

## **Resiliência Climática: alternativas sustentáveis nos projetos de cidades compactas.**

### *Climate Resilience: sustainable alternatives in the design of compact cities*

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#### **Resumo**

As cidades contemporâneas encontram-se cada vez mais populosas e demandam alto nível de recursos naturais, com uma realidade urbana espraiada e desafios climáticos a serem enfrentados nas próximas décadas. Cabe ao planejamento urbano entender os novos desafios e propor estratégias para cidades mais dinâmicas, inovadoras e resilientes. Para tanto, o presente artigo analisa exemplos de projetos que apresentam diretrizes de resiliência climática em diferentes escalas a fim de encontrar relações importantes para o desenvolvimento urbano. Utilizando-se de conceitos de desenho urbano propostos por Donald Watson (2017), identificaram-se projetos com padrões sustentáveis similares aos princípios levantados pelo autor empregando temas como: paisagem, resiliência climática, cidade compacta, adensamento urbano e acupuntura urbana. Utilizou-se o método qualitativo, sistematicamente elencando projetos exemplares para análise e discussões com base nos princípios levantados. Os resultados deste trabalho evidenciam a importância da utilização inteligente dos recursos naturais, da ressignificação dos espaços urbanos e da sociabilidade criada em áreas densas de qualidade.

**Palavras-chave:** Resiliência climática; sustentabilidade; cidades compactas.

#### **Abstract**

*Contemporary cities are increasingly populated and demand a high level of natural resources, with a sprawling urban reality and climate challenges to be faced in the next decades. It is up to urban planning to understand the new challenges and propose strategies for more dynamic, innovative and resilient cities. Therefore, this article analyzes examples of projects that present climate resilience guidelines at different scales in order to find important relationships for urban development. Using the concepts of urban design proposed by Donald Watson (2017), projects with sustainable patterns similar to the principles raised by the author were identified, using themes such as: landscape, climate resilience, compact city, urban density and urban acupuncture.*

*The qualitative method was used, systematically listing exemplary projects for analysis and discussions based on the principles raised. The results of this work show the importance of the intelligent use of natural resources, the redefinition of urban spaces and the sociability created in dense, quality areas.*

**Keywords:** *Climate resilience; sustainability; compact cities.*

## 1. Introduction

This article is the result of an exercise applied in the subject Environmental Planning, promoted by the Graduate Program in Architecture and Urbanism at UEM/UEL (PPU). It proposes to analyze real cases considered as being good examples of projects that used the principles of landscape, environment, and sustainability discussed in the course. This exercise brings important points for urban planning to provide improvements in environmental systems, provide the relationship between the population and its nature, as well as encourage the debate on ecology for urban managers.

Donald Watson (2017) points out proposals for urban planning and projects to respond to climate phenomenon, increased density, the alteration of the natural landscape, the formation of heat islands and air pollution. Its principles must be achieved by guidelines and strategies implemented in sustainable projects, incorporated in the different scales: regional, urban and local. In order to offer harmony in environmental systems and to guarantee the population's security against climate change, new principles must be applied to urban design in the 21st century.

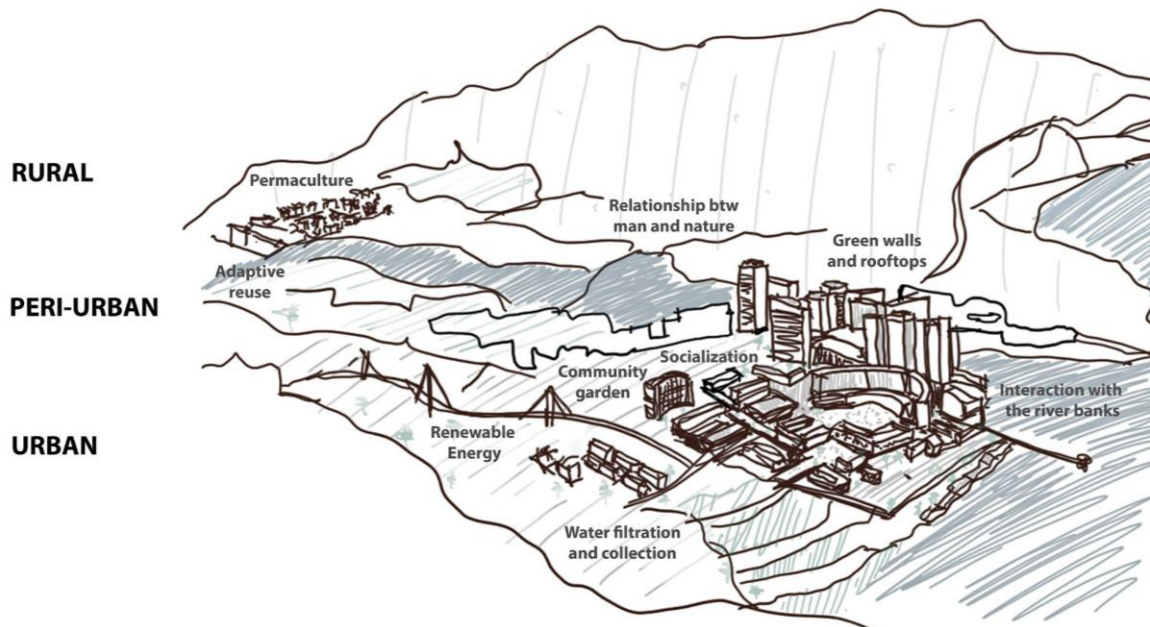
As Watson (2017) only presents guidelines and strategies in his article, through the interpretation of his urban design principles, selected examples with sustainable design solutions that present similar proposals to those mentioned by the author. In front of this, six examples classified in macro, medium, and micro scale were chosen, giving relevance to trans-scale and evidencing their applicability in different territorial contexts.

The structuring of the article follows in order, first, with the explanation of Donald Watson's urban design theory and principles, in order to identify how cities can reverse climate change and achieve sustainability. With this approach, it is possible to verify how the author's urban design principles can be implemented at different scales. In this way, the most comprehensive themes such as landscape and climate resilience were listed, directing them to the scenario proposed in this article: compact cities, dense areas, and urban acupuncture. In a second moment, a fact sheet of the six examples are presented, justifying the choice through a summary table relating the proposed objectives. And finally, a critical point of view about the conceptual relations among the examples is presented.

## 2. Literature Review

Considering the forms in which cities are structured, with the overload of production and consumption systems seeking quick solutions and high flow of exchanges, the actions of the pursuit of accelerated development reflect on the environment and change the territories, climate and landscape (SACCARO JÚNIOR; COELHO, 2016; MAGAGNIN, CONSTANTINO, BENINI, 2018). To change this scenario, Watson (2017) recognizes that quick solutions must be modified by sustainable projects to decrease carbon emissions, achieve climate resilience and urban sustainability. The author proposes guidelines and strategies in order to improve the quality of systems (water, energy, waste, vegetation, soil, etc.) and promote opportunities (adaptive reuse, community and sociability services, etc.) for cities to operate with lower energy and carbon emission standards. Also according to the author, the trans-scale nature of these principles is realized in different contexts, being: rural, medium mixed use, and high density (figure 01). In the end, the urban design

principles must be complemented by other sustainable actions to provide climate resilience to the different characteristics of each region.



**Figure 1: Diagram of the proposed guidelines at regional, urban, and local scales.**

**Source: Watson (2017), edited by the authors.**

The image presented by Watson (2017) synthesizes the strategies presented by the authors in different forms of occupation, from rural to urban landscape transition, in a city bathed by a river. It highlights the importance of the relationship between human action and nature in the built space, emphasizing the Peri-urban - transitional space, where low-density urban occupation and rural-related activities coexist. Strategies are related to these different areas. Permaculture and adaptive reuse are related to rural areas; water filtration and collection and the use of renewable energy to the peri-urban region; and the creation of community gardens, socializing spaces, and areas for interaction and integration with the river waters, as well as the construction of green walls and roofs, to the urban area.

The landscape shows itself in different forms of occupation, being transformed over time, and the balance of urban and rural are essential for man to move together with nature (MCHARG, 1696; MACEDO, 1993). Thus, through the understanding of free spaces, the object of landscape context, and the understanding of the character of the place, it is possible to enhance and preserve it (AKAMINE et al, 2009; MAGAGNIN, CONSTANTINO, BENINI, 2018). Another issue is the search for urban resilience regarding climate change. Climate resilience is the capacity that a city has to face internal and external vulnerabilities, as well as to resist future climate change through adaptive solutions that reduce carbon emissions (SACCARO JÚNIOR; COELHO, 2016; WATSON, 2017). Therefore, for resilience to guarantee mitigation to climate change, it must be achieved through projects at different scales, such as regional, urban, and local (WATSON, 2017).

Another important concept for the study is the concept of compact cities, as it is of critical importance to educate the next generations of urban planners to rethink the design of cities

(WATSON, 2017). Compacting the city means avoiding sprawl and reducing distances, in this way using fewer resources and creating fewer deployment impacts. Density is an urban aspect that should be well treated together with sprawl, because, combined with good sustainability concepts, it can result in good sustainable solutions for cities.

Good models of compact cities are those that generate connectivities in the urban network, bringing out cultural aspects, with their morphology well established in order to create interesting dynamics in the space; also their access points intend to improve mobility, with a road layout that favors green spaces and walkability. In other words, compact cities propose quality densities, because there is no point in compacting spaces without seeking well-being and a sense of community (LEHMANN, 2017). Quality public spaces should be prioritized in order to produce intelligent compactness. An important aspect discussed in research (BAY; LEHMANN, 2017) is the concept of "Eco technology", which links to the concept of compact cities, being about buildings supporting energy production and water capture, in other words, exploring as much as possible the built environment to capture available resources and explore the potentiality of urban space (ANDA, 2017).

The urban densities are an objective and measurable urbanistic parameter, however, to subjective and cultural aspects, not limited to the merely statistical aspect (ACIOLY JR & DAVIDSON, 1992), and its study is expected to understand that part of the problem is the correlation between density and built form (META BERGHAUSER PONT & PER HAUPT, 2009). In this sense, it is concluded that "it is no longer known where the countryside is, where the city is" (GOULART REIS, 2006, p.79), being decentralization and urban dispersion phenomenon that result from the process of stretching the urban network, in other words, the lack of continuity caused by the punctua densification, in small urbanized areas. One of the main challenges for urban and environmental planning in the 21st century, non-planned densification must be opposed to the promotion of increased density, a strategy not only to regulate land use planning, but also to reduce carbon emissions (BAY; LEHMANN, 2017). In order to face these challenges for urban and environmental planning, it is important to mention urban acupuncture, a theory initially developed by Manuel Solà-Morales and later popularized by Jaime Lerner, which proposes a strategic and punctual urban intervention, on a small scale, that causes expected impacts on the urban network, similar to the millennial Chinese technique (YIMENG, 2015). To be effective in the intervention, in the search for urbanity, Solà-Morales recommends paying attention to the reality and the urban context, understanding what is a priority and rearrange these elements in order to redesign the city: "It is necessary to make the city react (...) It is necessary to interfere to redevelop" (LERNER, 2011).

### 3. Methodology

The method of the work is qualitative, the kind that collects examples for analysis and discussion, divided into steps that range from a theoretical foundation to a critical evaluation of the selected examples:

1. Reading and summarizing Donald Watson's article: The article supported the analysis of the examples, as it provides a framework for analysis from the perspective of urban resilience and compact cities, making the choice and reading of the aspects of the examples well-based.



2. Interpretation of the scales: Micro, medium, and macro: The examples will be divided into dimensions in order to be able to analyze sustainable practices and actions at different scales;
3. Using the guidelines to select and interpreting the examples: Watson's article brings guidelines that a resilient city can apply in its space, be it urban, peri-urban or rural. Such guidelines are also pointed out in the chosen examples, thus providing a direction for the analysis and relationship of the examples;
4. Group choice of six examples: With the reading done, and the guidelines established, it was selected six examples within the scales already mentioned, always seeking projects with aspects of climate resilience and sustainability, compatible with the principles of the compact city;
5. Interpretation of six examples;
6. Summary table of analysis and relationship between examples;
7. Analysis and discussions of differences and disparities between the aspects found.

#### 4. Analysis and Discussion

With Donald Watson's (2017) didactics, urban design principles in the pursuit of resilient cities are effective when they are implanted at different scales, such as space, urban, peri-urban or rural (figure 1). Therefore, the following examples are part of a selection of projects intended to ensure compact, sustainable, and resilient cities, and two projects were chosen for each type of scale, in increasing order, micro-, medium-, and macro-scale.

**Roof cover of the Ronda de Dalt**, the first microscale example presented in the analysis, is a project that is part of a plan to improve and humanize residential and non-residential neighborhoods of Barcelona, having UTE *Batlleiroig* as the company responsible. The goal of this project was to create a connection between areas through a linear cover, promoting sociability in a space with vegetation, that is, the space brings a treatment of the human scale in a sustainable way, with energy capture, community garden, spaces for socializing and recreation areas, in order to boost the urban design already established in the area.

**The Lowline** was the world's first underground public park project, established in the space that once housed the Williamsburg Bridge streetcar terminal in New York City. The terminal operated from 1909 until 1949, and then remained empty until the 2000s with the project proposal. The park's activities began in 2015, hosting cultural and community events and programs; however, services were closed in 2018 due to lack of resources for its maintenance.







The **Chicago Riverwalk** project is a 2016 project with medium-scale dimensions, with Sasaki Projects as the author. The project takes the Chicago River, which is a natural resource of the city, and transforms it into a recreation spot, divided into several sections, inviting users to interact and care for the water, humanizing boarding areas and promoting tourism and local mobility. It is also important to highlight the educational character of the project, where the community is involved in the dynamics of the city's watercourse to learn in a practical and participatory way about ecology and sustainability.







**The Brooklyn Navy Yard** can be classified as an urban farm, which is agriculture conducted within urban boundaries (MOREIRA, 2020). The company responsible operates the largest urban farms on rooftops in the world, and the example is classified as the second largest farm ever established. The project was founded in 2010, and to this day promotes community and school actions, besides the free distribution of food to the needy population. In this way, its activities help to overcome climate impacts by transforming empty areas into green spaces, and ensure food security through horticulture.

**The Articulated Life Units** are a set of projects that propose to solve urban disarticulation, violence, and local insecurity through the renovation of underutilized spaces, promoting the integration of communities and public spaces and equipment in places lacking it, making use of the areas where water tanks were originally located. Fourteen spaces were renovated, located in the poorest neighborhoods of Medellín, located in the steepest regions of the city (MOSTAFAVI, M., et al. 2019).

The **Mapocho River 42K Project** consists in the recovery of 42 km of the Mapocho River banks in Santiago, Chile, carried out in 2009, shaping a green corridor on a metropolitan scale in order to promote quality of life and equality. The project came from the Department of Architecture at the Pontificia Universidad Católica de Chile (IBID) and aimed to integrate active mobility with social integration and socio-environmental balance.

The selection of the projects is justified through a summary table highlighting the characteristics of choice. The table presents authors, location, year of implementation and completion of the projects, and the relationship of the project with the strategies and guidelines proposed by Watson (2017). And finally, the projects were classified regarding their dimensions and functionalities to achieve climate resilience at different scales.

	(a)	(b)	(c)	(d)	(e)	(f)
						
<b>Project name</b>	Dalt's Round Coverage	Lowline	Chicago Riverwalk	Brooklyn, Navy Yard	Articulated Life Units	Mapocho 42K
<b>Author</b>	UTE Batlleiroig	Raad Studio	Sasaki projects	Brooklyn Grange	PCM (Public Companies of Medellín)	Faculty of Architecture at PUC - Chile
<b>Localization</b>	Horta-Guinardó District, Barcelona	New York, USA	Chicago, Depart. of transportation	New York, USA	Medellín, Colombia	Santiago, Chile
<b>Year</b>	2017 - 2020	2015 - 2018	2009 - 2016	2010	2013	2009

	(a)	(b)	(c)	(d)	(e)	(f)
						
<b>Relationship btw Watson article</b>	Green walls and rooftops, community garden, socialization, porous paving, energy generation, relationship btw man and nature	Adaptive reuse, renewable energy, community gardens; socialization, ecology	Use of natural resources for recreation, interaction with riverbanks, socialization, ecology	Adaptive reuse, permaculture, green rooftops, socialization, filtering and collecting water	Adaptive reuse, socialization, use of natural resources, relationship btw man and nature	Relationship btw man and nature, active transport, interaction with river banks, socialization, ecology
<b>Scale</b>	Micro Scale	Micro Scale	Medium Scale	Medium Scale	Macro Scale	Macro Scale
<b>Strategy used</b>	Improve segregation, area connection, humanization	Transform abandoned areas into free public space	Sectorization of areas	Transform idle space into community green rooftops	Transform idle space into quality public spaces	Recovery of the river banks for the formation of a green corridor on a metropolitan scale
<b>Climate resilience function</b>	Green areas, public space and energy production	Implement renewable solutions (solar energy) and be a lighting and horticulture laboratory	Preserve water, promote tourism and mobility	Promote community green rooftops, irrigated with collecting rainwater	Create connections in urban space, promoting better socialization and use of urban space	Connect riparian parks in a system to consolidate a geographic and ecological matrix

**Table 1: Conceptual relationships between correlates.**

**Frame source: Authors (2021).**

Image (a) - Baku Akazawa, 2021.

Image (b) - Michelle Young, 2021

Image (c) - Kate Joyce, 2015.

Image (d) - Lore Croghan, 2020.

Image (e) - Departamento De Diseños Arquitectónicos, Empresas Públicas de Medellín, 2016.

Image (f) - Sandra Iturriaga, S; Francisco Croxatto Cristóbal Correa, 2019.

Analyzing the projects through Watson's (2017) principles, it is noted that all examples promote sociability, allowing the appropriation of the spaces by the population and their contact with their nature. Second, the green roof/roofing concept is used in three examples, being Dalt's Ronda Penthouse, Brooklyn Navy Yard, and the Articulated Living Units in Medellin. The application of this type of roof helps to reduce the heat island effect, improving the quality of public spaces, and bringing vegetation closer to the human scale.



The Brooklyn Navy Yard and Lowline projects, both located in New York City, are projects that promote the adaptive reuse of buildings, since verticalization and the high level of densification is an evident characteristic of the city. Both projects evidence the reuse of empty spaces and/or abandoned areas, reusing areas at different levels of design, for example, from the basement to the rooftop. Another issue is the adaptive reutilization consistent with compact city concepts by redefining urban spaces.

The Riverwalk, Mapocho, and Medellin projects are projects in which the authors identified the river as an important and characteristic element of cities, through the use of resources for recreation and environmental recovery. Therefore, with the understanding of the natural aspects of a region, it increases the quality and attractiveness of urban spaces.

The goal of exemplary projects at different scales brings important analyses of how urban design can operate with energy and carbon emission reduction, promoting compact, sustainable and climate resilient cities. Despite the multiple scales, it was observed the existence of predominant urban concepts in the projects (sociability; green roof/roof), while others highlight the particularities of each region (porous paving, watershed integration, permaculture, solar energy for underground spaces, etc). However, all the projects seek a relationship between man and nature through quality and innovative urban spaces.

## 5. Conclusion

The research demonstrated the importance of knowledge of consolidated strategies in the relationship between the built environment and the landscape to contribute to sustainable and resilient cities. It is perceived that the sustainable and climate resilient future will take place in existing cities and that, therefore, densification should be encouraged, promoting redesigns, well-being and spatial quality through the relationship between man and nature.

As already explored, the compacting of cities should be done through intelligent solutions, using the resources and strategic connections so that the density can be effectively implanted. The example of the city of Balneário Camboriú, located in the state of Paraná, is recognized for presenting high density without the development of a good project, because it was driven by the speculative interests of the real estate market. This issue has repercussions in the urban mobility and in the segregation of the city, for presenting problems of conflicting traffic zones during the summer seasons, besides promoting bad air quality by the intense flow of vehicles. Another contrasting argument is the characteristics of the modernist city, such as its sectorization and sprawl, not promoting the mixed use of the soil that results in the segregation of urban space in socioeconomic and socio-spatial layers.

Watson's (2017) article proved important in responding to the climate challenges of this century, providing systemic vision of the built environment and the perception of trans-scale needed to base the strategies and possible solutions exposed. Methodologically, the work of surveying and analyzing examples contributes to the debate and discussion of urban design principles, making relationships and reinforcing the main concepts.

In conclusion, we highlight that the analyzed projects made use of three strategies that perhaps summarize, in practice, the essence of urban acupuncture theory and new principles of urban design in the 21st century: (re)utilization of resources in a dynamic

way, (re)signification of urban spaces, and promotion of sociability and sense of community. The importance of studying examples of sustainable projects to foster this debate and influence space planners is highlighted.

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