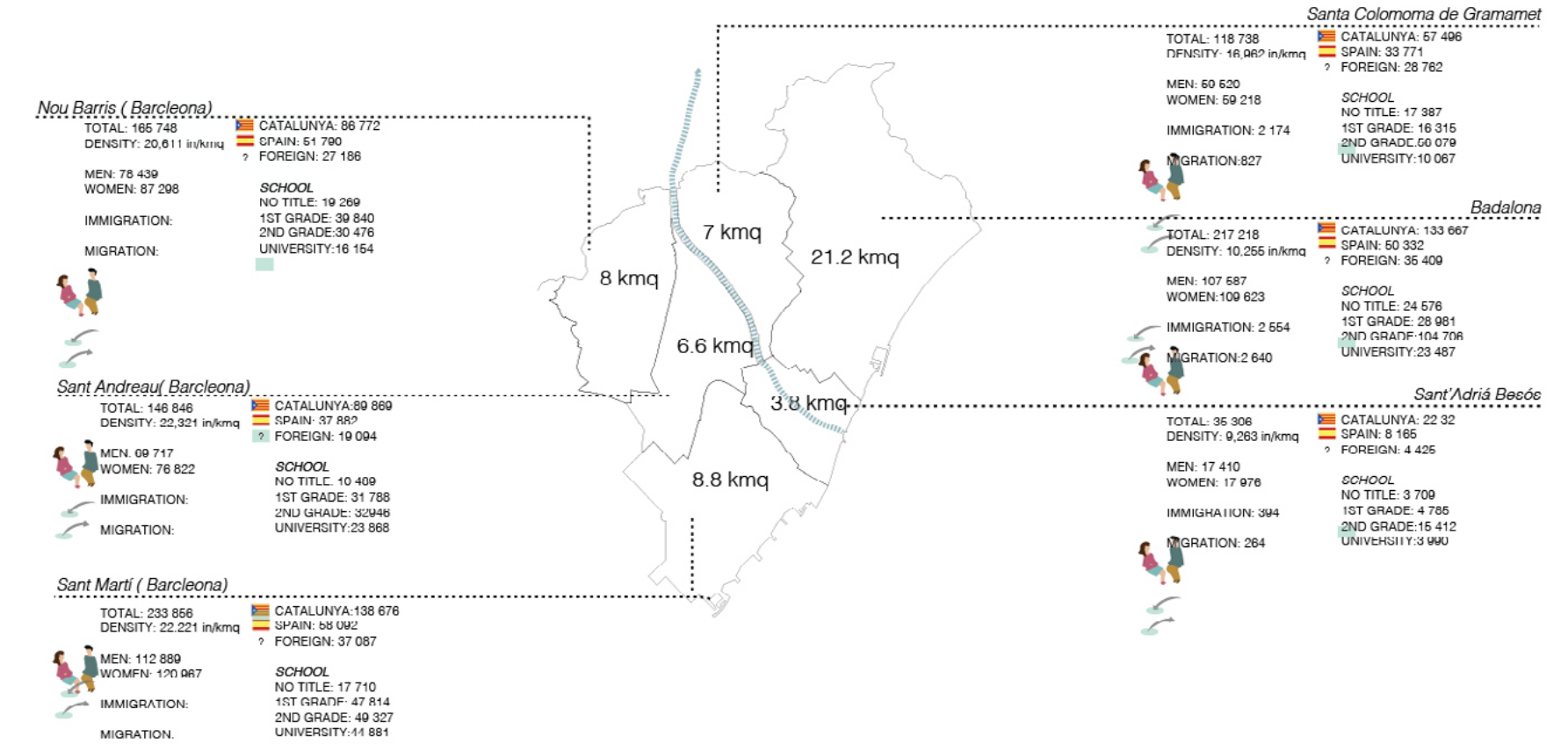
The third part of the Besós is characterized by a wild and natural environment, despite the quality of the water and the soil that are still very low, the river flows more wildly, this is because the walls of containment of the river do not arrive until this part.





POPULATION

STATISTICAL DATA OF THE SOURROUNDING



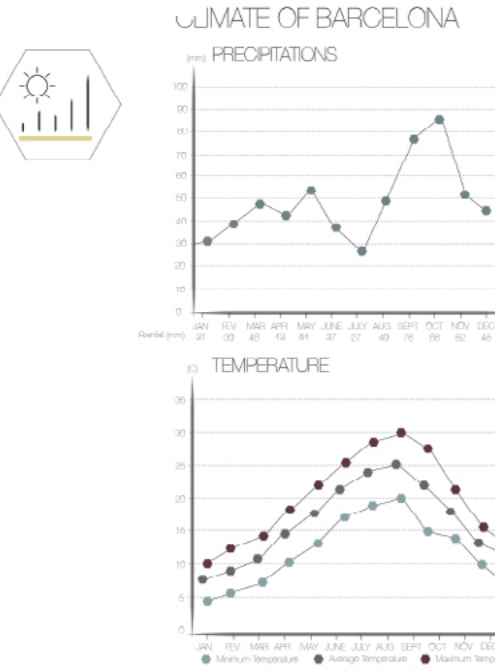
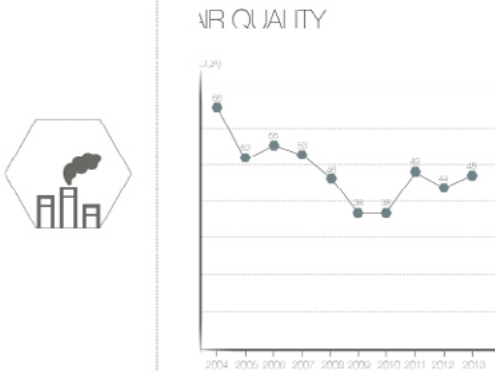
PROGRAM

HUMAN ACTIVITIES AND THE RIVER

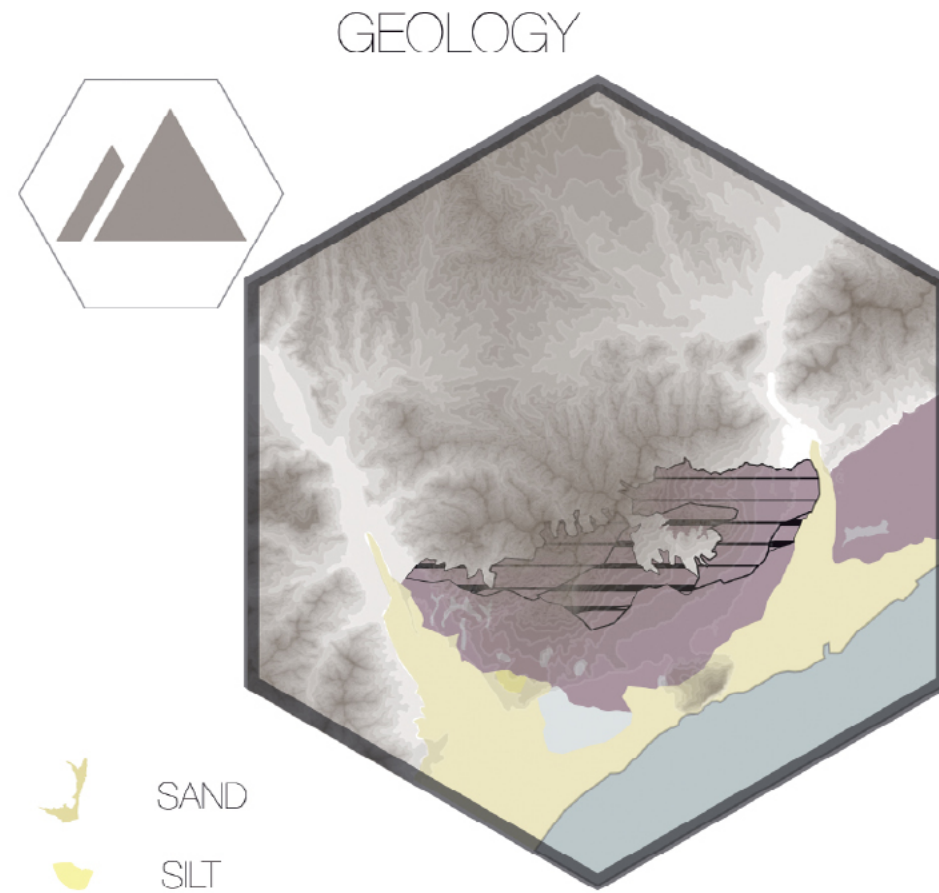
The project wants to deal with the human presence, this is why the mapping of the program is really useful to understand how the environment has been used. It is clear that the area around Besós is very urbanized and presents a dichotomy between industrialization and residential. This area is one of the most industrialized of Barcelona because of the presence of the Besós. The conditions of the river shows that it has been used and exploited by the industries. Besós is polluted, the soil and the water is classified as one of the worst in Catalunya (21) even if in the last years, the trend changed and the factories have adapted to the environmental laws respecting the limits related to the pollutions. Nevertheless, there is still there is an important lack of biodiversity.



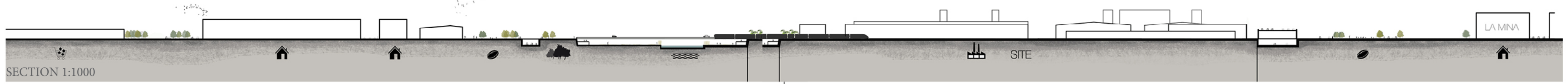
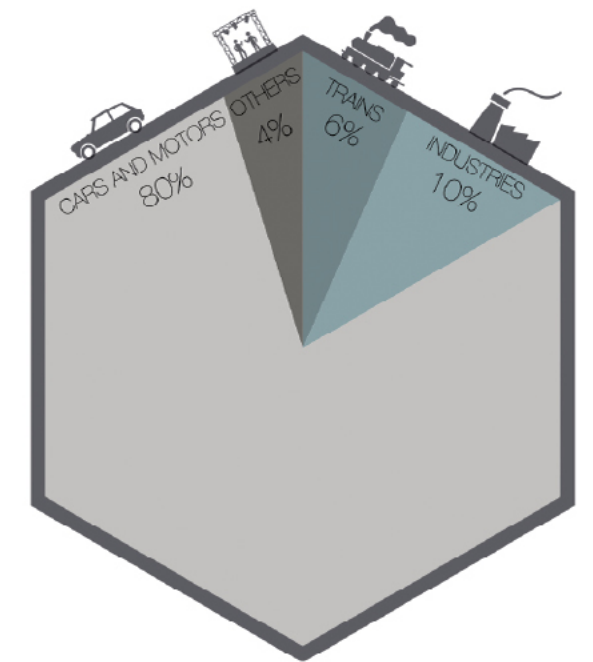
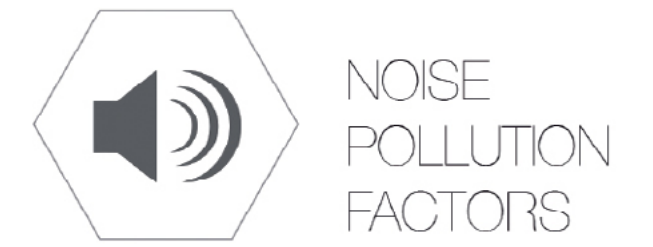
ANALYSIS OF THE CONDITIONS



GEOLOGY and PERCENTAGE OF THE NOISES



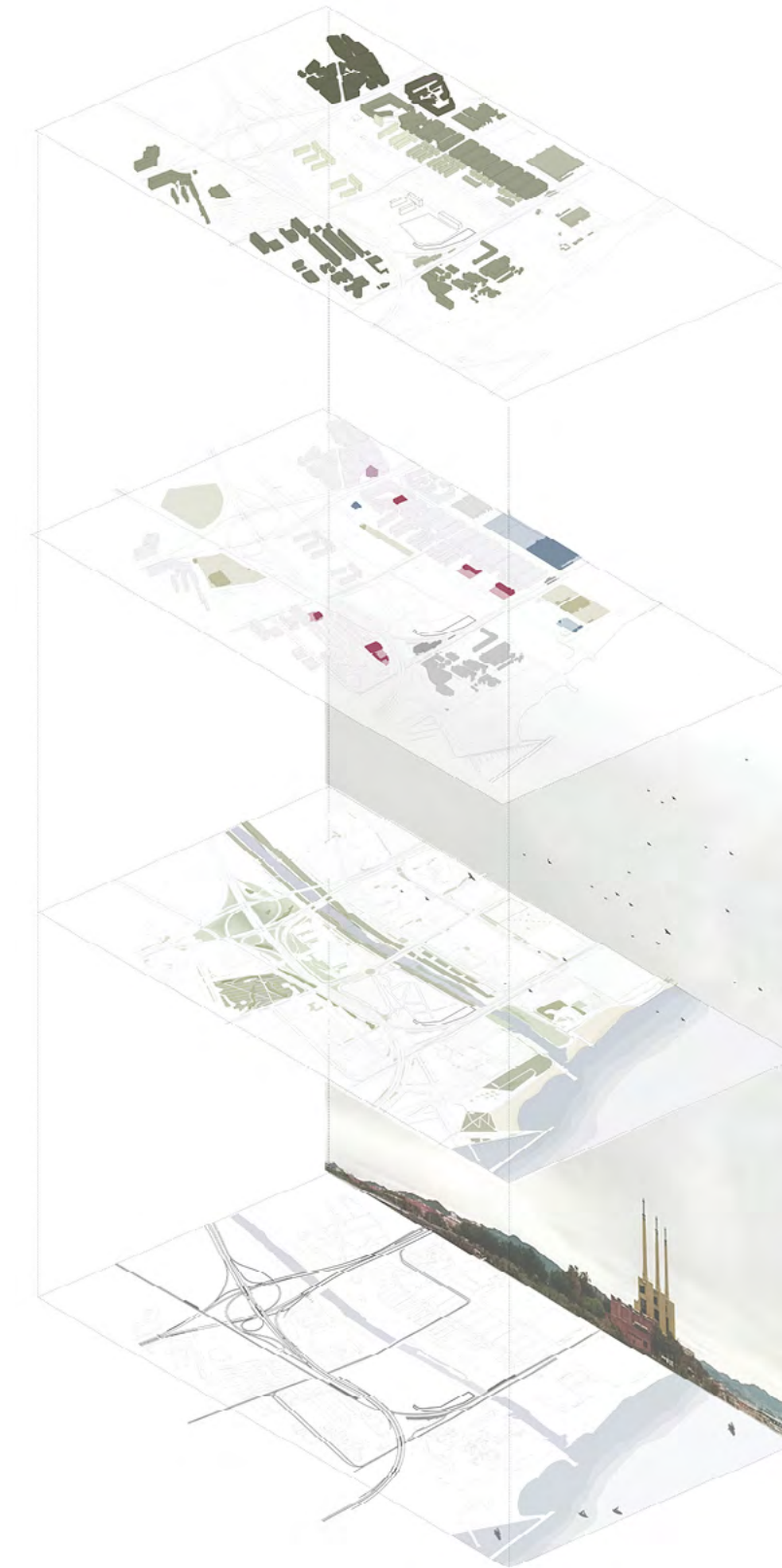
- SAND
- SILT
- TERTIARY
- ANCIENT TERTIARY
- PALEOZOIC
- GRANITE BASEMENT
- PALEOZOIC BASEMENT

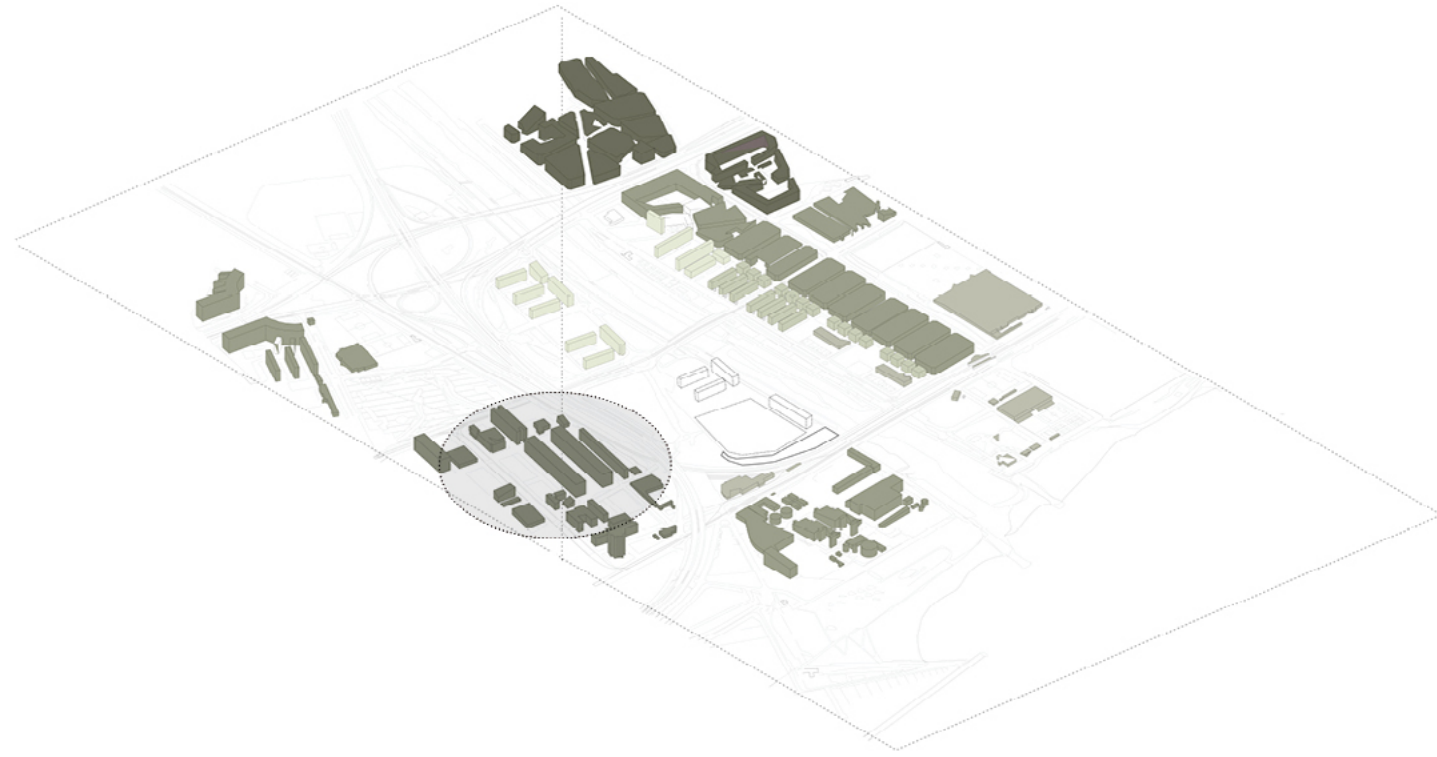









SITE ANALYSIS


WHY? CHALLENGES

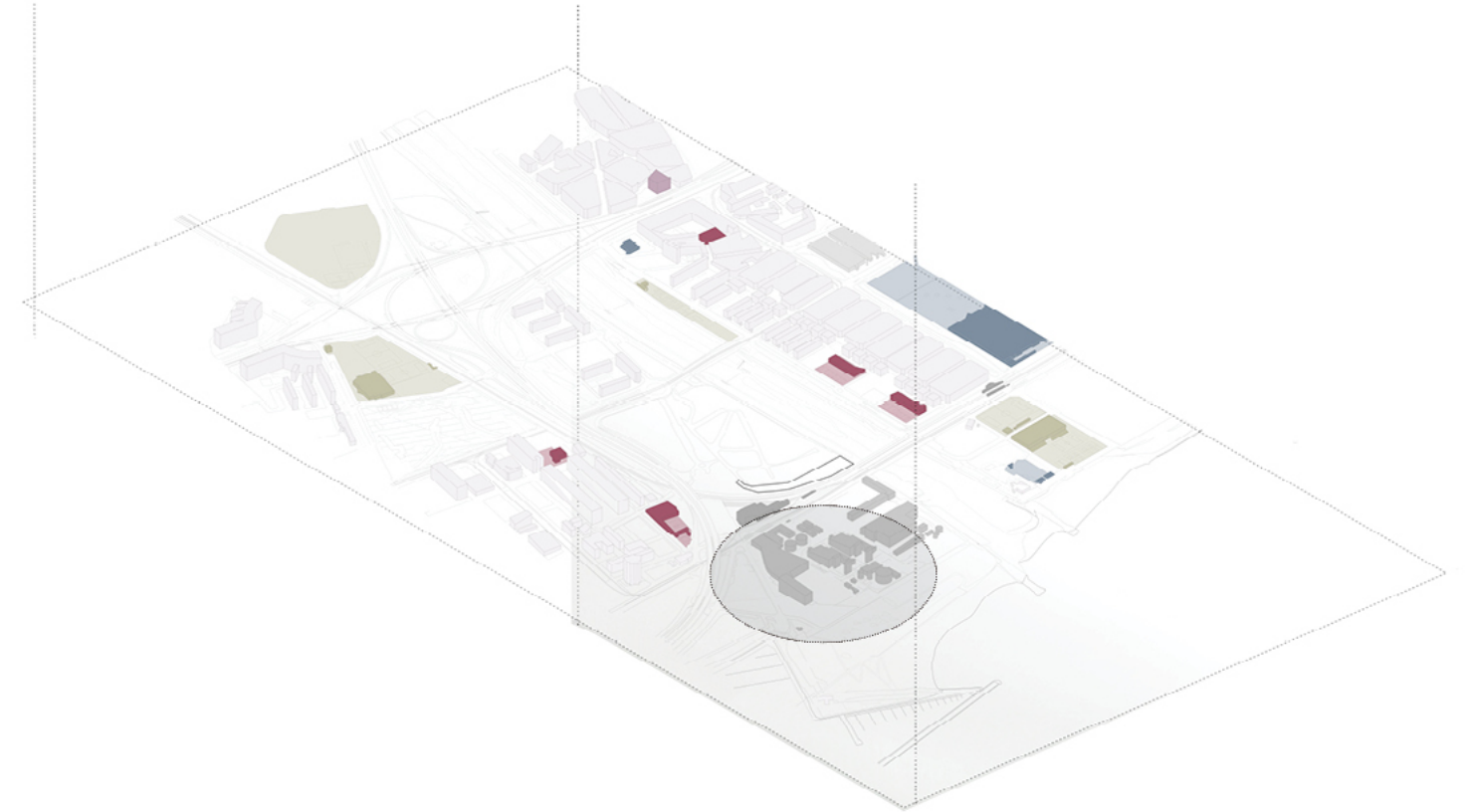
The choice of the site came up after the meeting with Consorci del Besos, responsible of the construction around the river. This solution is related to the decision of being stick to the reality. The plot is closed to the delta of the river and it is called *La Catalana*. The area is now abandoned and in five years is planned to be built. A new residential area , a rugby field and a park will raise in *La Catalana*. The suggested plot is a stripe of 40 by 200 meters next to the future constructions on the level of the city (4 meters up to the river). The site presents many challenges because of the proximity to the river, the infrastructures, the industries and the problematic neighborhoods as *La Mina*.






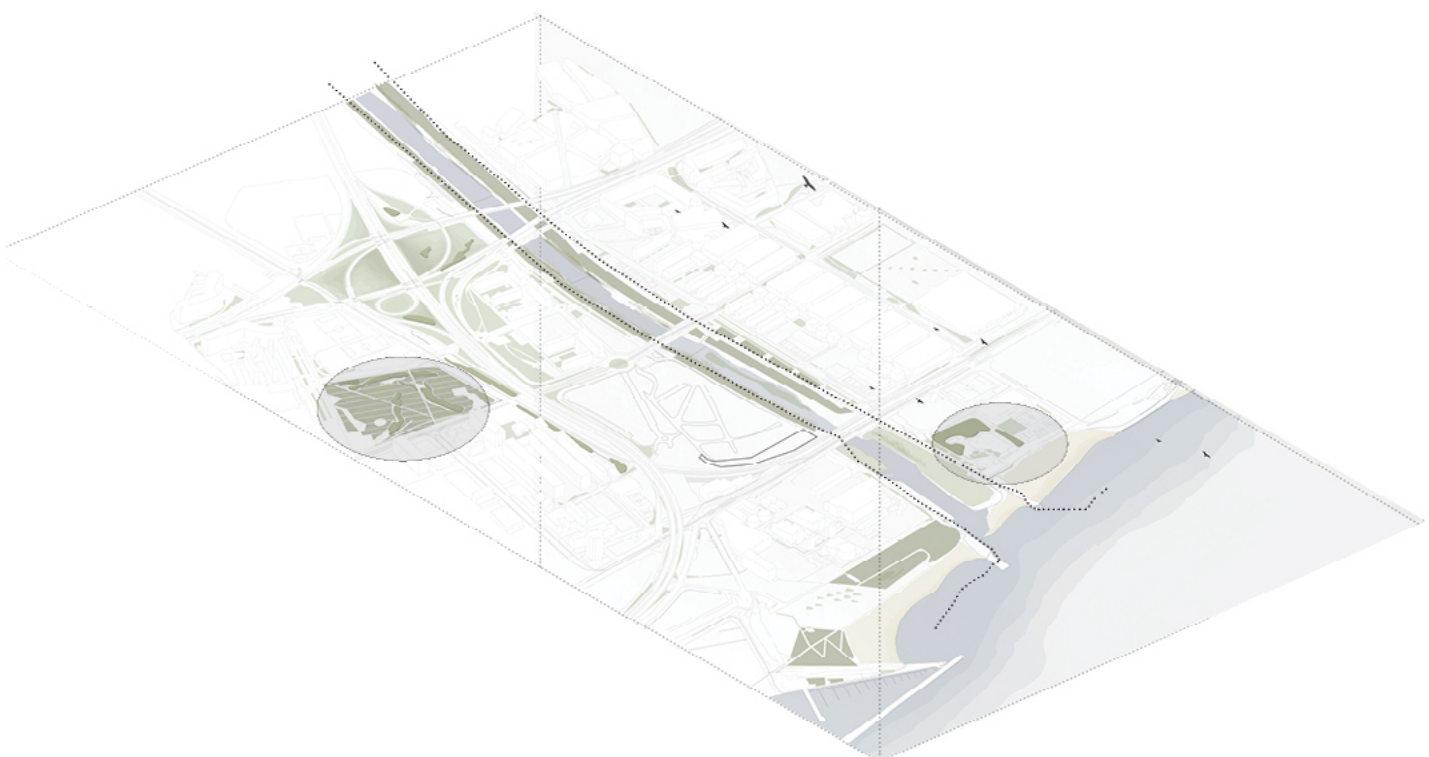
- HISTORY
-  IN COSTRUCTION
 -  2005-2015
 -  1995-2005
 -  1985-1995
 -  1980-1985
 -  1975-1980
 -  1975-1980

 La Mina:
 In the early 70s the delta of Besós has been a spot of consistent industrialization. The area needed new housing because of the strong affluence of new inhabitants employed in the industries. This is why the municipalities built La Mina in 1973. This neighborhood was isolated from the city and the bad conditions of living facilitated the raising of a "ghetto" that in the last decades became a hotspot for social issues and criminality. The area is also limited by the presence of the highway Prelitoral. This infrastructure obstacles the connection between La Mina and the rest of the surroundings.



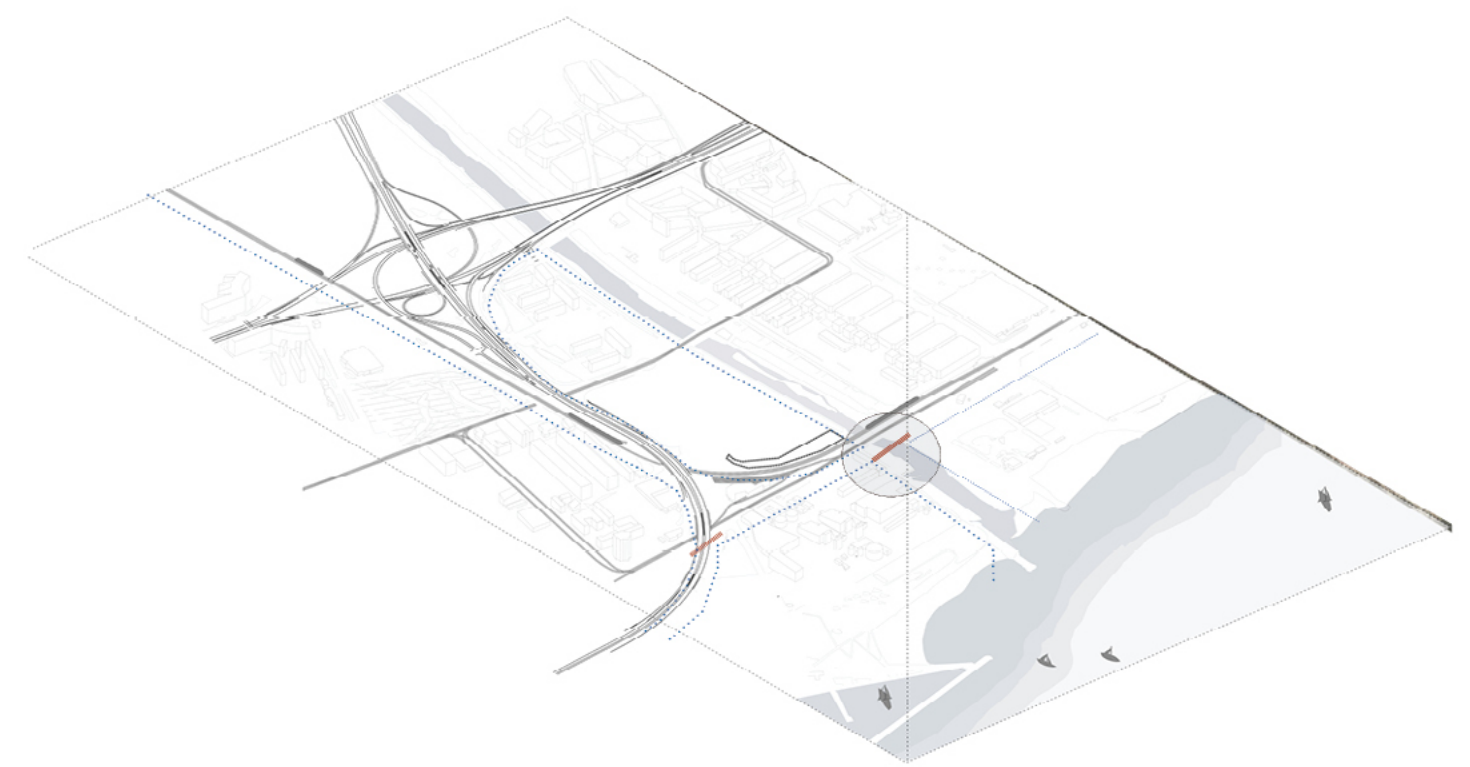
- PROGRAM
-  RESIDENTIAL
 -  COMMERCIAL
 -  CULTURAL
 -  SPORT-ACTIVITIES
 -  TRANSPORTTION-STATION
 -  INDUSTRY

 Endesa and the industries:
 Electricity industry that rejects steam and water in the delta, increasing the level of the river. This also increases the temperature of the water of 2-3 degrees. This change provokes thermopollution in the delta and does not permit the precipitation of the oxigen, good for the growth of many aquatic plants. For this reason the delta does not attract the fauna. The site sees the presence of high density of residential buildings. Beside the industry is a main element of the site.



- BIOTOPES
- RIPARIAN VEGETATION
- GREEN INFRASTRUCTURE
- PARKS
- TREES
- BEACHES
- RIVER-SEA
- FLOODING LIMIT

Parks:
 The important biotopes of the site is the Parc del Besós that runs for 9 km from the sea to Collserola. Other two parks are important spots for the biodiversity: Parc del Litoral and parc de la Ribera.



- INFRASTRUCTURE
- PRELITORAL-HIGHWAY
- RAILWAY
- PEDONAL UNDERGROUND CONNECTION
- OPEN AIR CONNECTION
- BOUNDARIES - LIMITS

One of the big challenge for the human and the biodiversity is the presence of the infrastructures in this area. Prelitoral and the railway are strong cuts for the connection of fauna between the biotopes. These infrastructures represent an obstacle also for the pedestrian connection. The points of connection between the areas are few and bad mantained.

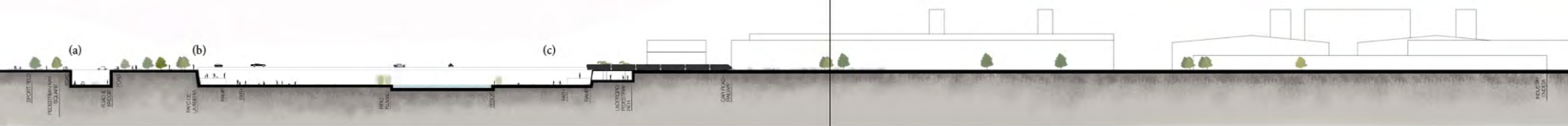
ECOLOGIES AROUND THE SITE

The site sees the presence of different situations for the biodiversity
 1 under the bridge
 2 under the preitoral
 3 Park fluvial

It is possible to see how the biodiversity is much more present in the last section, because of the presence of the river (green corridor).



LA CATALANA PCTURES OF THE SITE



PROJECT

BIODIVER-CITY

EXPERIMENTATION - SHARED-SPACE - CITY - SCALES -
PROGRAMS - INTERACTION - ATMOSPHERE

The Biodiver-City project is an experimentation of a new system that deals with the idea of a shared-space for humans and biodiversity. Implemented in a city context in order to deal with the urbanisation challenge, the project is developed at different scales, from the regional intervention to the site, building scale and detail materiality, in order to understand how the system can be applied through this scale 's interconnections.

The project is developed through different buildings, acting as a sequence for a connected city, that can propose programs related to a pedagogic aim. The main role of the Biodiver-City project is to create several interactions and atmosphere between biodiversity and humans, enabling them to coexist in an urban dense environment.



DESIGN PROCESS

PROJECT AS A CONNECTION

SITE FEATURES - CATALYST - SPREADING

The project aims to create a connection between biodiversity and humans and between the city and river.

Fitting to the prototype that deals with river context and dense urban context, the project take in consideration the main features of the site that are both limits and opportunities for the enhancement of biodiversity.



-River channel Besos: connect the Mediterranean sea with the Collserola mountain range.



-Parc del besos, parc fluvial and parc del litoral: need to be connected to create a green corridor.



-Preitoral infrastructure: creates pressure and obstacle for the biodiversity

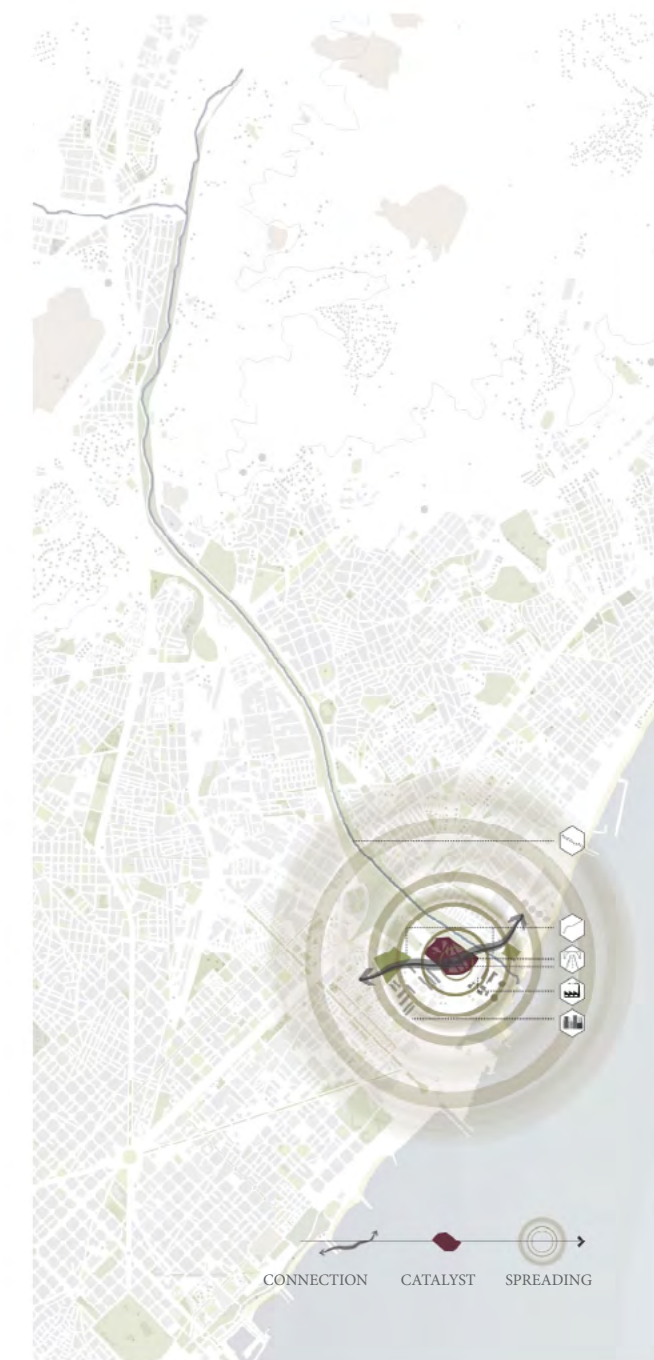


-Endesa Electricity industry: rejects water and smoke from its activity



-La Mina neighborhood: Area disconnected from the river side and with social issues.

In order to develop this connection, the project is developed at three different scales that are interconnected. Indeed, the catalyst situated on site, defined as the shared-space aims to spread biodiversity in the city trough the existing green corridors and the ones that are going to be enhanced.



TOOLS

SCALE - AUTOCHTHONOUS - NEEDS - HABITATS

In order to integrate biodiversity in the project and to develop the shared-space, the process was to define tools from the analysis in order to translate these informations, datas and knowledge in a design.

First of all, it is important to enhance autochthonous species that are native from the place. Indeed, losing those species could destruct all the ecosystem functioning.

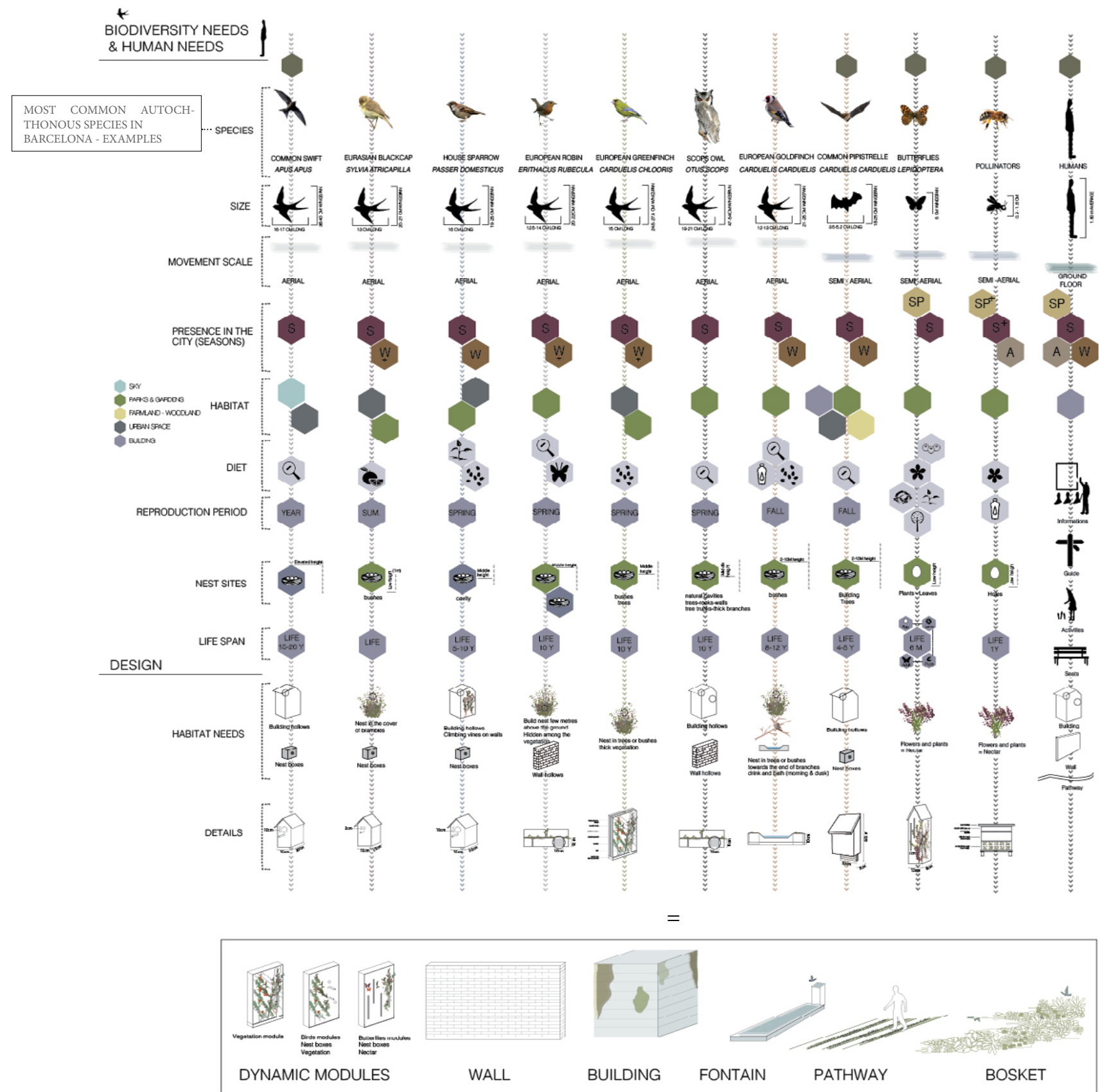
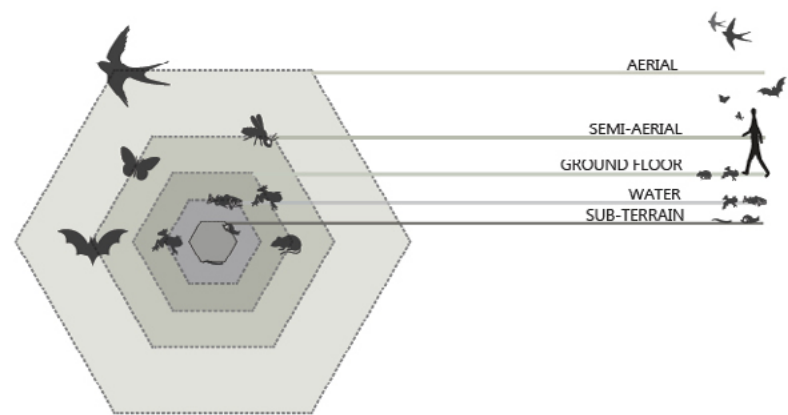
Secondly, since the proposal aims to work at different scales, it will focus on enhancing species with a big movement scales - the ones that can fly. In this way, the project is dealing with birds, bats, butterflies and pollinators.

The study trip in Barcelona was an opportunity to meet Xavier Ferrer, ornithologist in the faculty of Biology, UPC, Barcelona. He suggested us to select the most common species and the one that can adapt in a shared-space and urban context. The graphic next page presents some examples of these common species.

Then, we had to study and collect the information concerning the biodiversity and human characteristics and needs in term of size, movement scale, seasonal presence in the city, habitat area, diet, reproduction period, nest sites and life span.

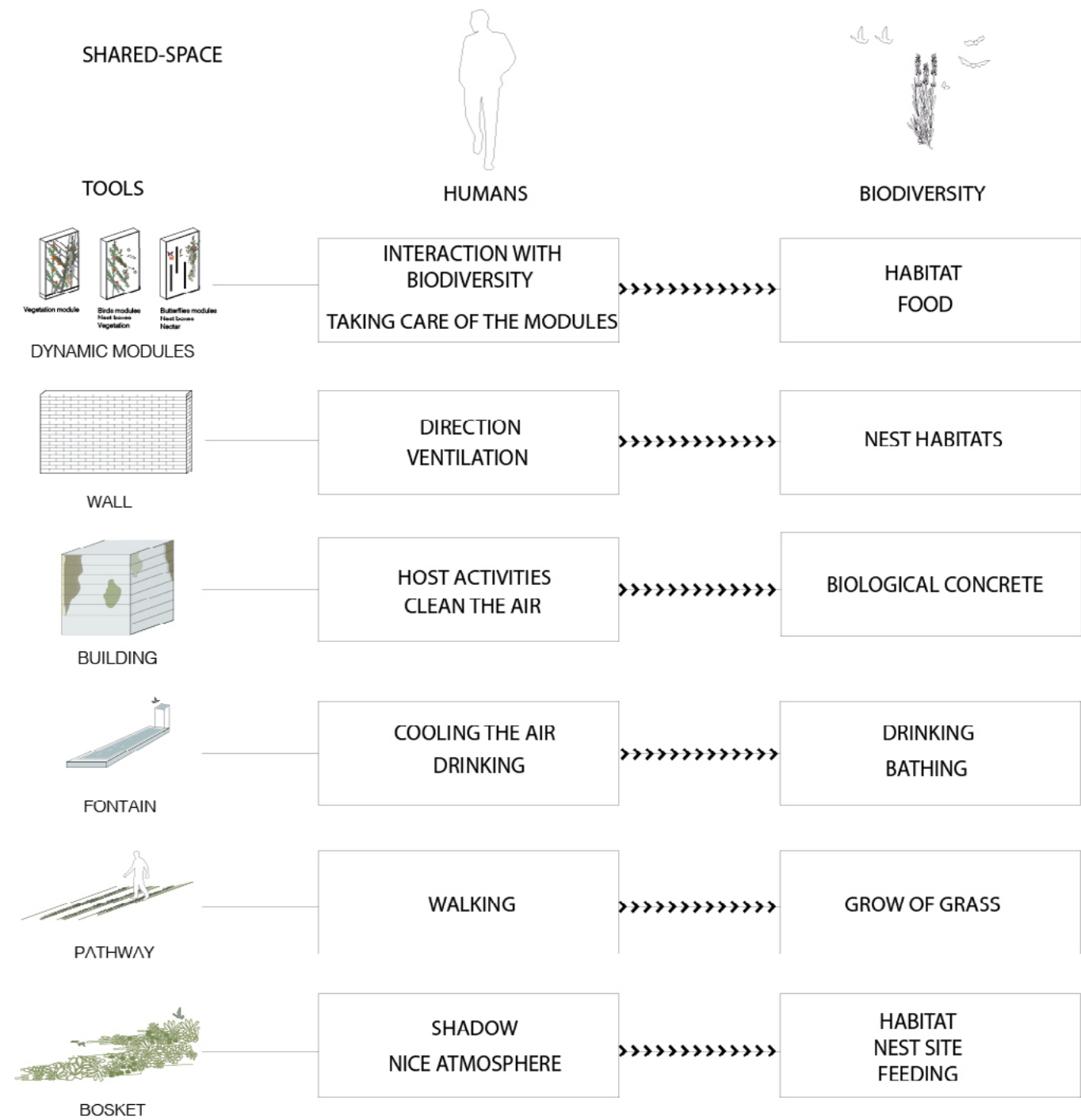
The last step was to understand precisely the habitats needs of the species in order to define a design that could be implemented at different scales, in the building or either in the city.

The result is composed of different tools that are meeting both needs of biodiversity and humans that enable a good development of the shared-space.



TOOL FUNCTIONS AS A SHARED-SPACE

The main feature of these tools is that each of them is adapted to both human and biodiversity needs, becoming in this way part of the shared-space by being profitable to them.



Perspective from a shared-space

IMPLEMENTATION OF TOOLS

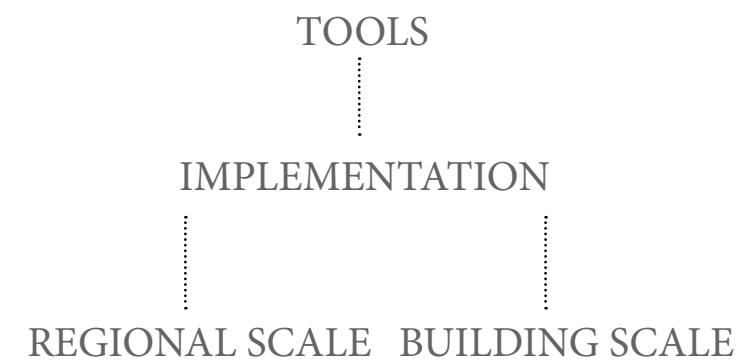
REGIONAL SCALE - BUILDING SCALE

After having defined the different tools, some of them will be used at the building scale, integrated to the design process and to the materiality choice.

Nevertheless, some of the tools are common for the regional scale strategy and the building scale.

Indeed, the dynamic modules are implemented in the regional scale to create green corridors. They can be plugged to existing building or existing structures in the city or either put on balconies, terraces and roofs. These modules, spread in the city can create stepping biotopes for the biodiversity, enabling them to move through the city and meeting in this way their habitat and feeding needs.

They will be as well implemented in the shared-spaces in order to first, attract the biodiversity and secondly, allow the people to interact with it by taking care of it and by observing the biodiversity.

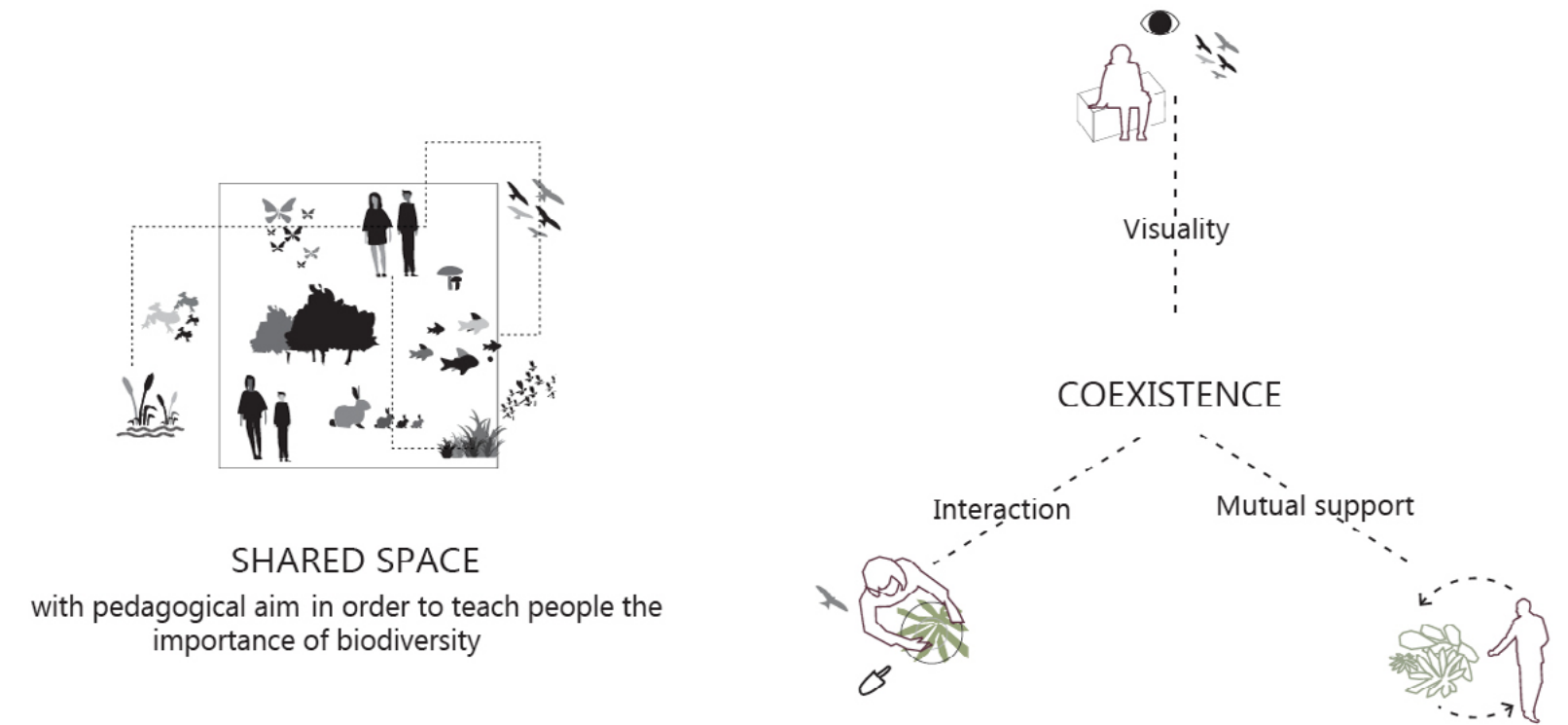


CONCEPT

SHARED-SPACE - COEXISTENCE - PROGRAM

The question at the base of this project is : Is it possible to create a shared space in which the biodiversity and humans can live together in a situation of equilibrium? Asking ourselves how we can solve this challenge brought us to the concept of coexistence that means to exist together, at the same time, or in the same place.(1)

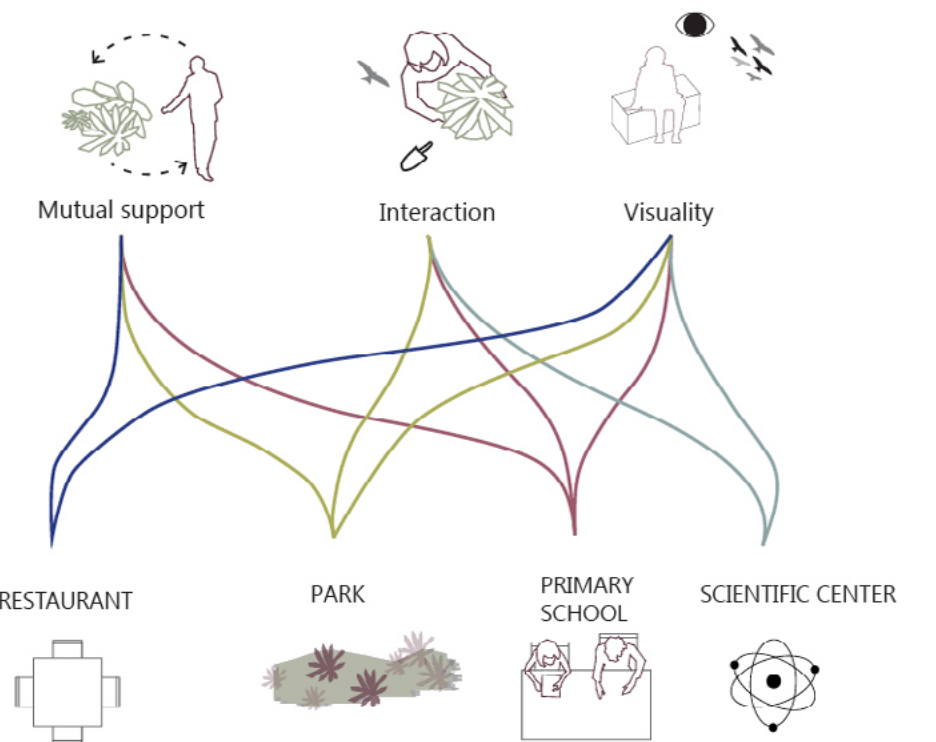
We established three kind of relation between the nature and the human in a built environment: VISUALITY, MUTUAL SUPPORT and INTERACTION. According to them we developed the program, leaded by a pedogogical aim. The project itself aims also to teach to the people how is possible to coexist with the nature in a built environment.



SHARED SPACE
with pedagogical aim in order to teach people the importance of biodiversity

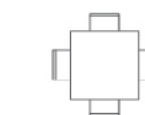
PROGRAM

Relation between human and biodiversity:



Program:

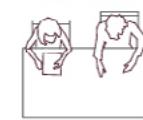
RESTAURANT



PARK



PRIMARY SCHOOL



SCIENTIFIC CENTER



WATER, THE FIRST ELEMENT

IMPORTANCE of the WATER as first element that provide life. Its presence permits the growth of the lichens that enhance the development of vegetation. Thanks to that the fauna is attracted and a new ecosystem is created.

FRAGMENTATION: CONCEPT FOR THE BUILDING



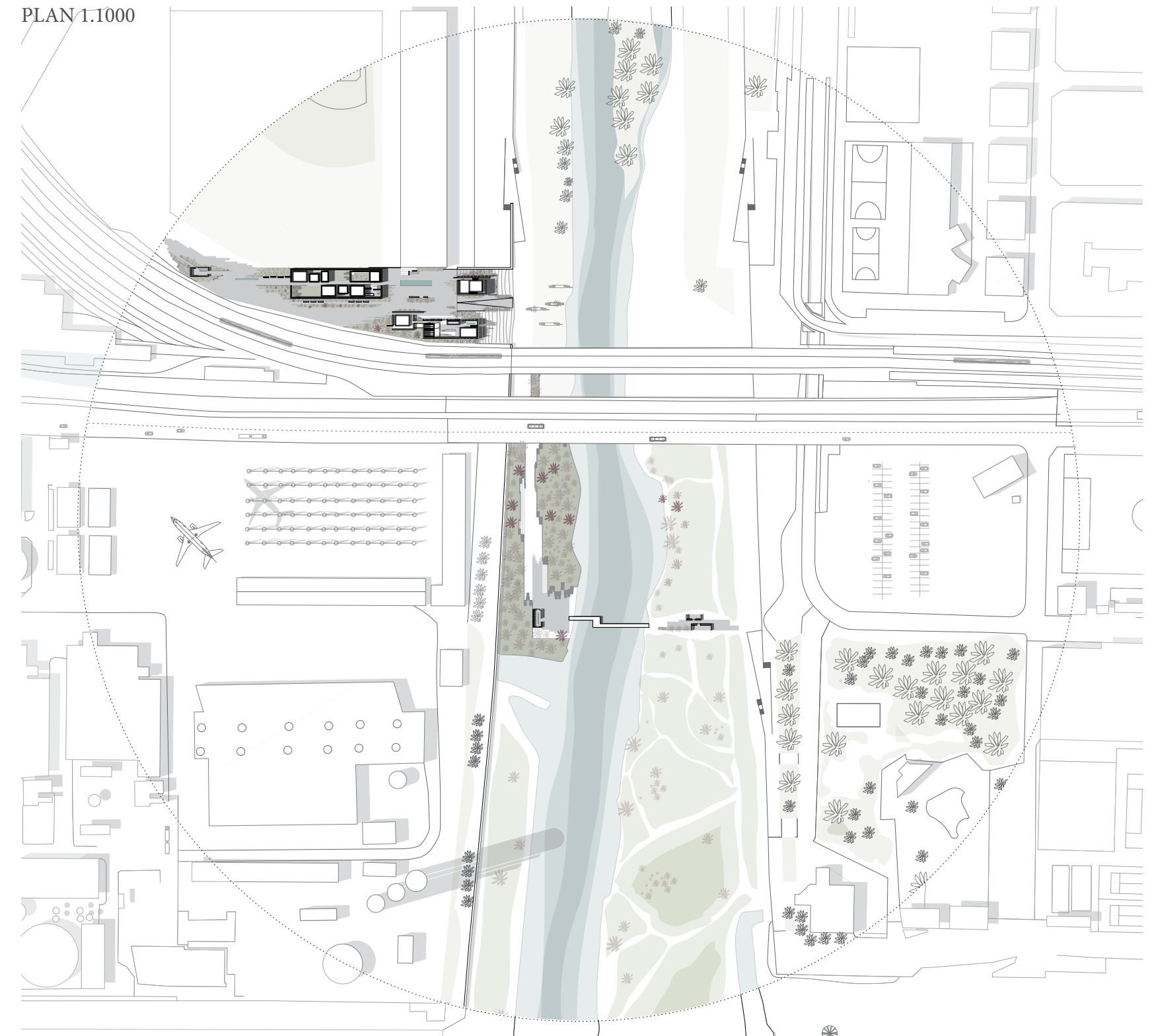
THE PARK

CONNECTION FOR BIODIVERSITY AND HUMANS

The project at the local scale is the requalification of the delta through the implementation of a park-pathway in which the selected vegetation will help the cleaning of the soil. The river in fact presents bad soil condition but with the change of the plants after 5-10 years it is possible to requalify the quality of the ground. The renaturalization of the delta, with the introduction of mediterranean plants, will attract autochthonous species of fauna. This is related to the fact that the originate species of a specific area feed themselves with the native flora (if herbivorous). The renaturalization of this spot of the river will recreate a good environmental condition that will enhance and give strenght to the biodiversity.

The park, for this reason, is a catalyst for the biodiversity development but at the same time it is also used as a connection for the humans between the city and the riverside. Since the actual connection between the two parts of the river are quite difficult for pedestrians, the project provides a small bridge at the level of the river (sealevel).

PLAN 1.1000



SECTION 1.1000

THE SHADOWS AND THE FLORA

The project takes in consideration different aspects for the implementation of the flora and the adaptation of the fauna.

The study of the shadows of the building on the bosquets aims to define which are the most and less exposed parts of green in the park. According to this criteria and the need of water and sun of the plants, the vegetation will be planted in the different spots.

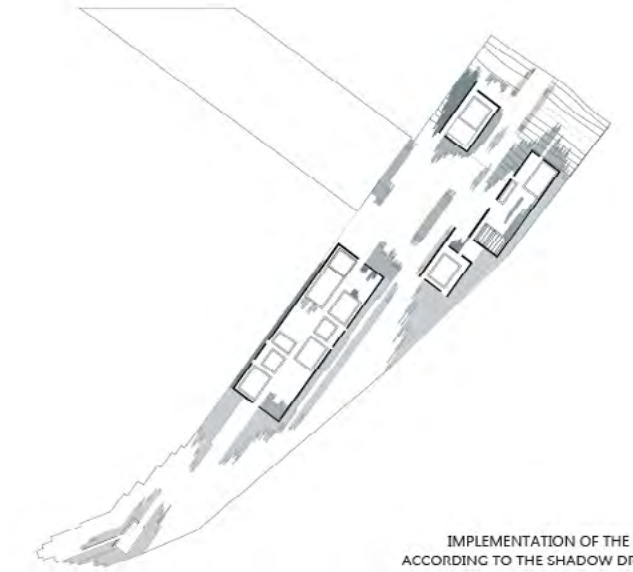
THE WALL

One of the most important element of the project are the walls in bricks, that can host different species of birds, butterflies and insects according to the altitude they use to live in, and also they can be use by the humans as instrument to interact with the biodiversity. The wall infact is divided in 3 level. The lowest one presents holes adapted for the nesting of butterflies, since they are close to the bosquet and spots for the implementation of the green modules built by the humans.

The middle part is suitable for the small size birds since the holes are 3 cm by 3 cm . This layer can also hosts the bats in the strict and long dark fessurations.

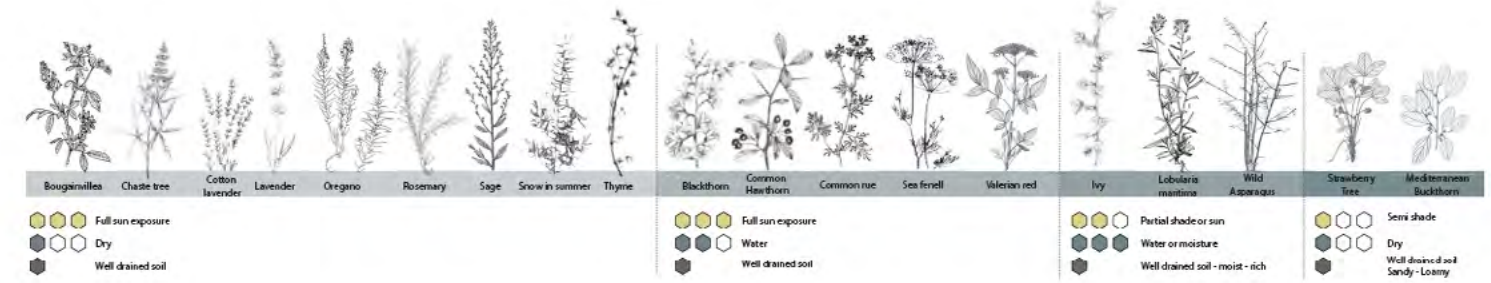
The last part is aimed to be used by the big size birds because of the holes of 10 by 10 cm.

SHADOWS

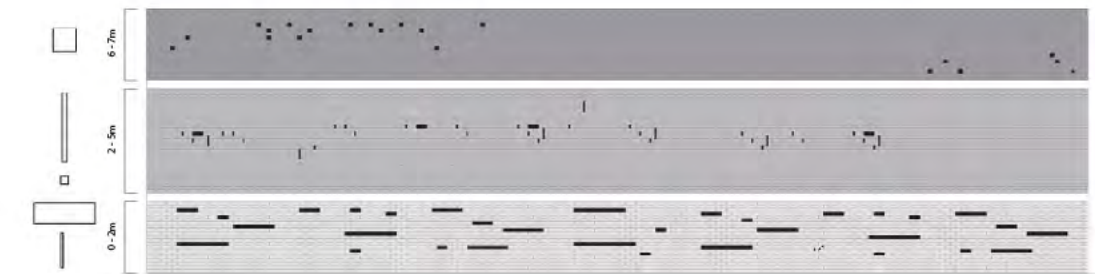


PLANTS
SELECTION OF AUTOCHTHONOUS SPECIES -
TYPE OF HIGH BUSHES, LOW BUSHES, AROMATIC AND ROCKERY PLANTS

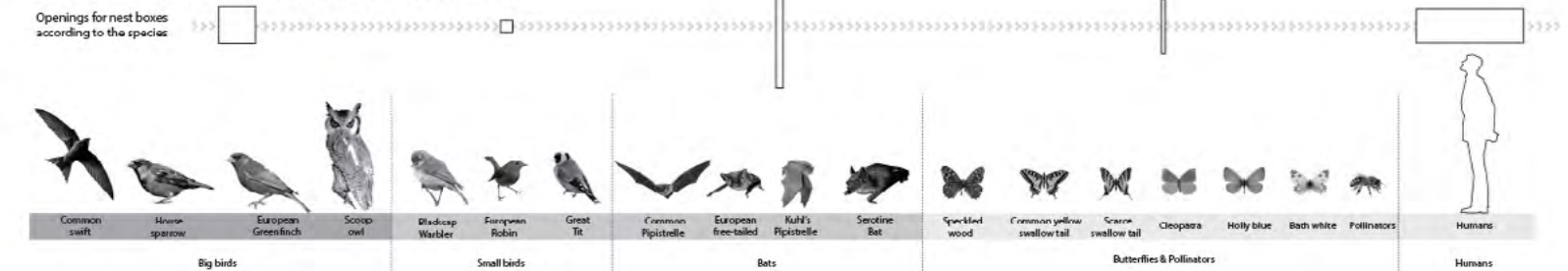
IMPLEMENTATION OF THE PLANTS
ACCORDING TO THE SHADOW DRAWING



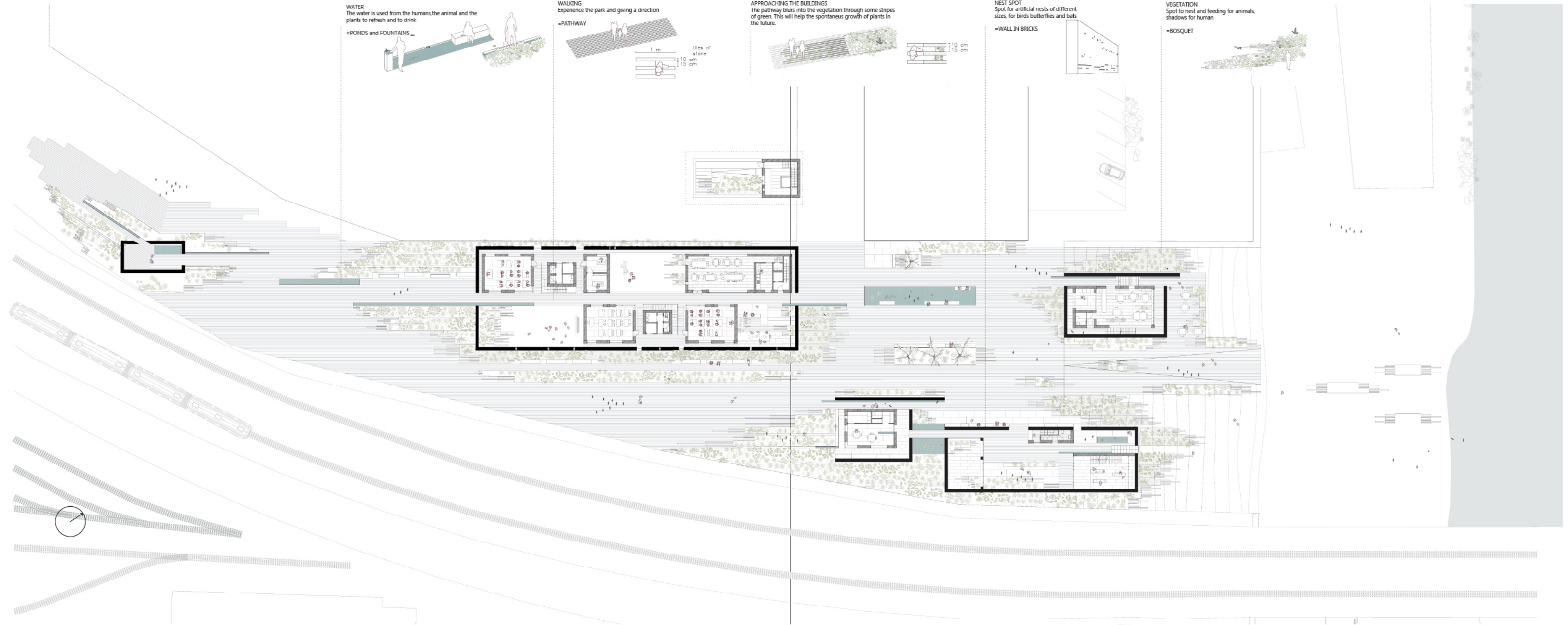
BUILDINGS



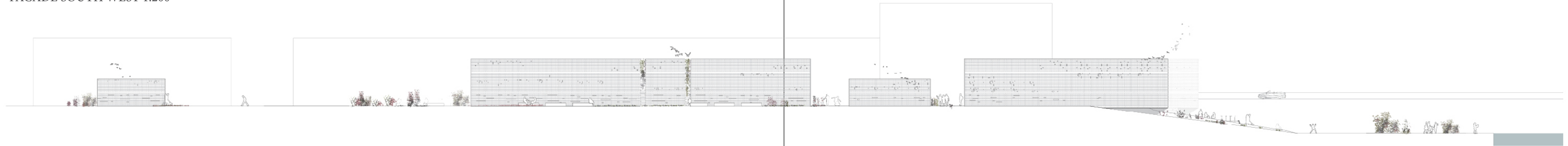
ANIMALS
SELECTION OF AUTOCHTHONOUS SPECIES - BIRDS, BATS AND BUTTERFLIES



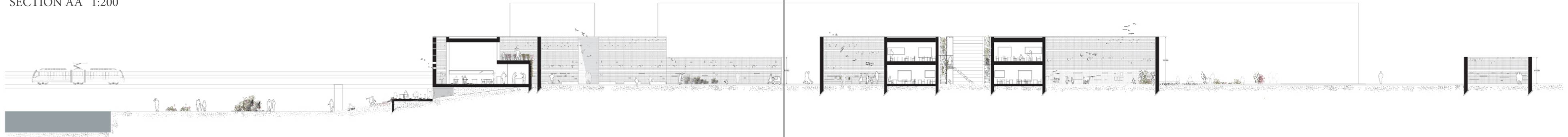
PLAN GROUND FLOOR 1.200



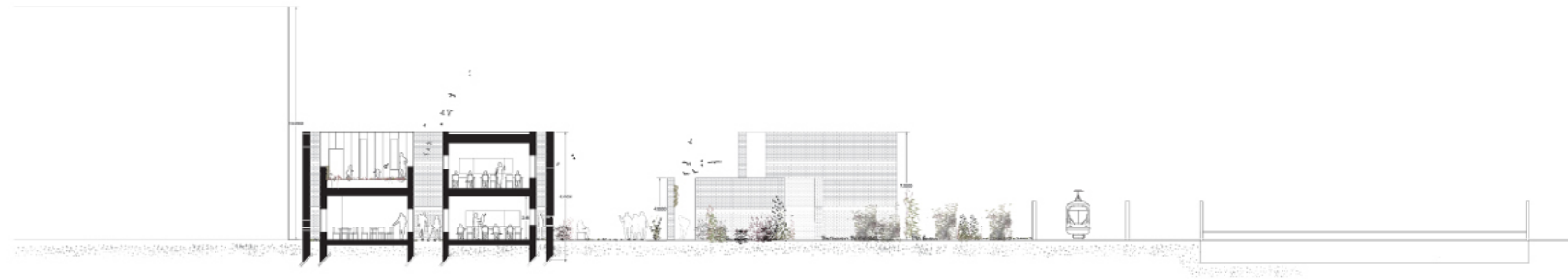
FACADE SOUTH WEST 1:200



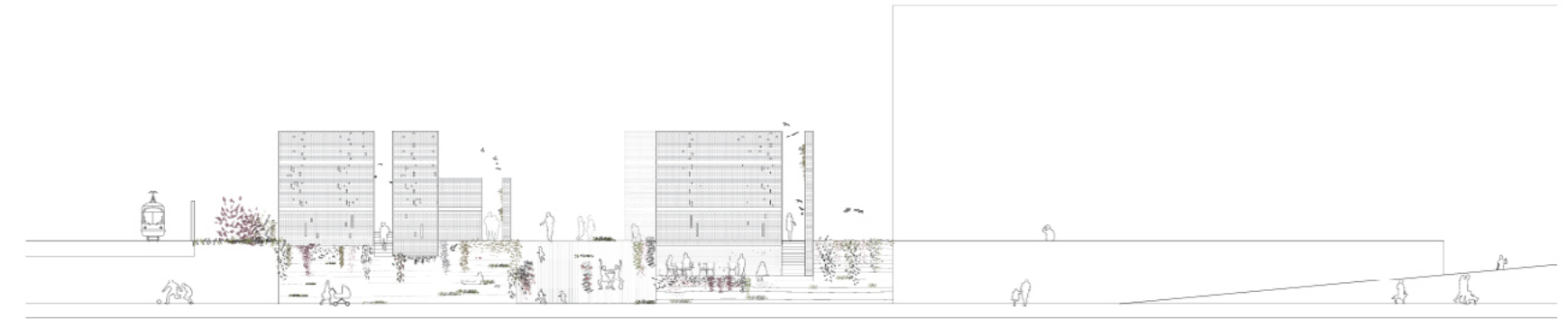
SECTION AA' 1:200



FACADE NORTH EAST 1:200



SECTION BB' 1:200



MATERIALITY AND INTERACTIONS

INTERACTION - MATERIAL - BIODIVERSITY

The project deals with different materialities that are in relation with the several interactions that it proposes.

In this way, the materialities are a signification of visibility, interaction and mutual support.

There is four main materialities developed in the project, aiming to enhance the biodiversity in the architecture.

Brick: Brick wall used to integrate habitats for biodiversity

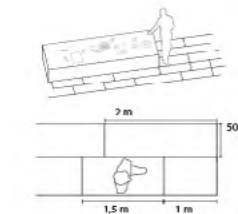
Biological concrete: New material composed of porous layers that capture the water and permit the growth of lichens. It has been developed at UPC School of Biology, Barcelona. It is composed of three layers that can be attached to the structure of the building. Thanks to the presence of lichens, it has the capacity to reduce the quantity of CO2 in the air.(2)

Pathway - stone and grass: Pavimentation used in the project, composed of stripes of stone (15cm) and stripes of grass (10cm) blurring in the bosquets. The stripes of grass let the possibility for the vegetation to grow.

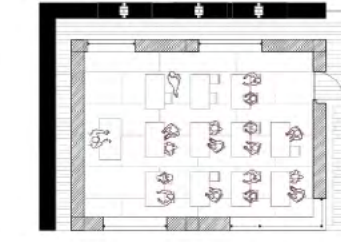
Iron posts: Constructive elements designed for the facades or outdoor spaces to provide solar protection thanks to the plants.

INTERACTIONS

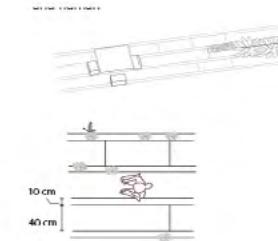
VISUALITY



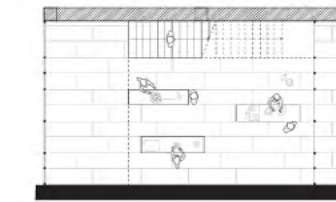
SCHOOL -CLASSROOMS > VISUALITY
VISUAL CONNECTION with the wall AND NEST PLACES



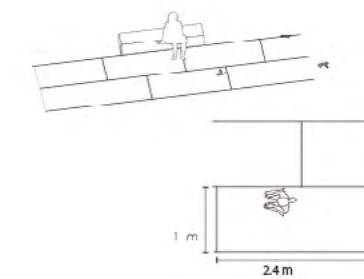
INTERACTION



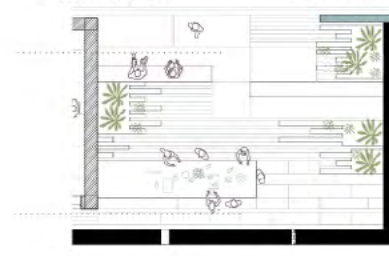
TEACHING CENTER- WORKSHOP > INTERACTION



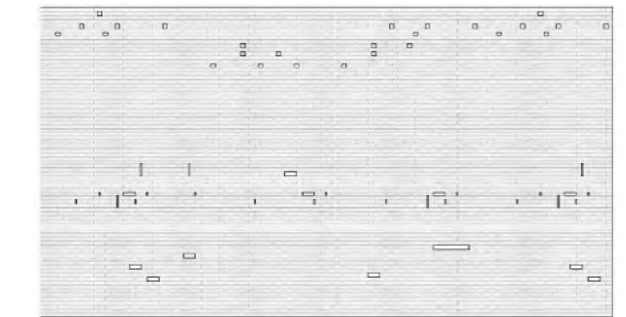
MUTUAL SUPPORT



SCHOOL- WAITING AREA > VISUALITY
SCHOOL- EXTERIOR WORKSHOP > INTERACTION



MATERIALITY



BRICK



BIOLOGICAL CONCRETE



STONE AND GRASS



IRON POSTS

DETAIL

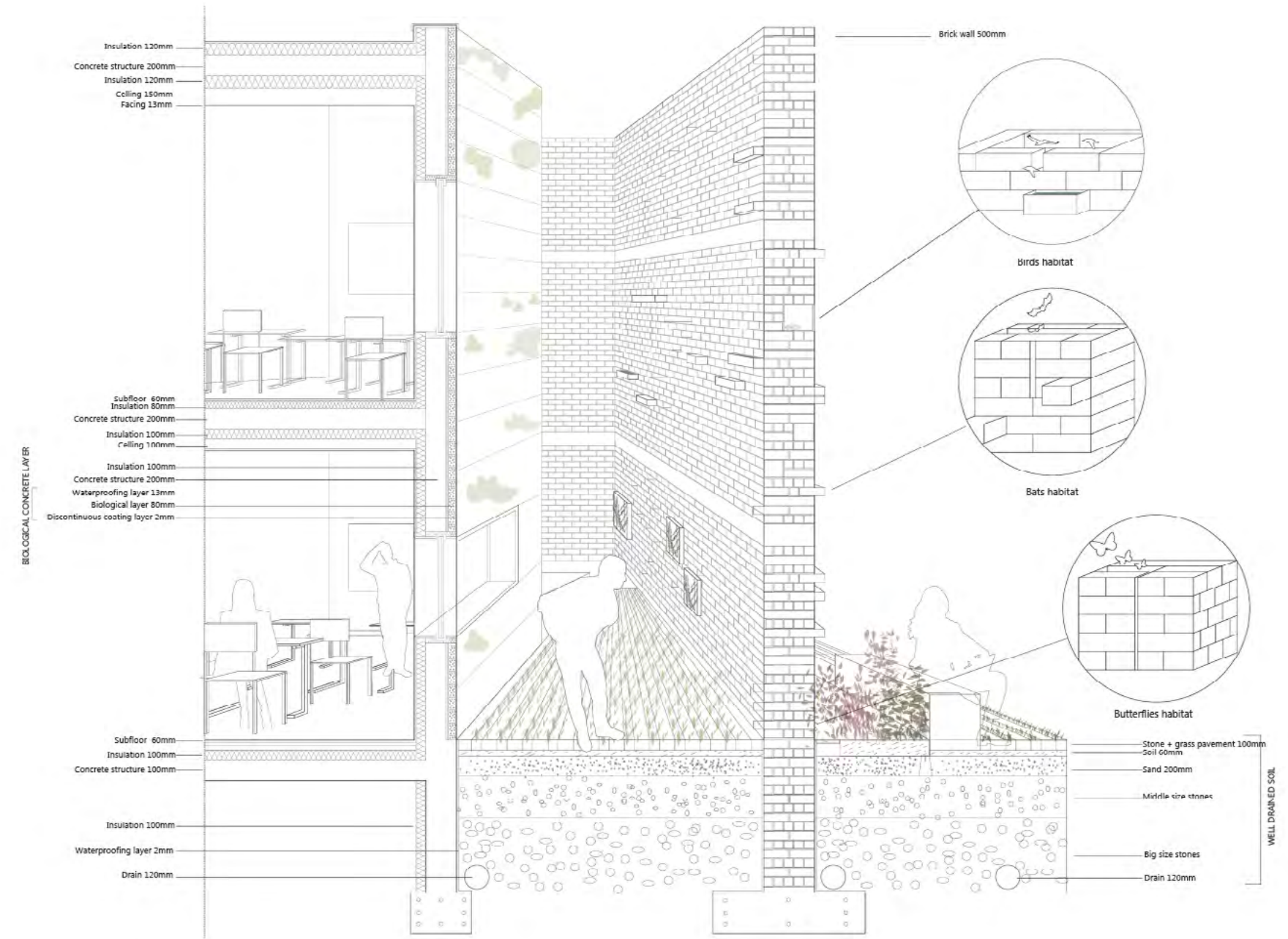
SOIL - BRICKS - BIOLOGICAL CONCRETE

This detail shows the interaction existing in between the modules (in this case the classrooms) and the envelope represented by the walls in bricks. The materiality of the buildings is aimed to enhance the biodiversity in the project. The walls of the modules are covered with a special biological concrete studied in the UPC (Universitat Politècnica de Catalunya) that thanks to the different layers is able to collect water and permits the growth of lichens.⁽³⁾ This material will evolve along the years and end up really helpful for two main reasons: attraction of fauna that will eat the vegetation and moreover the improvement of the thermal conditions inside the modules, since the outside layers of the coating will help the insulation of the interiors. The biological concrete, made of modules, can be plugged to the existing structure of the building.

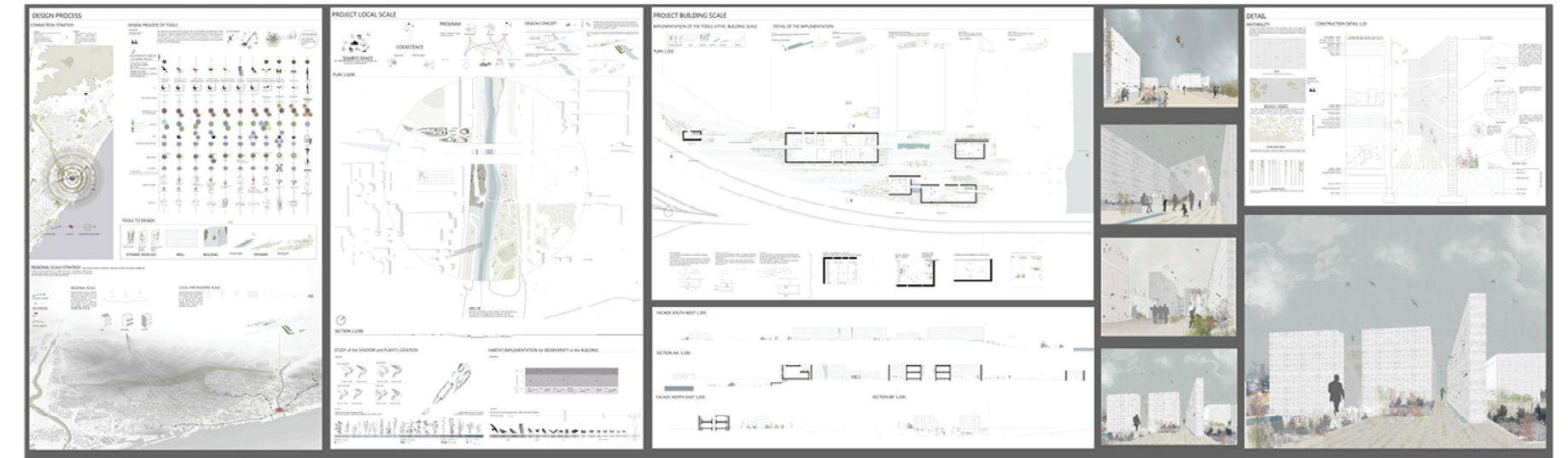
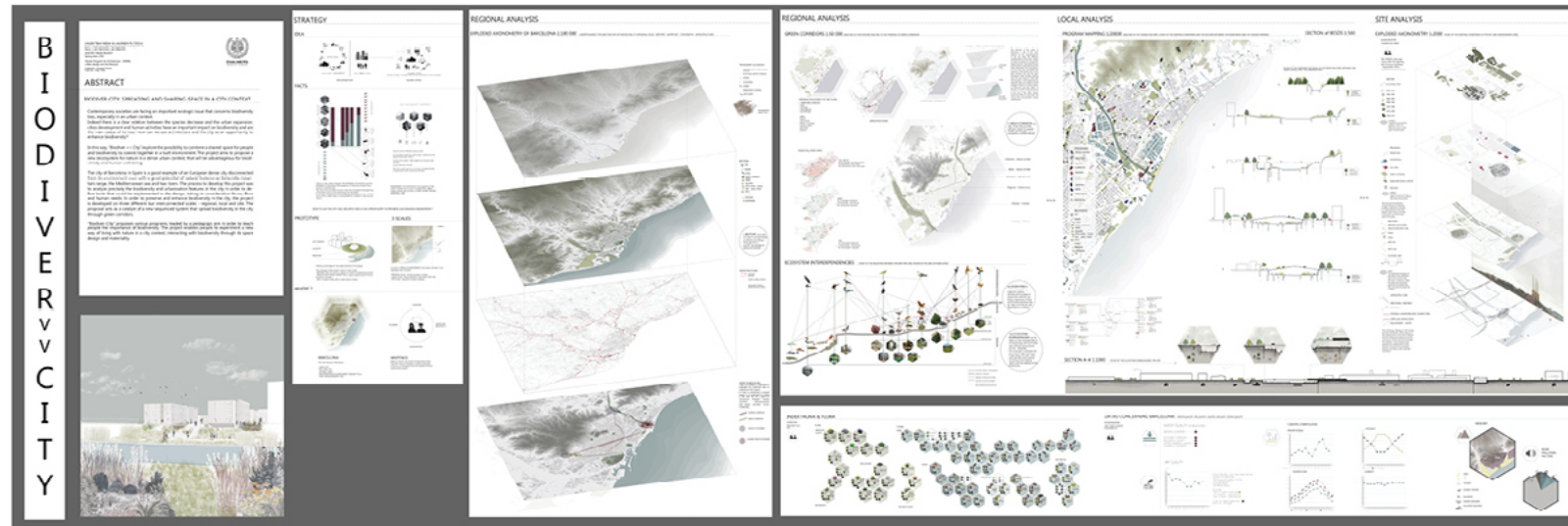
The envelope, composed of bricks 9x27cm dimension has been adapted to create habitats for the different species, possible by the movement of the bricks, in and out the wall structure.

The exterior soil is made of stripes of stone and grass, allowing a really good drainage of the water through the different layers of sand and stones.

The space that has been designed between the modules and the envelope is a good element for the interaction between the humans and the biodiversity since the childrens can see the species in their own environment without disturbing them. This detail shows the concept of the shared-space that the "Biodiver-City" project aims to develop.







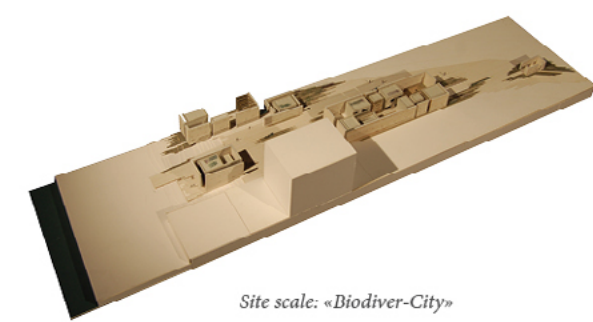
Posters of the Master thesis - June 2015 - Chalmers University of Technology



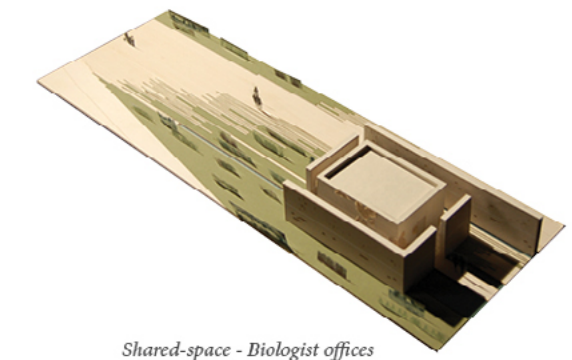
Regional scale: Region of Barcelona



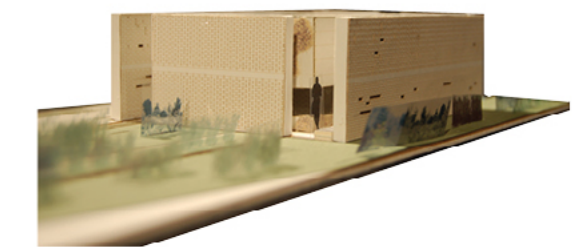
Local scale: Green corridors



Site scale: «Biodiver-City»



Shared-space - Biologist offices



Shared-space - Biologist offices

STRATEGY DEVELOPMENT

ADAPTIVE MANAGEMENT

TESTING IDEAS

STRATEGY - ADAPT - LEARNING PROCESS - MANAGEMENT

By proposing a project that deals with biodiversity and humans as an experimentation of a shared-space, the proposal has to be progressive and adaptable. In this way, the notion of adaptive management - Adaptive management is a structured, iterative process of robust decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring – is integrated to the long-term strategy of the project.

Adaptive management is a tool that induces a learning process on a long time period in order to be able to adapt actions and strategies according to the results.

Indeed, the project provides an office for biologists to work on site. In order to observe, test ideas and strategies, it could be a good opportunity to find adaptive solutions according to scientific reports concerning the enhancement of the biodiversity on site.

Moreover, one of the tools defined for the design process are the dynamic modules that fulfil birds, butterflies and flora needs. They are dynamic in the sense that they can be plugged at different places on site.

These movable modules offer the possibility for people to interact with it in the workshop by growing plants, build nest houses for birds and butterflies for example. At the same time, they can be adapted to enhance as much as possible the biodiversity by offering the possibility of changing the soil, the sun exposure or its situation on site.

ADAPTING MANAGEMENT STRATEGY

1 CONCEPTUALIZING

- .Development of scope, vision, targets
- .Identify criteria
- .Complete situation analysis

2 PLAN ACTION and MONITORING

- .Development of goals, strategies and objective
- .Development of monitoring plan
- .Development of operation and plan

3 IMPLEMENT ACTION and MONITORING

- .Development of work plan and timeline
- .Development and refining budget
- .Implement plans

ARCHITECTS

BIOLOGISTS:PROFESSIONAL

4 ANALYZE USE and ADAPT

- .Prepare data for analysis
- .Analyze results
- .Adapt strategies plan

5 CAPTURE and SHARE LEARNINGS

- .Documentation learning
- .Share learning
- .Create learning environment

TESTING IDEAS - REPORTS EVERY 5 YEARS



EVOLUTION OF THE PROJECT IN THE FUTURE

The image shows how the city could engage a new strategy for the future. Using «Biodiver-City» as an example of a shared space, the city could develop the strategy in other spots of the city, increasing the connection of the flora and fauna all around the city. The idea is that many shared-space could be implemented as several sequences along the years, creating new biotopes. At the same time, the strategy can be adapted to other cities, but has to take in consideration many criterias.

ADAPTING THE STRATEGY TO CITIES

- ANALYSIS OF THE CITY GENERAL CONDITIONS (Biodiversity and urbanisation)
- PLACE THE CATALYST IN A STRATEGIC SITE (Connection humans and biodiversity corridors)
- DEFINE TOOLS TO IMPLEMENT IN THE PROJECT (Relation architecture and needs)
- DEFINE PROGRAMS ACCORDING TO THE AREA NEEDS

CONCLUSION

The project «Biodiver-City» explores how the architecture can be an opportunity to find solutions concerning the biodiversity loss in dense cities. The project propose a new way of living in our societies that are more and more urbanised to show that it is not an utopia to live in cities without destructing the nature.

«Biodiver-City» proposes solutions at different scales, from green corridors to architectural details of constructions. Indeed, the importance of the materiality is pretty clear since it can enhance the presence of different species thanks to the advantage that it can offer. Firstly, using bricks or stones in the building construction can be really good to create habitats that are adapted to the needs of the species. Secondly, the biological concrete that we have integrated to our project is a new technology that is really efficient to the development of the flora and then, the attraction of fauna. The presence of different vegetation, designed as a bosquet is a true advantage for the fauna. Nevertheless, as we precised in the project, it is essential to select autochthonous plants to protect the ecosystem stability of the region.

Moreover, dealing with the biodiversity in the city induces that the strategy is developed at different scales. The project proposes the strategy of the tools - designed according the accurate analysis of the biodiversity and human needs- and more particularly the green modules. Fulfilling the needs of the species in terms of habitats, nest sites and food, it can be really easy to implement them into the cities by putting them on balconies, terraces, roofs and walls. Acting as a small biotope, a sequence of them in cities can create a green corridor even if the city is really dense and cannot offer more parks for example.

According to the fact that people are mostly not aware of the biodiversity loss and its real issue, the project is leaded by a pedagogic aim. Indeed, the inhabitants of the city can come on site and experiment how it is to live with biodiversity and the city and how it can be beneficial for both. That is why, as a catalyst, «Biodiver-City» is proposing programs that welcome people and teach them in a playful way the matter of biodiversity.

The biodiversity field is really complex and we cannot find directly the good solutions for the site, the building or the city. It needs to be adaptable and that is why the project is developing a strategy that can change and be improve along the years and the different places.

Finally, as architects, we do need to meet several specialist of biodiversity. Our meetings with municipalities, ornithologists, biologists and landscape architects in Barcelona have been essential to translate their knowledges to architecture. The discussions with all of them and their interests for the project «Biodiver-City» shows that relying architecture, city and biodiversity is not an utopia but can be our future.

REFLECTION

Working on this master thesis has been really interesting since we approached a topic that we did not know really well at the beginning. It has been a real challenge to integrate all these knowledges in order to develop a project that could fit the best with the reality.

The opportunity to go to Barcelona for one month to visit the site and meet the different actors has been essential for the good development of the project and we are really grateful for that.

We do think that «Biodiver-City» is a complete exploration of the relation between architecture and biodiversity and we are now even more conveyed that architecture is a good opportunity to rely nature and city since it can propose a lot of different solutions and advantages.

Finally, working in group of two persons, having different backgrounds from different schools and countries has been a real strength for the project since our intense discussions, reflections and design sessions have always been really reflected and pushed forward.

THANKS

Thanks to Quentin, Simon and James that always helped to keep the good motivation and the good music in the studio. Thanks to Carlotta who has been an awesome cake baker and a good support during those months. To Maud, Niklas and Madga for being amazing flatmates. To Dani for everything. To Silvia and Victor that hosted me in Barcelona during the trip and show me the real catalan life. Thanks to Antonio Gomez, Alexis, Jaume, Consorci del Besos, Maria José Chesa Marro, Xavier Ferrer, Denia Beliver and Victor Tenez for receiving us and being so generous. Thanks to Joaquim that has been an amazing supervisor . Thanks to Adem, who gave me self confidence and real passion for architecture. Thanks to Vale, without who the project will not exist, for being my mate. To my family. Laureen

I wish to thanks all the team of the studio and all the Chalmers' people that have been around during our days on this amazing process that is our thesis. Thanks to Joaquim that gave us new hints and suggestions every day. Thanks also to the whole big family of Barcelona, to Antonio Gomez especially and to Vio. To Lau for being one of the most competent mate that I have ever had, never giving up and always bringing ahead the project with sthrength and dedication during this year. And last but not least to Francesco, Marta, Matteo, Chiara and to my lovely family that supported me every day. Valentina

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