

The role of urban parks to enhance metropolitan sustainability: the case of Oporto

Luís Loures and Laura Costa

Abstract— Throughout the past century, the World's population had been rapidly congregating in urban areas. Increasing population and urbanization is recognized as one of the most complex process at global scale. This massive urbanization begun in the industrial revolution in the nineteenth century and the decline of nature during the twentieth century increased public awareness to the necessity of introducing natural assets and components in urban contexts, what led to the creation and development of the urban park movement with the objective of increasing life quality in the modern city. In this scenario sustainable development have been recognized as widely accepted strategic framework considering city planning and the creation of urban parks play an important role in it. Nonetheless, it is argued, that urban parks and other open green spaces are important for the quality of life of an increasingly urbanized society. This paper approaches three different urban park projects of the Oporto metropolitan area. These case studies were examined and analyzed with objective to study how does urban green spaces contribute to ecological, social and economic sustainability of metropolitan landscapes, addressing the importance of urban nature for citizens' quality of life and sustainable city development.

Keywords— Urban Parks, Metropolitan greenspace, Oporto, city planning, sustainability

I INTRODUCTION

LANDSCAPE is continuously changing [1, 2] as a result of complex and interacting natural processes coupled with planned and unplanned actions by man [3, 4, 5 and 6]. However, this on-going “transformation of landscapes, worldwide (...), has raised global concerns” [7], as it is the need to rethink landscape while protecting the environment.

Additionally, throughout the past century, the World's population had been rapidly congregating in urban areas. Increasing population and urbanization is recognized as one of the most complex process at global scale. This massive urbanization begun in the industrial revolution in the nineteenth century and the decline of nature during the twentieth century increased public awareness to the necessity of introducing natural assets and components in urban contexts

This scenario led to the creation and development of the urban park movement with the objective of increasing life quality in the modern city. Urban parks are an important part of the complex urban ecosystem network and provide significant ecosystem services. Still, even if the location, structure, form and typology of urban green spaces is increasingly recognized as a significant asset that encompasses a wide range of social, economic and environmental issues [8, 9, 10], little have been done in order to improve the quality of these spaces in metropolitan areas.

Urban parks are an important part of the complex urban ecosystem network and provide significant ecosystem services. They benefit urban communities environmentally, aesthetically, recreationally and economically. Nevertheless, urban parks and other green spaces as we know them today is the result of a deep and long evolution started in England during the 19th century (industrial revolution era). These urban green spaces if developed at a larger scale and across multiple sites could contribute to restore natural processes and functions, create multifunctional landscapes and promote sustainable growth [11]. However, the complexity of these spaces, evident in the number of different ways in which they have been characterized, both in the literature and by designers and other specialists who worked and/or analyzed them, make urban parks' role in urban development, hard to explain and even more difficult to envision and design.

It is a fact that urban parks, open space structure and related human health issues are a critical component of any state, regional and local infrastructure plan. They promote the core values at stake in building public infrastructure: providing children the simple joys of playing; improving health and recreation; equal access to public resources; democratic participation in deciding the future of the community; economic vitality for all with increased property values, local jobs, small business contracts, and affordable housing; spiritual values in protecting people and the earth; the environmental benefits of clean air, water, and ground; and sustainable regional planning.

The last years we have seen a tide of interest sweeping across Europe in the development of nature in cities, and an increasing amount of landscape development in urban areas [12 and 13], since they have significant ecological, social and economic functions. Greenspace has significant ecosystem services, which are defined as “the benefits human population

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derives, directly or indirectly, from ecosystem functions” [14]. It can sequester carbon dioxide emissions and produce oxygen [15], purify air and water, regulate micro-climate, reduce noise [16], protect soil and water [17], maintain biodiversity [18], and have recreational, cultural and social values [19]. Additionally, urban parks and other natural areas can have a statistically significant effect on the sale price of houses in close proximity to those resources [20, 21]. In fact, a functional network of green space is important for the maintenance of the ecological aspect of a sustainable urban landscape. Landscape connectivity should be promoted with the development of greenways and use of autochthonous species, adapted to local condition, with low maintenance cost, self-sufficient and sustainable. However, in order to achieve these goals it is essential to follow all dimensions of sustainable development (environmental, social and economic) at the same time and with the same weight, following the principles presented in Florence in October 2000 in The European Landscape Convention, where the Council of Europe quoted that to achieve sustainability, development should be “based on a balanced and harmonious relationship between social needs, economic activity and the environment”. Public open space that is well designed and well maintained can provide areas for appreciating nature, as well as for recreation and sport. The benefits include improvements in people’s physical and mental health, and the environmental value of biodiversity and improved air quality.

This paper will address three different case studies that were able to create a cultural landscape with potential to fulfill economic, social, and environmental sustainability goals, paying special attention to landscape quality and efficiency, carefully using natural resources, and involving stakeholders in the process during its different stages, once active public involvement and a healthier dialogue between political representatives, residents and economic actors is essential to find better solutions for sustainable city planning.

II METHODOLOGY

Figure 1 shows the methodology diagram that is based in the holistic concept of landscape as a resource. The first phase considered the study of the origin of urban parks, analyzing the evolution of urban park design, assessing formal and development issues in significant urban parks recently designed, the ways in which they marked the metropolitan landscape and the areas in which they were developed considering the embellishment of an oriented landscape analysis.

The second phase considered the collection and analysis of information about the different components of the landscape (geology, geomorphology, soil, relief, flora and cultural heritage), taking into consideration the existing territory constrains (urban plans and administrative servitudes), based on a performed SWOT analysis.

Afterwards, a synthesis of the abovementioned information provided a sensitivity synthesis that together with the established planning and design strategy enabled the development of specific urban parks master plans that after implemented were assessed and monitored in order to identify their influence and benefits to the metropolitan area at different levels.

Considering this objective numerical data was collected regarding both form and dimension of the areas attributed to the different uses and functions implemented on the analyzed parks, and its influence to achieve sustainability considering at the same level the social, economic and ecological aspects. Additionally, the collected information was also used in order to define the importance of the analyzed case studies mutually as green areas (as isolated parks) and as greenway corridors (as an integral part of the metropolitan green structure).

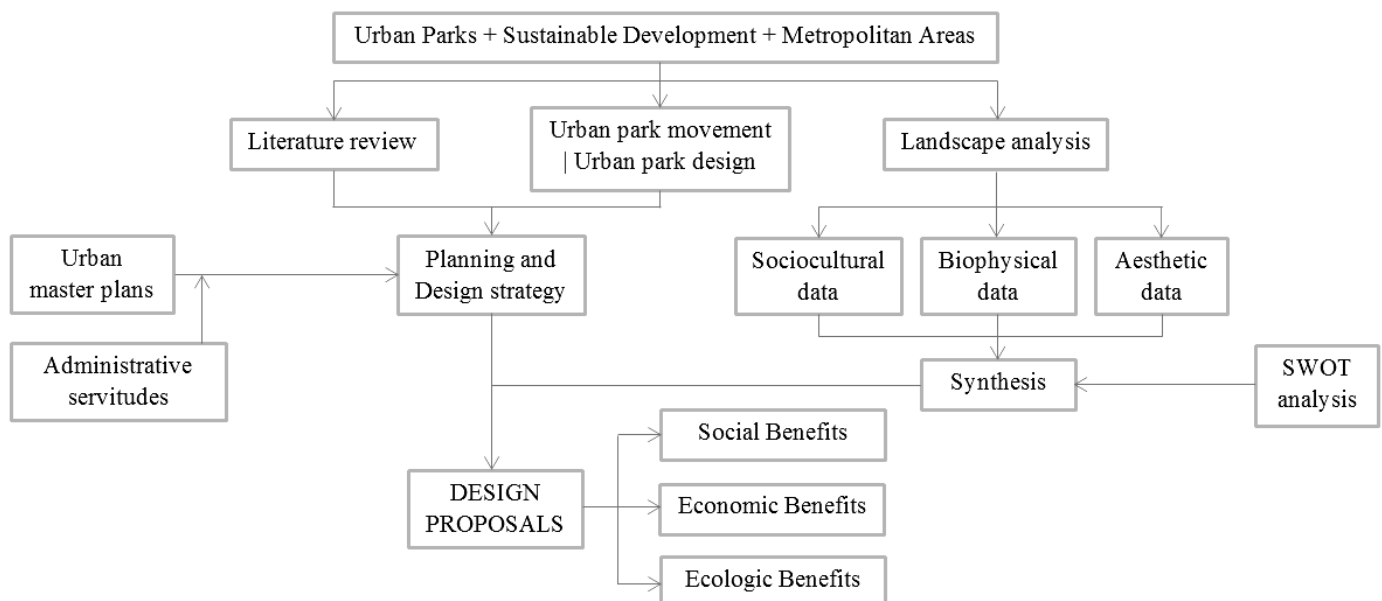


Fig 1 – Methodological framework.

III ANALYZED CASE STUDIES

To specify how different scales are equally important in metropolitan landscapes three case studies will be briefly presented highlighting the main objectives and achievements

of each one (fig 2).

The presentation of projects with different scales and types will reinforce and emphasize the importance of that kind of project in metropolitan areas.

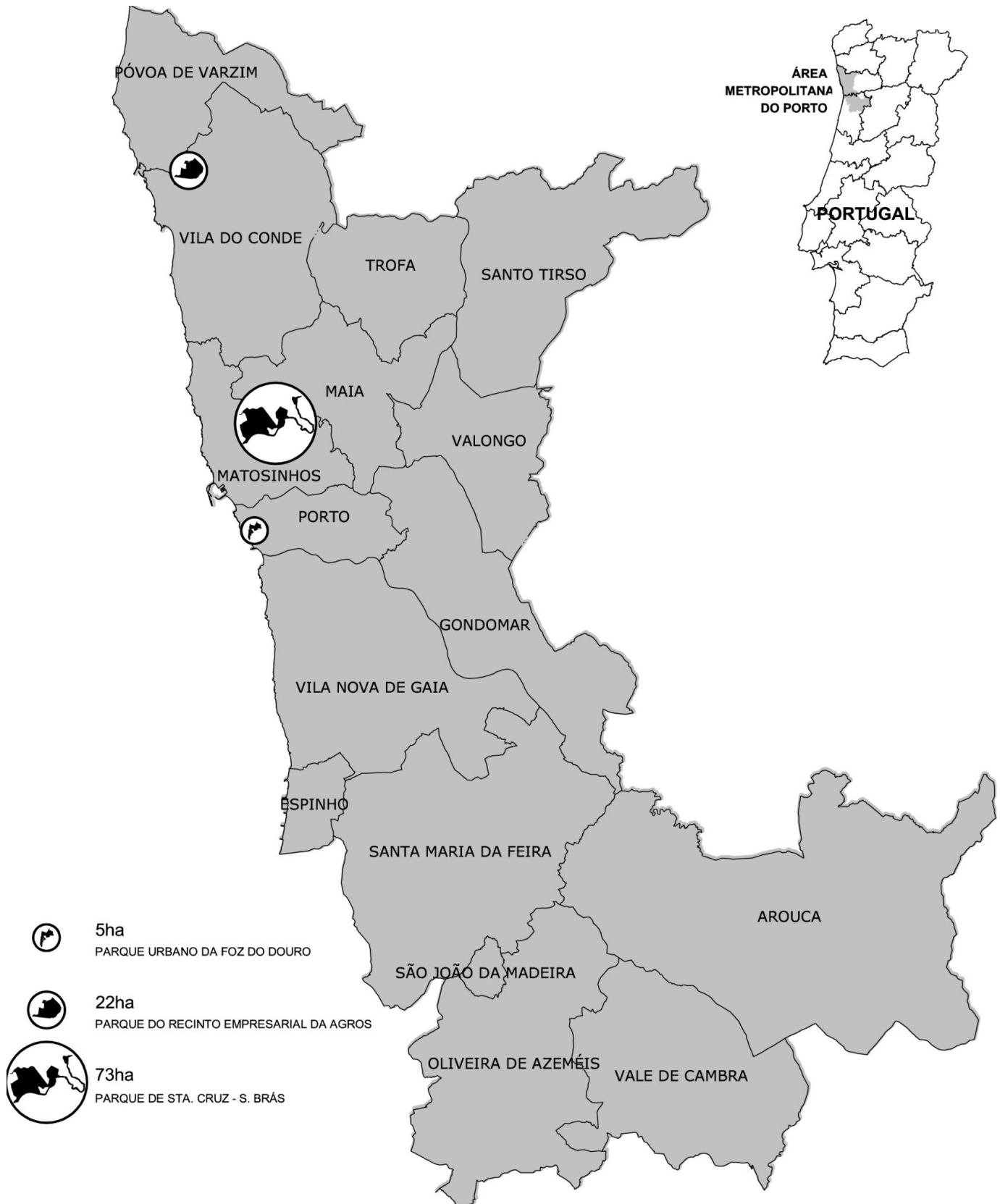


Fig. 2 – Location of the addressed case studies

3.1 - S. Brás Park – Matosinhos

Designer: UTAD and Laura Roldão Costa – Landscape Architecture

Headquarters: Vila Real

Park area: 260ha – developed in three phases

Client: City of Matosinhos

Brief description: Located on a valley this park constitutes a key element of the ecological structure of the Metropolitan Area of Porto. The park incorporates fundamental ecological values and natural resources constituting a structural element to enhance the quality of the urban region. The park area (fig 3) incorporates several assets, infrastructures, urban areas, open spaces, all set in a specific social, economic and environmental structure.

This entity offers ecological balance and biodiversity while preserving fundamental activities such as agriculture, recreation, socialization and safety. Additionally it contributes to frame operation of several metropolitan infrastructures such as highways, metro landfills, etc.

The project that has been structured in three phases: - landfill recovery, considering not only design issues but also ecological and legislation constraints;

- construction details, including the implementation of the Municipal Nursery and wood recovery;

- redevelopment of the agricultural land located along the River margins, considering the transformation of the existing farming, gardening and also the installation of a bike path along the river and several equestrian and pedestrian paths.

Near the river the landscape is dominated by large-scale fields of corn and meadows, marked by natural lines, and subtle and transparent riparian trees. Churches and chapels of the eighteenth century looked at us as vigilant sentinels in the landscape.

This project emphasises the need to develop new strategies in the metropolitan area of Porto to increase the primary sector as part of agriculture in a perspective of ecological preservation to the concept of recreational green corridors.

The Program defined in the project have the intention to recover the forest through natural regeneration strategies and techniques for landscape management, creating different types of forest in the North Atlantic trying to achieve climax communities with specific characteristics of soil, exposure, moisture and maintenance levels (Oak, Pine, Birch, Lips and Cork).

Still the main structural aspect of the project was to preserve the character of the landscape. In this regard landscape design aimed to increase space identity, highlighting the fact that even if landscape character is constantly evolving the introduction of new compatible functions constitutes a crucial aspect in urban park development.

Additionally landscape structure was respected as a crucial element of its sustainability both at environmental, cultural and social level.



Fig 3 – S. Brás Park – Matosinhos - Master Plan

3.2 - Agros Business Park - Vila do Conde

Designer: Laura Roldão Costa – Landscape Architecture - Matosinhos

Park area: 11ha – developed in two phases

Client: AGROS U.C.R.L.

Brief description: this project (fig 4) was developed for the greenspace structure of the AGROS Business Precinct, located in Vila do Conde, in the Porto Metropolitan Area. It was developed in two phases considering the evolution of various

buildings and entrances in the park area.

The main objectives to achieve with this project can be summarized as follows:

- organization of outdoor spaces to maximize the chromatic, volumetric and textural effects;
- use of vegetation as a sculptural element that mark the landscape, maintaining whenever possible the existing vegetation and the existing spatial structure;
- establishment of an area of high scenic value, taking into account the views of and from different buildings;

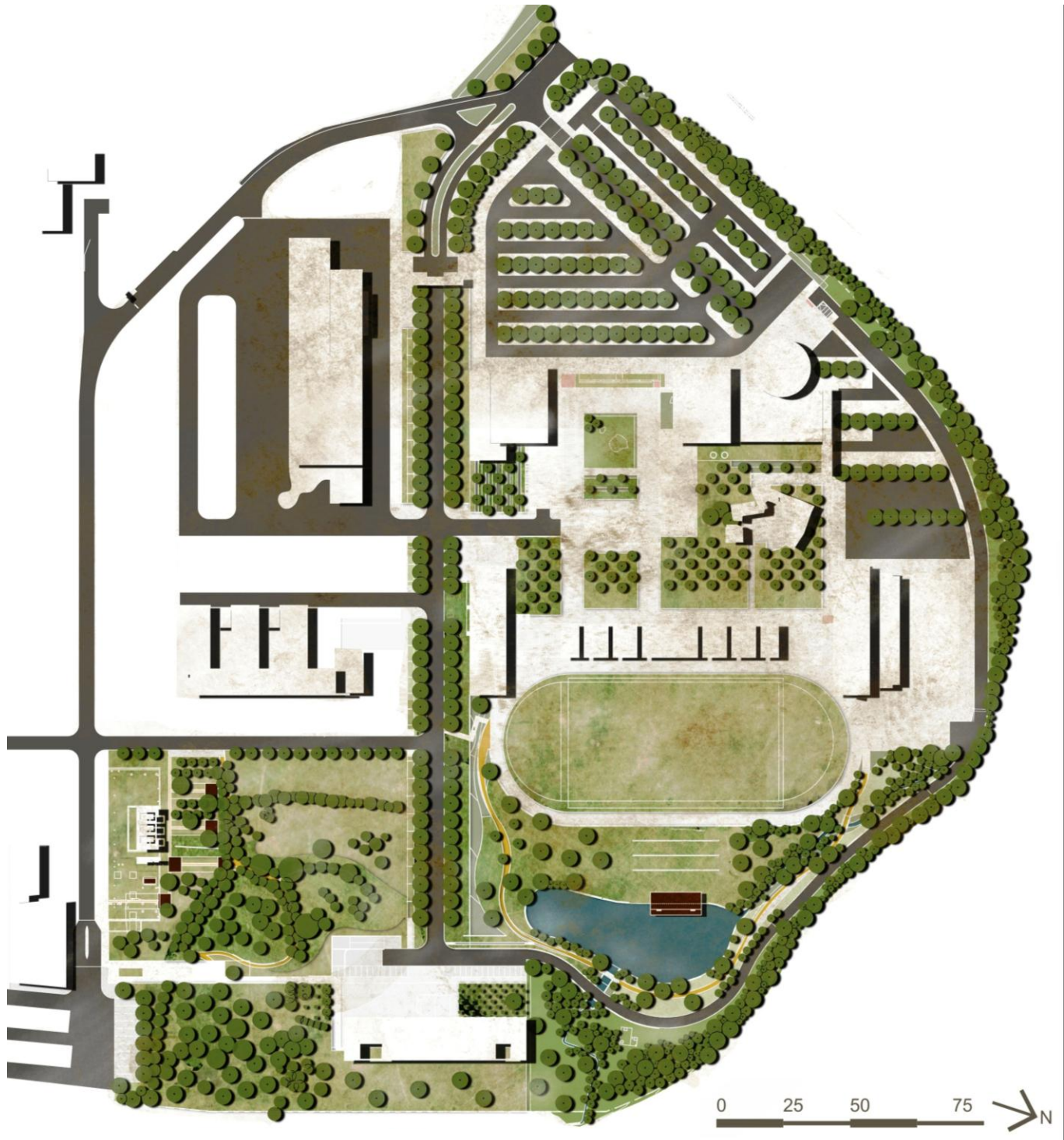


Fig. 4 - Agros Business Park - Vila do Conde – Master Plan

- define private areas devoted to the exhibition of agricultural products; and

- define of a green area that falls within the ecological structure of Vila do Conde and the Porto Metropolitan Area.

On a broader sense it is possible to mention that this project was mainly based on principles of sustainable intervention, promotion of biodiversity and adaptation, while optimizing construction, management and maintenance of green spaces, so that they respond to multiple-uses and needs enabling a greater qualification of the new aesthetic and ecological space and its surroundings.

In this scenario, this project presents a set of sustainable solutions that are easy to maintain and which respond perfectly to its surroundings.

3.3 - Foz do Porto Urban Park - Porto

Designer: Laura Roldão Costa – Landscape Architecture - Matosinhos

Park area: 4.3 ha

Client: City of Porto.

Brief description: located in the city of Porto the envisioned idea for this park (fig 5) results in the first phase of the evaluation of the regional context in which the park is part of the consideration of local conditions and capabilities, the need for visual framing, environmental and ecological amenity of the intervention area and the relationship of this space with its surroundings.

Considering these aspects the main objectives of this project were:

- to establish a high scenic value area, taking into account different views and perspectives of movement and use;
- to use of vegetation as a recovery and implementation element of the park;
- to preserve and enhancement of specific systems and habitats able to create their own identity in the space; and
- to define a green area that falls within the ecological structure of the Porto Metropolitan Area.

The proposed landscape redevelopment was based on landscape preservation and conservation principles applied to key systems that marked the study area, while promoting biodiversity, high suitability (introduction of Forests with adapted and or autochthonous species), and optimizing construction, management and maintenance of the proposed green spaces.

Moreover, the envisioned design increased multifunctionality while fostering environmental, aesthetic and ecological quality of the new space and its surroundings, using connections not only to increase park's attraction but also to strengthen the existing green structure as a crucial element of metropolitan sustainability.



Fig. 5 - Foz do Porto Urban Park - Porto Masterplan

IV CASE STUDY ASSESSMENT | TOWARDS SUSTAINABLE GROWTH AND DEVELOPMENT

The brief description of the addressed case studies, coupled with the numerical analysis of the data related to the different uses implemented on the addressed case studies stressed out not only the importance of the different scales and approaches to urban park development, but also the importance of these spaces to the overall metropolitan sustainability.

As one can see in table 1 and associated graphic, the analyzed parks are not merely green landscapes associated to recreational and leisure activities. More than green areas the envisioned park designs considered goods/food production areas as well as landscape protection and maintenance areas that integrate as it is described below several types of areas.

4.1 - S. Brás Park

Conservation areas include - the whole range of water line associated to the Leça River considering also the area associated to the riparian forest;

Recreation areas include - small gardens surrounding buildings, the Car Bridge and the Science Park, recovered from a former landfill and currently opened to the public as a space for recreation;

Production Systems - All Woods (with the exception of riparian), grasslands / gardens / orchards / and also municipal nurseries.

4.2 - Foz do Porto Urban Park

Conservation areas include - pre-existing forest will be preserved (Pines, oaks and oaks) and forest areas along water lines were totally preserved – these areas include the *Ervilha* River and its flood zone;

Recreation areas include – the whole new area, recovered out of the old landfills and old gardens is now dedicated for active recreation;

Production Systems - There is not a specific area devoted to production systems, though former productive areas were integrated into the design proposal as memory.

4.3 - AGROS Park

Conservation areas include - The Bocage Forest, mixed forests with Oaks, Cork oak, Pine and Maritime pines and also the scattered riparian forests along the water line;

Recreation areas include - All the other areas like the exhibition field, reception area, orchards and framing areas;

Production systems – As it happened for the Foz of Douro

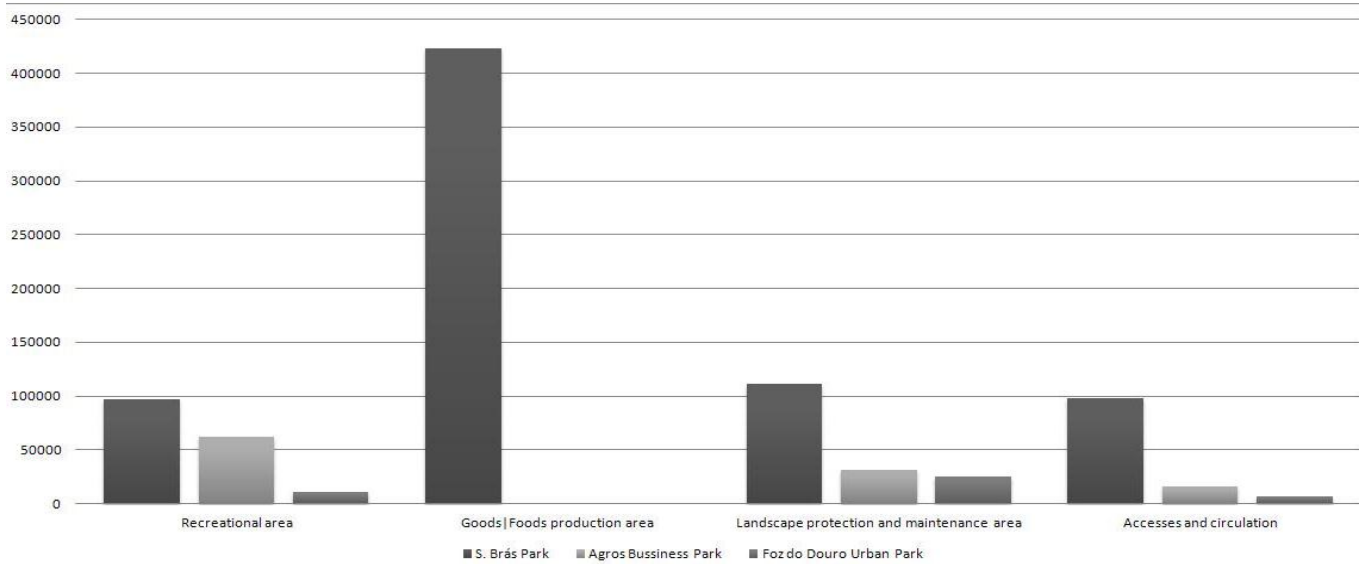
Table 1 – Numerical data collected from the analyzed case studies

	S. BRÁS PARK	AGROS PARK	PARQUE DA FOZ
Recreational area	97 300 sqm	62 450 sqm ³	10 500 sqm
Goods/Food Production area	423 600 sqm	Though there is not a specific area devoted to food production the former production areas were integrated on the conceptual approach.	Though there is not a specific area devoted to food production the former production areas were integrated on the conceptual approach.
Landscape protection and maintenance area	110 800 sqm	31 750 sqm	25 600 sqm
Accesses and circulation	98 300 sqm ¹	15 800 sqm	6 900 sqm ²
	73 ha	11 ha	4,3 ha

¹ including bike paths and equestrian circuits

² including bike paths

³ almost 50% of this area is multifunctional fulfilling at the same time recreational functions and/or circulation/ parking areas.



Park there is not a specific area devoted to production systems, though former productive areas were integrated into the design proposal as memory.

This analysis highlights that park design constitutes an important resource in urban redevelopment, adding a new dimension to the competitiveness of cities and regions, as it is evident by the analysis of table 1 regarding the benefits that the assessed urban parks brought for the urban/metropolitan landscape.

Considering the aforementioned benefits it becomes apparent that new redevelopment efforts, in previously developed urban areas, should consider the design of new multifunctional and sustainable green spaces able to fulfill different functions and objectives regarding ecological, economic, cultural, historical and aesthetical concerns as the ones summarized in table 2.

Still, even if every landscape has the potential to be sustainable, to different extents, the performed analysis showed that sustainability may not be overlooked in the interests of promoting one function and subordinating all others.

Only by attributing equal importance to different functions it is possible to implement planning and organizing principles that goes beyond the common needs of the entire society, helping to focus priorities, guide policies, and to develop and implement positive long-term programs that mobilize government, business, institutions and citizens.

However, in order to maximize the benefits introduced by the creation of new urban parks, more than merely “greening” interventions, parks should provide other benefits and opportunities on an integrated manner, such as environmental, cultural, economic and leisure and recreation activities.

In this regard, designers need to understand that urban park design should consider not only the interactions between landscape dimensions (social, economic and ecological), but also the ways in which they influence each other, considering both the aforementioned issues and the fact that landscapes are highly dynamic and multifunctional.

V FINAL CONSIDERATIONS

Often characterized merely as the coexistence of biophysical and human systems, the meaning of sustainable landscapes spans far beyond this idea. Sustainable landscapes are much more than landscapes composed by the juxtaposition of different uses and functions, they are the result of the coexistence, interaction and connection of different dimensions such as ecology, economics, culture, history and aesthetics.

By the analysis of the presented case studies it is possible to conclude that urban park design should take into account ecological principles but also people’s needs for green space and recreation. The analyzed Parks and green spaces encourage a broad range of recreational, leisure and public uses that utilize the available facilities and infrastructure and add to the unique qualities of each park for visitors, workers and residents. Cultural, educational and environmentally orientated uses were also envisaged. The envisioned approach to sustainability used in the analyzed projects aimed to balance economic, environmental and social factors in order to ensure resource conservation and protection of the environment now and for future generations. Both parks will serve the diverse interests of different users in a balanced system that includes places for physical activity to improve health, active recreation, passive recreation, and wilderness areas.

Environmental values like clean air, water, and soil, and habitat protection, were also promoted, not only in species selection and management measures, but also in the use of sustainable design construction techniques and strategies. The role of urban parks as provider of social services and their importance for city sustainability has been addressed.

Finally, the analysis of the application of different “sustainable” design solutions on the assessed case studies suggests that “no size fits all”: a variety of problems face different landscapes in diverse ways. It is only fitting then, that the most meaningful solutions for particular landscapes, towns and cities are achieved through a range of plans, methods and technologies. These issues, increasingly relevant to metropolitan landscape redevelopment might, serve as a core idea for holistic theory of landscape conception [and redevelopment] that should be the basis for urban park design.

Table 2 - Benefits of urban parks and other green areas

	ENVIRONMENTAL	ECONOMIC	SOCIAL
FUNCTION	- Produce oxygen	- Highlight historic (heritage) information	- Provide space for leisure and recreation
	- Promote water quality - filtration	- Scientific and educational information	- Space for food production
	- Food and fiber production	- Fuel and energy production	- Enhance social inclusion
	- Protect and purify soil and water	- Space for agriculture	- Highlight aesthetic beauty
	- Storage and recycling of organic matter	- Increase land value	- Promote people physical and mental health
	- Decomposition of human waste	- Increase property value	- Strengthens the sense of community
	- Regulation of local climate	- Economic vitality, small business	- Provide space for leisure and recreation
	- Promotion of biodiversity		
	- Enhances the ecological structure		
	- Reduce noise		

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