

## Learning from Rio: Promoting Resilience in Zona Oeste

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### Abstract

**In Rio de Janeiro's western zone, global challenges can be seen in many forms such as infrastructural investments associated with recent mega-events and tourism. In order to support these global events, world class sporting venues were built and others renovated, regional transportation improvements were undertaken, and specialized event housing was built. Despite this growth, countless opportunities to sustainably transform the area have been**

development and cultural patterns with a planning horizon of the year 2100 (by which time sea-level rise will have impacted the city). By leveraging the studio environment common to design education, faculty from both universities created opportunities for applied research that resulted in the book *Rio de Janeiro: Urban Expansion and the Environment*.<sup>4</sup>

### Engaging Rio:

#### *The Workshops, Concepts and Context*

The workshops aimed to highlight how building resilience into urban areas requires adapting and integrating a city's physical, economic, social, and ecological aspects. In order to do so, it is necessary to understand the specific vulnerabilities of an urban system (its natural, social and constructed aspects) through diagnoses of socio-climatic characteristics on an appropriate scale. This also requires reducing system exposure, thus avoiding the intensification of urban occupation in threatened areas. Such a diagnostic process is central to the definition of the action in order to reduce a system's physical sensibility to existing and new threats and increase its adaptive capacity, or the ability of individuals, groups and institutions to make use of available resources for locally-specific adaptation.<sup>5</sup>

### Introduction

In Rio de Janeiro's western zone, global challenges can be seen in many forms such as infrastructural investments associated with recent mega-events and tourism: the 2007 Pan American Games, the 2014 World Cup, and the 2016 Summer Olympics Games.<sup>1</sup> In order to support these global events, world class sporting venues were built and others renovated, regional transportation improvements were undertaken, and specialized event housing was built. Despite this growth, countless opportunities to

The exposure of a system to climatic threats is directly related to urban design. The decision to occupy threatened areas, as well as the control of unplanned expansions of a city, are two of the main responsibilities of local urban managers. The vulnerability of an urban system is directly affected by the condition of existing buildings, infrastructure networks, the distribution of public utilities, as well as other aspects of an urban system. Adaptive capacity, in turn, is affected by economic conditions, technology and access to it, information dissemination, government or institutional stability, and social capital. Adaptive capacity is particularly impacted by weaknesses in government policies and its three main aspects - exposure, sensitivity and adaptive capacity - are profoundly influenced by poverty and inequity.

Thus, urban designers and planners must play an important role in building a city's resilience. They need to understand risks and master possible mitigation solutions, and they also must understand how to carry out these actions and influence the population, using their projects as both manifestos and as educational tools. In this sense, urban designers and planners must influence decision-makers about a city's future despite the fact that, in many cities around the world, development is largely governed by the private sector. In other words, urban designers

and planners must work to increase the climate literacy of those who hold the power to shape a city's future. Climate literacy is vital if we expect future leaders to make "important decisions that stem from or impact climate change and sustainability."<sup>6</sup>

#### *The Contextual Challenges*

Climate literacy levels, in the case of Rio's western coastal neighborhoods, proved to be low at best if measured by conventional development practices. Rio is not resilient despite its fame as a "marvelous" city of natural beauties. Interestingly, those features for which the city is often best known, comprise a mere 10% of its territory. However, this is the 10% of international fame featuring granite "sugar loaves", urban lagoons and beachfront neighborhoods.<sup>7</sup> The other 90% of the city lacks basic services such as good sanitation, transportation, environmental health, safety, and other urban resources. By continuing to promote this 'marvelous' 10%, the city extends its existing risks and vulnerabilities thus engendering the reproduction of unsustainable, unequal and poorly adapted urbanization models.

Conventional development has been enabled through lax public policies throughout Zona Oeste and the Jacarepaquá lowland (the region that includes Barra da Tijuca and the Vargens neighborhoods).<sup>8</sup> Unfortunately, the Jacarepaquá lowland is made up of a network of double-barrier coastal lagoons, east-west running mountains, and a regional drainage network connecting the South Atlantic Ocean.<sup>9</sup> This watershed is also particularly susceptible to sea level rise given its geological formation, elevation and coastal location.<sup>10</sup> Despite these limitations, conventional suburban growth and informal development have virtually erased the area's native ecological systems. What this means is that, by the year 2100, much of the region, which is commonly known as Barra after its most famous neighborhood, may be inundated by rising sea levels.

Unfortunately, Rio's development community has not considered climate risks as it encouraged growth in Zona Oeste. This may be due, in part, to late 1960s efforts to establish Barra da Tijuca's as a new regional center. The area's importance is evidenced by the choice of Lucio Costa, one of the country's most noted architects and planners at the time, to create a

vision for Barra in 1969. Inspired by Modernist principles, Costa proposed separated land-uses, monumental highways, and a system of open spaces intended to create a "cidade oceanica" dominated by natural landscapes and vistas to both mountains and the coast. However, market pressures and lax governmental policies allowed growth to take on a very different tone and, particularly from the 1980s forward, Barra's urbanization resulted in gated suburbs. To the north of this coastal area is the Vargens region, an area of 52 square km, which until recently was largely rural with small residential farms and reduced transportation access, sanitation by septic tanks, and artesian well-water. The area retains almost all of the remaining unique marshes in the city that have already suffered substantial depredation and reductions since 2002.<sup>11</sup> Much of this area would be lost when sea levels rise. However, this is not the only risk in the area, as there is much flooding caused by extreme rainfall, which also causes landslides and, ironically, the area is plagued by droughts.<sup>12</sup>

Careful scrutiny of the area's social and environmental aspects would result in prioritizing guiding densification to neighborhoods in other areas of the city. For example, the city's northern neighborhoods could be densified considering the present and potential capacity of mass rail transit, in addition to already deployed sanitation networks, and local commercial centers (attributes clearly lacking in the coastal western zone). The city's western interior zone, in turn, comprises a large area of low-density occupation, the lowest HDI in the city and its worst sanitation, transportation and housing conditions. In addition to the aforementioned gains, the prioritization of investment in these areas would allow time for more careful planning of the eventual occupation of Vargens, considering its threatened environmental status, the vulnerability of its inhabitants, the absence of urban infrastructure, and the need for a planned focus resiliency.

But private capital has spoken louder and the entire area (Vargens, Recreio and Barra da Tijuca) has become the center of recent public and private investment, thus repeating the pattern of historic irresponsible urbanization that has marked Rio for decades. This is due, in part, to the influence of mega-events like the 2016 Summer Olympic Games, which were

concentrated in Barra. This region received over 50% of all investments made in the city associated with the Olympic Games and that contributed to a large increase in local real estate dynamics. The Olympic Games and their economic ripple effects represented a unique opportunity to establish a resilient Legacy Plan for the Games. But, unfortunately, an unsustainable model of expansion took hold, which is similar to those found in megacities world-wide. With few exceptions, these megacities are concentrated in developing countries and characterized by: (1) excessive consumption of energy and natural resources; (2) socio-spatial segregation; (3) disconnection with surrounding natural and rural areas; (4) concentration of poverty and the growth of informal areas; (5) lack of proper transportation infrastructures; (6) risk area occupation; (7) informal work; (8) urbanization without climate adaptation; and (9) health risks for the population.<sup>13</sup>

The 2016 Olympics only reinforced these trends in Rio. This event featured a Public Private Partnership that exchanged future private development rights for the infrastructure needed for the Games. As a result, the private sector leveraged interest in the area for financial gain. This event also leveraged the expansion of socio-climatic risks, driving growth to the areas vulnerable to climate change.<sup>14</sup>

### Mixing Modernisms

Thinking about resilience for the Barra region through architecture and urban design was the challenge for collaboration between the UNC Charlotte's MUD program and PUC-Rio's Department of Architecture and Urbanism's U.Lab, which brought together master's and continuing education students from both institutions in urban adaptation design workshops.<sup>15</sup> The workshops discussed development solutions tailored to the regions of Vargens, Recreio dos Bandeirantes and the neighboring Metropolitan Center of Barra da Tijuca. The solutions focused on resilience and adaptation to climate change, particularly with regard to sea level rise, and current floods caused by heavy rains and deficient drainage conditions. The workshops and design investigations were supported by group discussions, expert guest talks, symposia, field visits, and documentary surveys.

Students in these workshops proposed buildings and landscapes that operate on inter-related planes. While this may seem naïve, it opened discussions among teams about the role of natural systems in urban design as well as discussions of urban typologies that could anticipate sea-level rise. For example, bioremediation provided a way to foster discussions of active water systems, such as biodigestors, that could be both infrastructural and potentially recreational: existing canals could be revitalized, new ones introduced and new hydrological networks could be established as a means of regenerating the region's ecology; greenways, new public spaces that double as floodable plazas and recreation fields, and aqua-based economies could follow.

These three years of working in partnership have added to a critique of development models fostered in this region by current legislation, particularly the Urban Structuring Plan (PEU), which has been continuously modified since 2006.<sup>16</sup> Its latest version (2015), combines recent interventions promoted by the 2016 Olympics with construction trends favoring *in-vogue* commercial and residential typologies.<sup>17</sup> The questions that motivated the students are those that managers, planners, architects, designers, and residents still urgently must answer, such as: How should we build in an area so threatened by rainfall and sea level rise?

Such questions compel us to reflect on the roles that urban design and planning can play in the transformation of an unsustainable model towards resilience. Despite the limitations of student-driven design scenarios, their urban analysis was thought-provoking. Upon reflection on our several years of international programming, it is clear that unique opportunities exist to prepare students for success in a global profession and to engage professionals in robust discussions about the impacts of climate change.<sup>18</sup> This represents a new role for designers: they must be able to manage a wide range of cultural and technical expertise through sustainable city-building processes.<sup>19</sup> And, our experience connects with literature indicating that direct exposure to questions of climate change puts students and collaborating partners in situations in which they are able to formulate innovative roles for design as it may shape resilient cities—thereby extending their climate literacy. Although more research needs to be conducted in this area, an



Figure 1: Student vision of Vargem Pequena transformed by rising sea levels.

expanded ecological ethos can be nurtured through hands-on experiences like our workshops in Rio. This also points to professional “values and valuation” as they relate to “duties and obligations within the human-nature relationship.”<sup>20</sup>

*Law and disorder in the case of Vargens: a model of non-resilience*

The Olympic Games provided a way for students to view Rio within a larger landscape of global urbanization. A city is the result of actions by public and private sector players and the coordination and coherence of these actions must be established through the use of a set of urban design, planning, and management tools. The construction of a resilient city depends on the coordination of these agents and, therefore, depends on governance capacity and regulatory legislation. In the case of Vargens, urban resilience is difficult to achieve due to a combination of (1) a weak planning framework, (2) a low capacity for public control over the occupation of territory, (3) oscillating economic and real estate dynamics, and (4) recurring conflicts of interests between the government, private companies, and the population. In this case, the area's urban legislation, particularly the last revision of the PEU, has been engulfed in enormous uncertainty. Attempts to update and approve these laws have twice been thwarted in the political process, thus reducing stability for on-site construction.

The workshops sponsored by PUC-Rio and UNC Charlotte can serve as an opportunity to envision how Rio can be guided towards a more sustainable future. Judging from recent conflicts between the population and the government over plans for Vargens, confidence in government seems to be diminishing. This is in addition to the area's new transportation system – a decisive factor in boosting occupancy – based on wheeled vehicles and fossil fuel, Bus Rapid Transit (BRT). Without a transportation feeder system complementary to the main trunk of the BRT, most of the population still depends on private cars. The model that has been practiced in Vargens clearly increases social differences, weakens the relationship between public power and the local population, and intensifies occupation in the areas of greatest risk. As a result, adaptive capacity is reduced, exposure and vulnerability has increased. The good news is that the Vargens's occupation has not been yet consolidated and here is still time to build resilience into the area. Despite the fact that unsustainable urbanization models persist and despite the numerous opportunities for transformation lost in the area, there are still miles of undeveloped areas in Vargens—most of which should remain unbuilt in order to provide the basis for a resilient urban model.

The latest version (Complementary Law Project 140/2015) has been under discussion in the city council for two years and is still not approved. This ongoing dispute weakens local legislation in its capacity to provide the basis for sustainable development of the region.<sup>21</sup>

## Endnotes

1. These global crises demand global practices, pedagogies and preparedness. I mention this because it sets the stage for the discussion of a series of urban design workshops that were held between the University of North Carolina at Charlotte's Master of Urban Design (MUD) program and the Pontifical Catholic University at Rio de Janeiro's (PUC-Rio) Urbanism Laboratory within the Graduate Program of Architecture of the Architecture and Urbanism Department.
2. See: Intergovernmental Panel on Climate Change (IPCC). (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]; see also: Ferguson and Gleeson, *Vulnerability of coastal aquifers to groundwater use and climate change. Nature Climate Change* 2 (2012), 342–345.
3. Rosenzweig et. al. *Climate Change and Cities: First Assessment Report of the Urban Climate Change Research Network*. Cambridge University Press, Cambridge, UK, 2011.
4. Design teams for the workshops were composed of students and faculty from each participating university and each also engaged local professionals from a range of industries and organizations. Typically, teams included 4 or 5 students—2 or 3 from Charlotte and 2 or more from our Brazilian hosts. In order to enrich the experience of the UNC Charlotte students, we cross-listed our coursework with the university's graduate program in Latin American Studies, which gave our students opportunities for new cultural insights. Additionally, our collaborating partners at PUC-Rio opened the workshops to their sustainable urbanism program so the mix of local students ranged from architecture to urbanism to environmental sciences and biology. Given the topic of sea level rise, the added depth provided by non-design students proved to be particularly valuable. While the results of each three-year cycle produced substantial design and pedagogical research, each individual workshop contributed significant insights. The final outcomes typically came in the form of four or five group projects presented at a final review with jurors from local universities, client/developers, and municipal organizations as well as principals of international design firms such as AECOM and MLA+. See: Jose Gamez, Zhongjie Lin, and Jeffery Nesbit, *Rio de Janeiro: Urban Expansion and Environment* (London: Routledge, 2019).
5. Davoudi, Crawford, & Mehmood, (Eds.), *Planning for Climate Change: Strategies for Mitigation and Adaptation for Spatial Planners* (London: Earthscan, 2009).
6. Katrina Leona Marzetta, 2017. "Changing the Climate of Beliefs: A Conceptual Model of Learning Design Elements to Promote Climate Change Literacy" in *The Journal of Sustainability Education*, Volume 16; accessed online May 22, 2018: <http://www.susted.com/wordpress/content/changing-the-climate-of-beliefs-a-conceptual-model-of-learning-design-elements-to-promote-climate-change-literacy-2018-01/>
7. Rio is a megacity of 1,255 square km and 6.5 million inhabitants, inserted into a metropolitan continuum of 6,744 square km and 12.3 million inhabitants. The marvelous ten percent represents a landscape of only 130 square km, which corresponds to two percent of the Metropolitan Region of Rio de Janeiro (RMRJ).
8. See: Rabha, N. M. C. E. (2010). Rio, uma cidade e seus planos. In A. I. F. Pinheiro (Ed.), *Rio de Janeiro – cinco séculos de história e transformações urbanas* (pp. 205–229). Rio de Janeiro: Casa da Palavra
9. This kind of geological formation is often called a "double barrier system." Zona Oeste itself is made up of the Jacarepaguá, Camorim and Tijuca lagoons and shallow lakes all of which have historically been fed by watersheds and rivers stemming from the Pedra Branca and Tijuca massifs; see: Gilberto T. M. Dias and Björn Kjerfve, 2009. "Barrier and Beach Ridge Systems of the Rio de Janeiro Coast" in *Geology and Geomorphology of Holocene Coastal Barriers of Brazil*. Edited by Sérgio R. Dillenburg and Patrick A. Hesp. (Verlag: Springer) 242.
10. Dieter Muehe, 2010. "Brazilian Coastal Vulnerability to Climate Change," in *Pan-American Journal of Aquatic Sciences*, 5 (2) 173-83.
11. Articulação Plano Popular das Vargens. (2017). Plano Popular de Vargens. [online]. Available at <[http://sertaocarioca.org.br/content/uploads/2018/01/CADERNO\\_PLANO\\_POPULAR\\_VARGENS\\_COMP\\_LETO.pdf](http://sertaocarioca.org.br/content/uploads/2018/01/CADERNO_PLANO_POPULAR_VARGENS_COMP_LETO.pdf)>. Accessed on Dez 2017.
12. Secretaria Municipal de Meio Ambiente/PCRJ (SMA/PCRJ), Instituto Pereira Passos/PCRJ, Laboratório de Gestão do Território/Ufrj and Centro de Ciências Matemáticas e da Natureza/UFRJ. (2007). Registro dos resultados do seminário sobre aquecimento global: Rio: próximos 100 anos. 10 e 11 de outubro de 2007, Rio de Janeiro. Disponível em: <[www.rio.rj.gov.br](http://www.rio.rj.gov.br)>. Acesso em: jun. 2008.
13. Lemos, M. F. (2013) *Cidades Saudáveis: para a resiliência urbana no contexto da mudança climática*, in Abreu, A. and Guanaes Rego F. (eds.) *A Ciência na Rio+20: Uma visão para o futuro*. Rio de Janeiro: PUC-Rio, NIMA, pp. 114-129; see also: UNHABITAT (2011). *Cities and Climate Change: Global Report on Human Settlements 2011*. London: Earthscan.
14. Britto, A. L. and Lemos, M. F. C. (2016). *Changements climatiques, adaptation et aménagement urbain à Rio de Janeiro*, in Rudolf. F. (ed.) *Les villes à la croisée des stratégies globales et locales des enjeux climatiques*. Québec : Presses de l'Université Laval, pp. 133-158.
15. These workshops were conducted on the PUC-Rio campus and each lasted four weeks during the month of June from 2015 to 2017.
16. The PEU is an urban plan with the force of law behind it, which has been submitted to the Municipal Master Plan, thus allowing a definition in local scale, by city region, the parameters of use and occupation of the soil and urbanistic instruments to be applied in the area.
17. The OUC is a legal instrument that allows the association of public and private initiatives, coordinated by the latter, to carry out an urbanization project in a specific area, with a view to reducing direct public investment in sectors such as infrastructure.
18. Clearly, our workshops represent a limited sample with regard to pedagogical research and the impacts that climate change-related design experiences may have had upon participants generally. Overall, 15 students, 3 faculty, and 4 local practitioners on average (per workshop per year) were involved and their disciplinary demographics were overwhelmingly tied



to architectural, urban design or development. However, the premise and formats of these workshops can be applied to others and to design studios with a range of globally-engaged formats. Despite limitations that we faced while abroad, workshops such as these are springboards for continued research into questions of both pedagogy and sustainable development.

19. Dana Cuff. *Architecture: The Story of Practice* (Cambridge: MIT Press, 1991) 248-63.
20. See: Viniece Jennings, Jessica Yun and Lincoln Larson, 2016. "Finding Common Ground: Environmental Ethics, Social Justice, and a Sustainable Path for Nature-based Health Promotion" in *Healthcare* (4) 61; doi:10.3390/healthcare4030061.
21. Examples of the use of public power for the development of the area are the Venice Carioca project on the use of the existing water system for internal transport and local development in 2010 and the 2017 proposal for attracting Arab investors to the OUC, in order to make feasible the execution of a set of urbanization works for years identified as necessary - dredging of channels and execution of sidewalks, for example. Between the first and second idea launched in the media, seven years have passed and nothing has been done except the proposals to change legal parameters to intensify urbanization.