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Benefits of Greenery in Contemporary City

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Abstract. Greenery has always played an important role in the construction of cities. The need for green spaces has been present at city level since ancient times. However, the description of the evolutionary process of form and function of urban green spaces as it has developed from antiquity depends greatly upon the different roles played by these places throughout history. Nowadays, given that the main part of the world population is living in cities, it can be said that greenery has a strategic importance in the contemporary urban fabric. Therefore, urban design solutions should always consider both buildings and vegetation as being defining city's elements. However, the city is currently dominated by building structures which are detrimental to green spaces, causing problems of congestion and pollution. The most recent and compulsory Portuguese urban rehabilitation principles emphasize the improvement of sustainability. It is, therefore, critical to draw attention to this area and find innovative solutions in this domain, especially with regards the integration of vegetation in historical areas. In this sense, this research aims to present an approach about the importance of greenery in cities, referring some examples of green spaces as landmarks in the urban historiography. It is also focused on the benefits of green spaces in dense urban areas and their contribution for the sustainability of the cities.

1. Introduction

There are several types of green spaces in the contemporary city and all of them have their own role in the urban context. These different types of greenery are designed in different urban scales with several functions in the city. Green spaces elements (i.e., trees, small gardens, green parks or green surfaces on buildings) are all identifiable components in the city structure, making part of the composition of the urban fabric, contributing to the organization and definition of spaces. In this sense, it can be said that the priority given to green spaces has not changed much in city's policy. The provision and the localization of green spaces have particular importance in the configuration of the city due to their influence in the quality of life of citizens in many ways. The integration of plants affects positively the urban environment, because vegetation is a climate moderator, helping to reduce the imperviousness of soil and contributing to storm water management, improving the air quality through the production of oxygen, absorption of pollution like CO₂ and heavy metals, and trapping dust particles.

On the one hand, green spaces can have a positive effect on urban environmental conditions and consequently in the health of citizens. When applied in a significant scale they can be beneficial to the thermal comfort of cities, providing shade, promoting the evapotranspiration, inducing a cooling effect and contributing to the mitigation of urban heat island effect. On the other hand, they have a social and emotional importance in the citizen's quality of life and well-being. In fact, the presence of nature in



cities encourages the use of outdoor spaces, increasing the interaction and social integration among citizens. Given that the main part of the world population is living in cities, it can be said that the green spaces have a strategic importance in the task of rethinking contemporary urbanity.

2. Importance of greenery in the cities

2.1. Green spaces as landmarks in the urban history

Vegetation was always present in the construction of cities and in some cases, green spaces were landmarks in the urban history. Greenery has been used for many centuries in urban context and integrated with buildings. One of the most famous example is the Hanging Garden of Babylon ordered by Nebuchadnezzar in the 7th and 8th centuries B.C. This garden was characterized by terrace construction with trees of many species of fruits on the top of small hills, with waterfalls and irrigation systems maintained by slave labour. It was built as part of the ornamental roof used by the ancient civilizations of the Tigris and Euphrates river valleys in Mesopotamia [1], creating the perception of being suspended, being visible from a vast distance from the palace walls.

In the ancient Greek and Roman empires, plants such as olive trees and grapevines were cultivated purposely so as to climb buildings walls [2].

With the dawning of industrial city and a new concept of spatial planning practise, green spaces (including parks, gardens, tree-lined avenues or curtains of trees) began to be used as landmarks in urban context, as parts of the city make-up and of urban design proposals. A notable example is the model of the garden city proposed by Ebenezer Howard at the end of the 19th century. The British cities of Letchworth (1904), Hampstead (1906) and Welwyn (1921) were the first garden cities built on the outskirts of London. They were part of an idea of spatial planning emerging at the time in the United Kingdom, which had the aim of integration cities and green elements. Thus, green elements started to be used in order to define the design of public spaces by ample parks and gardens, wide avenues as a type of boulevard or in addition to private plots of dwellings. A dense curtain of trees separating the industrial zone from the urban fabric, was essential to guarantee the city's autonomy and productivity.

Such as in other countries which were not in the first line of the spatial planning innovations in the late 19th century, in Portugal, there are no real examples of garden cities. However, there are planned garden suburbs, especially in the decades from 1940 to 1960, built during an urban expansion process as new residential areas with large green spaces and a wide range of public facilities.

2.2. Urban density and sustainability

As part of a process of increasing urban density, cities began to unveil a new organizational model based on expansion and dispersion of even more distant suburbs. This process, based on the accessibility of the population, moving every day from residence to workplace, the commuters, required efficient network infrastructures and transport systems. Thus, urban expansion resulted in increasing levels of air and noise pollution, energy consumption, lack of amenities, unhealthy housing, high maintenance costs of infrastructures or absence of green spaces. In recent years, the containment of cities has been called for instead of their expansion. The authors indicate the urgency to create cross-functional policies in order to support the concentration of activities, discouraging the extension of infrastructure, which would reduce the need for mobility and transport, and consequently resize urban perimeters [3]. That's why is vital to redefine green areas to turn them into being more liveable and sustainable [4].

Nowadays, urban areas occupy around 3 per cent of the earth's entire land. At the same time, the growth of urban population is a universal tendency in modern societies. For the first time in history, half of the world's population is living urban spaces, which "is expected to be 69 per cent urban in 2050" [5]. In this scenario, urban sustainability as a concept has been discussed intensively since the 1990s. In addition to traditional environmental dimension there are also the economic and the cultural dimensions to consider. On the environmental side, urban sustainability requires that the rate of consumption of renewable resources (including water and energy) does not exceed the replacement

rate, and that the consumption of non-renewable resources does not exceed the capacity to develop renewable resources. Thus, current levels of consumption in industrialized countries will not be achieved without the destruction of natural capital [6], including green areas.

In contemporary city, due to urban non-sustainability, it has become clear that there are serious ecological problems. Factors such as pollution (water, air, noise, soils or aesthetic), congestion or waste destination, have called into question the meaning of the interaction of the urban spaces with nature. In cities currently dominated by building structures to the detriment of natural elements, green spaces should be present alongside one of their fundamental elements. Not only because they improve the city's image, from an aesthetic point of view, but also due to social, cultural or landscape factors. They are official moderators of the climate, helping to reduce imperviousness of soil, producing oxygen, absorbing pollution, and operating as acoustic curtains. Greenery (i.e. trees, gardens or green parks) is an identifiable component in urban structure, making part of its composition, organizing, defining and containing spaces [7].

3. Sustainable urban rehabilitation in the spatial planning system framework

Currently in countries with a weak economy such as Portugal, there are many reasons which justify the need for improving urban rehabilitation actions instead of keep building new urban developments. Spatial planning policies of the last thirty years have been based on urban expansion leading to a situation where the urban spaces of villages, towns or cities are three times bigger than the needed (considering the housing, facilities or industrial activities). This fact results in waste of infrastructures, discontinuity of the urban fabric and creation of urban voids, with lots of empty dwellings. Therefore, the only way forward now, in terms of urban planning policies and strategies, is to promote the urban continuity and to preserve the historical parts of cities, focused on the urban rehabilitation.

Recently, emerged new planning strategies, designed to encourage a praxis that incentives urban rehabilitation. There are unequivocally signs of policies for cities which are aimed at the rehabilitation of consolidated urban areas and cultural heritage. Consequently, urban rehabilitation has begun to be integrated into spatial planning framework, as its task, with the creation of new figures of detailed local plans (the urban rehabilitation plan and the heritage safeguarding plan). At the same time in the Portuguese planning system, sustainability (in financial, sociocultural and environmental terms) is being defined as one of the principles of urban rehabilitation (see Fig. 1).

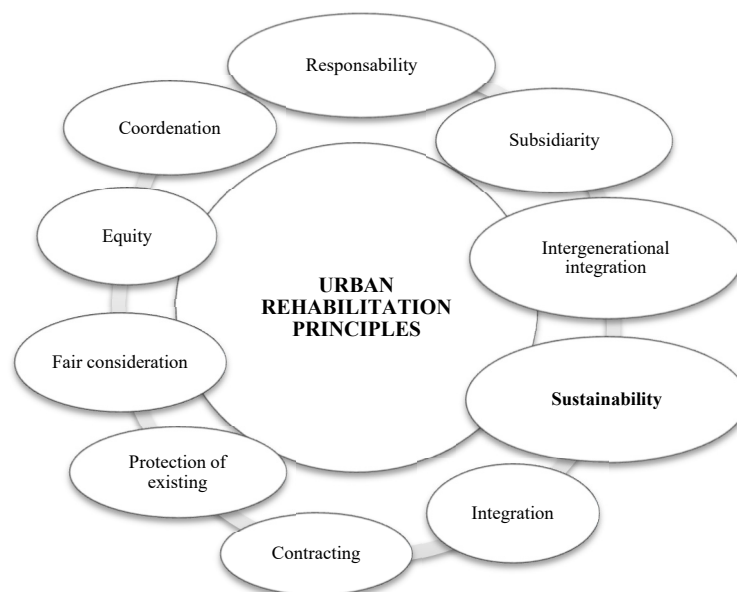


Figure 1. Urban Rehabilitation Principles

The spatial planning system framework defines ten principles in order to achieve the sustainability in cities throughout urban rehabilitation actions, which are the following: responsibility (of political authorities and buildings owners to promote urban rehabilitation), subsidiarity (which means that urban rehabilitation must be promoted by the most proper level of public administration), intergenerational integration (refers to the diffusion of the cities' legacy to next generations), sustainability (in economical, sociocultural and environmental terms), integration (of urban rehabilitation actions in the urban planning framework), contracting (means that public realm should contract with privates in order to promote urban rehabilitation), protection of existing (the heritage legacy), fair consideration and equity (in between landowners and promoters of urban rehabilitation), and coordination (among stakeholders).

4. Green surfaces benefits in contemporary city

Green surfaces in the urban context can be considered a new field in many worlds such as in the domain of ecology, horticulture or buildings. In the sphere of urban design, their applications are still surprising and unexpected concepts, not only because of the result is the chance of having the presence of green elements in the city centres, but there are also several benefits (socioeconomic, cultural, aesthetic and environmental) associated with the public and private realms of urban context. There are justifiable reasons for the non-priority of greenery or so-called 'ecological' matters in cities, nevertheless, there are non-deniable advantages and benefits coming from their presence in urban spaces.

In terms of socioeconomic aspects, greening the buildings can contribute to the improvement of property value [8], not only of rehabilitated buildings, but also of streets and neighbourhood in which they are integrated. While improving the quality of human experience in packed areas [9] green walls have the ability to become a landmark, which contributes to clarify the city's order, helping to state clearly and visually that a place is significant [10].

Given that vegetation is recognized for its therapeutic effects, human comfort is usually associated with sensory aspects. In this sense, the green walls contribute to urban amenities, evoking symbolic values and aesthetic emotion of having natural landscapes in the humanized contexts. Consequently, the urban experience becomes more stimulating for citizens in the presence of greenery, such as in the example of using green walls to rethink old industrial areas, contributing to hiding ugly or boring surfaces and to enhance existing features [1], improving their visual value. More than just a green vertical element covered with plants, is possible to have living surfaces, which can change in colour, variety, shape or image depending on the season. However, the selection of species of plants should be made not only based on visual features, but also in functional aspects such as variations in hardiness, size, vigour or growth habit which are criteria to be appreciated in the vegetable elements of green walls. The presence of growing plants in the city, not only contributes to its aesthetic performance but also to the local environment, promoting the biodiversity (in terms of flora and fauna), allowing the presence of several species of plants, birds, bees and other beneficial insects [11]. Since the 1980s many studies have been addressing the urgency of greenery related to the benefits for buildings and urban environments, in which recent approaches of living walls and green facades have emerged. Most of these studies are focused on energy efficiency, thermal and acoustic insulation of buildings, reduction of greenhouse gases and dust in the atmosphere. The promotion of energy efficiency by green walls is related to the protection of the external surface of buildings from the sun's radiation and the consequent temperature reduction [12]. The use of "evergreens on the side facing away from the sun and deciduous climbers on the sunny side" [1] will shade the building wall in the summer, allowing solar heating to warm the external surfaces and solar radiation to enter through windows in the winter. Finally, plants contribute to the reduction of noise levels from the exterior to the interior of buildings, which depends on the depth of growing substrates, the materials and the overall coverage [4]. The urban air quality can be improved by the filtering effect of green walls, because plants have the ability to absorb CO₂, heavy metals [13], and dust particles circulating in the air [14].

5. Conclusions

Some mentioned studies indicated that green spaces have a crucial role in the promotion of a qualified urban image and a confident perception of the urban space by citizens, justified by the visual interest that plants provide, hiding aesthetically uninteresting surfaces and valuing the property.

Greenery is a promoter of a positive environment at the city scale, provided by extensive spaces invoking the presence of the nature on a built context. It can be used in urban rehabilitation actions as being an icon of modernity in a competitive city, which typifies the contemporary society. In this sense, there is still ahead a long way for public authorities and private urban developers, which are dealing with spatial planning instruments, to use innovative strategies, while creating policies, territorial strategies and urban design projects, in order to bring nature to urban fabric by using green surfaces.

References

- [1] N. Dunnett, N. Kingsbury, N., *Planting Green Roofs and Living Walls*, revised and updated edition, (1st ed., 2008), Timber Press, Portland, London, 2010.
- [2] J. Newton, D. Gedge, P. Early, S. Wilson, *Building Greener: Guidance on the Use of Green Roofs, Green Walls and Complementary Features on Buildings*, CIRIA, London, 2007.
- [3] R. Rogers, P. Gumuchdjan, *Cities for a Small Planet*, Farber and Farber Limited, London, 1997.
- [4] AA.VV. (2008). *Urban landscapes sostenibilidad*. Barcelona: Equipo editorial Monsa.
- [5] AA.VV. (2010) United Nations, Department of Economic and Social Affairs, Population Division. *World Urbanization Prospects: The 2009 Revision, Highlights*. New York : United Nations, March 2010.
- [6] AA.VV. (1994). *Charter of European Cities & Towns Towards Sustainability*, Aalborg, Denmark, 27 May 1994.
- [7] J. Lamas, *Urban Morphology and Design of the City* (in portuguese: *Morfologia Urbana e Desenho da Cidade*), Fundação Calouste Gulbenkian / *Junta Nacional de Investigação Científica e Tecnológica*, Lisboa, 2003.
- [8] K. Ichihara, J.P. Cohen, The New York City property values: what is the impact of green roofs on rental pricing? *Letters in Spatial and Resource Sciences*. 4 (2011) 21-30.
- [9] AA.VV., *Introduction to Green Walls Technology, Benefits & Design*, Green Roofs for Healthy Cities, 2008.
- [10] J. Jacobs, *The Death and Life of Great American Cities*, Random House, New York, 1961.
- [11] S.K. Weiler, K. Scholz-Barth, *Green Roof Systems - A Guide to the Planning, Design, and Construction of Landscapes over Structure*, John Wiley and Sons, New Jersey, 2009.
- [12] N.H. Wong, A.Y.K. Tan, Y. Chen, K. Chiang, K. Sekar, P.Y. Tan, D. Chan, N.C. Wong, Thermal evaluation of vertical greenery systems for building walls, *Building and Environment*. 45:3 (2010) 663-672
- [13] M. Bruse, M. Thönnessen, U. Radke, Practical and theoretical investigation of the influence of facade greening on the distribution of heavy metals in urban streets, in: <http://www.envi-met.com/documents/papers/facade1999.pdf>, 2009.
- [14] M. Köhler, Green facades - a view back and some visions, *Urban Ecosyst*. 11:423 (2008).