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Barcelona / A tale of two rivers

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In Barcelona, the connection between the city and its natural environment is very clear in multiple images linking the mountains to the sea. However, what is much less perceived, is the presence, and importance, of the two major rivers entrapping the city on either side. The Besòs and Llobregat rivers have long played a crucial role in the development of the city, not only for their historic importance during the industrialization period, but also for their presence as green axis, much needed for citizens, as well as for urban renewal. Today both rivers contribute to generate vast green spaces at metropolitan level.

Throughout this article, we will focus on the transformation of these two rivers over the last thirty years and will examine their situation before human intervention, projects and implementations took place. Undoubtedly, the renovation of these spaces into a green belt for the metropolitan area of Barcelona have strengthened the relationship between natural spaces and urban infrastructure. Furthermore, their recovery vindicated the identity of the surrounding areas, which have always been related to water.

Introduction

A popular image associated by Barcelonans, regarding its territory, is that of a city strongly in touch with the Mediterranean. In this vision, the mountain appears as a backdrop to the urban scene. The physical and virtual connectivity between both natural elements, the sea and the mountain, is clear for most citizens. However, much less perceived

is the presence of the two major rivers surrounding the city. The Besòs and Llobregat rivers have played a crucial role in its development and today reclaim their pertinence by forming vast green spaces at metropolitan level. The passage of the Llobregat and Besòs rivers through the coastal mountain system excavated the valleys that now connect the plain of Barcelona with the interior lands, turning them into two large access routes to the plain. This condition and their proximity to the city made the plain of the rivers the perfect place for major infrastructure (roads, highways, railways, electricity, etc.). The Llobregat is one of the biggest and most relevant rivers in Catalonia and played a major role on the industrialization of the region. Its riverside held several industries which settled on either side to generate energy to operate. The Besòs river is smaller and is located much closer to the city; hence its importance is more related to de metropolitan and local level rather than to the regional one.

The growth of the city throughout the twentieth century contributed in the complete integration of both rivers into the Metropolitan Area of Barcelona. Today, the two of them represent the largest free spaces in the city, together with the Collserola mountain range and the seafront (Figure 1). They also have the advantage of being highly accessible, which make possible their public use at a much greater scale. The Besòs and Llobregat rivers function as green infrastructures for the metropolitan area. The idea of "green" consists of the use of natural elements, such as vegetation,



Fig 1 / The Llobregat and Besòs River as natural borders of the city of Barcelona source / Google Earth, further edited by the authors

and soil and the processes associated with them for the creation of healthier environments. The concept arises as a response to the growing loss of landscapes and biodiversity due to human action in the environment. In urban areas, the use of green infrastructure implies the improvement of the city's natural elements while generating environmental, social and economic benefits. Therefore, green infrastructure is perceived as an interconnected network of spaces of environmental importance aiming to maintain the processes and ecological flows that occur within. The metropolitan ecological matrix, as proposed by Enric Batlle, is a set of interrelated green infrastructures, either public or private domain, forming a structured system at a territorial level.

In 2013, the European Commission officially introduced the green infrastructure strategy. According to the document, green infrastructure is conceived as "a network of natural and semi-natural areas and other environmental elements, strategically planned, designed and managed for the presentation of a wide range of ecosystem services. It incorporates green spaces (or blue in the case of aquatic ecosystems), other physical elements (including coastal areas) and marine spaces. At land level, green infrastructure is present in rural and urban environments"(Comisión Europea, 2013). A key point, highlighted by said strategy, is that green infrastructure projects need to be integrated into planning and spatial planning processes

in order to assure viability. The European Union has encouraged the creation of green infrastructure, especially supported by Natura 2000 spaces. This network was designed to stop the loss of biodiversity in Europe and represents approximately 18% of the EU's land area, to which important maritime zones are added. In Barcelona's case, the Natura 2000 network includes the coastal mountain system (Garraf, Collserola and Serralada de Marina), the Delta del Llobregat and its adjacent maritime space (Figure 2). This network is established on various scales, from the broadest scale which covers the regional level, to the local or municipal. Natura 2000 then becomes a great influence to the Llobregat and Besòs rivers, firstly by articulating environmental dynamics at a regional level, and secondly by developing excellent natural spaces at a neighbourhood level. Needless to say, each scale faces different challenges, needs and limitations, but it also presents a superb opportunity to bring nature closer to the city and provide urban solutions based on natural processes.

In order to enhance connectivity, other strategies have been implemented. The Ronda Verda (Green circular path) relies on physical actions working hand in hand with routes in order to promote and connect people with its environment. The municipality has sought to interconnect the two fluvial spaces with the sea and the mountain through a continuous path¹. This cycle route covers approximately 72 km of bike lanes and includes several municipalities in the metropolitan area. One of the 6 stretches established on

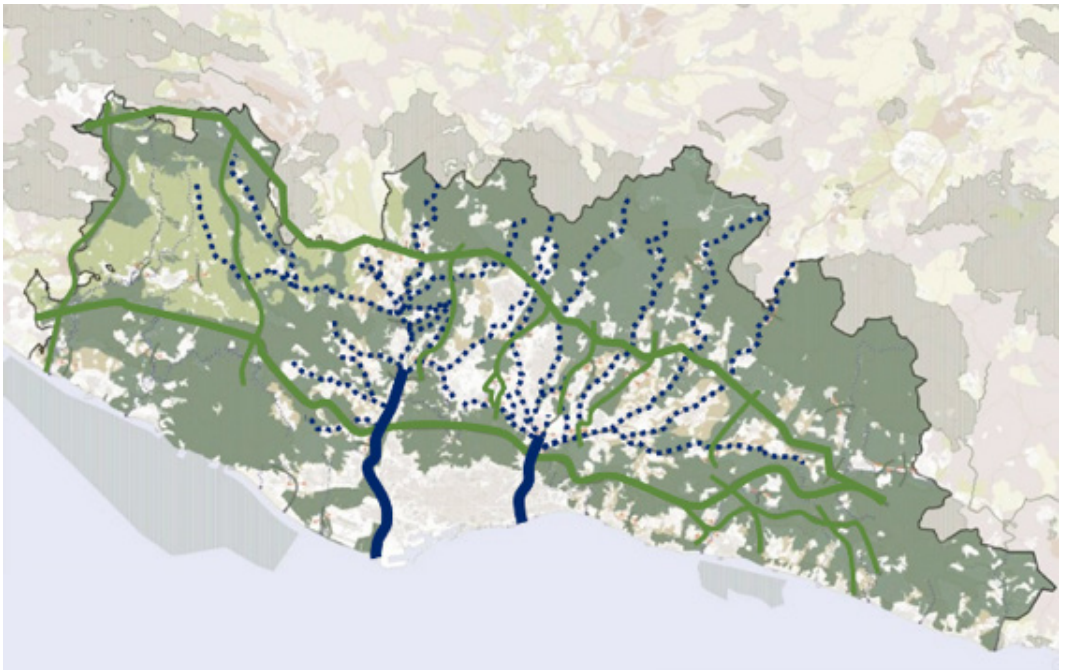


Fig2 / Green spaces structure in the Province of Barcelona
source / territori.gencat.cat

this route runs along the river Besòs. The section related to the Llobregat, brings the cyclist to its basin, allowing connections with the river channel, the delta area and Collserola Park. On the other hand, the Plan Verde (Green Plan) is a set of strategies that aim to improve environmental conditions on a one on one basis. Barcelona's 2020 Green and biodiversity plan appoints Llobregat and Besòs rivers as places for the exclusive – or at least of high priority – use for both pedestrians and cyclists². Their proposal crosses the urban fabric guaranteeing the connection between the various "green spots" in the city. For this plan, both rivers work as natural corridors forming a true ecological infrastructure within the city, where the green network connects functionality with the peripheral natural spaces. The Green Plan reinforces the idea of urban green corridors that perform as axes, distinguished by the quality of the space, and by the presence of nature close to its citizens. This not only makes the city friendlier, while creating attractive habitats for wildlife and multiplying environmental and social benefits; but by doing so, they play a strategic role in achieving a healthy city. Such visions presented of the rivers and green corridors are relatively recent. Historical uses during the 20th century were focused on fast urbanization and intensive industrial activity along the river; causing high degrees of degradation of the fluvial landscape and the loss of natural ecosystems. Their deterioration paired with the need of green spaces reclaimed its value for urban renewal.

Throughout this text, we will analyse the

most relevant riverside projects that have strengthened the relation of these two green corridors and the city of Barcelona. We will look out to their evolution and assess their contribution to the city.

The Llobregat River

The Llobregat emerges in the Pyrenees and has a total length of 170 km through Catalan territory, and its water has been used to impulse the industry since 17th century. The metropolitan course of this river has a length of 30 km and goes through 16 municipalities before arriving to the sea. The Llobregat River Park represents a new model of public space, shaped by the large open space generated by the river connecting the Collserola massif with the coast, playing an essential part in the metropolitan area, and contributing great ecological value. The revitalization of its surroundings appears as a solution that all western metropolis with fluvial spaces are only now beginning to value, both for its multiple uses and for the opportunities generated. Its riverside renewal aims to increase sustainable mobility and improve the quality of leisure and health activities, within a framework facilitating sports and contact with nature.

This space is understood as a great ecological infrastructure providing a continuous road on both riverbanks, enabled for the circulation of pedestrians and cyclists. This broad route includes pedestrian crossings, access to all riverside municipalities as well as the metropolitan public transport network. It is a path through a landscape of great richness and biodiversity that combines elements



Fig3 / The rivers Besòs and Llobregat, transformation stretches source / Google Earth, further edited by the authors

of historical and cultural heritage with outstanding points of interest.

The intervention in the area was divided into 2 main stretches, along with the intermediate stretch and the special area of the delta. The whole intervention is part of the Baix Llobregat agrarian park, a patrimonial and productive protected environment.

The special plan of protection and improvement for the Llobregat Agrarian Park was approved in 2004 and is comprised of 3350 ha along the last 18 km of the river. This initiative was born from a proposal raised by the agricultural authority of Lower Llobregat back in 1994 in order to resolve the region's specific problems. The main objectives of the plan were to consolidate and develop agricultural activity, to achieve an environmental reclassification and integration, and to foster social experiences within the agricultural region (Sabaté & Schuster, 2001). The structure of the park was developed so as to provide "gates" to the park, sea-mountain direction routes, and routes of agricultural interest, for pedestrians and/or cyclists, among other points of special interest,

making it possible to mix the productive activities with visitors (Sabaté, 2015).

Along the first stretch, access to neighbouring towns was created thanks to the recovery of riverside roads as main environmental and landscape interventions. The planting of trees in terraces to mask external surroundings filled with abundant infrastructures and industries was proposed as well as the restoration of artificial slopes, the manipulation of small elevations to absorb decomposition by industrial routes, the formation of ponds and hillocks to retain or conduct waters have shaped the new relief of the high platform of the channel. Likewise, ponds used to refill the aquifer were recovered, contributing to the environmental recovery of the land and the landscape of this area.

The project considered two ponds with differing functions: the first one receives water captured from the river and recreates a natural wetland area with artificial slopes and islands suitable for the development of flora and fauna. It also serves to decant the matter in suspension on the river before passing to the second pond, where water filters into the aquifer.

1 / Ronda Verda bike lane, see more at: www.rondaverda.cat/en/index.php

2 / Plan del Verde y de la Biodiversidad de Barcelona. Available at: http://ajuntament.barcelona.cat/ecologiaurbana/sites/default/files/PlanVerde_2020.pdf, p.65

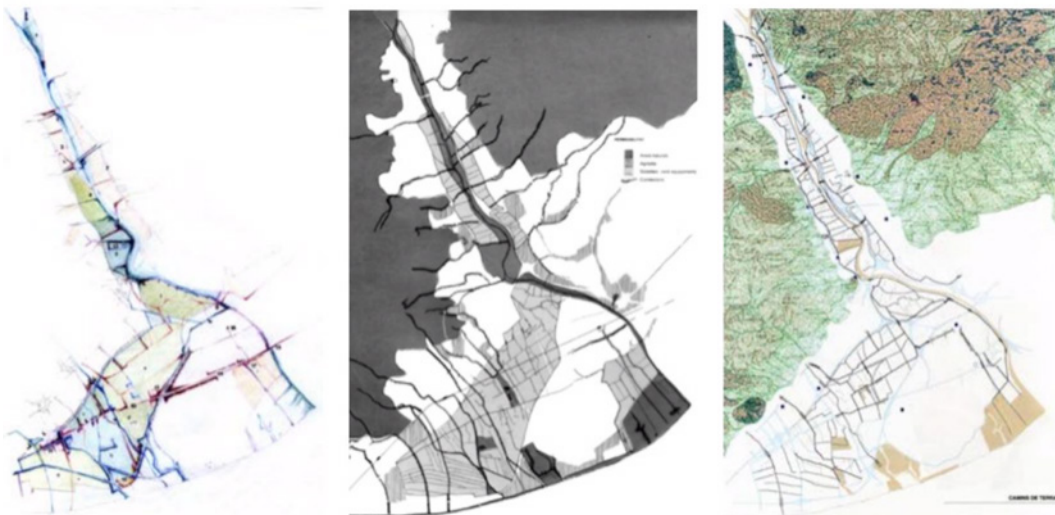


Fig4 / Agrarian Park of Llobregat
source / Plan for the Agrarian Park of Llobregat, CCRS Arquitectes

In the second stretch, the connection between the two riverbanks is essential, and the pre-existing road networks are intertwined. Here punctual and concentrated interventions have been implemented, improving accessibility. These include the Sant Boi River Park, a space formerly occupied by illegal gardens inaccessible to pedestrians. Today a walkway connects the itineraries and overcomes the barriers posed by the railway and road. At the same time, the planting of different species of shrubbery and aquatic silvers, as well as a type of vegetation consistent with the available water resources was carried out. Additionally, a system of deflectors used to stimulate the river's natural tendency to generate meanders was implemented, diversifying the ecological fluvial habitat in the medium and long term.

The delta of the Llobregat river is an extensive plain of 98 km², which emerged during the Roman period. The aquifer's presence has made the introduction of agriculture possible, facilitating its intensive use as one of the richest agricultural areas in the Mediterranean. For many centuries, it was inhospitable, with a precarious and scattered settlement subject to the harsh conditions of the territory. Since the fifteenth century, it has been occupied continuously, first with agriculture on dry land and then with irrigation. These were the dominant economic activities until the twentieth century, when industrial and finally, tertiary activities, appeared in the area. Its continuous changes result in a mosaic of landscapes that include natural spaces, crops, urban areas, industrial and

services, road and rail networks, as well as infrastructure such as the Port and the Airport.

The Besòs River

The Besòs is a relatively short river in the province of Barcelona, being only 17 km long. However, it has been of extreme importance for crop watering in Barcelona's plain since Roman times and, more recently, it has been used for industrial purposes. It is a typical Mediterranean river, having dry periods along with short and rainy ones. In the event of rain, the area can suffer from flooding due to an increase of almost 100 times its normal flow. During the 1960's, rapid urban growth in the surrounding area considerably affected a section of the river and therefore its hydric capacity. In September 1962, a large flood took several victims and caused significant economic loss. So, among other actions, a wall was built to canalize the river. This wall, located along the last 9 km, was 130m long and 4m high giving the Besòs the aspect of a sewage canal, together with several concrete bridges and electricity pylons along its riverbed. The wall also became a barrier between adjacent neighbourhoods which remained dissociated from the territory (Figure 6).

In 1995, the municipalities involved agreed to develop a unitary Project and there were public consultations where several administrations participated with local collectives. The Consortium for the defence of the Besòs Basin, created in 1988, asked for funding from the European Commission to develop the project and



*Fig5 / Sant Boi river park, by Batlle & Roig
source / Jordi Surroca, Batlle i Roig arquitectes (www.batlleiroig.com)*



*Fig6 / Bridge across Besòs River in 1964
source / barcelofilia.blogspot.com*

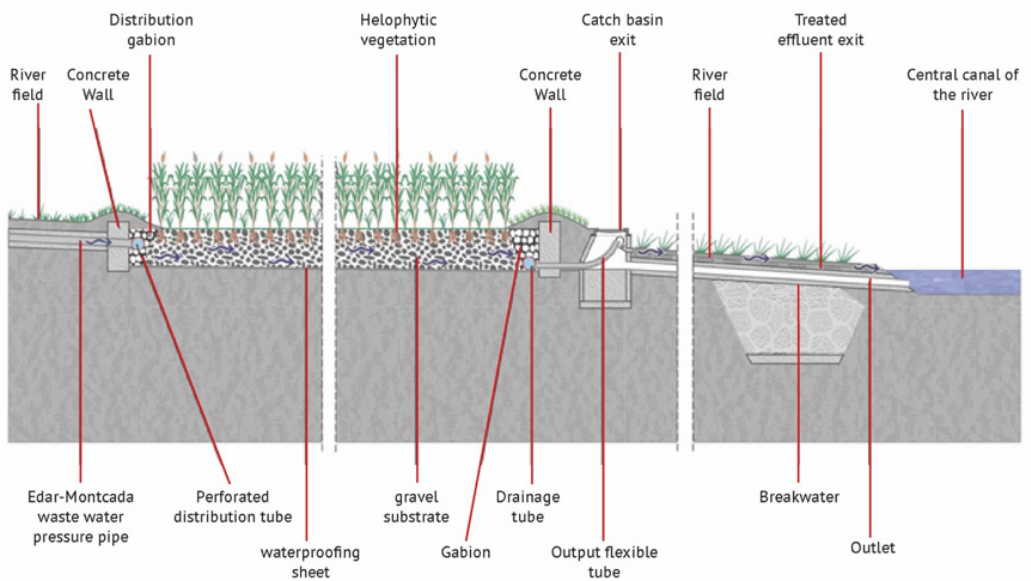


Fig7 / Water treatment system in Besòs wetlands
source / planur-e.es

the final cost was around € 40 million, 85% of which was financed by the awarded Cohesion Fund (Alarcón, 2015). The final project for the Besòs Fluvial Park (2001) was divided into three phases, developed between 1999 and 2006. The Fluvial Park included the development of wetlands for the biochemical natural treatment of waste water and ecosystem recovery; the regulation of hydraulic conditions of the river through the construction of five automated inflatable dams; and finally, the reconstruction of the walls, rebuilt leaving more space for the river in case of flooding and should such an event take place a control and alert system was also installed to evacuate the park.

The first stretch of the river's redevelopment –completed in 1999– starts in Montcada and finishes in Santa Coloma, totalling 6 km. This is the sector with the most environmental and ecological character. A part is restricted to the public and contains 7,66ha of wetlands that perform a tertiary treatment of 30% of the effluent from the Montcada wastewater treatment plant. The area consists of plots planted with reed beds and areas of meadows that surround them making it an attractive ecosystem for birds. The water level is regulated so it circulates through the plot sub-superficially, resulting in water coming into contact with most of the gravel and the reed roots without flooding the surface, preventing the proliferation of mosquitoes and the generation of bad smells (Figure 7). The second stretch of the Besòs park goes from Santa Coloma to Sant Adrià. This area is substantially different to the

upper area, due to its urban and public character. Here the treatment of the two river banks includes park areas and cycle lanes (Figure 8). On the left bank, access to the park was created by wide ramps connected to the street and local parks. In 2003, the 65 pylons were removed, and the park was finished in 2004, coinciding with the Forum of Cultures event.

The final stretch, the mouth, was finished in 2006. This formerly deteriorated space has a high ecological and landscape value and is essential in achieving the total ecological connectivity of the river. So, it was not projected as a public space but as a renaturalization area and includes a site for the resting of migratory birds and typical coastal vegetation, proven effective for the recovery of lost biodiversity. This area completes the whole natural corridor of the Besòs river from the Serralada de Marina mountain system, to the Mediterranean Sea.

Conclusions

The renewal of Barcelona's two great rivers poses, without a shred of doubt, massive benefits to the city. From an environmental point of view, they have been able to recover several kilometres of natural spaces of great value that were highly degraded and such spaces have become operational as main axes of the city's green infrastructure providing huge benefits at both metropolitan and local levels. The social and economic benefits of these interventions are related to the general environmental improvement and fundamentally, the improvement of the quality of life and the increase of public



Fig8 / Besòs River Park
source / media-edg.barcelona.cat

spaces in the districts bordering the rivers. Both rivers provide the city a chance to connect the sea with the mountain through two large fluvial areas. The Llobregat, due to its size and location, includes productive uses and a large space of ecological value within the metropolitan area, both along the first stretch and in the delta. The Besòs' use of space, meanwhile, is limited to recreational uses, and water purification processes.

The work, in both cases, was carried out in sections, establishing uses and variables for the asymmetric sections, each section representing a challenge in itself, requiring a different approach to the problem and integrating a temporary sequence of actions. It is important to note the special protection that has been given to the mouths of the rivers, which have been treated as singular spaces where ecological values prevail over the uses that man can give as recreational spaces. In both processes of transformation and valorisation, citizen participation was essential, given that it was the driving force behind the improvement works. The claim of the actors involved led administrations to take action in the matter and acquire external financing crucial for the resolution of these spaces. Undoubtedly, these spaces face new challenges today. Most of them have to do with the high intensity use they have achieved, due to the great appeal they represent at an urban level. However, we believe it is necessary to emphasize the careful work that has been done to both rivers in preserving their structures and ecosystems. This has allowed reinforcement of the identity in

neighbouring populations and, above all, increase self-esteem on the environment we have at our disposal, after a long period of high degradation and contempt. As Enric Batlle once said: "We need to work not with the river we would like to have but with the river we do have".

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