



Complexity of improvement

A sustainability analysis of the park along Riachuelo river connected to marginalized areas in Buenos Aires

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Complexity of improvement: A sustainability analysis of the park along Riachuelo river connected to marginalized areas in Buenos Aires

Förbättringens komplexitet: En hållbarhetsanalys av parken längs floden Riachuelo kopplad till marginaliserade områden i Buenos Aires

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Abstract

The Riachuelo river in Buenos Aires was considered one of the most polluted watersheds in the world, where industries, sewers and illegal dumping have contaminated the river for over 200 years. Over 8 million people live in the Matanza-Riachuelo Basin, many of which live in informal settlements without official waste management, sanitation- or water systems. A rehabilitation project along the riverbanks started in 2006 and a 35-meter strip of the riverbank is turning into a 4.5 km long park along the north side of Riachuelo. This has led to complex consequences such as the relocation of families in informal settlements. Landscape architecture has an obligation to consider effects in a long-term holistic perspective and the aim of this work is to analyse and evaluate the sustainability of the park along Riachuelo within the rehabilitation project, with a focus on marginalized areas, to give a long-term holistic perspective of the project. The method used in this research is based on *travelling transect*, with pre-travel research, fieldwork on-site and a post-travel where the material was assembled. To evaluate the sustainability of the park, *Ekologigruppen's* manual was used with indicators for social, economic and ecological sustainability. The research suggests that the new construction of the park has improved some sustainability aspects but is still insufficient. There has been a neglect of ecological sustainability in the planning of the park which affects both the social and economic dimensions of sustainability and therefore the park cannot be considered to uphold requirements for sustainable development.

Keywords: Landscape architecture, urban planning, informal settlement, water pollution, sustainability, Riachuelo river, Buenos Aires, Argentina

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Abbreviations

ACUMAR	Autoridad de Cuenca Matanza Riachuelo
FADU	Facultad de Arquitectura, Diseño y Urbanismo
FAR	Floor area ratio
IVC	The City Housing Institute
MB	The Swedish environmental code
PBL	The Swedish Planning and Building Act
SLU	Swedish University of Agricultural Sciences
SDG	Sustainable Development Goal
UBA	Universidad de Buenos Aires
UN	United Nations

1. Introduction

The majority of the world's population lives in cities, and urban areas are growing at an unprecedented rate. Cities generate wealth and opportunities (UN Habitat 2020). However, accelerated urbanization also brings significant challenges such as inequality, poverty and pollution (Vaca 2020). Because of the high population density, urban areas are more exposed and vulnerable to global warming, climate change and extreme weather (Merlinsky 2016). Approximately one billion people in the world live in 'slum areas' and informal settlements in urban areas. They tend to live along riverbanks, near polluted grounds, along waterfronts in coastal areas, on floodplains and on unstable hillsides (UN Habitat 2020). These sites are in general hazardous, unattractive and with rising sea levels, floods and droughts poor people have little choice but to live with disaster (Davis 2006).

Like many countries in Latin America, Argentina is a highly urbanized country. In 2020, 92.11% of Argentina's total population lived in urban areas (Statista 2020) of which 40% live in the Buenos Aires metropolitan area (Debenedetti 2020). About 6% (Memolo 2017) of the 15 million people in the Buenos Aires metropolitan area (World Population Review 2022) live in informal settlements without official waste management, sanitation or water systems. The informal settlements in Buenos Aires are called *Villa* and are located in clusters throughout the city, often along rivers. One of Buenos Aires's largest informal settlements is Villa 21–24; located along Riachuelo which is among the most polluted watersheds in the world (Pardes del Puerto et al. 2021). Villa 21–24 is often flooded and the toxic water from Riachuelo leaks into the residents' homes. Riachuelo's contaminated condition has been implicated in a range of health problems, from severe skin rashes, diarrhoea and headaches to heavy metal poisoning, high cancer rates and infant mortality. Approximately 90 000 tonnes of heavy metals and other harmful substances are dumped into its water every year, which has been going on for about 200 years (Ray 2019).

In 2004 a group of residents in the informal settlement *Villa Inflamable* in the Matanza-Riachuelo basin filed a lawsuit against the Argentinian Government and 44 businesses for damages to their health because of the pollution of the Matanza Riachuelo River. This is known as the *Mendoza Cause* (Business & Human Rights Resource Centre 2004). In 2006, the highest judicial authority in Argentina mandated the Matanza-Riachuelo Basin Authority, ACUMAR, with the purpose to clean the watercourse and improve sanitary conditions along the riverbanks

(ACUMAR n.d.a.). This project is expected to be completed in 2024 with an estimated cost of approximately US\$ 1.5 billion (The World Bank 2021).

To protect the inhabitants from pollution, flooding and to reduce sewage in Riachuelo, a 35-meter strip of the riverbank will turn into a 4.5 km long park (Scharager 2016). According to Buenos Aires City, the purpose is to increase the value of the sector and optimize the public space. The *Environmental Linear Park of the Ribereño Path* also called *Camino de Sirga*, meaning towpath, will become a green area for recreational activities, leisure, pedestrians, bicycles and improve the environmental conditions in the Riachuelo area (Buenos Aires Ciudad n.d.a). The winner of a design competition in 2009 for the park was ATV Arquitectos (ATV Arquitectos 2009). This design proposal did not become a reality, but it has inspired the new construction of the park on the north side of Riachuelo.

Today, some sections of the park are finished as in La Boca, but in Villa 21–24 it takes time because the construction of the park causes relocation of the inhabitants of the informal settlements along the river. The City Housing Institute (IVC) is responsible for the relocation where over a thousand new homes have been built within complexes distributed across different locations. Many of the houses have been criticized, both due to the quality of construction and location of housing, such as the Padre Mugica complex in Villa Lugano, located in the outskirts of Buenos Aires (Scharager 2016). In general, the relocation program accounts for the financial standing of Villa 21–24 residents to match living costs at their new accommodation. However, oftentimes the costs at the new complexes significantly exceed their income (Casado 2021).

Landscape architects have an important role within sustainable development, where the political, economic and equity aspects of projects also are important in addition to the aesthetic and ecological. The ethical issue, where landscape architects' purpose is to create aesthetically green areas that benefit human health and climate adapting cities, can at the same time lead to displacement, green gentrification and other problems. This can be considered to be wicked problems, a term that the design and urban planning theorists Horst Rittel and Melvin Webber (1973) use to describe an issue that has innumerable causes without a clear-cut remedy. Diedrich and Kahn (2020) assert that “the prevalence of wicked problems means there are no creative solutions that don’t end up creating other problems, down the line. In short, we need to accept the fallacy of the ‘solution’” (Diedrich & Kahn 2020). Yet, the landscape architects and others involved with the project have an obligation to investigate the consequences, analyse how different social groups are affected and reflect on the priorities, agendas and actors (De Block et al. 2020). For these reasons, our work will investigate the sustainability of the park along Riachuelo.

1.1 Aim and research question

The work aims to analyse and evaluate the sustainability of the park along Riachuelo within the rehabilitation project, with a focus on marginalized areas, to give a long-term holistic perspective of the project. This will in turn discuss the context and the complexity of an improvement project for a more inclusive, resilient and sustainable urban development.

To do this we will focus on the question:

- How does the park along Riachuelo contribute to long-term sustainability from a social, ecologic and economic perspective?

1.2 Delimitation

The thematic delimitation is the ecological, economic and social sustainability of the park within the rehabilitation along Riachuelo. The “Matanza-Riachuelo Basin Sustainable Development Project” is very complex and Matanza-Riachuelo Basin Authority, ACUMAR, has been accused of corruption many times. This research project will not focus on the associated political issues, but since landscape architecture is transdisciplinary it will consider the political effects connected to the upgrading of Riachuelo. Since the work is done by two landscape architectural students, it will not go into depth with the political and economic issues of the project.

The City of Buenos Aires had to arrange our visit in Villa 21–24, therefore we only visited these places once during our stay. La Boca was visited twice, the first time on our own and the second with a guide born in the area. The visits were only done during the warm months of the year which can affect the result because the park will probably be used differently with a change of weather. The geographical delimitation is the park along the watercourse Riachuelo in Buenos Aires as shown on the map (figure 1), from La Boca to Villa 21–24 on the north bank and the main focus will be in these two neighbourhoods. The areas were chosen for observation because of the dense population in direct connection to the park, compared to other areas of the park, where there are big industries instead, but also because of the difference of identity, socio-economic situation and formality between La Boca and Villa 21–24.



Figure 1. Aerial photo © Google maps. The park is marked in red and follows Riachuelo's north bank from La Boca to Villa 21–24 and is 4,5 km long (Illustration of Jogefalk 2022.03.10 on an aerial photo from Google maps 2022)

1.3 Method

Our method is inspired by two methods that are both used to answer our research question. The first, travelling transect, is primarily used to guide the fieldwork in an open-minded and adaptive approach and is incorporated in the entire work. The second, *Ekologigruppen's indicator for sustainable development* is used to analyse and evaluate the sustainability of the park during and after the fieldwork.

1.3.1 Travelling transect

The *travelling transect* method is described by Diedrich and Lee (2017) with the purpose to capture site qualities, fragilities and atmospheres in water landscapes. A transect is known as a fieldwork method for collecting empirical data in the natural and social sciences. Including *travelling* allows for mobile, relational and open-ended knowledge generation. It aims to seek the diversity of layers and perspectives that define the deeper experience, narrative and history of a place. Furthermore, to support adaptive design in conditions of climatic, socio-economic and political change. These aspects are important when analysing the park project to not restrict discussions of sustainability.

We have implemented this method in our work in the three steps the *travelling transect* suggests. Firstly, pre-travel research and preparations were done through research of previous literature, covering topics such as social justice, sustainability, water regimes in Buenos Aires and informal settlements. Literature from local actors such as Merlinsky (2016) describes the social aspect connected to the Riachuelo river basin and Scharager (2016) gives the inhabitant's perspective of relocating due to the upgrading of Riachuelo with interviews. Janches (2011) gives an overview of the previous and current state of the urban situation in Buenos Aires and literature from Sassen (2014) frames the narrative of marginalization and exclusion as a worldwide issue to give a broader perspective.

This was followed by fieldwork armed with an itinerary open to divergence which was performed in Buenos Aires between February and April 2022. The field studies were carried out in marginalized areas in the park along Riachuelo. In Villa 21–24 and La Boca observations were made for the analysis and evaluation of sustainability. In La Boca, the first visit was on 21 February between 11:00-12:00 and the second visit on 2 March 10:00-13:00. In Villa 21–24 the fieldwork was done on 14 March 14:30-16:30. The visits were conducted with as little prejudgment of the place as possible to capture the current features to be observed. The data was collected by notes, sketches and photography.

Lastly, a compilation of our material was conducted, and a discussion session was held with other architectural students while analysing the park's sustainability through our second methodology which will be explained in the next section. The aim is to reach a wider audience post-travel when publishing at SLU, which Diedrich and Kahn (2017) call “the tableau physique”.

1.3.2 Indicators for analysing sustainability (Ekologigruppen)

To analyse the sustainability of the rehabilitation project and the construction of the new park along Riachuelo, values were observed and evaluated based on the manual *Ekologigruppens indikatorer för hållbar stadsutveckling* (2020) which translates to *Ecology group indicators for sustainable urban development*. The manual was produced by a transdisciplinary team of professionals in ecology, biology, environmental and social science, engineers and landscape architecture etc (Ekologigruppen 2020) at the landscape architecture company Ekologigruppen in Stockholm, Sweden.

Ekologigruppen's manual (2020) was used because it is a tool to evaluate, present and compare the sustainability of projects transparently and distinctly. The manual provides indicators and key figures for sustainability, but we evaluate and analyse, therefore it is of normative character. Each category under social, ecological and economic sustainability in the manual visualizes which of the 17 Sustainable

Development Goals (SDGs) it is connected to and how it is relevant for spatial planning. Spatial planning is particularly important for Goal 11: Sustainable cities and communities, a goal that can only be achieved together with several of the other SDGs.

The new park along Riachuelo will be analysed using a protocol of indicators (Appendix 1) to observe on-site. Ekologigruppen's indicators (2020), key figures and guidelines are presented for evaluation and a value-rose diagram (figure 2) illustrates the high and low values of each category. How we evaluate high or low values is based on the following description.

Evaluation of sustainability

The indicators in Ekologigruppen's manual (2020) are both objective and subjective, which can be seen as a strength compared to focusing only on measurability and an opportunity to include all knowledge and competencies within a planning process. The social, economic and ecological dimensions of sustainability are divided into four categories each. We use high or low levels of social, ecological and economic value and make a critical evaluation of the project, but a word of caution is required since the subjective values are evaluated from the reviewer's perspective which affects where on the value-rose diagrams high-low scale the category is estimated. How we evaluated each category from Ekologigruppen's manual (2020) will be described under social, economic and ecological sustainability.

Social sustainability

Ekologigruppen (2020) defines social sustainability as including equal opportunities for a good life, good health, equality and justice. It includes conditions for human encounters, security and local involvement. A well-planned urban environment promotes healthy habits where urban planners must ensure human rights.

The four categories of social sustainability are recreation, identity, meeting, safety and engagement, health and security. To evaluate the recreational value, Ekologigruppen (2020) describes indicators such as access to green space and gives key figures for distance from residential areas for different types of parks. In the manual, a local park, should be reachable within 200 meters of walking distance from the residence and without having to cross busy roads.

The numbers of green areas per person connected to the floor area ratio (FAR) are recommended in the manual and GIS-methods can be used for evaluating proximity and size. Based on *Stockholm sociotophandbok*, a mapping of societies Ekologigruppen (2020) propose that a dense or highly urbanized area that is equal

to a FAR number around 1.5-3, should have 22 square meters of green public space per person. A medium-density residential area with a FAR number between 1-2, 38 square meters of green public space per person is recommended. Our evaluation did not use GIS, but by measuring areas in Google Earth, FAR was calculated by dividing the gross floor area of buildings by the total area of land upon which it is built (Appendix 2).

The cohesive green structure affects recreation where the fragmentation of the structure, how sensitive it is to impact, the physical structures and resistance to movement are indicators to look at (Ekologigruppen 2020). Through studying maps and observation on site, we could identify the cohesive green structure.

Variation of recreational qualitative is also an indicator in Ekologigruppen's manual (2020) for recreation values where the size of the public area and the number of activities and functions are investigated. Ekologigruppen (2020) have suggested that areas of less than 2,500 square meters can only accommodate a few characters, activities and functions.

To evaluate the identity of the place, Ekologigruppen (2020) gives two different levels of scale to investigate, the landscape's character and cultural connection. When a district has a recognizable and positive identity, it makes it easier for the residents to identify with the place and feel connected to others who live and work there.

The category meeting, safety and engagement include that people should be able to walk in the area at any time of the day without being limited by fear where lightning and a safe traffic environment. Orientability and human scale also affect the feeling of safety. Places for people to meet are a prerequisite for people's lives and contact between residents, where the meeting place's function and quality are indicators of this. Connectedness such as connected walkways indicates the movement of people in the areas.

Health and security are similar to the previous category, but the focus is on people's physical and mental health. Accessible walkways are significant and a safe traffic environment. Clean air, low exposure to environmental noise and a toxic-free environment are indicators for this category, but Ekologigruppen's manual (2020) doesn't provide key figures for example measurement of noise in decibel or air quality measurement. We used our own senses for noise and smell.

Economic sustainability

According to Ekologigruppen (2020), economic sustainability in a district is the urban structure's ability to generate diverse businesses including local businesses

and services, long-term economic growth with the opportunity for employment for the community.

The category local economy in Ekologigruppen's manual (2020) includes local activities that can contribute to a greater commitment to the area, which in turn can contribute to strengthening the district's identity. Here indicators are variations in the supply of premises for business, in strategic and attractive locations with a customer base and throughput. A local economy generates diverse and inclusive environments that can contribute to employment and social network development.

Social assets are not only important for social sustainability, but it also creates a potential for economical sustainability at both local and socio-economic level. Ekologigruppen (2020) points at factors that contribute to security and inclusion in long-term and sustainable ways like variation in places to meet. To generate social diversity and equal resource use, access to diverse housing possibilities and access to community services and life chances.

Long-term resources management is also important for economic sustainability and Ekologigruppen (2020) describes that a long-term perspective is required when planning buildings, infrastructure and technology supply. Effective land use and resilient technical systems, climate adaptation, food and drinking water production are indicators to look for.

Some of the economic indicators were not observed during the fieldwork and therefore our evaluation was complemented with information from the pre-travel research.

Ecological sustainability

In Ekologigruppen's manual (2020), it is described that ecological sustainability is greatly affected by how efficient land use is. In a sustainable society, resource consumption must also be arranged in sustainable cycles for materials, water and industry, preferably on a local scale to reduce the need for transport as much as possible.

Blue and green structures for biodiversity are the basis for ecosystem resilience and cohesiveness, water purification and tools and policies for biodiversity is indicators for this category in Ekologigruppen's manual (2020). The category cycles and environmental technologies include a circulatory system for waste, environmentally adapted construction, energy sources and water and sanitation management. Therefore, we looked for renewable energy sources, recycling containers and stormwater management in the areas along the park to evaluate this, but we did not take any water samples.

Sustainable travelling is important because the transport sector today causes a large part of our societies' total emissions of greenhouse gases and also noise and air pollution, which in turn are linked to health issues and safety risks. The street structure with prioritized pedestrian and bicycle lanes are indicators for this aspect and policy for sustainable travelling.

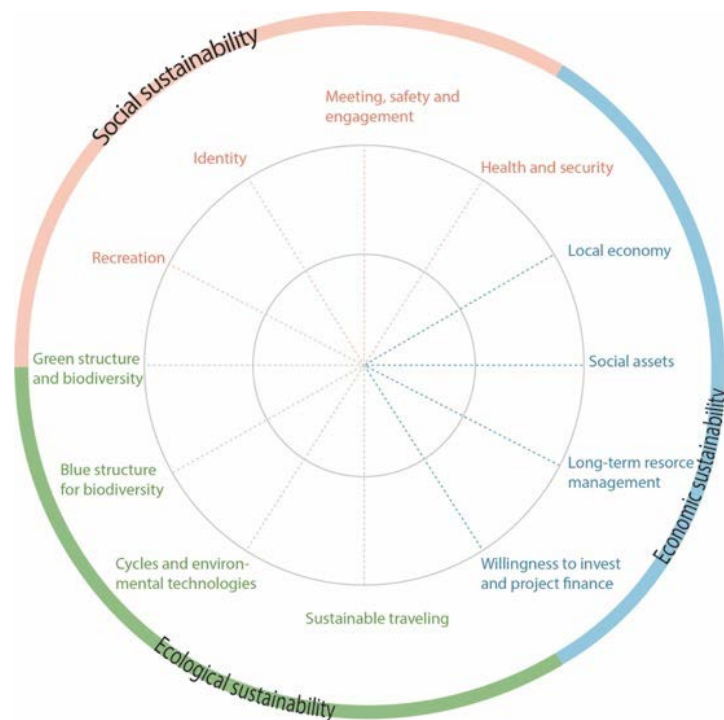


Figure 2. Value rose diagram © Ekologigruppen 2020. The diagram is a visualization of the social, economic and ecological values. At the far end of the circle is the highest possible sustainability value and in the middle of the circle is the worst imaginable from a sustainable perspective (Illustration of Jogefalk 2022.03.15 based on the diagram from Ekologigruppen 2020).

2. Background

In this chapter, the historical background of Buenos Aires, the water regime, the rehabilitation project and marginalized areas are presented to give an understanding of the problems facing the city and why. The first section gives an insight into the economic and social history in Argentina to acknowledge the background for a sustainability evaluation. In the following section, the ecological environment will be explained, followed by a presentation of marginalized areas to understand the socio-economic situation. Sustainability will be defined to give a distinct perspective for the evaluation of the park in this work.

2.1 Buenos Aires historic development

Buenos Aires, Argentina's capital and political, financial and industrial hub is located on the country's east coast in South America. The city was founded by colonizers from Spain in the 16th century, but Argentina is since 1816 an independent state. From the mid-1800s, the country had years of stability, economic growth and civil governance, which would make it one of the economic power hubs in the world and the economic growth was centralized to the coasts in the city of Buenos Aires (Wilson 2007).

In the second half of the twentieth century, industrialization was in full swing in Buenos Aires. The development of international trade, fertile soil as well as expansion of railroads, all contributed to the industries and the flow of raw materials to factories. This attracted migrants from neighbouring countries and the provinces within Argentina (Wilson 2007), which in turn started the growth of informal settlements around the factories in 1930 (Scharager 2016). The city became multicultural, as the city is home to migrants from all over the world (Wilson 2007).

Buenos Aires' industrialization has led to great growth but also great difficulties. Saskia Sassen, professor in sociology, describes the areas left behind from industrialization and extractive methods of finance as a loss of habitat. These areas are no longer fit as habitats for humans and some of the elements that can cause such loss of habitat include pollution or rising sea levels (Sassen 2014). These negative effects of industrialization are present in the city of Buenos Aires, often in

areas with informal settlements. According to Sassen, there is a lack of knowledge of these areas and the people in them, which hinders us from confronting the issue they express, because they are not seen (Sassen 2014). Furthermore, industrialization is only a part of the reason for informality and the difficult situations in Buenos Aires. The economic climate and governance have played a significant role and this will be described in the next section.

During the 1990s Argentina and Buenos Aires saw economic growth, with an increased income per inhabitant along with a strong drop in inflation, but this would also coexist with high rates of unemployment as well as poverty. The economic segregation and polarization in the city were increasing, in part because of the political influences of neoliberalism during this period. There was a dismantling of the national industries that employed many of the inhabitants. As much as 80% had a substantial loss of income while 20% saw an increase. The increase of social inequality, as well as a dangerous relationship between the integrated and the marginalized inhabitants of Buenos Aires (Janches 2011) could be considered a wicked problem of integration and urban planning.

Today, Buenos Aires has seen an economic downfall and unstable inflation that are affecting the value of people's money. The inflation rates are one of the highest in the world with 50.9% in the year 2021. The inflation intertwined with the effects of the covid pandemic has made the economic situation difficult for the inhabitants (TIMES/AFP/NA 2022) and could potentially increase poverty in the city in our view.

2.2 Buenos Aires water regime

The metropolitan region of Buenos Aires is located on the western shore of Río de la Plata, an estuary with brackish water where large rivers including the Uruguay River and Parana River confluence and flow into the Atlantic Ocean (Merlinsky 2016). Estuaries are among the most productive ecosystems in the world (National Ocean Service n.d.) since the mixing of seawater and freshwater provides high levels of nutrients both in the water column and in sediment. The estuary also provides freshwater for human consumption that has in turn been a contributing factor in the development of the city of Buenos Aires (Merlinsky 2016).

Estuaries are dynamic systems, where temperature, salinity, turbidity, depth and flow all change daily in response to the tides, waves and *sudestada*. *Sudestada* is the Argentinian name of a weather phenomenon particular to the Río de la Plata estuary consisting of a sudden rotation of cold southern winds to the south-east which pushes ocean water up the estuary. This has the effect of flooding the Paraná

delta and in low-lying areas on the Argentinian coast, especially the densely populated zones around the Riachuelo (Landscape and instruments 2012).

Buenos Aires has a history of lacking water basin management and the high environmental impact from the inhabitants has led to natural systems not being able to regenerate themselves (Merlinsky 2016). Pollutions including heavy metals, polychlorinated biphenyls, radionuclides and hydrocarbons, from industries, sewage and coastal settlements enter rivers affecting the ecosystem and the inhabitants (Scharager 2016).

2.2.1 Matanza-Riachuelo

The Matanza-Riachuelo Basin is considered one of the most polluted areas in the world (Pardes del Puerto et al. 2021), where 70% of the pollutants come from sewage and over 8 million people live in the Matanza-Riachuelo Basin (Merlinsky, 2016). Riachuelo defines the southeast geographical boundary of the Buenos Aires federal district. This division between the Autonomous City of Buenos Aires (CABA) and the province of Buenos Aires affects the rehabilitation project since it involves different governing bodies and the park is only constructed on the CABA side. The watershed is 64 km long and flows through 14 municipalities before emptying in Río de la Plata near the neighbourhood La Boca (Instrumentalism 2012).

The Matanza-Riachuelo Basin is divided into three zones; the rural upper basin consisting of wetlands, the intermediate basin where the international airport Ezeiza is located and the urbanized highly industrialized lower basins (Pardes del Puerto et al. 2021) as shown in figure 3. The river's upper basin is referred to as Río de la Matanza ("the slaughter river") and its lower part is referred to as Riachuelo ("little river") and has the nickname "bosteros" by locals, meaning manure, because of the smell (Kindle 2017). Riachuelo has been canalized for reasons such as flood control, navigation by larger ships and drainage for agriculture, which has led to the loss of wetlands. Wetlands are ecosystems with high biodiversity and are flooded permanently or seasonally. They contribute to ecosystem services among others water purification, flood control and groundwater replacement (Brandoline et al 2013).

MATANZA RIACHUELO BASIN: POLITICAL TERRITORY

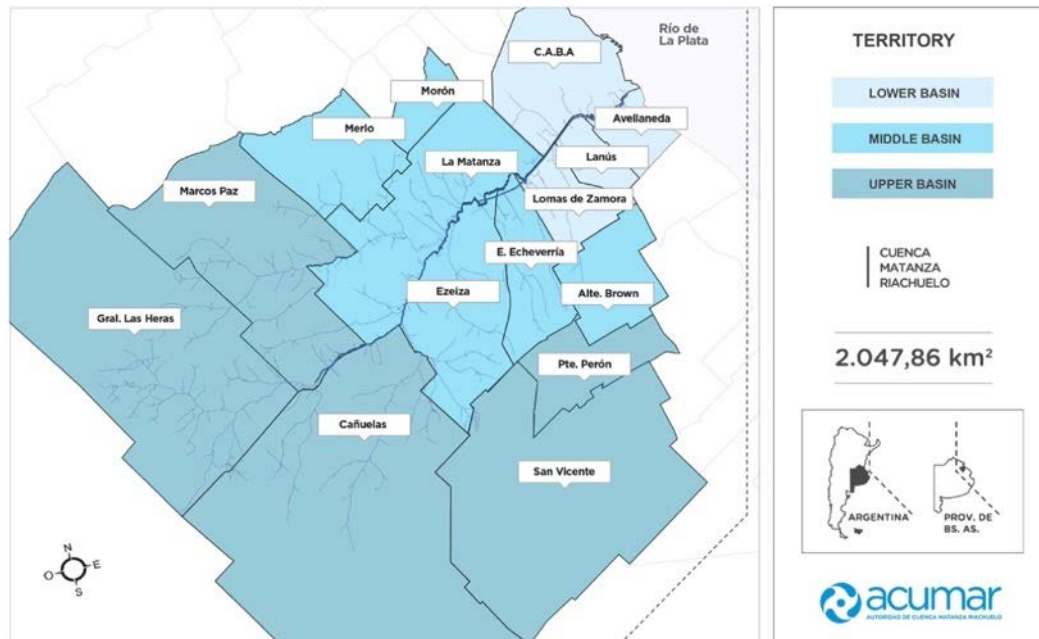


Figure 3. Map over Matanza Riachuelo basin and the political territories ©ACUMAR. The three zones of the Matanza Riachuelo basin are marked in different shades of blue (Translation by Jogefalk 2022.04.26 on a map from ACUMAR n.d.b).

When the Sudestada occurs together with tides the water level can rise four meters and cause flooding around the Riachuelo. Combined with heavy precipitation, the effects can be devastating as the stormwater has no outlet (Landscape and instruments 2012). Riachuelo's contaminated water and sewers are then running along the streets and into people's homes (Merlinsky 2016).

2.2.2 The rehabilitation of Matanza-Riachuelo

The rehabilitation of Riachuelo started a long time ago and is still not completed. In 1991 the Ministry of Natural Resources and Human Environment was founded in Argentina (Development aid 2020) and the pollution of the Matanza-Riachuelo Basin was considered as one of the environmental problems that had the greatest impact in the country. In 1993, the Secretary of Natural Resources and Sustainable Development María Julia Alsogaray presented a project to clean up Riachuelo, which would be completed in a thousand days. This project never came to fruition and the officials were accused of illegally enriching and embezzling funds (SAIJ 2005).

The project was resumed in 2006, following a legal process, the "Mendoza Cause" in 2004, where a group of residents in the informal settlement "Villa Inflamable" in

the Matanza-Riachuelo basin filed a lawsuit against the Argentinian Government and 44 businesses for damages to their health suffered as a result of the pollution of Matanza-Riachuelo River (Business & Human Rights Resource Center 2004). ACUMAR was established in 2006, as a new inter-jurisdictional authority, addressing the worrying environmental situation of the Matanza Riachuelo River and its surroundings (ACUMAR n.d.a). The organization is led by representatives of the Province of Buenos Aires, the Autonomous City of Buenos Aires and the Argentinian state. It has its own budget provided by the state, intended for the implementation of an environmental management plan and its main objective is to reduce pollution in the river.

ACUMAR has the authority related to the conversion and control of polluting industries and also administratively in matters of prevention, sanitation, restoration and the rezoning of land including the relocation of inhabitants living in flood-prone areas (Merlinsky 2016). Today, this rehabilitation project is the country's largest and most expensive environmental restoration project (Trofelli 2021).

2.2.3 The new park along Riachuelo

In order to protect the inhabitants living along the riverbank from pollution and to reduce sewage in the river, as well as reclaim public space, ACUMAR is working to clear a 35-meter strip of the riverbank for the transformation into a 4,5 km long park (Scharager 2016). ATV Arquitectos won an architecture competition in 2009 with a design proposal for a master plan of a park on both sides of Riachuelo. The idea was to improve accessibility and the conditions for citizens to walk and bicycle along the river and connect new green spaces to the city (ATV arquitectos 2009). This master plan was not constructed however, it inspired the construction of the new park along the north bank of Riachuelo. This rehabilitation of the riverbank has meant a relocation of homes in marginalized areas along the river (Scharager 2016) and below the complexity of marginalized areas will be further described.

2.3 Marginalized areas in Buenos Aires

With the rapid rate of urbanization, many of the world's cities are growing quickly. Argentina is no exception. The city of Buenos Aires is today home to around 15,4 million inhabitants (World Population Review 2022) and combined with economic segregation this comes with great planning challenges. Many areas lack significant planning and the urban growth was and is not systematic (UN habitat 2020). Some of these areas or neighbourhoods can be referred to as slums, in Buenos Aires villas de emergencia (Janches 2011) or informal settlements.

2.3.1 Informal settlements

The United Nations (2016) describes informal settlements as “areas where groups of housing units have been constructed on land that occupants have no legal claim to, or occupy” and as “unplanned settlements and areas where housing is not in compliance with current planning and building regulations”. The houses, alleyways and all the urban production were made by the people living in them and the settlements take the form of different degrees of deprivation and levels of permanency (Ekholm 2017). Some are built as temporary dwellings out of metal and/or plastic sheets and some are built with more stable materials such as concrete and tile. Most of the houses lack the recognition of the local government and therefore also the support from them (Ekholm 2017). Informal settlements can be found in many places all over the world, predominantly in the developing world (UN habitat 2020). It is estimated that one-third of the world's population lives in informal settlements (Helberg 2018).

The people living in informal settlements often do not have access to official waste management or sewer systems (Memolo 2017). Because of this informality and the lack of infrastructure and planning, the villas are exceptionally vulnerable to disasters, such as flooding (Merlinsky 2016). The villas in Buenos Aires are the areas of the city where the population growth is the highest. Step by step there has been an expansion of the villas either through densification or new sections created (Tella & Potocko 2014). Authorities have at times attempted to remove the settlements along the Riachuelo river but because of heavy demand for housing, they have been built back (Marcucci 2020). According to Flavio Janches, professor of Urban planning at FADU UBA, the existence of the slums in Buenos Aires is an expression of economic segregation but also of socio-cultural segregation. The villas and the inhabitants, called villeros, are often subjected to stigmatization because of the high rates of violence and crimes in their home neighbourhoods (Janches 2011).

2.3.2 Villa 21–24 and Barracas

The informal settlement of Villa 21–24 is located in the heart of Buenos Aires along the Riachuelo river (figure 1) and is the most populated of the villas in the city. The area is delimited by big roads, a railroad and Riachuelo. The neighbourhood started to take form in 1940 into the 1970 and most of the homes were close to the railroad and the industries (Scharager 2016). With the years, the spaces in-between have been filled and this has created a compact and multistorey streetscape (Marcucci 2020). Because of the rehabilitation of Riachuelo and the park, 1334 families from Villa 21–24 had to relocate (Scharager 2016) and in 2016, a national competition was performed for moving houses along Riachuelo to a new area called Barrio Orma, right by Villa 21–24 (SCA 2016).

Villa 21–24 is included in the district Barracas but is separated from the rest of the district in the east by big industrial buildings. The area has a history of leather production and informal housing but is today except for Villa 21–24 predominantly an area of formal housing. Barracas follows the river Riachuelo and the new park on its southeast border. In the centre of the area lies a big train station and there is also a big highway that crosses the Riachuelo (Buenos Aires Ciudad Barracas u.å.).

2.3.3 La Boca

La Boca is located at the mouth (“boca” meaning mouth) of the Riachuelo river. It is one of the first natural harbours where the migrants first arrived in Buenos Aires, as the migrants came to work in the industries. They often built big houses from materials from the industries and lived in communities called “conventillos”. They were painted with leftover bright colours from the boats and this is today a signature feature of the area. The area is filled with murals that tell stories of activist movements and tributes to idols such as football players, painters, or religious leaders. It is a tourist area with several restaurants, shops and cafés (Guano 2003). La Bocas waterfront is part of the new park project although the area is not considered an informal settlement it is still a marginalized area of the city.

2.4 Sustainable development

Sustainability can be viewed with varied interpretations, models, and perspectives. The term sustainable development was first popularized in 1987 with the description as a development that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland 1987:16). The term often refers to three dimensions of sustainable development; ecological, economic and social, and emphasizes the importance of a holistic approach, critical thinking and dialogue. The most common model, and the one used in this work is presented in a model below (figure 2), where the three dimensions are of equal value (Lozano 2008). They can be in conflict with each other or cooperate, and it follows a sustainable development if social, ecological and economical sustainability are achieved. In 2015 all United Nations Member States adopted 17 Sustainable Development Goals (SDGs). The goals are included in a broader agenda for sustainable development called Agenda 30, to which 193 countries have committed, and Argentina is one of them (United Nations 2021). Ekologigruppen’s manual (2020) is used to evaluate the sustainability of the park, as described under the method, from a social, economic and ecological perspective.

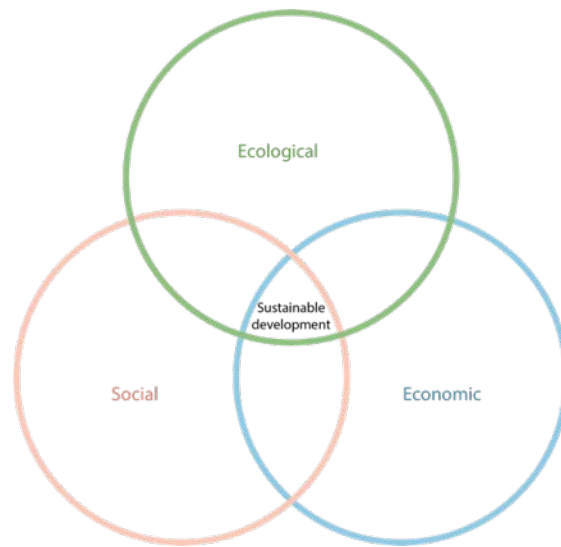


Figure 4. Modell of the three dimensions of sustainability; social, economic and ecological. When all the dimensions are achieved, it follows sustainable development (Illustration of Jogefalk 2022.03.15)

3. Analysis of the park along Riachuelo

In this chapter social, ecological and economic sustainability are analysed and the result from the site visit is presented in a protocol (Appendix 1) developed from Ekologigruppen's manual (Ekologigruppen 2020). Empirical data was collected through observation and interaction with the landscape along Riachuelo aligned with the method travelling transect. The use of both methods through observation, literature research and discussion sessions have all contributed to the result. From the site visit, it was observed that the park was not fully completed in Villa 21–24 and the day of the visit a house was demolished (figure 5).



Figure 5. Picture from the site visit in Villa 21-24 showing the ongoing demolishing of houses to make place for the construction of the park along Riachuelo river (Jogefalk 2022.03.14).

3.1 Social sustainability

Parks and green areas have a positive effect on human health and social sustainability. They reduce stress, promote cognitive ability, improve mental health, promote physical activity and facilitate social interaction (Sjöman &

Slagstedt 2015). The social sustainability of the park was analysed by using Ekologigruppen's manual (2020) with four categories of social sustainability.

3.1.1 Recreation

The park along Riachuelo is a public space that is accessible to everyone and encourages people to meet, which can be considered an improvement in the social aspect. The park provides a cohesive green structure and gives a view of the river, but the green structure is not of high quality. There is a lack of mid-high and high green structures such as bushes and trees in many places of the park, which Robinson (2016) describes would provide both aesthetical and social qualities. In La Boca, under a big adult tree sat several people having a conversation and mate. This behaviour might also occur in the park, when the newly planted juvenile trees grown bigger and provide a sufficient amount of shade (for the summer season).

A significant part of the park's area was a flat surface, which can be seen as an aspect of accessibility for people that have physical limitations. It also makes the area accessible for bikes and strollers. There is no busy road to cross to the park, but only about a fourth of the residents in Villa 21–24 live within 200 meters from the park along Riachuelo (figure 5). However, before the construction of the park, Villa 21–24 did not have many green public spaces in the area and the park along Riachuelo could have a considerable positive impact on the recreational values.

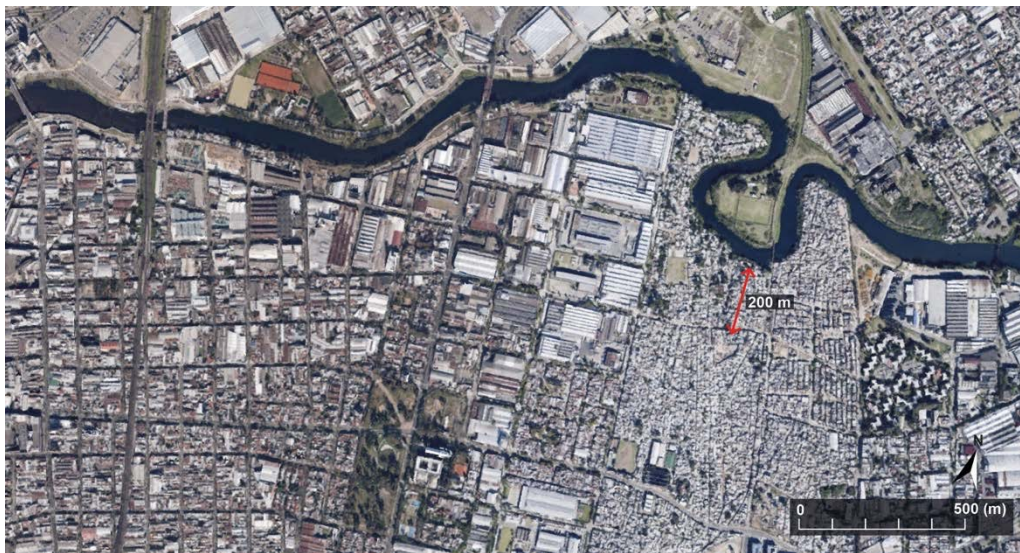


Figure 6. Aerial photo © Google Earth. About a fourth of the residents in Villa 21–24 are within 200 meters from the new park along Riachuelo (Illustration of Jogefalk 2022.04.29 on an aerial photo from Google Earth 2022).

The area of the park is approximately 2.4 km². As described in the method, Ekologigruppen (2020) have suggested that areas of less than 2 500 square meters

can only accommodate a few characters, activities and functions, which is not the case for this park. Activities and functions that were found in the park were playgrounds, an outdoor gym, benches and tables. In relation to the size, it could have been more variety in activities and characters for example amphitheatres, skateparks and variations of plants.

The area of green public space per person in Villa 21–24 is less than the recommendation in Ekologigruppen's manual (2020), even with the new park. The calculation (Appendix 2) gives FAR 1 in Villa 21–24, which is a medium dense residential area and should have 38 m² of green space per person. In Villa 21–24 there are over 45 000 inhabitants (Estadística y Censo 2009), which gives 1.2 m² of green public space per person.

The area of green space is low in the entire city with 1,9 m² of green space per person compared to a document by WHO stating that every city should have a minimum of 9 m² of green space per person (Price 2017). It is not surprising that the number of green spaces per person is lower in an area of informal settlements. The average household in informal settlements in Buenos Aires is almost double the average for the rest of the city (Mitchell 2016). Also, since the areas were not planned, green spaces have not been prioritised.

3.1.2 Identity

The paving stones of the walkway in La Boca were painted in red, blue, green and yellow, which reflects the identity of the colourful neighbourhood (figure 3). The park provides an obstructed view of the historical Avellaneda bridge in La Boca that used to take people over the river in a big metal basket, which raises the historical identity of La Boca. Although La Boca is a natural and historical harbour for Buenos Aires there was no ships or boats except the one cleaning the river. In Villa 21–24, some of the houses' fronts towards the park had been painted by the inhabitants, but this aspect cannot be observed in the park itself. The park lacks identity because of the simple concrete and mass-produced materials (figure 4). There were no signs of identity input such as in La Boca. Although the inhabitants brought grills to the site at the provided benches, which gave the place some social aspects of value.



Figure 7. Picture of the park in La Boca showing the identity of the colourful neighbourhood with painted stone pavement (Jogefalk 2022.03.02).



Figure 8. Picture of the park in Villa 21–24 with a mass-produced playground, concrete, rubber asphalt and a lack of identity. The only greenery in the new park is grass (Jogefalk 2022.03.14).

3.1.3 Meeting, safety and engagement

The function of social interactives with benches and scenery is supplied in the park, but there is a lack of integration of business-oriented functions, such as cafés, restaurants and kiosks, which is intertwined with economical sustainability. These functions could be found in ATV Arquitectos (2009) proposal of the master plan of the park, but not in the built park.

The walkway in concrete and paving stones is elevated from the river and a railing separates the pedestrians from the water physically. The structure does not invite you to go down to the water and the pedestrians are disconnected from it, which is a safety aspect now when the river is still polluted. The park has outdoor lighting, which provides a vital security aspect to the park during the night.

The park has a lack of trees and bushes, which provides orientability and the ability to see the river. In La Boca, the river can be seen and accessed from the touristic area. This might also become the case when the construction of the park is finished in Villa 21–24. In public places like the park along Riachuelo, the height of vegetation affects the feeling of security. Robinson (2016) describes how shrubs can be used to create spaces and still allow vision for security and give private shelter. Knee-high planting could be used to separate pedestrians from the river instead of the railing to still have the overview and orientability. Depending on the size of the vegetation relative to the human scale, different characters of spatiality can be created (Robinson 2016). Since the majority of the park's green spaces were grass, it does not provide spaces in human scale.

3.1.4 Health and security

The park is a relatively quiet place because of the low frequency of traffic. This could change if more people will be able to drive all the way along the park when it is finished. However, it is unlikely that it would be a lot of traffic on the road because it is narrow and some parts are made of paving stones. As observed, the paving stones slow down the traffic, but increases the noise from the vehicles. The roads with paving stones are already in bad quality because they were built before the construction of the park and heavy vehicles have now made potholes in the road. Greenery reduces sounds and with more trees and bushes along the park, it would not get as affected by the noise from the road.

During our site visit to Villa 21–24, we observed the burning of waste in the area by the inhabitants, which can be connected to poor air quality. Despite the negative values, the new park provides a place for physical activities. In La Boca, a few joggers were spotted running along the river, which indicates a health-promoting environment.

From a social perspective, there has been a positive change with the construction of the park, but there is still a problem from a long-term perspective and cannot be considered sustainable. The analysis of social sustainability using Ekologigruppen's manual does not consider the effects of relocating families from the area, which will further be discussed.

3.2 Economic sustainability

The economic sustainability was analysed in the categories social assets, local economy, willingness to invest and project finance, and long-term resource management as described in the method.

3.2.1 Social assets

The park does provide walk and bike lanes and a car road that extends through different neighbourhoods. This could potentially connect the areas along the river, but there is an absence of bridges and boats linking to the other side of the river (figure 6). This reinforces the barrier between the province of Buenos Aires to the Autonomous City of Buenos Aires (CABA). There is also a lack of integration of the youth in the neighbourhoods along the park in Villa 21–24. Social assets such as playgrounds and chess tables were noted in the park, but not any form of soccer fields or basketball area that can be observed as a popular leisure activity for the youth of the neighbourhood. There is a soccer club on the other side of Riachuelo from Villa 21–24, but it is private and the inhabitants are separated by the river.

There was a lack of a place to gather and meet in larger groups, such as amphitheatres or stages, pergolas and dance floors. The only place that had this aspect was a big old port in wood that people in Villa 21–24 used to gather, but this was now closed. A clear gender division in the use of the park was observed. From the site visit in Villa 21–24, no woman was seen visiting the park, although in the houses facing the park women and small children were sitting in the front yards and talking. This could be an issue of insecurity, where women do not feel comfortable using the park. This aspect could change over time if the park provides safe social places for them to meet (Appendix 1).

3.2.2 Local economy

Local activities for small businesses could be found in the neighbourhood Villa 21–24, but could not be observed along the park. There is no variation of premisses for local business in the park or along with it, which is not the case in the neighbourhoods themselves. In La Boca there is a great variety of restaurants, cafés and shops and also a vivid touristic trade, but not by the river. In Villa 21–24 there

were many local kiosks and shops that the inhabitants run from the bottom floors of their own houses (Appendix 1). Local trade and services play an important role in the national economy and can contribute to jobs. Local activities also contribute to a greater commitment to the area and strengthen the district's identity (Ekologigruppen 2020). Although local business could be observed in the new housing complex Orma (figure 5), they are several floors up and this could affect the prosperity of the business (Appendix 1).



Figure 9. The new housing complex Orma, next to Villa 21–24 with the marketing of the inhabitants small business on the second floor (Jogefalk 2022.03.14).



Figure 10. Picture of the closed railway over Riachuelo in Villa 21–24, but nowhere to walk over the river (Jogefalk 2022.03.14).

3.2.3 Willingness to invest and project finance

From the site visit in Villa 21–24, it was observed that the construction of the park has a complex economical aspect. Families along Riachuelo needed to move from their homes because of the rehabilitation and the construction of the park but there was a setback. This could be a result of documentation issues and unwillingness to move. A man and his family living in a house by the water, was observed collecting garbage, sorting and selling it. The park had been built around his home and this could also indicate that the construction had to account for the family's income. These intricate situations make the project of the park take longer and this, in turn,

affects the economic aspect. Although, the regard for the livelihood of the inhabitants to some extent does bring an aspect of economic sustainability for the inhabitants in the short term even if sustainability should be long-term.

Another aspect is that the new housing complexes are relatively cheap. They are subsidized to make them more achievable (Casado 2021), which does bring an economically sustainable value, but also a complex situation for the future. How will the inhabitants pay for the housing long term if they don't have an income? This reinforces the importance to keep in mind the aspect of employment for the inhabitants as well. The land in the area is cheap because of the intricate problems explained in the background and this has made the settlement of people in the area possible. They have a home, but a home that might lack in important aspects and maybe that is better than not to have one at all.

The rehabilitation project of Riachuelo is estimated to cost approximately US\$ 1.5 billion (The World Bank 2021), but the budget for the park is very low. This could be because of the issues of corruption presented in the background, and also because of the extensive work to clean the river. Additionally, there is an aspect of political change, the park has been constructed under different policies with different agendas. This aspect is important to recognise because it affects the probability of professionals being involved in the project and also what they can achieve. Unfortunately, the lack of funding is being reflected in many aspects of the park and the economical sustainability is inadequate (Appendix 1). In this chapter, the analysis of economical sustainability has been presented and in the next section, the ecological analysis will further build on the sustainability analysis.

3.2.4 Long-term resource management

The new park did not take advantage of ecosystem services for flood control and climate adapt the area. The majority of the park is concrete pavement (figure 10) that doesn't infiltrate stormwater and it will run off the surface and bring garbage and pollution to the river. It was observed that the garbage was thrown on the ground (figure 7) since there is no operating garbage management in Villa 21–24. The lack of green infiltration systems that regulate, clean and produce drinkable water, was missing (Appendix 1). The park has been constructed to stop the flooding risk by the ground being elevated and by relocating the homes in Villa 21–24, which were most at risk of flooding. Although, the concrete park is a short-term solution. If the water level exceeds the heightening of the elevated park, the areas with houses will still be flooded with the toxic water from Riachuelo because they lay somewhat lower than the park in some places (Annex 1).



Figure 11. The park stops abrupt in the industrial area of Barracas and becomes a concrete road. (Jogefalk 2022.04.04)

Trees and green structures affect the economical aspect and the long-term resource management (Ekologigruppen 2020) and therefore this might be an issue in the future of the park from an economical sustainability aspect. In short, it will be expensive to not plan for climate change and extreme weather such as flooding and heatwaves, because it will have to be reconstructed in the future instead. There was an implementation of flooding regulation with the elevated park in Villa 21–24, but not with ecological technical. Therefore, one issue might be solved, but hinder sustainability in other aspects. The three dimensions of sustainability are interconnected and overprioritizing one aspect will in turn not provide an abdicate sustainable urban structure.

There is also no planning for food production in the park. Although there were bananas trees growing in the riverbank that can bring food security, but the fruits are probably contaminated by the toxic water and cannot be consumed by the inhabitants (Appendix 1).

3.3 Ecological sustainability

From an ecological sustainability perspective, green structures in cities can be seen as an important resource for a range of ecosystem services, reduce the heat effect and control wind flows (Sjöman & Slagstedt 2015). To analyse ecological

sustainability using Ekologigruppen's manual (2020), blue- and green structures for biodiversity, circulatory system and sustainable travelling were observed in the park.

3.3.1 Green and blue structures for biodiversity

The green structure in the park in La Boca was sparse and the place did have the components of a square than a green park. Concrete pavement and paving stones covered the majority of the park, with a few new small trees. In Villa 21–24, most of the green spaces in the park were lawns and only a few trees were saved. The trees that were saved gave the park some dimension and green structure as well as shadow. In between the walkway railing and the Riachuelo, the diversity of plant species was high. As observed in the finished parts of the park, the shrub layer between the river and walkway will be cut down and become a lawn instead. This will in turn give even poorer biodiversity. Lawns have a limited infiltration capacity which is not optimal for an area that often is flooded. Lawns also require irrigation on the hot summer days to not dry out along with expensive and extensive maintenance.

In Villa 21–24, almost no new trees and zero bushes were planted. This will obstruct the overall lifecycle of the plants and it might end up with sparse greenery over the years, especially when most of the natural greenery was removed. The plants between the river and the walkway support the water cleaning of stormwater through sedimentation processes and when the plants and other organisms obtain nutrition and degradation of pollutants. Plants have the capacity to clean and purify the water from toxins to a certain degree (Ekologigruppen 2020). To preserve, strengthen and create green spaces instead of removing them could have a positive effect on Riachuelo water quality. Biodiversity was not only low in the aspect of plants but also of animals. A few birds were spotted by the river in La Boca but none in Villa 21–24 and no fish or mammals could be observed (Appendix 1).

3.3.2 Cycles and environmental technology

From the site visits the collecting of garbage could be observed on the river and its banks, but there was still a big accumulation in many places, especially in Villa 21–24, where the waste management systems were clearly inadequate. Not one trash container could be found in the park in Villa 21–24 or La Boca. This could accelerate the present issue of waste management and undermine the cleaning of the river. There were places where inhabitants accumulated the waste and signs that said "don't throw waste here" (figure 7) could be observed. Although the inhabitants have implemented circular waste management systems themselves, by reselling the waste. This is not a systematic and fully effective system, although it is a positive adaptation. There was also no evidence of the rehabilitation regarding small

particles and toxic chemicals, which as explained before plants can do. In Villa 21–24 there was a local stormwater collection system in place but that flows in pipes into the river and not through an ecological purifying system.

The high use of concrete and rubber asphalt in the park can be problematic from a sustainability perspective. The initial use of paving stones could have been a more sustainable solution, but in Villa 21–24 the roads of paving stones will have to be redone properly because the heavy vehicles in the construction phase destroyed the roads (Appendix 1). This is not a sustainable effect that could have been avoided with adequate planning for the construction, but it is also difficult to anticipate when there are many aspects to account for in this site.



Figure 12. The sign to the right in the picture says “no tirar basura acá”, meaning do not throw garbage here. Despite the sign, garbage was thrown on the ground because there was no functioning waste management in Villa 21–24 (Jogefalk 2022.03.14).

3.3.3 Sustainable transportation

The park did support the possibility of sustainable transportation with bike paths and walkways along the river. There is also a possibility for the buses to go along the park on the road, extending into the neighbourhoods and bettering the connections for sustainable transportation. No evidence suggests the use of green energy production such as solar panels, but this can be an effect of the tight budget because it is still an expensive technical solution. Although energy production is

vital for sustainability, considering the inhabitants of informal neighbourhoods often lack sufficient energy supply (Appendix 1). This concludes the presentation of economical sustainability and now to the conclusion of the analysis.

3.4 Conclusion of the analysis

The analysis and evaluation of sustainable values of the park manifest neglect of the ecological dimension and an insufficient execution in upholding the economic dimension. One could argue that the removal of natural plant diversity has led to a degradation of the ecological dimension, but the construction of the park and the new housing complex will lead to a better sewer system which reduces the pollution in the river and could therefore lead to upgrading in a long-term perspective. The park might bring about a graduate transformation and economic profit along with the employment of local workers in the project. Although there is a lack of integrating the local business in the park itself and therefore falls short.

The park does however provide social values such as accessible public space and connecting the neighbourhoods along the river and safeguarding the inhabitants from flooding and pollution, which is an important factor for social and economic sustainability. However, the social costs of the project are significant where inhabitants of Villa 21–24 had to relocate from their homes. Ekologigruppen's manual (2020) does not take into account the effects of projects which is an important part of the sustainability and this will be criticised in the discussion.

Even though the name of the project is the "Environmental Linear Park of the Ribereño Path" (Buenos Aires Ciudad n.d.a), the environmental aspect cannot be found in the park. To visualize how the park relates to sustainability, we have produced a value rose diagram (figure 8) translated from Ekologigruppen (2020) with our evaluation and a Venn diagram (Lozano 2008) with the sustainability of the park marked in red (figure 9).

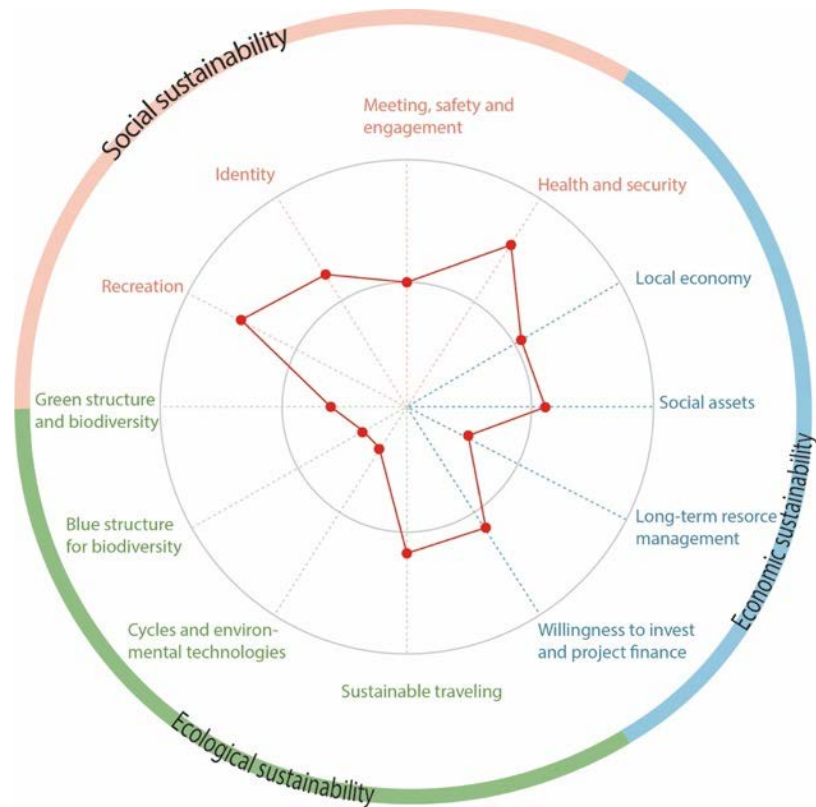


Figure 13. Value rose diagram © Ekologigruppen 2020. The diagram shows the evaluation of the park along Riachuelo with categories of social, economic and ecological sustainability. At the far end of the circle is the highest possible sustainability value and in the middle of the circle is the worst imaginable from a sustainable perspective. (Illustration of Jogefalk 2022.03.15 based on the diagram from Ekologigruppen 2020)

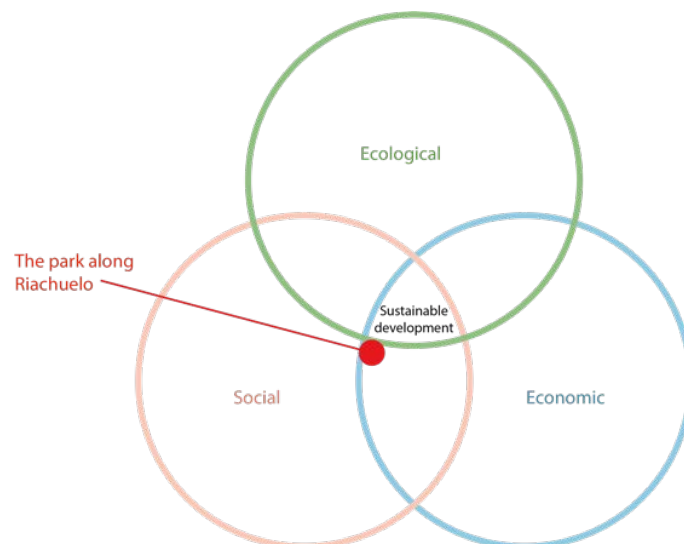


Figure 14. Model of sustainable development with the three dimensions; social, economic and ecological. Our sustainability evaluation of the park is marked with a red dot and does not include the ecological aspects of sustainability (Illustration of Jogefalk 2022).

4. Discussion

The method and results will be discussed and critically reflected upon in this chapter. The complexity of an improvement project in an informal settlement will also be discussed.

4.1 Reflection of the method

The manual by Ekologigruppen (2020) that was used to evaluate sustainability in this research worked as a tool for presenting, comparing and communicating values that are prioritized in projects, but it does not include the social aspects of relocating families. Social sustainability is analysed through the benefits the park gives but ignores the effects that the project entails.

As described in the introduction, it is important to investigate the consequences, analyse how different social groups are affected and reflect on the priorities, agendas and actors with the question “for whom?” (De Block et al. 2020) in landscape architecture projects. Ekologigruppen’s (2020) indicators are not a tool to analyse the consequences of the project or secure sustainable development and do not include considerations for political and social equity.

However, by complementing with the method *travelling transect*, ephemeral qualities of the place could be represented such as the dynamic, relational and atmospheric aspects. Through pre-travel research, site visits and post-travel discussion sessions values that were not included in Ekologigruppen’s manual could be found, such as the consequences of the rehabilitation project of Riachuelo. Ekologigruppen (2020) makes you seek out qualities and values but *travelling transect* guides you to see those values in their context and therefore nuancing the analysis.

Unfortunately, we were not able to do the interviews with the inhabitants of Villa 21–24 which could have brought layers of narratives to the analysis. By reading previous literature by Scharager (2016) we got a perspective of the inhabitants through his interviews. The text by Merlinsky (2016) also brings an aspect of the social equity narrative to the analysis of the park.

Ekologigruppen's (2020) indicators were, in addition to the international SDGs and ecosystem services, based on Swedish regulations in a local context such as Sweden's environmental goals, MB and PBL. Because of the socio-economic stability in Sweden and the relatively high budget for sustainability projects (Vicenzotti 2020), the country has been able to prioritize sustainability in planning and urban development. Argentina's economic and political difficulties described in the background might have limited the budget for the sustainability of the park and as Ekologigruppen (2020) mentions, the SDGs are global goals that can be misleading in a national context, even though all the member countries in the UN strive for the same goals. For example, the SDG goal number 1 is no poverty, whereas in Sweden absolute poverty doesn't exist and the focus is to reduce income disparities in society (Ekologigruppen 2020), while in Argentina absolute poverty exists and is a problem (Janches 2011) which might affect the focus in sustainable evaluation.

When evaluating sustainability using Ekologigruppen's manual (2020), a word of caution is required since it is subjective. The assessments that were made without measurable key figures were based on our observations on-site and our evaluation on the high-low scale. There is also a risk with indicators focusing on the values that can be measured without reflecting where the values come from. For example, the key figure for green public space per person connected to FAR in Ekologigruppen's manual (2020) is taken from *Stockholm sociotophandbok* and applying those requirements in an area of informal settlements can be problematic since they are not planned areas and lack basic needs such as water and sewer systems. The site's unique conditions need to be regarded to make qualitative assessments.

It is important to remember that we have values, both as individuals and as Swedish landscape architects' students, which affect the evaluation. Therefore, the evaluation and analysis of the park's sustainability is normative, and our personal morals and ethics will influence the research. The analysis could also have been more nuanced with a transdisciplinary team for the evaluation of sustainability. As well as with more visits at different hours of the day and on weekdays to observe the social life in the park.

4.2 Complexity of improvement

The park along Riachuelo has improved some aspects of sustainability, but it also came with many challenges. The project started for environmental justice of

citizens in the basin and resulted in the relocation of many families which can be regarded as a paradox and a wicked problem.

A visit to the park and research about the project gave an overview of the situation and the project of the park, but it is only a small observation compared to the bigger picture. Riachuelo has a complex narrative, where the landscape and the people have a lot to tell. Rehabilitation of the Riachuelo river was needed and it was expressed by the inhabitants, but if this leads to demolishing of their homes, then what improvement was made? Therefore, the urban landscapers need to make sure that there is a reconnection of identity to the new place for the inhabitants so that they do not end up in a new but still unsustainable environment. The new landscape created amid the relocation of inhabitants' homes must meet certain requirements. They have to be multi-functional and dimensional and foremost sustainable. Unfortunately, our method with the use of indicators does not fully take into account the complexity of the situation and only evaluates the project itself, not the surrounding consequences described in the background. Therefore, this limits the research findings. Also, the evaluation of the sustainability of the park can only bring information of the sustainability of the park now, not how it has changed.

There is also an aspect of complexity when executing an improvement project in a place with marginalized neighbourhoods. Some might lack documentation and inhabitants are dependent on their income from the business they have in their house discussed in the analysis. How do you plan and construct public space in this context? Our observation shows an effect of flexibility, but also a lack of systematically executed construction and providing sustainability.

In addition, there is an issue of unclaimed land being the place for people to settle. This makes the production of the park inherently bound to control the environment and therefore might lack the freedom of design. How can green public space be designed to not be settled upon but still doesn't result in strict formality lacking in sustainability? This is an example of a question for further investigation and development strategies to meet the needs of a sustainable future.

At the site visit, in Villa 21–24, we observed activities on the streets, urban density, mixed functions and shops with activity spilling out on the street, which are positive aspects from a Global North perspective, but in informal settlements it is a result of poverty with small living spaces. Overcrowded homes and a substandard number of parks and playgrounds create pressure to pack the streets with many more functions than those in the formal city.

In La Boca the connection that inhabitants have to their area is strong and it is expressed physically on their walls. In Villa 21–24 there is a community that deserves recognition and the chances of a better life. This needs to be done by

providing social equity for the inhabitants during and after the rehabilitation project. It is the quality of sustainable living spaces, in all aspects, where the developing possibilities are most relevant.

4.3 Future development of the park

The park will change over time and therefore sustainability might also do so. Our result is a fixed analysis of the present and therefore it cannot predict the future if the conditions change, but it can analyse the future from the present conditions observed. The park can be seen as an opportunity and a part of the work towards a solution. Even if a landscape architectural project does not provide an adequate level of sustainability now, there is a possibility for change and provide it for the future.

The continuation of the evaluation of sustainability and the solution-based work is curial to find achievable and cheap ways to design that will uphold more of the sustainability aspects. In our view, the use of plants can provide sustainability in all aspects, especially of the ecological dimension. Green spaces of quality can provide an interactive social space for recovery and interaction, purify the air and water, and generate a sustainable space in more aspects than in the present. Wetlands can bring sustainability by regulating floods in a long-term way, that regenerates itself. It will safeguard the inhabitants and reduce the pricy consequences of flooding. A more dynamic green spaces with plants adapted for the site will improve all sustainability aspects of the park. Additionally, integration of the identity of the place with local businesses so that the park can give back in recreational purposes and for the economic aspects of sustainability. Implementing spaces where the inhabitants can interact with the water will lift the connection to the river and make use the natural resource of the water again. When the water is clean, these aspects could be such as swimming and fishing, and for now the use of boats could be a realistic implementation.

5. Conclusion

From the site visit and research, the sustainability evaluation of the park along Riachuelo shows a neglect of the ecological aspects of sustainability. The lack of funding and planning of the park could be the reason. From the sustainability evaluation, the park provides social values but does not consider the social equity aspect of the inhabitants who had to move from their homes because of the construction of the park. The analysis also shows low economical values, therefore the park cannot be considered sustainable.

However, the construction of the park offers an opportunity for change and connectivity, which could potentially generate a change. The difficulties of providing adequate green space in a complex setting is truly a wicked problem and require adaptation and flexibility in the work. The complexity of an improvement project in the setting of informality and its interaction with the water regimes needs creativity and an acceptance of reality.

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Appendix 1

This protocol is inspired by and translated into English from © *Ekologigruppens indikatorer för hållbar stadsutveckling* (2020) and was used in field to observe sustainability indicators. The protocol was made and translated the 10/03-2022.

Social sustainability

<u>Categories of social sustainability</u>	<u>Observation</u>
Recreation	
Close access to urban green space	Accessibility to green urban spaces have improved with construction of the new park. Public space, open to everyone. Although little greenery. 1,2 m ² public green space per person in Villa 21-24 (appendix 2).
Cohesive green structure	There is a cohesive green structure, but because of lack of trees, bushes and other plants, the quality and the cohesiveness are not ideally. The unplanned green structure complemented the planned green structure in a cohesive way.
Variation of recreational qualitative	Simple playgrounds and benches, tables with chessboards. Outdoor gym. Missing activities for youth for example basketball court, soccer field (that we saw them play in the street). Grill (Asado) were used in the evenings. The area of the park is 2.4 km ² .

Identity	
The Landscapes character	La Boca, colours on the paving stones. Villa 21–24, had no identity in the park. Private mural paintings on people's houses. Their facades towards the river were upgraded.
Cultural connection	La Boca – the bridge is saved that's not used but has a strong cultural connection. Old harbour.
Meeting, safety and engagement	
Connectedness	Continuous walkway. But areas that feel a bit bare, little eyes.
Function integration	No cafes, boutiques and other services in the park in any of the observations. Although in La Boca there was plenty just a few meters of by the houses.
Accesses to meeting place with quality and function	Benches, although often in sun exposed spots. Might change with time when trees grow bigger. Also, a good thing in winter. Grills been bringing their own grill to the park.
Safe street space and environment	New lightening along the walkway. Not many people in some places of the park.
Human scale and orientability	The scale of the park is big and there is a lack of more private rooms. There are no bushes “walls”. It is easy to orientate yourself along the water, it provides a good visual experience.
Health and security	
Good noise environment	Villa 21-Not much noise. No passing cars, but some motorbikes. Paving stones made it more noise when cars were passing.
Clean air	Smoke from burning garbage in Villa 21–24.

Safe traffic environment	Road and walk/bike lanes bring a positive change. Trains don't go through the area anymore after a person got killed in 2015.
Risk management and toxin free environments	Still toxic ground and garbage. Although the ground has been elevated and houses been moved away from the toxic water.

Economic sustainability

<u>Categories of economic sustainability</u>	<u>Observation</u>
Local economy	
Customer base and throughput	No, not in the park. But in the new houses. Local kiosks, shops and small business in the Ground floor of the houses in Villa 21–24.
Premises for business in strategic and attractive locations	The is no plan along the park for local business, but this might start from the local initiative.
Variation in supply of premises for business	No, all the business is in the houses.
Social assets	
Social capital and social diversity	Partly, they plan for spaces with playgrounds and tables with chess. But there are not spaces for football which can be observed is a popular pass time for the youth. Locals often employed in the project.
Access to community services and life chances	The was no clear place for big gatherings, and no communal house. In Orma (new housing complex) there was an office for the communal workers that people gathered at.
Equal resource use	The waterfront is now available for everyone. But there was little to no

	women using the at observation, the women where on the edge of the park but still in their homes.
Long-term Resources management	
Effective land use and resilient technical systems	The park does use the natural barrier of the water but it is not connected to the water and with infiltration plants and habitat. Low use of plats with deep roots and therefor no natural reinforcement of the land mass.
Food Production	Bananas growing but probably toxic and people will not consume them.
Drinking water production	No, no plats (except a few trees) that can infiltrate and clean water.
Climate adaptation	Reducing floods, but not by ecological solution.
Willingness to invest and project finances	
Attractive location and identity	Low budget on the new park. But it is an attractive location if the water was clean, which is not the case. The park is built in stages because they must move people, flexibility.
Achievable threat holds for investments and building costs	City project. Yes and no. The houses in the Villa are achievable but the new buildings are subsidized. The land is cheap
Market flexibility and stage division	The flexibility of the project is high. The construction was put to a halt in sections because of conflicts with the inhabitants of the houses and delayed construction of the new housing complexes.

Ecological sustainability

<u>Categories of social sustainability</u>	<u>Observation</u>
Green structure for biodiversity	
Green infrastructure	Some trees were saved, but plants were not prioritized in the plan. No new trees were planted. Ex. Jacaranda trees (Jacaranda mimosifolia), ricin (Ricinus Communis), Tipa blanca (Tipuana Tipu) and banana tree
Tools and policies for biodiversity	Low biodiversity, few trees, grass.
Blue structure for biodiversity	
Cohesive blue structures and valuable water biotope	No. The water was field with trash as well as the banks. The water is cohesive but not a valuable blue structure or biotope, close to animals/plants in the water.
Water purification	Cleaning of the water, pick up trash. Close to no plants that can help purify the water was implemented in the park.
Cycles and environmental Technologies	
Low energy use and environmental adapted energy sources	No green energy production.
Circulatory system for waste	Waste management – a man collects garbage and sell it.
Environmentally adapted water and sanitation management	Stormwater management new in the area.
Environmentally adapted construction	High use of concrete (rough estimate 70%) and industrially made playgrounds/rubber asphalt. Initial use of paving stones that had been

	destroyed by constructing and now needed to be covered by concrete.
Sustainable traveling	
City and street structure for sustainable traveling	Public transpiration (busses) might go through the area. No walking bridge to the other side of the river
Pedestrians and bicyclists	Yes. There were walkways and bike lanes. But the car road was big and distinct.
Attractive nodes of public transport	Yes/no. Now there are only public transport to take outside the neighbourhood in Villa 21–24, but that might change with the construction of the park, because there will be a road. In La Boca there were many busses to take
Policy for sustainable traveling	There was a bike lane along the water, but the car road was still prioritized. This to allow ambulance and construction vehicles to get access to the area.

Appendix 2

Calculation of FAR in Villa 21–24:

Built area:

$$720\,000\text{ m}^2$$

The parks area in Villa 21–24:

$$1600\text{ m} \times 35\text{ m} = 56\,000\text{ m}^2$$

Total area:

$$720\,000\text{ m}^2 + 56\,000\text{ m}^2 = 776\,000\text{ m}^2$$

FAR:

$$776\,000\text{ m}^2 / 720\,000\text{ m}^2 = 1,07$$

Calculation of green public space per person in Villa 21–24:

$$56\,000\text{ m}^2\text{ park} / 45\,285\text{ inhabitants} = 1,2\text{ m}^2\text{ public green space per person}$$

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