

**RADBOUD UNIVERSITY**

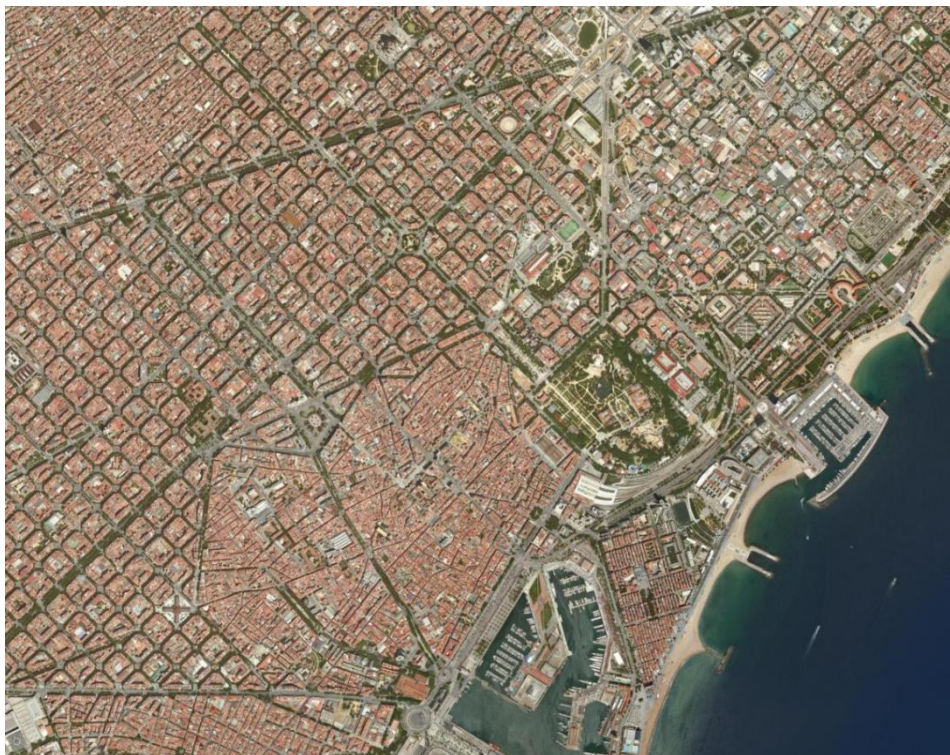
**NIJMEGEN SCHOOL OF MANAGEMENT**

**Master Thesis for the Spatial Planning programme**

**Specialization European Spatial & Environmental Planning**

**How can accessibility tackle environmental justice issues?**

**The case study of Barcelona**



**Adelaida Corbera González-Tablas**

**September 2021**

# How can accessibility tackle environmental justice issues?

## The case study of Barcelona

Adelaida Corbera González-Tablas (s1059270)

Academic year 2021/2022

Supervisor: Dr. Iulian Barba Lata

Date of submission: 21/09/2021

**Radboud University**



Cover image from Institut Cartogràfic i Geològic de Catalunya

## Summary

During the recent years, climate change has become an ongoing topic considered in many of people's daily lives. Many techniques have been developed in order to assess and mitigate these negative effects that are impacting in our environment. This thesis has its focus on green infrastructure, and how its planning might have some side effects among social inequalities through the level of accessibility this green spaces have.

Nowadays there are several objectives and goals that have been settled from the highest institutions to the local ones, such as regional governments or municipalities. Local reports and green planning strategies have brought the benefits of green and care of public space to the list of important topics that needs to be assessed. If the last years have not resulted into the pressure needed to achieve the settled goals, the ongoing Covid 2020 pandemic has showed to institutions and citizens the need of more open and health spaces. Important elements are being considered into municipalities greening agendas, stating different priorities to consider in order to offer the best public green spaces to its citizens.

The conducted research has been based in the Spanish city of Barcelona allowing to open a door to understanding the ongoing situation of green planning when it comes to social and environmental benefits. Through the realization of semi-structured interviews with experts, and the analysis of public documents and plans from the municipality, several results and conclusions have emerged in order to understand the main role of green infrastructure within the city's layout and its citizens daily life. This research has gone as deep as it could into the perspective on how is green planning done in Barcelona through the lenses of different experts, and how planners have considered the possible social inequalities that can emerge.

## **Acknowledgments**

I would like to express my gratefulness to all the interviewees for giving some of their time to meet with me and share their knowledge and opinions about green infrastructure and environmental justice issues.

I would like to thank my supervisor Dr. Iulian Barba Lata for guiding me the best way he could through the process of writing this research.

Finally, I am very grateful to my family and friends for being there during this difficult and stressful times.

## Contents

1. Introduction.....	7
1.1. Problem statement.....	9
1.2. Research aim and research questions.....	9
2. Scientific relevance.....	9
3. Societal relevance.....	11
4. Theoretical framework.....	12
4.1. Green Infrastructure planning.....	12
4.1.1. The rise of green infrastructure literature and the mobilization in cities and urban regions.....	12
4.1.2. Integration in planning policies.....	14
4.2. Green Infrastructure and Ecosystem Services.....	15
4.2.1. The benefits of ecosystem services.....	15
4.2.2. Cultural ecosystem services.....	18
4.3. Environmental justice.....	21
4.3.1. Accessibility to green infrastructure.....	22
4.3.2. Green Gentrification.....	23
4.4. Conceptual framework.....	24
5. Methodology.....	26
5.1. Research philosophy.....	26
5.2. Research design.....	26
5.3. Methods: Data collection.....	27
5.4. Research ethics.....	29
5.5. Limitations.....	29
6. Case study: Barcelona's compact layout.....	30
7. Results.....	32
7.1. Barcelona's green infrastructure planning evolution.....	32
7.1.1. Current direction: Pla del verd i la Biodiversitat 2013-2020.....	34
7.2. Perception of ecosystem services' role in urban planning.....	36
7.2.1. Green corridors.....	39
7.2.2. Super Blocks.....	40
7.3. Environmental justice lenses over Barcelona's greening agenda.....	42
7.3.1. Ensuring accessibility.....	44
7.3.2. Green gentrification concerns.....	46

7.3.3. Participatory process: what to consider.....	48
7.4. Main elements to develop high quality green areas.....	49
8. Discussion.....	51
8.1. Answering research questions.....	51
9. Conclusion.....	54
9.1. Reflection.....	55
9.2. Recommendations for further research.....	56
10. References.....	57
11. Annex I: List of interviewees.....	60

### List of tables and figures

<i>Table 1:</i> Scholars definitions for green infrastructure.	P. 12
<i>Table 2:</i> 7 principles for a successful green infrastructure.	P. 13
<i>Table 3:</i> The relations between social determinants of health and its benefits linked to cultural ecosystem services.	P. 19
<i>Table 4:</i> Methods used for the analysis on the basis of the research question and sub-questions.	P. 28
<i>Table 5:</i> Strategy guidelines.	P. 35
<i>Figure 1:</i> The Grey-Green continuum.	P. 14
<i>Figure 2:</i> Conceptual framework.	P. 24
<i>Figure 3:</i> Research model.	P. 27
<i>Figure 4:</i> Barcelona layout overview.	P. 30
<i>Figure 5:</i> Classification of ecosystem services.	P. 37
<i>Figure 6:</i> Green corridors, metropolitan scale.	P. 39
<i>Figure 7:</i> Street hierarchy of the super blocks.	P. 41
<i>Figure 8:</i> Sant Antoni.	P. 41
<i>Figure 9:</i> Accessibility to any green space.	P. 45
<i>Figure 10:</i> Accessibility to parks and historic parks.	P. 45

## 1. Introduction

During the last decades, the amount of people living in urban areas has been increasing. According to the statistics released by the United Nations, in 2018 already 55% of the world's population was living in urban areas. Due to the current social and economic situation, these numbers are expected to keep increasing gradually in the future. Projections by the United Nations show that it will increase up to 68% by the year 2050. As mentioned, this rapid urbanization has been going on for some decades now, but it has not been until the recent years that public institutions and third parties have realized the issues regarding poverty and environmental degradation in urban areas that comes with it.

To face this problem, institutions all around the world started developing and implementing a set of mitigation and adaptation strategies for climate change effects. The implementation of these strategies vary according to the geographical location and the needs of the population in each urban region. One of the strategies that can be found across several local and regional plans, in order to help cities or regions increase their resilience and their citizen's health, is the implementation of an extended urban Green Infrastructure network.

Green infrastructure planning in cities is based in the standards that protect and enhance nature, integrated into territorial development and society (EEA, 2021). Green spaces started as a way to promote multifunctionality and offer the chance to create a space where several functions can be performed generating benefits for the city like climate change mitigation effects and the allowance of social interactions (EEA, 2021).

This new way of urban development that considers green areas as a solution to climate change effects and promotion of this new facade of sustainable urban development, might have the chance to be the solution to environmental justice. During the recent years, environmental literature has brought up the concept of environmental justice as a problematic issue in many compact cities (Hansen, Olafsson, van der Jagt, Rall, & Pauleit, 2019). The existence of uneven distribution of green areas brings issues to the social-ecological services of a city. Considering green infrastructure planning to achieve environmental purposes might be a great opportunity to consider tackling down environmental justice problems by offering a resilient and attractive city with equally distributed green areas ensuring access and equity.

Urban green planning has developed a whole section within the literature of sustainable development. Experts have seen the amount of benefits that green spaces can bring to its population, mobility and to the cities' layouts in general, hence it has become a very popular concept considered by many municipalities and planners. The emergency of a more sustainable society and less polluted cities started to be the main goal set by superior public institutions in order to mitigate the human contribution to climate change effects. Pressure on the presentation of a future bad scenario was enough to force cities to start considering initiatives and solutions within their planning reports. What was not included into this reports was the effect of the worldwide Covid pandemic of 2020 that would bring more attention to public and open spaces.

The mentioned pandemic has postponed and canceled many things, but in this specific situation has brought to the front page the need of public spaces with better quality and planned with coherence. This situation has meant for institutions such as municipalities, the right moment to accelerate the planning proposals regarding public space maintenance and increasing greening spaces. Not just governments have detected the importance of these spaces, citizens and residents have realized the benefits of having access to green areas too.

The increasing amount of research that is being conducted around this topic might have different approaches but, at the end of the day, they all present huge benefits of considering every day more green infrastructure within urban planning. It is possible for green infrastructure to be done in a way that adapts locally, stressing on the right type of greening that suits each place.

Initially the main focus was on environmental and citizen's health benefits. In this master thesis research the benefits of green infrastructure are being approached from the perspective of social injustices through the element of equitable accessibility. This is based on the idea that green spaces should provide environmental benefits but also allow social interactions to keep happening. There are certainly many ways to understand how beneficial green spaces are, but it can not be just based on ecologic and physical health values.



### **1.1. Problem statement**

Like it has been mentioned in the introduction, increasing the urban green areas has become a very popular solution to increase environmental quality. Barcelona has agreed to this challenge by working on its green cover and green spaces in order to offer major quality spaces to its citizens. According to the municipality itself, Barcelona is a very compact city with a very reduced number of green spaces. 70% of public space is dedicated to the use of vehicles, mainly private mobility. In order to face this problem, new techniques of greening have been assessed by the municipality to increase the number of green spaces and its quality.

### **1.2. Research aim and research questions**

Having presented the broad introduction to this thesis topic, the research aim is to understand how is the role of accessibility essential in greening plans in order to reduce environmental justice issues. This goal is related to the wish of understanding the elements that come together to achieve high quality and inclusive green spaces. In order to do so, this aim is represented in the main research question of this thesis and the 3 following sub-questions.

**Research question:** In what ways is Barcelona's green infrastructure planning tackling environmental justice issues?

#### **Sub-questions:**

1. How is Green Infrastructure planning mobilize in Barcelona?
2. How does the municipality's greening agenda considers accessibility?
3. In what ways is accessibility considered important as a solution to environmental justice?

## **2. Scientific relevance**

Modern compact cities such as Barcelona have been identified with a high-density and mixed used patterns (Ruso & Cirella, 2018). During several years, and mainly due to the environmental effects of the sprawled cities, researchers have defended that compact cities are the best urban form for sustainability (Artmann, Kohler, Meinel, Gan & Ioja, 2019). However, compact cities tend to have a very low proportion of urban green spaces which jeopardizes the ecosystem services supply (Artmann et al., 2019). Although cities and urban

areas are working on the implementation of several strategies in order to evolve towards a more sustainable lifestyle, cities with a low amount of urban green spaces tend to have an overall lack of ecosystem services (Ruso & Cirella, 2018).

According to some branches of the literature, green infrastructure planning must find a balance between the conservation of biodiversity and ecosystem service's enhancement in order to offer a city which defends its citizens well-being (Basnou, Baró, Langemeyer, Castell, Dalmases & Pino, 2020). Current compact cities with less than 9 m<sup>2</sup> of urban green spaces per individual (as the ideal indicator) might be able to evolve towards a greener city by focusing more on the quality of its green spaces and not just on the quantity (Ruso & Cirella, 2018). Nowadays Barcelona offers 7 m<sup>2</sup> of urban green spaces per inhabitant, being below the ideal indicator (Ajuntament de Barcelona, 2017).

The environmental effects and well-being characteristics will only be beneficial for all citizens if the distribution of these green spaces is done equally. Some researchers have determined that the current distribution of green spaces tends to benefit mainly white and wealthy communities making accessibility to green areas a recognized environmental justice issue (Wolch, Byrne & Newell, 2014). The environmental justice issues has led planners to be more innovative when planning green infrastructure, trying to increase accessibility to parks and other green areas. Researchers have found that greening a city can be done without the need of completely new urban green infrastructure, innovative green strategies allow citizens to re-use urban infrastructure such as back alleys, urban streets, corridors, etc. (Wolch et al., 2014).

Increasing and improving urban green infrastructure, its benefits and its difficulties, must be analyzed from the perspective of environmental justice (Sousa Silva, Viegas, Panagopoulos & Bell, 2018). This need tries to bring the relevance of creating inclusive and well distributed spaces within the city while keeping with the popular environmental benefits of green spaces. Researches on green infrastructure planning tend to have a strong focus on its ecological aspects, leaving equity and social issues in the background (Jennings, Gaither & Gragg, 2012). When researchers first started analyzing environmental justice, equal distribution and equitable access to green spaces was not considered as a suitable research topic (Jennings, Gaither & Gragg, 2012).

### **3. Societal relevance**

As a compact city and its aim to be more sustainable and increase its ecosystem services, the municipality of Barcelona has elaborated a report to promote urban green infrastructure. The report presents a solution to the main problem in Barcelona, the lack of green areas, as almost 70% of public space is dedicated to the mobility of private vehicles (Ajuntament de Barcelona, 2017). It also presents a proposal evaluating the current status of urban green spaces and the proposition of new strategies to increase its green infrastructure (Ajuntament de Barcelona, 2017).

The current strategy carried by the municipality will have positive effects on citizens by increasing their health benefits and well-being. Nowadays, due to the reduced public space free of cars, societal events such as the initiative “Obrim carrers” take place every weekend. The closing of some of the main streets of the city to car traffic allow citizens to enjoy a less polluted city and a wider accessibility to public space (Ajuntament de Barcelona, 2021). The popularity of this kind of initiatives demonstrates what are the needs of the citizens living in a compact city with a few spots of green areas. The benefits that this initiative can have in citizen’s health can be connected to the benefits of urban green infrastructure, mainly because of the car traffic reduction, but also because it motivates people to be more physically active and spend more time outdoors. This popular demand of public space demonstrates towards what kind of a green city Barcelona could evolve to. This type of initiatives are a good indicator to see how citizens would use the public space in a greener and more eco-friendly city.

Like mentioned earlier, many elements are considered to develop green planning, being society a very important part of it. The perspective of this research has the chance to add to the ongoing discussions of green planning the importance of considering social pillars within urban planning policies. It brings the opportunity to determine the relation of the emerging environmental justice issues with the green planning paths that are followed by the municipality of Barcelona.

## 4. Theoretical framework

### 4.1. Green Infrastructure planning

#### 4.1.1. The rise of green infrastructure literature and the mobilization in cities and urban regions

The approach of green infrastructure (GI) has been gaining some popularity across environmental researchers and planners due to its linkage between ecosystem services and human well-being (Lafortezza, Davies, Sanesi & Konijnendijk, 2013). Due to its increasing use across the literature, several definitions and perspectives of that concept can be found meaning different things to different researchers as it is shown in Table 1:

*Table 1: Scholars definitions for green infrastructure*

Scholar	What defines GI	Key elements
<i>Benedict &amp; McMahon (2002)</i>	"Interconnected network of green space that conserves natural ecosystem values."	The need to provide benefits to human population.
<i>Weber et al. (2006)</i>	"The abundance and distribution of natural features in the landscape."	The need of support in ecological processes and participate in bringing benefits to human health and well-being.
<i>Ewers et al. (2009) &amp; Lafortezza et al. (2010)</i>	"It is becoming a preminent approach for delivering essential goods and services to people."	GI planning is reversing environmental trends such as landscape and habitat fragmentation.
<i>Davies et al. (2006)</i>	"Integration and interaction of different services and benefits on the same area."	Importance of the "multi-functionality" effect, used to achieve several functions delivered in the same piece of land.

The first literature on the topic states that green infrastructure planning needs to be based on the promotion of nature values conservation along with land development, growth management and built infrastructure (Benedict & McMahon, 2002). Green infrastructure needs to provide benefits for the ecological, economic and social spheres of a city in order to become an efficient strategy (Mell, 2008). Planning for such approach can offer chances for a better integration between urban development, nature conservation of the ecosystem and citizen's health and well-being (Tzoulas et al., 2007).

Benedict & McMahon (2002) saw it very clear earlier in this century defending that investing in green infrastructure will provide a framework for future developments that seek for diversity in ecological, social and economic benefits all by restoring the natural ecosystems.

These benefits include the maintenance of natural environments and its biodiversity; improved human health; and a better connection to nature and its sense of place (Benedict & McMahon, 2002). In terms of money expenses, they defended that investing in green infrastructure is in long-term more effective over conventional public works in order to face climate change repair effects. This supports the idea of integrating green infrastructure approaches along with conventional land-use plans that consider other city elements such as roads, water lines, etc. Benedict & McMahon (2002) strongly defend the necessity to integrate green infrastructure planning design in order to connect the green side of the city with the gray one (buildings and roads) to create a more effective, economic and sustainable environment. In order to defend their idea they came up with a guide of 7 principles to consider to make green infrastructure initiatives a success. These principles are summarized in Table 2.

*Table 2: 7 principles for a successful green infrastructure*

#	Name	Aim
1	Green infrastructure should function as the framework for conservation and development.	Allows planners to create interconnected green spaces that meet the ecosystem services criterias of a natural environment.
2	Design and plan green infrastructure before development.	It Is essential to identify and protect critical ecological hubs and linkages in advance of development of a certain land. If development has already occurred, GI structure can still be restored to benefit people and nature.
3	Linkage is key.	A strategic connection of different green areas is essential to maintain the ecological processess. Also a linkage between the diffrent spheres (public institutions, civil society and private sector) is needed in order to make it work.
4	Green infrastructure functions across jurisdictions and at different scales.	The design of GI systems needs to connect across urban, suburban, rural and wild landscapes and to incorporate green space elements at the state, regional, community and parcel scales.
5	Green infrastructure is grounded in sound science and land-use planning theories and practices.	Green infrastructure planning should b carried out through the collaboration between expts from different land-use fieldssuch as geography, landscape architture, civil engineering, landscale ecology, etc.
6	Green infrastructure is a critical public investment.	The right planning for GI reduces the need to invest in grey infrastructure, allowing to spend more money on social causes. Also, it reduces community's susceptibility to floods, fires and other natural disasters.
7	Green infrastructure engages key partners and involves diverse stakeholders.	Green infrastructure's framework can be formed with partnerships between public and private companies.

*Source: Benedict & McMahon (2002), p. 16-17.*

In coordination with the theories revealed in the literature by Benedict & McMahon (2002), Davies, MacFarlane, McGloin & Roe (2006) also added their point of view on green infrastructure's characteristics. Like Benedict & McMahon (2002), Davies et al. (2006) also agreed on the integration of green spaces within the common gray infrastructure that form a city. This is the reason why they looked at the understanding of what does "green" means around urban infrastructure. In green infrastructure's literature the term "green" can also be used to refer to the facility that is provided by an element, rather if it is "green" or not in land use terms (Davies et al., 2006). In order to graphically explain this problematic and strict distinction of "gray" and "green" infrastructure they elaborated a colour chart (Figure 1) with different shades and several examples of green infrastructures. This colour scale demonstrates that even though if the infrastructure is not actually "green" in terms of land use, it does not mean that it does not provide a green infrastructure function.

Figure 1: The Gray-Green continuum

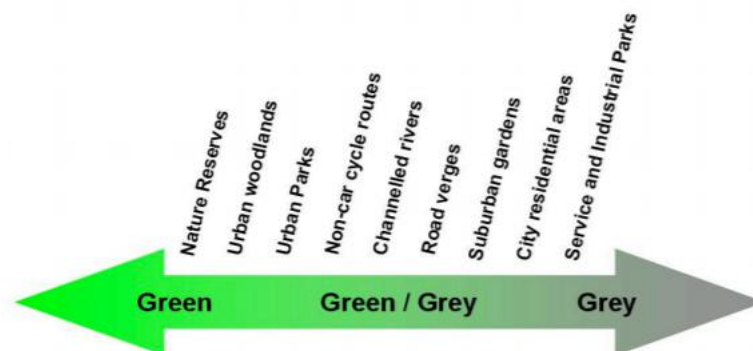


Figure 1: The Grey-Green continuum

Source: Davies et al. (2006), p. 3.

#### 4.1.2. Integration in planning policies

The rise of green infrastructure planning in several countries around the world stimulated researchers and institutions to seek for a way to integrate its planning in policy debates and regular infrastructure planning, as it was suggested by several researchers before.

The European Commission on a "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Green Infrastructure (GI) - Enhancing Europe's natural capital" (2013)

positioned the institution's opinion regarding the benefits of green infrastructure strategic planning. At this point the EU (2013) recognized the benefits of green areas in cities and urban regions and stated the need of integrating its planning into some key policy areas. It is a necessity that green infrastructure becomes part of spatial planning debates and territorial development and being integrated in developing projects that receive funding from EU mechanisms (European Commission, 2013).

Through this communication made in 2013, the EU urged their researchers and stakeholders the need for more reliable data assessed in a coordinated way. Although most of the decision-making processes of green infrastructure planning usually take place at a local, regional and national levels, the European Commission encourages the use of EU funds and certain level of consistency within the several levels (European Commission, 2013). The support of the EU through European funding encourages member states to develop and improve their urban green spaces in order to achieve the environmental and biodiversity goals settled by the European Union.

## **4.2. Green Infrastructure and Ecosystem Services**

### **4.2.1. The benefits of ecosystem services**

Several of the definitions given in the previous chapter refer to an existing relation between green infrastructure and the so called "ecosystem services". Ecosystem services consist of the provision of goods and services that are essential for the human well-being, and provided through the different natural ecosystems on Earth (Lafortezza et al., 2013). A report made by Forest Research (2010) offered some clearance on which ecosystem services could be attributed to green spaces based on the classification made by the Millennium Ecosystem Assessment (MEA, 2005). The report stated that green spaces are able to influence the capacity of an ecosystem to provide its services (Lafortezza et al., 2013). The availability of green areas helps mitigate climate change risks offering protection against floods, heat, etc. (Lafortezza et al., 2013). Some times the ecosystem services that are provided through the urban green spaces tend to be overlooked, as if the solution to climate change mitigation can not be found there (Gill, Handley, Ennos & Pauleit, 2007).

In green infrastructure planning there exists different levels of infrastructure that could be implemented depending on the situation and the location. This division was published as a guide by the TCPA (2004) and supported by David Goode (2006) in a Report to the Royal Commission on Environmental Pollution. This was done to demonstrate how green infrastructure can be implemented in urban planning to promote the benefits of ecosystem service's functions.

1. Existing green space infrastructure:
  - 1.1. Regional parks, green grids and community forests.
  - 1.2. Green-way linkages including both woodlands and wetlands.
  - 1.3. Parks and natural green spaces.
2. Green infrastructure within the built environment:
  - 2.1. Street trees.
  - 2.2. Communal and neighbourhood green space.
  - 2.3. Green roofs and the built environment.
3. New urban developments:
  - 3.1. Newly created green infrastructure as part of new urban developments, including green-way linkages and sustainable urban drainage.

*Source: Goode (2006), p. 3.*

The benefits that green infrastructure planning brings to the environment, and the help to the ecosystem services, played an important role in the literature of Gill et al. (2007). They present a vision that defends the role of urban green spaces in the adaptation of cities to climate change effects. Current literature can not provide a specific guide about the quality and quantity of green areas that is required, mainly due to the geographical and climate differences of each place (Gill et al., 2007). But what it is known are the environmental benefits of an "interconnected network of green space", like Benedict & McMahon (2002) stated, through which urban areas can adapt for climate change by offering cooler micro-climates, etc. (Gill, et al., 2007).

Through their study case based on the city of Manchester (United Kingdom), Gill et al. (2007) were able to quantify the benefits of green spaces in cities and urban regions. Their model allowed them to determine which kind of mitigation strategy is needed in each part of the city, since not all of the existing green infrastructure is adequate for every location. In the



end, they reached a conclusion confirming that urban green spaces such as private gardens, street trees and other green areas will become essential to preserve ecosystem services to mitigate the critical situation of climate change. In order to achieve these goals, they strongly suggested for a strategically planning of green infrastructure in order to invest in green planning in critical and needed locations. Increasing the green cover will help mitigate the heat and reduce the effect of a heat island, provide some shade to pedestrians and improve air quality (Gill et al., 2007).

Researchers have not only focused on the field of the environmental benefits by increasing green infrastructure in cities and urban regions, health benefits have also become study interest. Reviews on the relation of human health with green spaces made by Tzoulas, Korpela, Venn, Yli-Pelkonen, Kazmierczak. Niemela & James (2007) have agreed on the chances of green infrastructure to improve the air quality and mitigate the heat island effect. They also reviewed on evidence regarding the attraction that urban green spaces create towards the population leading them to spend more time outdoors and increase their physical conditions.

The outline that was proposed through their literature review revealed the linkages between green infrastructure, ecosystem and human health and well-being. This framework offered an explanation on how these connections and relations exist between the different fields, and as well a common conceptual model able to provide interdisciplinary definitions (Tzoulas et al., 2007). As mentioned by Gill et al. (2007), green infrastructure needs to be strategically planned. The elaboration of interdisciplinary conceptual models such as the one by Tzoulas et al. (2007) allows all the needed professionals to be familiarized with the components and main pollution problems, getting behind interdisciplinary collaboration between urban planners, ecologists, soil scientists, social scientists, public health specialists etc. (Tzoulas et al., 2007). This kind of researches demonstrate the fact that green infrastructure can provide benefits for the environment, but also benefits for physical and psychological health of the citizens (Tzoulas et al., 2007).

#### **4.2.2. Cultural ecosystem services**

Green infrastructure literature has tended to focus on its benefits within the environment and human health, as in physical health mostly. The concept “health” is defined by the World Health Organization as “a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity”. This has encouraged researchers such as Jennings, Larson & Yun (2016) to conduct an investigation on how social aspects can be useful to assess health objectives in a socially equitable way by exposing the relation between cultural ecosystem services and health. Despite all the direct and indirect health benefits green areas can bring to a city and its citizens, there is still an issue regarding its inequitable access to them marking a barrier to sustainable development as a whole (Jennings et al., 2016).

As mentioned earlier, researchers tend to focus only on what green infrastructure brings to the ecological side of the ecosystem services, while some other researchers defend the integration of what it brings to the cultural ecosystem services. The effects of cultural ecosystem services are much harder to assess and the reason is mainly because they generate “non-material” benefits that end up producing an intangible impact (Jennings et al., 2016). Some of these less tangible benefits defended by Jennings et al. (2016) include landscape aesthetics, outdoor recreation and spiritual and cultural values among others. The generation of all of these bring health benefits to the population by allowing them to increase their physical conditions, reduce anxiety and stress, plus the capacity of spiritual restoration (Jennings et al., 2016).

In Jennings et al. (2016) vision, they stated the existing links between urban green spaces, cultural ecosystem services and social determinants of health. Inspired by the theory and literature from Healthy People 2020 (U.S. Department of Health and Human Services), the resulted connection is presented in Table 3.

*Table 3: The relations between social determinants of health and its benefits linked to cultural ecosystem services*

Social Determinant of Health	Benefits linked to Cultural Ecosystem Services
Health and health care	Physical Well-Being
	Psychological Well-Being
Neighborhood and built environment	Sense of Place
	Community Satisfaction
	Reduced Crime and Incivilities
	Access to Healthy Food
Social and community context	Social Cohesion
	Social Capital
Education	Academic Performance
	Cognitive Functioning
Economic Stability	Property Values
	Community Revitalization
	Socioeconomic Status

Source: Jennings et al. (2016), p. 3.

Detailed explanations about each one of the groups and divisions made by Jennings et al. (2016, p.3) are included below:

- A. Health and Health Care:** Access to green infrastructure has shown in recent studies to have a link with the citizens physical health conditions. Green spaces have created a type of environment that motivate citizens to conduct a active and healthy lifestyle. Green infrastructure also has been relevant in the field of environmental psychology considering that the exposure to green spaces might have some benefits for mental health and social interactions.
- B. Neighbourhood and Built Environment:** This is mainly related to the fact that the way in which people experience a place can have certain type of health implications. Having a positive experience of sense of place can encourage positive behaviors which can determine health and well-being. Having aesthetic surroundings can motivate the population to be more social with their neighbourhood and become more social and active.

- C. Social and Community Context:** This one refers to social cohesion and civic participation. This group might overlap with the built environment, but here it mainly focuses on the social sphere and the way which urban green spaces can help improve the social cohesion creating a healthy environment.
- D. Education:** Some researchers have been able to relate the access to green infrastructure to educational achievements and cognitive functioning.
- E. Economic stability:** Researchers found that the distribution of green spaces across neighborhoods vary and can refer to differences in their socio-economic status. Green infrastructure participation planning have been used in some cities as a community revitalization to improve social cohesion and integrate the cultural ecosystem services. On the other hand, it has also been proved that access to green areas and neighborhoods with greening programs might have a rise effect on land economic value.

The creation of this framework demonstrated that cultural ecosystem services are as important as the rest and should not be undervalued (Jennings et al., 2016). The connections that are made in this framework, linking green infrastructure to public health, have integrated several paradigms that have allowed researchers to prove that green infrastructure benefits go beyond the environment and physical human health. With this framework presented in Table 3, all aspects considered by the World Health Organization in the definition of “health” are accomplished with a strong focus to social equity.

The study and field research within the literature of the linkage between green infrastructure and cultural ecosystem services presents an existing connection to environmental justice issues in urban regions and cities.

### 4.3. Environmental justice

The concept of “environmental justice” has been defined differently by scholars, opening the debate to several interpretations depending on the geographical context and historical background (Holifield, 2001). Although the existence of different comprehensions of this concept, a large amount of empirical research agrees on the fact that environmental justice takes place when “minorities, low income, and otherwise disadvantaged and susceptible neighbourhoods are disproportionately exposed to environmental hazards” (Bowen, 2002). Similar to this broad statement made by Bowen (2002), the U.S. Environmental Protection Agency (2002) published a detailed definition that has been a reference in many scholar fields:

*“The goal of environmental justice is to ensure that all people, regardless of race, national origin or income, are protected from disproportionate impacts of environmental hazards.”*

*(U.S. Environmental Protection Agency, Office of Environmental Justice, 2000)*

In words by Schlosberg & Collins (2014), initially, the movement of environmental justice was mainly focused on the richer and mostly white environmental organizations. Challenges in order to define the movement unanimously appeared due to the demand that environmental justice “should be understood as where people live, work and play, and that environmental movement focus on the way environmental risks threaten everyday life” (Schlosberg & Collins, 2014). In other words, the main aim was that the environmental justice movement considered traces of environmental sustainability and everyday environments with demands for social justice (Schlosberg & Collins, 2014). This type of combination elements was named in literature as “just sustainability”, and defended the mixture of interests regarding present and future generation’s quality of life, justice equity in resource distribution, and ecological limitations (Agyeman, 2013).

#### **4.3.1. Accessibility to green infrastructure**

The World Health Organization indicator states that the minimum amount of urban green spaces per individual is 9 m<sup>2</sup>, and the ideal value is stated at 50 m<sup>2</sup> per individual (Russo & Cirella, 2018). This indicator has been a reference for some scholars such as Russo & Cirella (2018) in order to defend the possibility to create a “green city” within a compact city, always considering the quality of these urban green spaces in order to create a coherent design with diverse green areas accessible to the population.

Generally, the unequal access to urban green spaces was never considered as a research branch of environmental justice (Jennings et al., 2012). However, during the last years, studies have demonstrated the importance of equitable access to green infrastructure due to an existing connection between the accessibility to green infrastructure and the economic, psychological and cultural benefits (Jennings et al., 2012). The environmental justice movement has embedded some other examples of ecological issues such as the equitable distribution of green spaces within a city and its fair access regardless of the socio-economic position (Jennings et al., 2012). Although most of the studies made in U.S. cities confirm the hypothesis about green spaces access depending on the socio-economic groups, there has also been some mixed findings (Jennings et al., 2012). It must be said that scholars defend the importance of how local conditions and observations can influence these results (Jennings et al., 2012).

A part of the environmental justice literature research has been focusing on how to measure these access to green infrastructures (mostly urban parks), and how this access is connected to socio-demographics and socio-economics indicators (Wolch et al., 2014). According to Wolch et al. (2014), although there has been an important progress in literature there is no unanimous answer on what is the right way to measure accessibility to a city's green infrastructure. The main methodology is via Geographic Information Systems (GIS), however, this measurement does not consider health benefits, only geographic accessibility (Wolch et al., 2014). Despite the way in which accessibility is measured and what elements considers, scholars have agreed upon the fact that there exists environmental justice issues in the distribution of urban green spaces within cities. These studies have mainly analyzed the differences in accessibility to green areas based on race/ethnicity and socio-economic indicators (Wolch et al., 2014).

The reduced accessibility to parks and other green areas in certain cities has encouraged researchers to study the way in which parks are distributed in the spatial dimension. According to Talen (2010, p.475) the park distribution can be understood through three main elements: proximity, diversity and social need.

**A. Proximity:** As a public open space, parks should be distributed equally within a city like the rest of public facilities. The right distribution allows different social groups to benefit from green spaces.

**B. Diversity:** The surroundings of a park need to be considered, rather than thinking that the more parks, the better. It needs to be analyzed whether the surroundings are diverse enough and whether the park will be sufficiently used.

**C. Social need:** Spatial distribution is key in order to achieve a fair distribution of green spaces. Other than that, value judgments are also to be considered to determine who should benefit.

#### 4.3.2. Green Gentrification

Several studies and analysis developed in U.S. cities have demonstrated that, although the increasing development of urban green spaces can bring many benefits for the city and its citizens, it has not always been the same life quality improvement for all citizens (Anguelovsky, Connolly, Masip & Pearsall, 2018).

The concept of “gentrification” by itself has been a very popular topic of study and research during the last decades. Researchers have been analyzing the effects and consequences that several urban planning actions have been having in different kinds of neighborhoods. But recently has appeared the concept of “green gentrification” which is a whole new leg of research focused on how urban sustainability planning along with redevelopment strategies have been a result for increasing gentrification (Anguelovsky et al., 2018).

In literature this phenomenon has been assessed through different concepts and adjectives, it can go by the term of green gentrification, ecological gentrification or environmental gentrification depending on the researcher’s aim (Anguelovsky et al., 2018). One of the most popular definitions of this concept, and most used, was given by Gould and Lewis (referenced by Anguelovsky et al., 2018, p. 5) defining green gentrification as the “urban

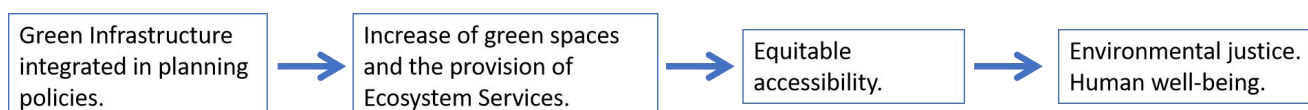
gentrification processes that are facilitated in large part by the creation or restoration of an environmental amenity”.

As it is analyzed by researchers such as Rigolon & Németh (2019) political leaders tend to use the urban greening strategies in order to increase its citizens quality of life and the environment quality of the city. Even though they might have done it with the best intentions, in many cases this environmental quality improvement has had an effect in increasing house prices related to the arrival of new wealthy residents and businesses. The arrival of these newcomers to certain low socio-economic neighborhoods contribute to displace long-term residents due to the increasing rates (Rigolon & Németh, 2019). This has become a very important issue for environmental justice challenges, forcing planners and institutions to seek for a way to provide major green infrastructure but avoiding the gentrification effects in order to finally give a fair access to green areas to all citizens (Rigolon & Németh, 2019).

#### 4.4. Conceptual framework

As it has been shown through the previous chapters of the theoretical framework used in this research, there is an existing linkage between the ecological and social factors that green infrastructure tries to cover. This need for a connection has been already stated by many researchers such as Benedict & McMahon and Davies et al (2002)., which encouraged many others to seek for the right way to create a conceptual model that could embrace the development of green infrastructure based on the relationship between ecosystem services and human well-being. All of these concepts have been summarized in this conceptual framework showing how the integration of the role of green infrastructure in planning policies can provide equal accessibility in order to tackle environmental justice issues and increase human well-being.

*Figure 2: Conceptual framework*





This conceptual framework (Figure 2) has been created on the basis of the main points stated on the literature review that refer to the research questions that affect this master thesis. As it can be seen in Figure 2, what this framework is trying to state is that the integration and consideration of green infrastructure in planning policies will lead to an increase in human well-being and environmental justice. The consideration of the benefits of green infrastructure by public institutions and companies will increase the number of green spaces within a city and allowing to increase the ecological benefits from the provision of the ecosystem services. This increasing number of green spaces will offer an equitable accessibility to these areas for all citizens allowing them to benefit from this spaces and gain human well-being and reduce the issues of environmental justice regarding accessibility like it has been stated in the previous chapter.

The connection between these several elements demonstrates that the research on green infrastructure also needs to consider other elements that are related to cultural and socio-economic values, rather than only focusing on ecological values. It is expected that urban planners consider all these values that derive from the ecological ecosystem services and the cultural ecosystem services in order to develop green infrastructure planning as green and as fair as possible. This conceptual model states that the achievement of human well-being and accessibility issues can only be tackled if green infrastructure planning is considered within planning policies.

These connections that have been shown try to bring all the dimensions together encouraging to develop a methodology for this research that considers all named aspects. It aims to solve the main research question and establish that existing connection between green infrastructure and environmental justice issues that are mainly represented by the unequal distribution of urban green spaces and therefore the lack of fair accessibility to them. The overview of this conceptual model is going to be useful in order to analyse up to what extent Barcelona's green infrastructure planning has considered, or is considering, accessibility to green spaces and environmental justice. Depending on the degree of consideration and presence of these values, the research analysis could determine if equitable accessibility is being offered in Barcelona through their green infrastructure planning.

## **5. Methodology**

This chapter contains the description on how the research was carried out in order to respond the research questions stated at the beginning. It involves the research philosophy, research design, the case study, the different methods used for the data collection, and finally the research ethics and limitations.

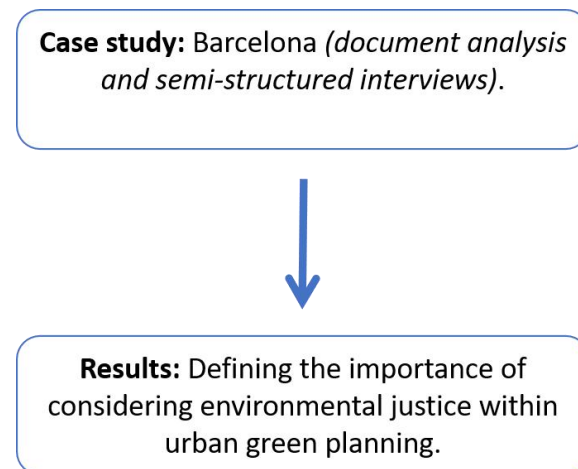
### **5.1. Research philosophy**

In order to get a better understanding of the methodology used to respond the research questions, it is important to define the paradigm perspective for this research. Like it was stated by Guba & Lincoln (1999), questions of method are secondary to questions of paradigm. Research philosophy tends to shape each research and frame research questions and methodology design. This is done mainly through the ontological and epistemological assumptions in which each research has a position (Guba & Lincoln, 1999).

This research particularly lays in the position of the *critical theory* paradigm, seeking for a combined methodology between the comprehension of current topic literature and new obtained data through dialogue. The new data is gathered in order to mix it with the theoretical framework and develop new results regarding the topic research, in which the researchers values and subjective conclusions are reflected.

### **5.2. Research design**

This research is based on just one case study, the city of Barcelona. The research questions and the methodology were defined for the research to be somehow exploratory but also descriptive. Keeping the research questions more exploratory allowed to state the issue of accessibility to green spaces in the city of Barcelona. This research is partly descriptive because the component of analysis of current planning documents is an important part in order to conduct the exploratory side of the research. In order to do so, the best approach was through a qualitative methodology research in which the consideration of accessibility and environmental justice in Barcelona's greening agenda is investigated through the interviews with experts and document analysis. Thus the research model is the following one (Figure 3):

*Figure 3: Research model*

Like it has been stated in the conceptual framework (Figure 2), this research model refers to the hypothesis that the integration of green infrastructure within planning policies will turn out developing reports that will stress on environmental justice and consider human well-being. So, as it can be seen in the research model on Figure 3, the conduction of a case study about the city of Barcelona, through document analysis and semi-structured interviews will result in a confirmation or denial of that initial hypothesis. Results will reflect the importance of considering environmental justice issues, such as equitable accessibility, to achieve a quality green infrastructure network.

### 5.3. Methods: Data collection

Like it has been mentioned earlier, and stated in research model (Figure 3), this research methodology is based on two different methods in order to gather the data. First one is the document analysis of several of the reports published by the municipality and partnering entities in order to offer a vision of Barcelona's greening agenda. The second one are the semi-structured interviews with experts from the fields of urban planning, landscape, urban ecology, health and ecosystem services. Final results will be presented according to the information gathered from these two methods in order to be able to finally give an answer to the research questions that conduct this thesis.

The two methods are equally important and are used according to their capability to offer information that can be used in the results chapter in order to answer the research questions. Document analysis is very useful for the descriptive part of the research. It allows

to explain and give context of what is the municipality's position regarding green urban planning. On the other hand, the interview method is settled to obtain opinions and concerns from experts from different fields. The conduction of semi-structured interviews is a really good tool to understand how experts feel about the same topic, but from different perspectives (Silverman, 2015). The combination of these two methods offer the chance for this research to develop its own perspective on the topic by stating the main topics and main information obtained that is useful for its purpose.

Table 4 presents the summarized methodology used for the data analysis in order to give answer to each one of the sub-questions and a final discussion to the main research question.

*Table 4: Methods used for the analysis on the basis of the research question and sub-questions.*

<b>In what ways is Barcelona's green infrastructure planning tackling environmental justice issues?</b>		
<i>Sub-questions</i>	<i>Method</i>	<i>Description</i>
How is green infrastructure planning mobilised in Barcelona?	Document analysis and interviews.	<i>Interviewees point of view on what the municipality is working on. Suggestion of reports.</i>
How does the municipality's greening agenda considers accessibility?	Document analysis and interviews.	<i>Gathering different perspectives on how the municipality is working on this issue and what problems are they facing.</i>
In what ways is accessibility considered important as a solution to environmental justice?	Document analysis and interviews.	<i>How do field researchers consider that environmental justice can be tackled through solving accessibility issues.</i>

In the Annex I of this report an anonymous list of the interviewees has been included with the organization they come from. Further details are stated in the data file submission that accompanies this report. The interview sample strategy has been based on the aim to get a diverse list of respondents, but maintaining a relation either with green infrastructure, urban planning and ecosystem services, or with environmental justice within urban spaces and social inequities. Since this thesis is aiming for a relation between green infrastructure planning and environmental justice, the sample of interviewees was divided between these two paradigms. It was also important since the beginning of the research to count on someone from the municipality itself in order to get an insight perspective that is able to complement the segment of the document analysis and respond to deeper questions and concerns.

#### **5.4. Research ethics**

Since the research included individual semi-structured interviews with experts, special attention was put in order to follow an ethic protocol. Before each one of the interviews started, the interviewer asked the interviewee for recording consent and use of the information and concepts discussed along the interview for research purposes.

In some cases interviewees did not mind to consent the recording, while some others required for the recording to not be shared with third parties. In order to develop an ethical research the interviewer assured the interviewees that the recordings were not going to be shared and on the basis of that requirement all identities will remain anonymous. Only professional information and relevant information about their field of expertise will be shared in this report if needed.

#### **5.5. Limitations**

From what it has been detected through the literature review, the document analysis and the interviews with the experts, accessibility is still a very unknown topic and not very related to green spaces. Is it true that there are several studies about the measurement of accessibility but they only consider the geographical aspects of it, they do not consider social and ecological values that can link it to environmental justice. This has been a limitation to start with this research, since there was this difficulty on how to connect the existing theory about green infrastructure (ecosystem services, health benefits, cultural ecosystem services, etc.) with the issue of accessibility.

On the other hand, the opportunities to book interviews with field experts, researchers and workers from the municipality have been quite a challenge. It has not been possible to get an answer from most of the interview requests, this has forced the research process to be stopped with 8 interviews. However, the information obtained from the conducted interviews has been successfully complemented with the different reports that have been suggested by some of the respondents.

The methodology plan design has not always been like the ongoing one. Initially the idea of actually measuring accessibility through GIS (Geographical Information Systems) was considered. Due to previous methods limitations this one was finally left out in order to develop a strong focus on the other two methods.

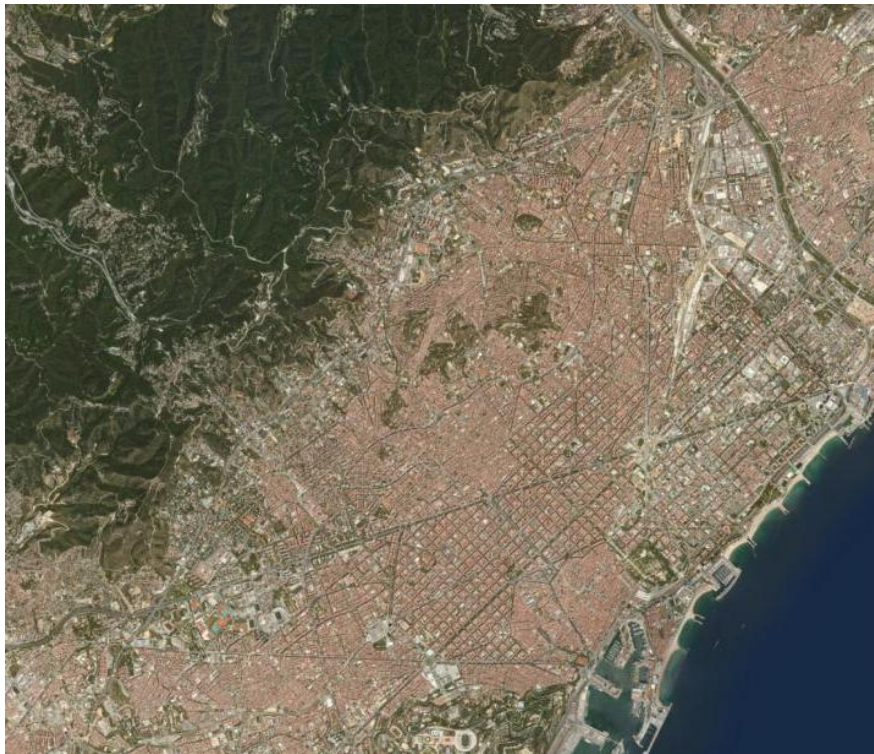
When it comes to the coding process and analysis of the result, the first idea was to do it through the Atlas.ti processor but some technical difficulties appeared and this was no longer an available option.

Finally, another aspect to keep in mind is the fact that the final results and discussion of this research are presented under the perspective of a single person, the researcher. This does not represent the view of all actors working in Barcelona's urban and green planning or the scholars. It just represents the final thoughts and opinions of this researcher after the document analysis, the interviews and its interpretation.

## **6. Case study: Barcelona's compact layout**

The city of Barcelona, Spain, is settled in a very unique geographical position where many different environmental elements and natural accents play a very important role. The city has grown within the limits of the sea (south-east), river Besós (north-east), river Llobregat (south-west) and mountains - Collserola forest (north-west). These different geographical accents have determined the shape and density of the city for the last years, creating a very unique and functional layout that can be appreciated in the city nowadays.

*Figure 4: Barcelona layout overview*



*Source: Institut Cartogràfic i Geològic de Catalunya (ICGC).*

Due to its limited urban expansion chances nowadays, green planning in the city of the 21<sup>st</sup> century has become a very important challenge for the municipality during the past years. Many experts from the field of ecology, urban landscape, sustainability and environmental science have always agreed on the difficulties of Barcelona's layout when it comes to the creation of new green spaces within the city. Its current elevated density of buildings and compact layout have challenged the municipality and urban planners in order to create a suitable design where social, ecological and environmental goals could be achieved.

This situation has lead to different opinions regarding which are the ways that this issue can be solved and what are the main elements that must be considered. "It is a very compact city, very dense, overpopulated and with many constructions. (...) What they are trying to do now is take any small space that becomes available to redo it and create new spaces" (respondent 6, 19/07/2021). "The evolution of Parks and Gardens as the entity (...) they have been improving not just existing spaces but also working on new ones" (respondent 8, 27/07/2021).

It is important to keep in mind Barcelona's main challenge according to this thesis topic is to *create a green infrastructure network with major accessibility, better distribution of green and achieving ecological and social justice values.*

As it can be observed in Figure 4, the chance of developing extensive green areas like in other European cities is not a possibility. This is the reason why greening the city has been presented as a very complicated task, since smaller green spaces initiatives and some overarching projects such as green corridors and the super blocks have been the main initiatives to create this well connected green infrastructure network. On the other hand, the elevated density of the city has been seen as a positive element as well since it has offered the a good accessibility to green spaces to many of the city's residents, even though they are not huge spaces.

This circumstance regarding accessibility has opened the door to environmental justice situation in Barcelona by analyzing which social groups have more access to green spaces, and how is the green distribution connected to social-economic situation of its residents.

Some coincidences have been detected, and the most outstanding one has been the one in the central district of el Raval. El Raval represents the historical center of Barcelona and it has a very complicated urban distribution, with very narrowed and short streets with a lack of squares or open spaces. At the same time it is the neighbourhood with more foreign residents with a very low economic wages. This is a clear case of environmental justice connected to the theoretical framework that has been published on the topic where urban layout difficulties have not make it easy for planners to reduce the gap concerning fair accessibility to green spaces.

In Barcelona the main entity to develop planning policies and changes concerning green spaces within the city is the municipality. They do have a department called “Management of of green and biodiversity” from where everything involving greening and ecological reports is done. It must be said that there is an external planning entity named Barcelona Regional who works close with the municipality in developing the different reports and together they come up with the proposals.

The results chapter of this thesis will conduct into the different elements that have been mentioned in the challenge above, all by doing some document analysis and extracting thoughts and experts opinions from the conducted interviews with experts.

## **7. Results**

### **7.1. Barcelona’s green infrastructure planning evolution**

The municipality of Barcelona has assumed their role as the main advocate for a healthier and greener city in order to achieve the standards that have been stated by superior institutions such as the European Union or the United Nations. In order to do so, the municipality wrote down a formal report called “Pla del verd i la biodiversitat 2013-2020” based on the European Union’s Biodiversity Strategy 2020. This report has served as a main intention to gather all the efforts the city is carrying out to offer a healthier environment covering air quality issues, protection of natural spaces or noise issues (Ajuntament de Barcelona, 2013). This demonstrated the interest of the municipality on developing a greener city in order to offer more benefits for citizens and increase their well-being, “now



the concept of green infrastructure is part of the urban and metropolitan politics” (respondent 2, 26/05/2021).

“At the very beginning, in 2013, the municipality barely had any policy related to greening and biodiversity of the city” (respondent 5, 13/07/2021). “During the upcoming years, concepts related to climate change became very popular. So, during these years many policies and strategies have been created around the topic and concerns of climate change” (respondent 5, 13/07/2021). These reports and policies have served to complement the main guideline that was stated for the period 2013-2020 in “Pla del verd i la biodiversitat”.

From now on this document’s (Pla del verd i la biodiversitat) horizon has expired, the department of Parks and Gardens from the municipality, along with other departments, started a process of discussion in order to create a new document that could proceed the one ending in 2020. This new document has been in the work for one year and is called “Pla natura 2021-2030”. According to respondent 5, it will be published at the end of the year 2021. This new document will provide a continuation of the projects from the previous document that are still on the works, it “includes more specific projects with qualitative or quantitative indicators that must need to be checked during the process of each project, in order to determine if the progress is good or not within the objectives that the municipality defends” (respondent 5, 13/07/2021). Because this report (Pla natura 2021-2030) has not been published yet, this thesis is focused on the previous one that served as a first push by the municipality into green spaces and biodiversity as a serious matter back in 2013.

The effort the municipality is developing within greening concerns has been noticed widely considered by experts and scholars, “Barcelona is currently a pioneer city in the European framework in having an ambitious planning of its green infrastructure by promoting a certain branding of a green city” (respondent 6, 19/07/2021).

### **7.1.1. Current direction: Pla del verd i la Biodiversitat 2013-2020**

“Pla del verd i la biodiversitat” is referred as a strategic tool that defines challenges, objectives and agreements that the municipality is willing to take in order to preserve green spaces and its ecologic elements and also promote the city’s biodiversity to its residents (Ajuntament de Barcelona, 2013).

With this objective as a main challenge for the municipality, the document was used to plan, in long term vision, the projects and actions that would allow the creation of such a green and ecologic infrastructure within the city following certain criteria:

- a) Produce benefits for the population.
- b) Provide environmental and social services.
- c) Create life spaces within the urban layout.
- d) Include nature in the city.
- e) Connect the city to its territory and land.
- f) Create a more fertile and resilient city towards future challenges.

*Source: Ajuntament de Barcelona (2013), p.10.*

Beyond these 6 main criteria stated by the municipality, the general goal of this report is to achieve by 2050 a city where nature and urban can interact and improve the city’s quality through a high quality connected green infrastructure. The vision that the municipality has does not imply a decorative task done through greening, it is based on a real ecologic infrastructure that has to follow two key elements: connectivity and redoing nature. The report presents the two tools that will help the city evolve towards a more naturalized and healthy city: the green corridors and the named “opportunity spaces”.

The first ones are thought to be the best option to create a connected network of green spaces within the city, these will not just be beneficial for the residents but also for the biodiversity of animals and plants that belong to this region. A good network of green corridors will allow all animal and plant species to travel from one point to the other through the city’s green infrastructure instead of being isolated in one lonely park or garden.

The second tool mentioned focuses on the chances of increasing green infrastructure by promoting different types and sizes of green spaces. This refers to work on unused land,

balconies, rooftops, etc. This tool is based on redoing urban nature through these “opportunity spaces” that otherwise will be kept empty.

Through this position on green infrastructure planning, the municipality developed a set of strategy guidelines and actions in order to keep with the criteria, mentioned earlier, to achieve a greener and connected city. Table 5 includes a summary of what the main lines that were defined:

*Table 5: Strategy guidelines*

Strategy guidelines	
1	Preserve natural heritage of the city.
2	Plan for urban green infrastructure looking for connectivity and equitable distribution.
3	Design the city and its green spaces considering ecosystem services and biodiversity criteria.
4	Create new spaces for nature and increase the presence of green vegetation and biodiversity.
5	Manage parks, gardens and the rest of green spaces following efficiency and sustainability standards.
6	Preserve and value cultural heritage, specially in historical gardens.
7	Increase the spread of knowledge regarding green and biodiversity preservation.
8	Spread the values of green spaces and biodiversity.
9	Promote green spaces as health and leisure places with public participation.
10	Strengthen the municipality's role and engagement for the preservation of city's green spaces and biodiversity.

*Source: Ajuntament de Barcelona (2013).*

In order to analyse and comprehend the evolution of green infrastructure creation and preservation in the city, within the same report the municipality made public how they planned to keep track of it. They plan to do it through an evaluation system that will measure the amount of work and actions that have been developed. This also will count on a set of regional, national, European and worldwide indicators that will determine how the evolution of the different strategies and actions that are presented in this report “Pla del verd i la biodiversitat 2013-2020” are being achieved (or not). Some of the indicators are:

- a) *Statistics of natural environment*, Generalitat de Catalunya.
- b) *Report about the natural environment status and tendencies in Catalunya*, ICHN.
- c) *Local strategy and indicator systems for the preservation and increase of biodiversity from the Network of Local Governments for Biodiversity & Streamlining European Biodiversity Indicators 2020*, European Environmental Agency.
- d) *City Biodiversity Index*, Biologic diversity convention from Rio 1992.

## **7.2. Perception of ecosystem services' role in urban planning**

Bringing back the function of the ecosystem services, they are formed by four main groups from which human beings and animals get benefits from. "Now more often this framework of the ecosystem services is being considered, or the benefits of the urban green spaces" (respondent 1, 19/05/2021).

Each group offers different services, there are the *supplying services*, the *adjustment services*, *cultural services* and *support services*. This are the four main groups in which ecosystem services are divided in to develop reports and analysis that study the different amount of services green areas offer and all of them are equally important. During the last years this concept has become a very important tool in order to work on a type of green and environmental planning that follows nowadays standards of sustainable and resilient cities. "In the urban context, unlike the natural ecosystem services from protected regions, they are a co-creation along with other elements. (...) In the end, a park is not formed just by the vegetation, other elements such as urban infrastructure and furniture are important" (respondent 1, 19/05/2021).

Seeing the increasing importance of the ecosystem services to achieve healthier and sustainable cities Barcelona was no less than other cities in order to incorporate this concept within its planning policies. This has helped to improve the way urban planning is done to consider most of the elements that intervene. "In general, city planning has always been a little bit unequal with regard to the benefits obtained through the ecosystem" (respondent 4, 10/07/2021). In order to do so, the entity Barcelona Regional along with the municipality, developed in 2018 a report called "Serveis socioambientals dels espais verds de Barcelona".

Figure 5: Classification of ecosystem services



Source: Barcelona Regional (2018), p. 5.

“What ecosystem services do is give you a method, a method to analyse and know the deficits and also the strengths” (respondent 5, 13/07/2021). This system has been a huge benefit for municipalities and entities to understand what does each park or green space offers to the city and its citizens. This is how the municipality of Barcelona used them in order to implement its theoretical background into the urban planning of the city. The use of the ecosystem services allow planners and technicians to determine which green areas are more strong in offering certain services and compare all analyzed spaces. “Some green areas are very strong in certain services and very weak in some others. So, what this does is gives us an analysis methodology, a comparison method and a method that allows to improve green planning” (respondent 5, 13/07/2021).

There is a huge benefit if a city manages to compensate the amount and levels of ecosystem services their parks and green spaces are generating. The municipality of Barcelona tends to consider them when they want to create a new green area in order to develop a space that complements the other green spaces in the surroundings. “This methodology is also useful to plan parks, if there is the need to create a new park in a concrete area we check the parks

that are in the surroundings in order to see which [ecosystem] services they are offering” (respondent 5, 13/07/2021).

The peculiar case of the report published by Barcelona Regional is that the concept of ecosystem services is referred through all the document as “serveis socioambientals” (socio-environmental services). The main reason behind this rename of the concept is due to the municipality’s strong consideration of social values within planning initiatives. “In Barcelona, the social values are very important within the total” (respondent 5, 13/07/2021).

The incorporation of the ecosystem services within green planning has demonstrated that it improves the quality of the spaces, creating a more inclusive and healthy green areas that are planned considering all elements concerning biodiversity, ecology and social values. This connection between the four ecosystem services groups and the general benefits of developing a green area following this method proves the need of considering it in urban green planning. “What they [the municipality] are mainly doing is integrate these concepts [ecosystem services] within green infrastructure planning” (respondent 1, 19/05/2021).

Ecosystem services have been very much considered in new small green planning, but also for two of the main initiatives that have gained some popularity during the past years. This two initiatives are the green corridors and the super blocks. Like mentioned earlier, the two initiatives have a very important role when it comes to achieve the municipality’s main goal in order to develop a well connected network of green spaces.

### 7.2.1. Green corridors

What the municipality of Barcelona understands as “green corridors” are passages with a big amount of vegetation where pedestrians and bicycles have priority over cars and other motorized vehicles. These corridors must guarantee a connection between the different natural spaces located in the periphery of the city, but also the spaces that can be found within it. In Figure 6 it can be observed the proposal of connecting the different spots of the city through different corridors.

*Figure 6: Green corridors, metropolitan scale*



*Source: Ajuntament de Barcelona (2013), p. 66.*

Like it has been mentioned earlier, Barcelona has a very complicated task due to its compact layout and the natural and physical elements that can be observed in Figure 6. This situation has limited the actions and creation of certain green spaces within the urban layout. This is where green corridors have been a very useful solution to give the city all the ecologic and social benefits a park can give but, through extensive green passages.

For some experts green corridors have become even a better option than the well known “pocket parks”. “You can have small green spaces distributed within the city, but you can also focus more in the green corridors in order to offer a green environment in people’s trips from one point to another” (respondent 7, 22/07/2021). This technique shows that green corridors can be used as a solution to increase green in very dense cities such as Barcelona. At the end of the day it is found for many people that the simple action of commuting or

going to do groceries through a greener street it is more efficient in their every day life. “This has more effect in our everyday life rather than having a park because you might not have time to enjoy it every day. Through this framework of green corridors there can be a lot of work done to achieve equality” (respondent 7, 22/07/2021). The way how green corridors are planned, they try to get green areas all around the city connecting the different green spaces such as parks and squares. “There was this idea to create this corridors in order to increase the accessibility to green spaces” (respondent 1, 19/05/2021).

### **7.2.2. Super Blocks**

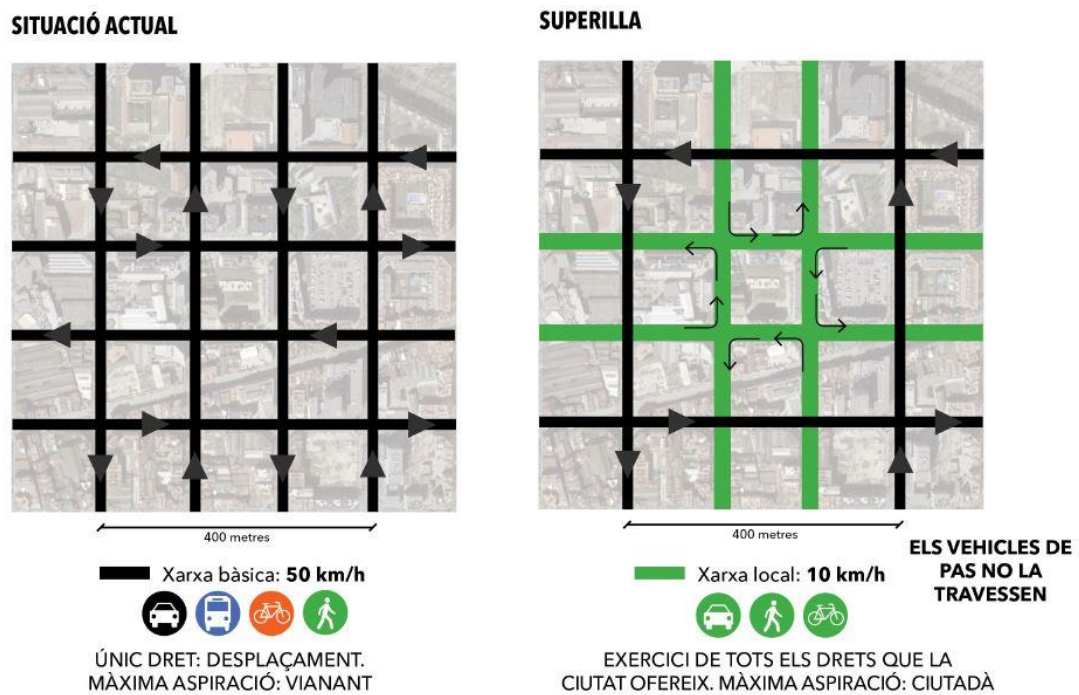
The figure of the super blocks has been around the planning discussions for a while now. In Catalan they are known as Super Illes, and they are the most revolutionary planning strategy used to evolve towards a more sustainable city. The main objective of this initiative is to reduce the amount of polluting emissions by reducing the car traffic through certain streets of the city. By cutting off private vehicles circulation, the remaining public space is used to promote sustainable mobility, increase the amount of green areas and public space dedicated to pedestrians and to increase the territorial cohesion.

This has been implemented already in two districts and the municipality is planning on keep implementing them in different parts of the city in order to achieve the goal of a clean and connected city. From the finalized initiatives the lesson has been learned and the noticed benefits and disadvantages are being considered in order to design future super blocks.

In Figure 7 it can be observed the difference between a super block and a regular set of streets. The left side demonstrates how the situation was previously, and how it is still in many parts of the city, allowing private vehicles to drive through at a maximum speed of 50 km/h taking up most part of the street (Rueda, 2017). On the right side of Figure 7 the model of the super block is presented. Formed by a set of 9 blocks and representing a total of 6.000 residents, private vehicles are not allowed to drive through the inside streets within the super block. The unique exceptions are drivers whose origin or destination is somewhere within the super block. Other than that, speed limit is set at 20 km/h creating a safer space for bicycles, pedestrians and other users of the public space (Rueda, 2017).



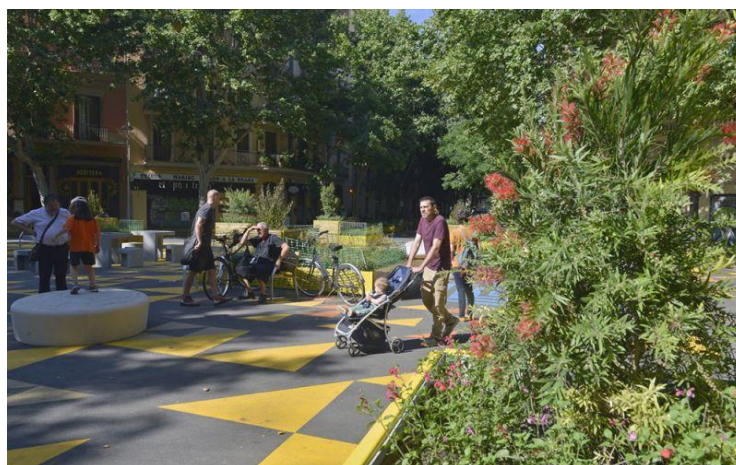
Figure 7: Street hierarchy of the super blocks



Source: BcnEcologia in Rueda (2017).

The reduction of motorized traffic has increased the chances to increase green in the streets within the super block by creating a space that generates most types of ecosystem services, from ecologic to social ones. Figure 8 shows how it has been done in some places of the super block of Sant Antoni where urban planning has been done around the goal of creating a greener environment for residents and the rest of the citizens of Barcelona.

Figure 8: Sant Antoni



Source: Ajuntament de Barcelona.

### **7.3. Environmental justice lenses over Barcelona's greening agenda**

Like it has been stated many times through the theory and research on environmental justice, it is mainly based on an equal distribution of the exposure of environmental negative effects. Bringing it into the scale of urban green spaces planning, it determines the distribution of those spaces within the city in order to make it more equitable. This kind of perspective translates into a more equitable distribution of those negative environmental effects. The key element in the theoretical framework, considered by experts, is to have a population equally exposed to the good and bad parts of a certain environment. "Environmental justice is thinking about how the distribution of those types of exposures can be made more fair or just, and affect whether for the good or for the bad people equally" (respondent 3, 06/07/2021).

The way how municipalities can really be aware of it and develop actions according to it, is by measuring the green areas within the city. This concern regarding environmental justice through urban planning is what can increase the greening in certain districts or neighborhoods where the perception of environmental justice is not achieved due to the lack of exposure to the benefits of the green spaces (ecologic and social benefits). This understanding of justice from the perspective of equity and inclusion has the aim to fight for a balance in green planning, promoting the work on those areas or districts where there are the needs. "In the measure that green spaces increase, it must be in coordination with the needs of each district and each environment, really allowing its use" (respondent 8, 27/07/2021).

How the municipality of Barcelona is through the NDBI (Normalized Difference Built-up Index) methodology. This method is used by entities such as Barcelona Regional in order to "describe and analyse the green distribution in a city" (respondent 5, 13/07/2021). It allows planners to check how much of green there is in different places. This technique counts all types of green and it can be done either through satellite or plane. This is the way all types of green can be counted such as public parks, private gardens, street trees, etc. This is a really good method for planners to determine the distribution of green and also the amount of green it is out there that can provide ecosystem services that are more related to the environmental benefits, rather than social. In order to complement it by considering important social values such as accessibility, the analysis must be done from the ground through field trips. (respondent 5, 13/07/2021)

Within the conceptual framework of environmental justice, accessibility has become a very popular topic. Its measurement in different cities around the world and the relation of its levels to socio-economic issues. The typical English environmental justice issue is based on the lack of access from less wealthy population to green spaces in comparison to other districts. Some experts defend that the city of Barcelona does not follow straight this paradigm. "In Barcelona there is a huge middle class that lives mainly in the Eixample who they have a very reduced accessibility to green spaces, and then less wealthy districts placed near the Maresme area, Collserola or the beach have a major access to green" (respondent 7, 22/07/2021).

This scenario does not present a very extreme situation of environmental justice in Barcelona mainly because it is not a general paradigm that can be appreciated in all parts of the city. Like mentioned earlier, one of the districts where most of the immigrant population lives has the most complicated urban distribution to gain accessibility to green spaces. On the other hand, the situation regarding accessibility in the Eixample is trying to be improved with the green corridors and the creation of the super blocks around the area. The benefit of the super blocks, like it has been previously mentioned, is that will increase the amount of green space in the district tackling down somehow the issue of poor accessibility from the residents in the Eixample.

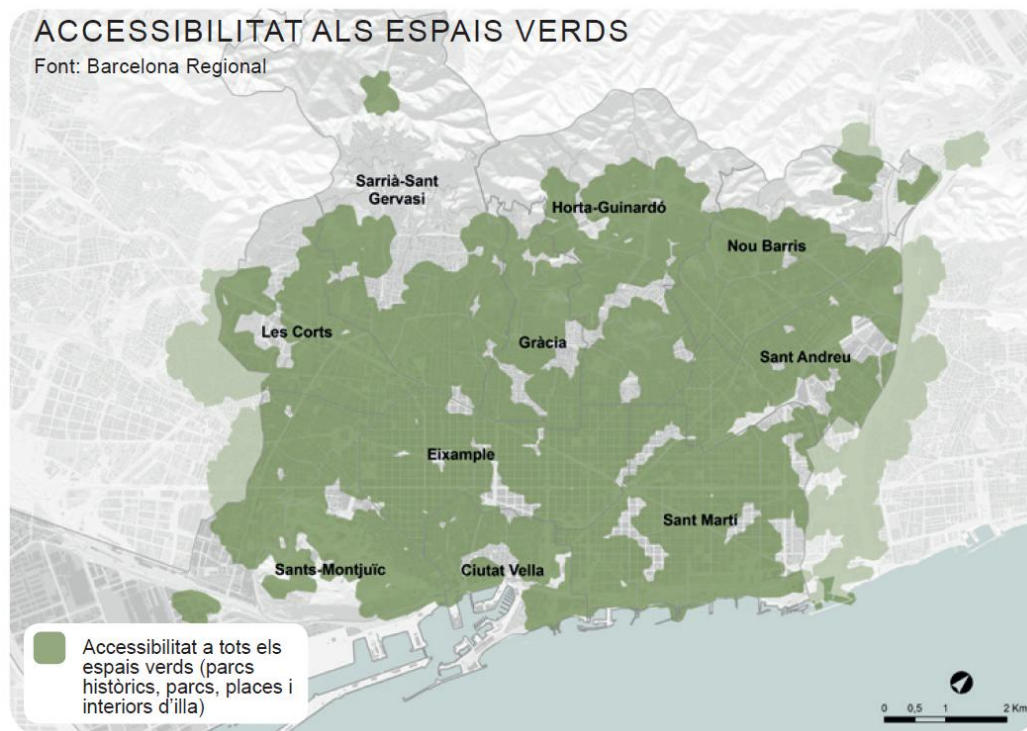
Understanding the situation in Barcelona when it comes to the perception of environmental justice concerns withing its planning policies and greening agenda, several experts have pointed out that it is not being applied from the social equity's perspective. The municipality and its partners are mainly addressing the lack of green from the concerns of where are green spaces missing, instead of where are they really needed by considering the social values. "They are not working on it from the social equity's perspective, but instead they are working on districts where here is less infrastructure [without considering the social variable]" (respondent 7, 22/07/2021).

### **7.3.1. Ensuring accessibility**

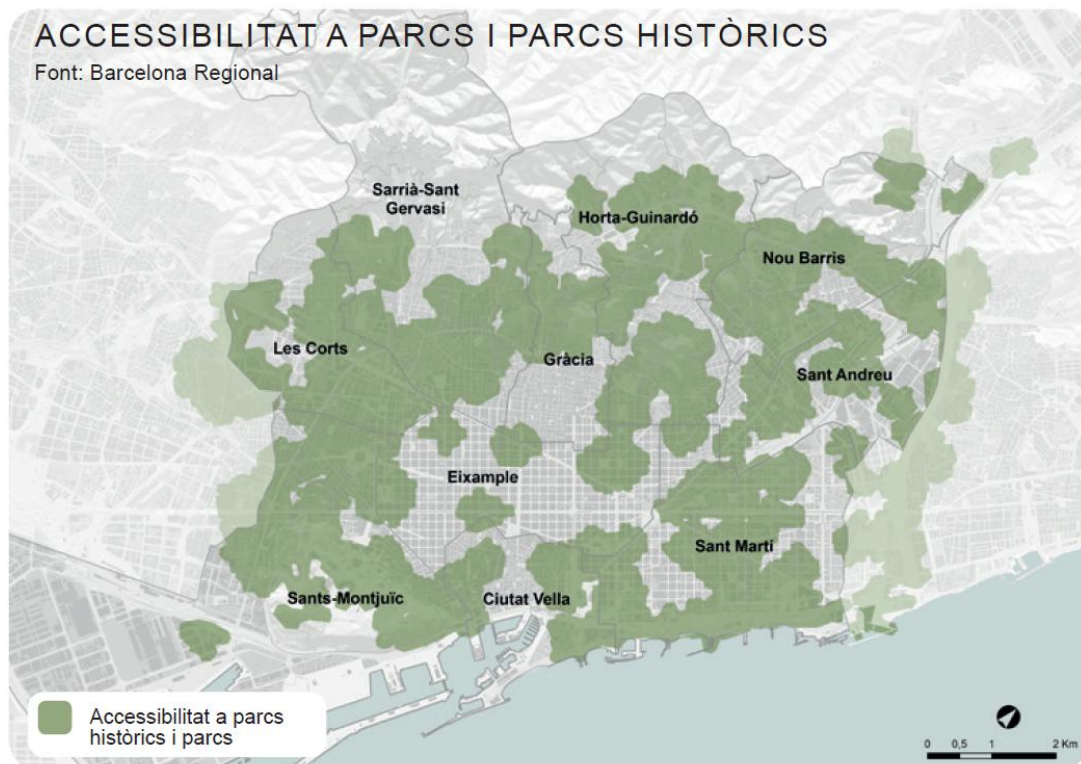
It might happen that the situation in which the municipality can be found, needing to increase the green in the city and ensuring a level of accessibility to its residents is perceived differently from what is planned to what is done. Resources, motivation and interest are key elements that must be there in order to develop a proper plan.

“Barcelona is a very compact city, so you can not create new parks in the middle of the city, it is impossible. This is the reason why they are trying to create small green spaces where it is possible, create more greenery in the streets and the creation of green alleys/corridors. They are also trying to work on the green roofs, but this is different regarding accessibility because most of these buildings are private and do not have access” (respondent 1, 19/05/2021).

The municipality in their 2018 report about the ecosystem services in the green spaces addressed the issue of the accessibility to them in the city, (Barcelona Regional, 2018). In there they confirm that 91,2% of the population has access to a green space within a walking distance of 5 minutes. This percentage refers to the access to any type of green space (parks, historic parks, private backyards and squares), while just 67,2% of the population has access to parks and historic parks. This two levels of accessibility can be appreciated graphically in Figure 9 and Figure 10, where the gray spaces that can be observed refer to the areas where the mentioned accessibility conditions are not achieved.

*Figure 9: Accessibility to any green space*

Source: Barcelona Regional (2018), p. 22.

*Figure 10: Accessibility to parks and historic parks*

Source: Barcelona Regional (2018), p. 22.

This major difference in percentage is very significant since not everyone has access to a backyard or simple squares with some green. Figure 10 demonstrates that even though most of the city has access to some public green, big parts of the districts of the Eixample, El Raval, Ciutat Vella or Sot Martí have issues when it comes to close distance green spaces. This is mainly justified because of the urban composition and layout of this areas, which makes it complicated to increase green.

Like mentioned earlier, accessibility should be considered in terms of environmental justice but entities can also consider it in terms of land distribution. “I do not know if there is a lot of consideration [from the municipality] for these type of deeper issues of access, like cultural differences or preferences. (...) Access is thought more in terms of just the distribution of spaces physically around the city” (respondent 3, 06/07/2021). “They placed green areas wherever they found a spot without considering the equitable distribution, with not much effort on trying to compensate economic inequalities with green equities” (respondent 6, 19/06/2021).

“Accessibility to green spaces should be understood as essential to achieve environmental justice into city’s planning” (respondent 4, 10/07/2021).

### **7.3.2. Green gentrification concerns**

The concept and use of green gentrification concept on research analysis has brought some controversy among researchers and planners / workers. “Green gentrification is a negative concept, it is not a benefit, is a loss” (respondent 5, 13/07/2021). This concept has been given a negative meaning among the green infrastructure literature by using it to explain the gentrification problems that emerge when new green spaces are created. This hypothesis has been tested in many different cities around the world and in some cases there has been a considered relation.

This topic spins around the general concept of gentrification and speculation processes that renovation of the public space goes through whenever new projects are implemented, mainly affecting housing prices. The fact that the creation of green has been related with such a negative effect such as gentrification and the process of expelling residents from their homes has not been well accepted by everyone and concerns among the use of this two words together have emerged.

There is no deny regarding the fact that gentrification is a loss and has been happening for years now, and that something must be done in order to protect residents every time renovations or new constructions are being done in an area. The controversy has emerged in using green planning in order to justify the negative effects of gentrification. Gentrification is not going to be less damaging if less green is created. By denying the creation of new green areas such as parks or squares, the benefits regarding the ecosystem services these spaces can bring will not be there. From the municipality they highly defend all the greening actions that are being carried out in different spots of the cities and promoting the environmental benefits they are creating. “What matters is not to not increase green in order to avoid that these actions might expel residents, because the benefits of greening are positive. So if you so not increase the green what you are doing is damaging the people” (respondent 5, 13/07/2021).

When a certain area is renewed or improved there are many elements that are involved in the process, not just the green part. With current policies, and environmental situation, it is very common to implement green wherever there is a chance and sometimes this happens when brand new buildings are built somewhere. In this case, the greening task is not the only responsible of the expelling effects this out of reach buildings are having in the district. “The main cause of the gentrification is the change in general of that space and not just the new green” (respondent 5, 13/07/2021).

This is the main concern certain parts are having around the fact that a positive measure like increasing green spaces is being associated with such a negative and damaging effect like gentrification.

Improvements must be done because more green spaces in Barcelona have demonstrated being essential, but it has to be done also avoiding the damage or destruction of current things. Some sort of balance must be achieved in order to develop green spaces where they are really needed without damaging the essence of the district it has been placed in. Under the overarching arm of environmental justice, in order to mitigate green gentrification, “a social and environmental balance has to be achieved” (respondent 8, 27/07/2021). It can happen that the initiative is very good, very sustainable and environmentally friendly, but the spot where it has been placed is not the right one. This situation has a positive impact for the environment side, but a negative one for the social side because it might expel



residents. “Planners need to be careful when planning for green infrastructure and how they implement this improve in urban quality. Because this might be planned with very good intentions but end up having a really negative effect to the original residents of the neighbourhood” (respondent 2, 26/05/2021).

This situation has increased the complicated task of green infrastructure planning in Barcelona, since it is not an easy task to avoid. Even in some cases they have resulted into social movements whose aim is to defend the district and its residents. “All these initiatives are generating resistance by social movements from the affected districts because they are afraid they could generate more inequalities” (respondent 7, 22/07/2021).

### **7.3.3. Participatory process: what to consider**

Participatory processes have become a very powerful tool in order to develop the kind of interventions in the public spaces that are really needed. “Maybe what matters more is not these technical aspects, but what type of participation the residents of an area might have in the design of new spaces” (respondent 3, 06/07/2021).

Barcelona has counted on the participation of its residents in different initiatives and benefits have been in both sideways, residents feeling heard and planners working on something that it is really wanted by the community. “They [the municipality] are trying hard” (respondent 6, 19/07/2021). According to experts this aim of participation has always been present in the DNA of the city. Back in the 70s the so called “Consells de barri” were a very interesting way to hear the thoughts and opinions of the residents of each district. From what participation was back then there has been an evolution, but it is still a very unclear process. Society has changed, and along with it priorities and visions have changed as well. “If planners do not consider different collectives and group’s perspectives, in the end the result might only benefit a specific group” (respondent 1, 19/05).

Involving a participatory process in urban planning requires to be based in co-creation and discussion. In order to do so, it is important that the main guidelines and tools of such processes are clearly stated and updated with what this involvement means. This is a very important challenge in order to avoid what can be described as “urbanism on demand” (respondent 8, 27/07/2021).



It is perceived by some experts that there is a lack of leadership when it comes to participatory processes. Urban planning is a very complex task and this processes where residents are involved can not allow them to be capricious about what they want to have. This processes are a good task for residents to understand that what is done in their district can affect other districts as well. There has to be a process of understanding of what can be considered and what is not an option because the external damages are higher than the internal benefits (respondent 8, 27/07/2021).

A strong update on how the participatory processes work will also be a huge benefit for the municipality of the entity that is developing the study. This will stress the main point on social values as well, and not just the ecologic criteria that are very well known by the experts. Understanding the residents will offer a different perspective that might not be just about the ecology side of public space, but also about the main elements that involve the district's territorial cohesion they have.

Communication between planners and residents is very much needed. Experts of the field have found these type of interactions a very strong tool to develop better spaces. On the other hand participatory processes are only worthy if there are some straight lines on who decides, whose social groups are heard, etc.

#### **7.4. Main elements to develop high quality green areas**

Through the document analysis of what the municipality's greening agenda is for the next years and the interviews with experts from different fields of planning, different opinions on how is the best way to achieve high quality green areas have emerged. What the different sections of the results chapter of this thesis have demonstrated is that in order to achieve a coherent planning there are different aspects that are considered essential.

“Depending on who you ask this question to, maybe quality is related to make green spaces accessible to all groups. If you ask it to people more from the world of ecology they might tell you that it needs to be focused on the biodiversity aspects, making green spaces more diverse” (respondent 1, 19/05/2021).

First of all, starting with the ecological values of green areas, not all types of vegetation offer benefits to Barcelona. Vegetation is a very delicate task, since not all types are equally valid for a climate like Barcelona. It is important to stick to vegetation that can follow the local guidelines avoiding any type of vegetation that can be harmful for the local species or disrupt the existing biodiversity from the city and its metropolitan area. Aside from this requirements, the combination of the different types of vegetation also must be able to produce the ecosystem services that the municipality has planned for.

Vegetation plays an important role within the ecosystem services groups, and at the same time, the ecosystem services have demonstrated to have a heavy weight when it comes to urban planning. Like mentioned earlier, within these groups cultural services are as important as the ecologic ones. This connects with the need of having an accessible and well distributed green infrastructure within the city. High quality green infrastructure can only be fully achieved if most of the ecosystem services are accomplished.

“Accessibility does not really matter if the place where it grants the access has poor quality” (respondent 4, 10/07/2021). Like mentioned earlier, this quality is also composed by some factors that are external to the ecologic ones. Planners must be able to design inclusive spaces where everyone feels welcome and safe in them. An inclusive design of green infrastructure promotes a diverse space and creates places that allow situations and encounters to take place. “Its design [green infrastructure] must be inclusive in order to offer the chance to situations to happen and not determine it” (respondent 8, 27/07/2021).

The process of designing and creating an inclusive and adequate space might be easily sorted out if paradigms like the one determined by the “political ecology of the place” (respondent 7, 22/07/2021). This terminology is based on the comprehension of what goes on within a certain district in order to determine what is the right action to develop. This mostly refers to the type of district it is, what is their main economy, type of population, what do they require, etc. This technique’s main aim is to help planners understand the district in order to better determine what kind of greening actions they need. At the end of the day, this process of understanding has to be able to develop a proposal that contributes to the current social cohesion of the district instead of damage it.

“Green infrastructure must be in constant interaction with society” (respondent 2, 26/05/2021).

## **8. Discussion**

This research has been designed to explore the possible relation between urban green infrastructure and environmental justice through the component of accessibility. In this chapter the research questions will be answered in order to assess its relation to what has been stated previously in the theoretical framework.

### **8.1. Answering research questions**

In order to obtain an answer to the main research question (In what ways is Barcelona’s green infrastructure planning tackling environmental justice issues?) three sub-questions were stated.

#### ***a) How is green infrastructure planning mobilized in Barcelona?***

The first sub-question was created to offer a chance to understand the current situation in Barcelona regarding green planning through the perspective given by the municipality and external experts. It was mainly used to identify the main tools that are being used currently by the municipality in order to develop its urban planning, focused on greening aspects. This offered a really good chance to comprehend the function of the overarching arm of urban planning tools by presenting the importance of integrating green infrastructure within planning policies. This aligns with the vision stated by the European Commission (2013), recognizing the benefits of green infrastructure in human health and the environment. Green infrastructure has a role that can not be ignored and should be considered within planning policies from now on in order to properly develop healthier cities (European Comission, 2013).

Experts confirmed that, indeed, nowadays green infrastructure planning is present in several of the municipalities official reports. This inclusion has shined some light on green spaces role within cities and urban regions. The main planning reports for most of the experts when it comes to urban planning and environmental care in Barcelona are “Pla del verd i la biodiversitat” and “Serveis socioambientals dels espais verds de Barcelona”. Like it has been stated earlier, these two reports are translated to English as “Green and biodiversity’s plan”

and “Barcelona’s green spaces socio-environmental services”. Through this two main reports is how the municipality has been considering environmental benefits and how to integrate them within the city’s urban planning. The reports presented by the municipality show the need to consider the inclusion of green infrastructure basing it on the conservation of natural ecosystems along with urban developments and growth (Benedict & McMahon, 2002). The fact that the municipality elaborated a report containing an analysis on Barcelona’s green spaces socio-environmental services reinforces the way how Mell (2008) saw the role of green infrastructure, the provision of benefits to the ecologic, economic and social spheres of a city. Like it has been mentioned earlier in the results chapter, green spaces ecosystem services comprises much more than just the ecological components of it.

The inclusion of green planning within urban planning policies have not just brought the need to develop a vision on a city’s green infrastructure, it has brought the need to define what is included within the green infrastructure. The municipality of Barcelona has shown in its reports a strong focus on the green corridors and the super blocks. This two elements main components and use align with the stated need to integrate green spaces within the gray spaces in the city (Benedict & McMahon, 2002). The green corridors and the super blocks have been designed and presented as the right tool to offer a connection or a passage to the different small green areas that can be found in Barcelona. Experts and the municipality themselves agree on the fact that they have been working on adapting Barcelona’s compact layout to improve its green infrastructure.

***b) How does the municipality’s greening agenda considers accessibility?***

This sub-question was included in order to discover how environmental justice issues such as equitable accessibility to green spaces are considered within Barcelona’s urban planning. Through the conducted interviews experts have brought their concerns regarding accessibility and its consideration in the municipality’s urban planning. It can be stated that the municipality has some concerns regarding this issue, since it is a topic that has been assessed through the report of “Pla del verd i la biodiversitat”. Although the municipality’s concerns can be detected, external experts have shared a different vision regarding the way how the municipality is addressing accessibility to the city’s green areas.

The main concern stressed by the experts has been the fact that the current plan to increase the amount of green spaces has been based on creating green where there is none. What this means is that the social variable is not considered a priority in order to determine where in the city are green spaces really needed and favorable for the residents' health.

The aim of this sub-question aligns to what has been referenced in the theoretical framework by Talen (2010) and the three main elements that are determinant for green distribution: proximity, diversity and social need. Accessibility is seen by the municipality as an objective to achieve by increasing the amount of areas within the city's green infrastructure. Equitable green distribution and the increase of accessibility must be developed from the perception of the spatial dimension understanding which social groups will benefit from these spaces, where will green spaces be more used and how can they be connected to the spatial distribution options (Talen, 2010).

***c) In what ways is accessibility considered important as a solution to environmental justice?***

This sub-question was created in order to determine what is actually the role of accessibility within the environmental justice fight. Environmental justice comprises different elements, being accessibility one of them. Like it was defined by Bowen (2002), environmental justice happens when "minorities, low income, and otherwise disadvantaged and susceptible neighborhoods are disproportionately exposed to environmental hazards". This definition is accepted by many of the experts and scholars out there understanding that it is not possible to define accessibility as the unique solution to solve environmental justice. This is supported by the fact that having access to green infrastructure does not mean that it is a high quality space, it could have ecological damages that can result into ecological issues for close residents.

This situation can be related to the scenario where unequal access to green spaces was never considered as a research branch for environmental justice (Jennings et al., 2010). Back then the main components that result into the development of problematic environmental situations were mainly based on ecological issues (Jennings et al., 2010). Nowadays research on accessibility to green spaces can be done under the umbrella of environmental justice issues since it has become for experts an important pillar of this fight. However, the solution

to environmental justice is perceived by experts to be wound in a combination of different elements going from ecological issues to including social issues.

## 9. Conclusion

Bringing back the main research question of this report: *“In what ways is Barcelona’s green infrastructure planning tackling environmental justice issues?”*, it can be said that urban planning is a very complex task. This question intended to be solved from the results and findings obtained in chapter 7, complementing the answers from the sub-questions that have been discussed in chapter 8.

The final conclusion is that Barcelona has been working and improving its green infrastructure planning by stressing on different elements that might not have coincided to the main scope of this research. In order to remind it, this research scope was mainly the analysis of the role of accessibility to green spaces. Looking back at what environmental justice meant for the scholars referenced in the theoretical framework, but also what it meant for the experts interviewed during this thesis research, it consists of many elements that must be considered and not just accessibility. The final results of this research based on a exploratory study have demonstrated that the municipality has its preferences in other elements concerning urban green spaces. Accessibility is indeed considered but, like it has been mentioned in the discussion chapter, it is handled differently than how it was presented in the theoretical framework of this report.

Through the analysis of what Barcelona has been working on this past years, the general perception is that ecological and physical health benefits are further more considered than social issues such as accessibility. The goal of reaching an equitable distribution of the green spaces has been proved in this research to be properly done through the consideration and align of different elements, like the ones presented by Talen (2010). It can not be said that Barcelona is tackling environmental justice issues through its urban planning if the distribution of green spaces is only done from the perspective of spatial distribution, without having in mind social variables in order to determine where can public green spaces be more needed and accessible.

Finally, through the course of this research it has been detected the difficulties of including a topic such as equitable accessibility into planning objectives and horizons. Although

researchers and many public institutions have showed the importance of considering social elements more regularly within green planning policies, it is still a very complicated task.

### **9.1. Reflection**

Analyzing at this point the final result of this research journey, it shows a study about the city of Barcelona considering its peculiar urban composition and the municipality's current vision on green infrastructure. Since the beginning it was clear that the only way this research could go through and evolve into a relevant result for either society and the academy was through an exploratory study based on semi-structured interviews. The total amount of conducted interviews were 8, and at the end it was considered sufficient in order to be able to develop the results chapter and give answer to the research question and sub-questions.

In the end all 8 interviews were conducted very successfully via Zoom and in several occasions new concepts and social situations were introduced, becoming a very meaningful element of this research during its final stages. An example of it was the mention of Green Gentrification by one of the early respondents, which ended up being a very interesting concept to discuss during interviews that connected social issues with green infrastructure. The fact that interviews were done online was a very positive aspect since most of the respondents were based in the city of Barcelona and I was living in Nijmegen at the time the interviews were scheduled.

Apart from the interviews and document analysis, the initial research design presented the intention of working with GIS as well along with the interviews, but in the end due to the lack of time and the lack of utility that it could bring to the research it was left out. GIS could have been a useful tool if some tasks of comparison or measurement of accessibility to urban green spaces were included within the research questions.

Finally, like it has been mentioned earlier in the limitation chapter within the description of the used methodology, at first there were several difficulties through the reaching process of the candidates. This research has been done during the Covid 2020 pandemic and there were some situations and states of mind that might have influenced the process at some point. This research process became a challenge for me, since it is the first time that I was working on a big project where many things needed to be considered. This lack of research

experience brought some added limitations to the current ones, but I think that the way how things turned out offered a somehow consolidated research process and results.

## **9.2. Recommendations for further research**

This research was solely based on the city of Barcelona, and how things regarding green infrastructure and accessibility are being done here. It definitely can have some implications on the greening process of other cities, but it must be highly considered that each city is different when it comes to its territory, its shape and its urban characteristics. This specific case can be seen as a guide but, from my point of view, it is sort of complicated to use this findings for other spatial areas that are not Barcelona. This does not mean that the issue can not happen in other cities, what this means is that the findings on how Barcelona considers accessibility in their greening processes might only help other towns to develop their own vision and specify their priorities.

Further research regarding this report's topic would gravitate towards the direction of social benefits that are related to urban green spaces. Through the results presented in this report it has been shown how ecological aspects are very much considered when it comes to this topic, whether social issues are less popular withing municipality's reports and scholars literature. I found this situation quite interesting and frustrating, since social issues is an aspect that should be considered within urban planning. Within the frame of academic research, I think there is still some ground to cover towards this direction in order to establish the existing connections between green infrastructure and its chance to reduce environmental justice problems.



## 10. References

Agyeman, J. (2013). *Introducing Just Sustainabilities: Policy, planning and practice*. London, UK: Zed Books.

Ajuntament de Barcelona. (2013). *Pla del verd i la biodiversitat*. Retrieved from <https://ajuntament.barcelona.cat/ecologiaurbana/ca>

Ajuntament de Barcelona. (2017). *Mesura de govern: Programa d'impuls de la infraestructura verda urbana*. Retrieved from <https://ajuntament.barcelona.cat/ecologiaurbana/ca/que-fem-i-per-que/ciutat-verda-i-biodiversitat/pla-infraestructura-verda>

Ajuntament de Barcelona. (2021). *Obrim Carrers*. Retrieved from <https://www.barcelona.cat/obrimcarrers/ca>

Anguelovski, I., Connolly, J. J. T., Masip, L. & Pearsall, H. (2018). Assessing green gentrification in historically disenfranchised neighborhoods: a longitudinal and spatial analysis of Barcelona. *Urban Geography*, 39:3, 458-491. <https://doi.org/10.1080/02723638.2017.1349987>

Artmann, M., Kohler, M., Meinel, G., Gan, J. & Iojă, I. C. (2019). How smart growth and green infrastructure can mutually support each other - A conceptual framework for compact and green cities. *Ecological indicators*, 96, 10-22. <http://dx.doi.org/10.1016/j.ecolind.2017.07.001>

Barcelona Regional. (2018). *Serveis Socioambientals dels espais verds de Barcelona*. <https://bcnroc.ajuntament.barcelona.cat/jspui/>

Basnou, C., Baró, F., Langemeyer, J., Castell, C., Dalmases, C., & Pino, J. (2020). Advancing the green infrastructure approach in the Province of Barcelona: integrating biodiversity, ecosystem functions and services into landscape planning. *Urban Forestry & Urban Greening*, (55). DOI: <https://doi.org/10.1016/j.ufug.2020.126797>

Rueda, S. (2017). Les superilles per al disseny de noves ciutats i la renovació de les existents. El cas de Barcelona. *Papers*, 59 – *Nous reptes en la mobilitat quotidiana. Polítiques públiques per a un model més equitatiu i sostenible*, 78- 93.

Benedict, M., & MacMahon, E. T. (2002, September). *Green Infrastructure: Smart Conservation for the 21st Century*. Retrieved from: [https://www.researchgate.net/publication/273127683\\_Green\\_Infrastructure\\_Smart\\_Conservation\\_for\\_the\\_21st\\_Century](https://www.researchgate.net/publication/273127683_Green_Infrastructure_Smart_Conservation_for_the_21st_Century)

Bowen, W. (2002). An analytical review of environmental justice research: What do we really know? *Environmental management*, 29(1), 3-15. DOI: 10.1007/s00267-001-0037-8

Davies, C., MacFarlane, R., McGloin, C. & Roe, M. (2006). Green infrastructure planning guide, pp. 45. Retrieved from: <http://www.scribd.com/doc/33007993/Green-Infrastructure-Planning-Guide>

European Commission (2013). *Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions: Green Infrastructure (GI)—Enhancing Europe's natural capital*. Brussels: Author

Ewers, R.M., Kapos, V., Coomes, D.A., Laforzezza, R. & Didham, R. L. (2009). Mapping community change in modified landscapes. *Biological Conservation*, 142, 2872-2880. DOI: 10.1016/j.biocon.2009.06.022

Gill, S. E., Handley, J. F., Ennos, A. R., & Pauleit, S. (2007). Adapting cities for climate change: The role of the green infrastructure. *Built Environment*, 33, 115–133. DOI: <https://doi.org/10.2148/benv.33.1.115>

Goode, D. (2006). Green infrastructure: Report to the Royal Commission on Environmental Pollution. London: Royal Commission on Environmental Pollution.

Holifield, R. (2001). Defining environmental justice and environmental racism. *Urban Geography*, 22(1), 78-90. DOI: 10.2747/0272-3638.22.1.78

Jennings, V., Gaither, C. J. & Gragg, R. S. (2012). Promoting environmental justice through urban green space access: a synopsis. *Environmental Justice*, 5(1). DOI: 10.1089/env.2011.0007

Jennings, V., Larson, L., & Yun, J. (2016). Advancing Sustainability through Urban Green Space: Cultural Ecosystem Services, Equity, and Social Determinants of Health. *International Journal of Environmental Research and Public Health*, 13(2), 196.

<https://doi.org/10.3390/ijerph13020196>

Laforteza, R., Davies, C., Sanesi, G. and Konijnendijk, C. (2013). Green Infrastructure as a Tool to Support Spatial Planning in European Urban Regions. *IForest - Biogeosciences and Forestry* 6(3), 102-108. DOI: [10.3832/ifer0723-006](https://doi.org/10.3832/ifer0723-006).

Mell, I. C. (2008). *Green Infrastructure: concepts and planning*. Retrieved from:

[https://www.researchgate.net/publication/228664177\\_Green\\_Infrastructure\\_concepts\\_and\\_planning](https://www.researchgate.net/publication/228664177_Green_Infrastructure_concepts_and_planning)

Rigolon, A., & Németh, J. (2019). Green gentrification or “just green enough”: Do park location, size and function affect whether a place gentrifies or not?. *Urban Studies*, 57(2), 402–420. <https://doi.org/10.1177/0042098019849380>

Russo, A. & Cirella, G. (2018). Modern Compact Cities: How Much Greenery Do We Need? *International Journal of Environmental Research and Public Health*, 15, 2180. DOI: <https://doi.org/10.3390/ijerph15102180>

Schlosberg, D. & Collins, L. B. (2014). From environmental to climate justice: climate change and discourse of environmental justice. *WIREs Clim Change*, 5, 359-374. DOI: 10.1002/wcc.275

Silverman, R. M. (2015). Analysing qualitative data. *The Routledge Handbook of Planning Research Methods*. (p.140-155). Edited by Elisabete A. Silva, Patsy Healey, Neil Harris, and Pieter Van den Broeck

Sousa Silva, C., Viegas, I., Panagopoulos, T. & Bell, S. (2018). *Environmental Justice in Accessibility to Green Infrastructure in Two European Cities*. *Land*, 7(4), 134. DOI: <http://dx.doi.org/10.3390/land7040134>

Talen, E. (2010). The Spatial Logic of Parks. *Journal of Urban Design*, 15(4), 473-491. DOI: [10.1080/13574809.2010.502335](https://doi.org/10.1080/13574809.2010.502335)

T.C.P.A. (2004) Biodiversity by Design. A guide for sustainable communities. Town and Country Planning Association

Tzoulas, K., Korpela, K., Venn, S., Yli-Pelkonen, V., Kaźmierczak, A., Niemela, J., & James, P. (2007). Promoting ecosystem and human health in urban areas using Green Infrastructure: A literature review. *Landscape and Urban Planning*, 81(3), 167–178. DOI: [10.1016/j.landurbplan.2007.02.001](https://doi.org/10.1016/j.landurbplan.2007.02.001)

U.S. Environmental Protection Agency, Office of Environmental Justice, 2000, F. A. Q.: What Is Environmental Justice?

Weber, T., Sloan, A. & Wolf, J. (2006). Maryland's Green Infrastructure assessment: development of a comprehensive approach to land conservation. *Landscape and Urban Planning* 77 (1-2), 94-110. DOI: 10.1016/j.landurbplan.2005.02.002

Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities “just green enough.” *Landscape and Urban Planning*, 125, 234–244. <https://doi.org/10.1016/j.landurbplan.2014.01.017>

## 11. Annex I: List of interviewees

Further details on the interviewees description is included in the set of gathered data.

Respondent #	Organization
1	Vrije Universiteit Brussel
2	Laboratori Metropolità d'Ecologia i Territori de Barcelona
3	Barcelona Laboratory fo Urban Environmental Justice and Sustainability
4	University of Algarve
5	Municipality of Barcelona
6	Barcelona Laboratory fo Urban Environmental Justice and Sustainability
7	Barcelona Laboratory fo Urban Environmental Justice and Sustainability
8	NGO Euro-Mediterranean Economists Association