



Planning, Futurities and Floods: an essay from the Brazilian Coast

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Resumo: este ensaio traz reflexões sobre o papel do planejamento como teoria e ferramenta essenciais para enfrentar as incertezas e desafios trazidos pelas mudanças climáticas, com foco nas inundações em áreas urbanas. No contexto atual, em que a futuridade é marcada por previsões de aumento da temperatura global e eventos climáticos extremos, o planejamento se torna ainda mais crítico. Destaca-se como as mudanças climáticas já estão presentes em diversas regiões, exacerbando a vulnerabilidade socioambiental e criando desastres em larga escala, como as enchentes no Rio Grande do Sul em 2024. Esses desastres, ao cristalizarem incertezas, podem gerar consensos sobre problemas públicos e estimular a busca por soluções através de políticas públicas e programas de prevenção e adaptação. Parte do financiamento para as requeridas obras de infraestrutura sustentável pode advir da tributação imobiliária, que também é afetada por expectativas sobre o futuro. O ensaio busca discutir como fortalecer o planejamento para enfrentar as crises climáticas iminentes, explorando a conexão entre as visões de futuro e a vida cotidiana, e propondo abordagens alternativas para políticas públicas de adaptação em regiões costeiras.

Palavras-chave: Planejamento. Previsões. Enchentes. Finanças Públicas. Políticas Públicas.

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Abstract: this essay reflects on the role of planning as an essential theory and tool to face the uncertainties and challenges brought about by climate change, with a focus on flooding in urban areas. In the current context, in which futurity is marked by predictions of rising global temperatures and extreme weather events, planning becomes even more critical. It is highlighted how climate change is already present in several regions, exacerbating socio-environmental vulnerability and creating large-scale disasters, such as the floods in Rio Grande do Sul in 2024. These disasters, by crystallizing uncertainties, can generate consensus on public and stimulate the search for solutions through public policies and prevention and adaptation programs. Part of the funding for the required sustainable infrastructure works may come from real estate taxation, which is also affected by expectations about the future. The essay seeks to discuss how to strengthen planning to face imminent climate crises, exploring the connection between visions of the future and everyday life, and proposing alternative approaches to public policies of adaptation in coastal regions.

Keywords: Planning. Forecasts. Floods. Public Finance. Public Policies.

Planificación, futuridades e inundaciones: un ensayo desde la costa brasileña

Resumen: este ensayo reflexiona sobre el papel de la planificación como teoría y herramienta esencial para enfrentar las incertidumbres y desafíos provocados por el cambio climático, con enfoque en las inundaciones en áreas urbanas. En el contexto actual, donde el futuro está marcado por predicciones de aumento de las temperaturas globales y fenómenos meteorológicos extremos, la planificación se vuelve aún más crítica. Se destaca cómo el cambio climático ya está presente en varias regiones, exacerbando la vulnerabilidad socioambiental y creando desastres de gran escala, como las inundaciones en Rio Grande do Sul en 2024. Estos desastres, al cristalizar incertidumbres, pueden generar consenso sobre la opinión pública y estimular la búsqueda de soluciones a través de políticas públicas y programas de prevención y adaptación. Parte de la financiación de las necesarias obras de infraestructura sostenible puede proceder de los impuestos inmobiliarios, que también se ven afectados por las expectativas sobre el futuro. El ensayo busca discutir cómo fortalecer la planificación para enfrentar crisis climáticas inminentes, explorando la conexión entre visiones de futuro y la vida cotidiana, y proponiendo enfoques alternativos a las políticas públicas de adaptación en las regiones costeras.

Palabras clave: Planificación. Previsión. Inundación. Finanzas Públicas. Políticas Públicas.

1 Introduction

Planning, understood in a broad sense as the mediating activity between technical and scientific knowledge for actions undertaken in the public domain (FRIEDMANN, 1987), or as the use of technical-political reasoning in public decision-making (MATUS, 2006), is an activity that moves away from the short term and points to the future. In this sense, planning depends fundamentally on the vision of the future that planners and stakeholders have. This vision of the future cannot be based on exact scientific laws that guarantee certainty about future events, since planning takes decisions in environments of radical uncertainty, and “its calculation is nebulous and is based on the understanding of the situation” (MATUS, 2006, p. 115). However, there are situations in which nebulosity dissipates, and relative consensuses are created that allow planning to impact reality.

When planning is studied in a more restricted sense as government planning or as a public administrative function, it generates public policies and programs. In this stricter sense, the literature points out that public policies have a life cycle composed of phases, namely: identification of a public problem and formation of an agenda; formulation of alternatives; political decision-making; implementation of public policy; and evaluation (SECCHI, 2013; SOUZA, 2006). Thus, expectations about the future — the so-called futurities (RANDOLPH, 2022) — fall, at least, on a substantial part of the public policy cycle (agenda, alternatives, and choice).

In the current context, marked by climate change, futures bring up the question of humanity's survival again¹ (MONTE-MÓR, 2022). Intergovernmental Panel on Climate Change's (IPCC) predictions indicate that the average global temperature

¹ Again, as the cited author recalls, because during the Cold War there was the pressing issue of a Nuclear War.

is expected to rise by more than 1.5°C between 2023 and 2027, a phenomenon that should be followed by an increase in extreme weather events, such as severe storms and droughts, in addition to rising sea levels. These predictions are followed by other predictions related to the consequences of these changes. Among them, scenarios that show that the socio-environmental vulnerability of regions and people will be exacerbated stand out, with significant worsening in terms of health, material conditions, and susceptibility to disasters (BARBIERI et al., 2022).

Nevertheless, it is worth noting that these futurities today are mixed with the already very present consequences of climate change, that is, with the “presencity” of these processes. Spatio-temporal proximity, because these changes are already happening in the present time or in the very near future, and, furthermore, there is enough solid evidence to affirm that these changes and their consequences will be perceived everywhere, as in the case of disasters resulting from extreme rainfall in the state of Rio Grande do Sul (RS), in April 2024.

In view of this global scenario, it is worth highlighting the particularities that certain socio-spatial configurations acquire. From a geomorphological point of view, part of Brazil's east coast is characterized by the uplift of granite massifs (such as Sugarloaf in Rio de Janeiro, Dedo de Deus in Teresópolis, Itabira Peak in Cachoeiro de Itapemirim, etc.), by the Sierra do Mar and by the Sierra Gaúcha and Catarinense, which form relatively short rivers that flow into the ocean and descend from relatively high altitudes². This causes these water bodies to acquire high flow speeds. These characteristics contribute greatly to flooding. In addition to this, the history of Brazilian territorial occupation after colonization (post-1500) made the coast of the south, southeast and northeast regions especially populated, with high population densities and economic clusters of central importance to regional economies – the state capitals and the entire network of economic and social infrastructure associated with them (MARENGO; SCARANO, 2016). Therefore, the consequences of excessive rainfall levels in short periods of time cause large-scale disasters, such as those observed in RS.

Major disasters crystallize previously ethereal uncertainties, connect futurities (already predicted for a long time) with the present, and tend to create consensus around the public problems of a society (MATUS, 2006; HIRSCHMAN, 1965)³. Moreover, they can foster the search for solutions, which renews the demand for planning capable of generating prevention and adaptation policies and programs. Thus, what forms of planning and what concrete actions can be envisioned today to ‘save’ the populations of these urban areas from increasingly greater floods? What risks are predicted, perceived, and measured with the techniques that exist today? What plans can be devised?

This essay aims to shed light on these issues. First, it delves deeper into the discussion on futurities and the formation of expectations, to highlight how the current context presents a crisis and an opportunity to strengthen planning in the

² It is interesting to note that the third highest point in Brazil, Pico da Bandeira, is on the east coast, a relatively short distance from the Atlantic Ocean.

³ Hirschman (1965) discussed fundamental aspects of decision-making in the public domain in Latin America, and even dedicated himself to the study of droughts in the Brazilian northeastern hinterland. Matus ([1993] 2006, p. 143) studied planning processes in Latin America, stating that “Improvisation dominates our daily lives, and blindness clouds the path we travel to where we do not know”.

face of the future of the climate crisis that is looming and approaching daily. Next, it offers an empirical literature review to advance the understanding of how the relationship between expectations about floods and real estate prices is crucial to fostering the debate on municipal revenue collection. Here, the literature review offers quantitative measurements of how these expectations of the future partly determine the monetary value of urban land in market societies and guide the amounts that public policies in this area may demand, as well as the amounts that planners can manage based on the social benefit generated by investments in sustainable infrastructure. Section 3 presents approach to possible alternative searches for public policies to adapt to climate change in part of Brazil's coastal areas in the face of climate change. Finally, concluding remarks are made.

2 Planning, future and futurity

What underpins the discussion on climate change and critical events in the contemporary world is a prediction about the future — futurity — mixed with the spatial-temporal proximity (“presencity”) of these changes. The IPCC forecasts indicate that the average global temperature should rise by more than 1.5°C between 2023 and 2027. Other forecasts related to the consequences of these changes are derived from these forecasts. Among them, the scenarios that show that the socio-environmental vulnerability of the poorest regions and people will be exacerbated with significant worsening in health, material conditions and susceptibility to disasters (BARBIERI et al., 2022) stand out. This mix refers to the fact that significant changes in the climate and their subsequent consequences are already being noted today. Spatial-temporal proximity, because these changes are already happening in the present or in the very near future, and, furthermore, there is sufficient solid evidence to affirm that these changes and their consequences will be perceived everywhere.

The concept of futurity used here was derived from linguistics (EHSEL, 2013 apud RANDOLPH, 2022) and was brought to planning theory by Randolph (2022). This concept expresses the idea of a hypothetical projection (therefore, a formulation about the future) with a certain degree of reliability. In linguistics, this projection is made based on the speaker's experimental and practical knowledge. In planning, however, empirical or practical knowledge is combined with scientific-theoretical knowledge, taking the very meaning of planning as the mediation between knowledge and (public) action, as formulated by Friedmann (1987). In this sense, planning can be described as a forward-looking activity that selects useful elements from the past for the analysis of present conditions from a privileged point of view on the future (FRIEDMANN, 1987). The degree of reliability of any type of forecast varies, and, in general, the higher it is, the more political power is attributed to the forecast or its author (RANDOLPH, 2022). Forecasting methods range from simple extrapolations of past trends to more sophisticated techniques such as constructing future scenarios (RANDOLPH, 2022; STAPLETON, 2020).

In other words, we can interpret futurity as the vision that is formulated about the future. The fundamental idea for this paper is that different futurities lead to different attitudes towards the present and, consequently, generate new future

trajectories that are dependent precisely on this vision/projection. Randolph (2022) indicates that futurity contains the future and does not just characterize it.

Our future, therefore, includes a scenario of a warmer world, with more extreme events (storms, cyclones, prolonged droughts, extensive fires), which are already beginning to alter our actions in the public domain — planning. Failure to act or maintain the *modus operandi* means accepting, colluding with, and worsening the scenario of destruction. The scale of individual action has already proven insufficient to resolve issues on a large scale in contemporary societies, such as crises of insufficient aggregate demand, wars, episodes of financial panics, or the provision of public goods and infrastructure. Is there any doubt about the degree of reliability of the IPCC forecast? In this post-pandemic moment, this doubt is confused with doubt in science itself and has even received its own neologism: denialism. Or, in a crudely pragmatic view, who is willing to ‘pay to see’?

In this sense, an important opportunity opens up for the resumption of planning. Although awareness and individual actions are important for the necessary ecological transformation, the scale of this transformation requires state coordination and action.

Brazil has a long tradition in planning. After the 1930 Revolution, during the Vargas government, the State has been developing technical and institutional capacities to face the challenge of creating and implementing plans. Between 1930 and 1980, a period in which the country achieved one of the highest global economic growth rates, state planning played a crucial role.

However, from the 1980s onwards, with the collapse of the national-developmental model, Brazil faced high inflation rates, imbalances in external accounts and a prolonged economic recession. In this context, planning was left aside, as short-term emergencies began to occupy the space and time that could have been dedicated to building a more solid future. With the rise of neoliberalism in the 1990s, the planning structure, which had been inactive between the second half of the 1980s and the beginning of the 1990s, was reinvented within the State modernization agenda in the second half of the 1990s. However, the proposed methodological innovations were not accompanied by due attention to the content and institutionality that would support them. In the 2000s and until 2014, there was an ambiguous stance towards planning. While sectoral planning was strengthened and some fundamental bureaus for planning gained relevance, there was no satisfactory articulation that integrated these efforts in a cohesive way (COUTO, 2011).

The period from 2014 to 2022 was marked by a dismantling of state capacities for national, regional and local planning. Despite this, and other sources of skepticism, planning continued to exist and function (CARDOSO JR., 2020) and, after 2023, showed signs of recovery at the federal level.

As will be detailed in the following sections, the plans that are being put in place for adapting to climate change in urban drainage bring benefits that go beyond the issue of massive flooding. For example, green and blue infrastructures, as the techniques for including vegetation and drainage surfaces in urban areas have been

called, offer much more than just ‘flattening’⁴ the flow curve over time, and can improve the urban microclimate, increasing evapotranspiration and even the quality of rainwater that reaches the galleries. Who would be against the canopy?

The next section seeks to help understand the accumulation of human experiences regarding flooding in urban areas. How have human populations perceived this natural phenomenon in different geographies in our time? We will use a tool that we have as a heuristic to shed light on this question that permeates the debate at hand — how the human urban experience in societies dominated by exchange value captures living with frequent floods and how this helps to project what there is to gain even within this strict logic, beyond the obvious question of survival.

3 Expectations, urban development and floods: measuring now for future public finances

Cities and urban areas are constantly changing, in a pattern that Harvey (2002) has called the urban palimpsest—past forms superimposed on one another. Change often does not erase the traces of previous periods, but rather rewrites them with new structures, following new concepts, ideas, and utopias. In each round of capital accumulation, branches of capital (notably, capital related to urban development and real estate capital) shape the built environment according to the needs of production and reproduction (Lefebvre, 2001).

Real estate markets drive and react to each new round of capital accumulation. In this sense, when the Industrial Revolution was penetrating every geography of the globe, developers and the State shaped urban environments to be adapted to the needs of large-scale industrialization—road infrastructure, energy supply, large-scale housing projects, and so on (ALMEIDA ET AL., 2022; SCOTT, 2011). In the case of peripheral economies (or the Global South), although this process has driven significant economic growth, it has also generated enormous social and environmental liabilities. In the Global South, climate change impacts socio-spatial structures replete with these liabilities.

At the beginning of the 21st century, however, sustainability and climate change have become serious issues on the public agenda, which has led to new forms of built space (NASCIMENTO ET AL., 2022). In this context, there is an emerging literature on how people in market societies interact with nature in dense urban environments. Thus, it can be understood that housing prices should be interpreted as the synthesis of locational advantages and disadvantages (SIMÕES, 2003), including future uncertainties about flooding brought to the present (value). This literature then investigates correlations between real estate prices and existing ‘natural artifacts’, such as urban parks or environmental preservation areas, and watercourses, or natural phenomena, such as floods. Some studies also deal with the correlation between floodplain areas (subject to flooding) and the negative effects on housing prices. These studies can inform public and academic debate about how new infrastructure required by climate change can be financially sustainable and raise

⁴See, once again, how the repertoire acquired during the Covid-19 pandemic helps in the discussion on climate change.

urban land values, which feed into local governments' generic property value maps that form the basis for calculating property taxes. They also investigate how natural events, such as floods, are capitalized into property prices, that is, discounted to present value.

For example, Konijnendijk et al. (2013) conducted a systematic review of the benefits of urban parks. They analyzed several benefits of these parks, including the potential for increasing housing value. In this regard, the authors collected 23 articles, of which 19 used hedonic price models to study the correlation between the presence of urban parks and housing prices. The number of property sales included in the datasets ranged from 112 to 24,862. In general, parks are positively capitalized (i.e., their price effects are positively carried over from the future to the present). They cite that the meta-analysis by Brander and Koetse (2011) concluded that open spaces in general, as well as parks specifically, generally increase the value of nearby properties, whether houses or apartments. The vast majority of other articles and studies confirm these findings, although the precise effect on property values varies widely across cities and countries.

Rents are also positively affected by proximity to urban parks. Size is a relevant factor, but studies indicate that even smaller patches of green space can have a positive influence. Interestingly, large private gardens (houses or low-density areas) can eliminate the effect of parks, possibly because the private green space already available within each property negates the incentive for public parks. When analyzing some studies for Chinese metropolises, Konijnendijk et al. (2013) found evidence that water bodies have larger effects than urban parks, a result particularly relevant to this essay.

Beltrán, Maddison and Elliott (2018) conducted a meta-analysis that is key to the current discussion: is flood risk capitalized in property values? If this is the case, green and blue infrastructures, which can reduce flood risk, should benefit local public entities (city governments, in the Brazilian case) by increasing the value of the calculation base present in property value maps, which enables an increase in revenue, generating funds needed for new sustainable infrastructure projects. The logic here is that the wealth available in a city is not a zero-sum game, because by increasing the value of a city's properties, it can attract new residents, and there is an effect on the allocation of greater resources from household budgets to this type of good, to the detriment of other goods or assets, which often have no relation to taxation at the municipal level. Furthermore, higher residential values tend to correlate with higher urban renewal rates, which can increase the adoption of green and blue techniques across the territory (NASCIMENTO ET AL., 2022).

In the meta-analysis carried out by Beltrán, Maddison and Elliott (2018), the authors selected US articles that captured flood risk by a binary variable measuring whether the property is inside or outside the floodplain for a 100- or 500-year return time. Thirty-three of the 37 studies reported, on average, a depreciation of -6.1% in homes within the floodplain, although the standard deviation is high. Considering only the results of dynamic models that studied areas that experienced recent substantive critical events with major floods, and flood spots with a 100-year return time (a rare event), the effect of being within the floodplain is -2.9%. The post-flood effect is -6.9%. In other words, the initial effect is higher ('fresh memory' of the disaster), and tends to dissipate over time. In the flood area equivalent to a 500-year

rainfall, the effect is +0.3%, but immediately after a flood, it is -5.2%. This result corroborates the interpretation that there is an update of beliefs or expectations after major floods in areas that had no history of flooding. Since these are real estate properties, these apparently small percentage variations actually represent variations of thousands of dollars per housing unit, which means amounts in the billions when an urban area is analyzed (ALMEIDA, 2019).

Like the paper by Beltran, Maddison, and Elliot (2018), Chen, Li, and Hua (2019) also conducted a meta-analysis covering all continents except Latin America and Africa. They focused on the correlation between urban rivers in general and housing appreciation, and not necessarily on the correlation between flood risk and exchange value. They contextualize their study by referring to investment programs in river restoration projects around the world, such as the Clean Water and Endangered Species Acts in the United States, the Water Framework Directive in the European Union, and the Urban Watercourse Rehabilitation Directive in China. The central methodology of the selected papers is the hedonic pricing model, and the number of primary studies included in the meta-analysis is 30, which provide 53 effect sizes of the investigated relationship. This shows the relative scarcity of primary studies on amenities/disadvantages of urban rivers, indicating that this is an area that is still under-researched and requires further research. In general, there is a positive and significant correlation between river proximity and housing prices. However, some studies show little influence of rivers on housing prices: riparian zones may be polluted or associated with land uses that are low valued in market societies. They also highlight that, compared to river views and water quality, a low relative value is documented for river proximity, although the effect of river proximity on housing prices has received the most attention in this literature. They explain this result based on the hypothesis that “the view of a river can elicit a wide range of beneficial psychophysiological and emotional responses, such as pleasure, fascination, and relaxation” (CHEN; LI; HUA, 2019, p. 6). They also highlight that household income is an important determinant of the relative value of environmental amenities/disadvantages of urban rivers: higher household income increases the effect of urban rivers on housing prices.

Kiel (2021) conducted a literature review based on a survey of articles that addressed the relationship between climate change adaptation and housing prices. The author summarized the findings of Madison (2013), who investigated the case of Lincoln Creek, an urban park designed to aid drainage, funded by the state of Wisconsin and the city of Milwaukee, in the United States. The residential equation indicates that the assessed prices of homes near the project increased by 20.4%, but this includes all benefits, not just those of climate change adaptation. She described the study by Kousky and Walls (2014), who studied St. Louis County, USA, where a greenway was created as part of a flood mitigation strategy. The land was acquired by state and local governments and maintained as undeveloped open space. This space also has recreational purposes in addition to flood mitigation. The dataset consists of 27,748 residential sales that occurred between 2008 and 2012 in an area no more than five miles from the Meramec Greenway. In their hedonic regression, the estimated coefficient for distance to a park suggests that for every 1,000 feet closer to a park, the home price increases by nearly 1 percent.

Regarding tree cover, Siriwardena et al. (2016) conducted a meta-analysis of studies that consider the impact of tree cover on property values in general. They analyzed 15 different studies, which yielded a total of 106 implicit price estimates. Their results suggest that homeowners value tree cover in their neighborhood more than on their own property, and that the impact on property values is different in different areas.

Grafakos et al. (2019) investigated the case of Santiago de Cali, Colombia, where their results suggest that trees and vegetation cover increase land prices. Flood exposure increases land prices in one regression, but decreases it when a variable that controls whether the polygon touches a water body is added. The authors suggest that this can “help differentiate between the benefits of a property that is located near a river that offers a pleasant view without being exposed to flooding and one that is exposed to flooding” (GRAFAKOS ET AL., 2019, p. 47). They found that green infrastructure attributes directly correlate with land values by 5.4% and indirectly by 1.4% due to reduced flood risk.

Kozak et al. (2020) outline scenarios for implementing green and blue infrastructure for the metropolitan area of Buenos Aires, Argentina. The main objective of their paper was to examine the extent to which such an approach could be accommodated in a dense and highly impermeable environment, the Medrano Basin, one of the largest basins in Buenos Aires. This basin has a residential population of 514,642 inhabitants and a density of 925 inhabitants/ha, and is primarily a floodplain with extensive water penetration, which then flows into the Río de la Plata. Its average impermeability level is 74%, with a predominance of the 51–75% and 76–100% ranges. They examined two main scenarios: (1) large ‘grey’ infrastructure solutions (retention pools, or, as they are popularly known in Brazil, ‘piscinões’) combined with smaller green and blue infrastructure in the form of non-structural dispersed facilities; and (2) structurally important green and blue infrastructure added, with reduced reliance on gray infrastructure. For each scenario, four variables were analyzed: (1) construction costs; (2) increased land values; (3) level of protection against flood events; and (4) untreated runoff discharge. The first scenario reflects a ‘business as usual’ proposal, which is the most likely outcome not only in Argentina but in Latin America in general. The second scenario was proposed as an exploratory and desirable scenario that aimed to show a significant contrast, keeping important variables fixed for ease of comparison, and significantly increasing the level of flood protection. As a result, they found that (1) the costs of implementing gray infrastructure are higher than the green and blue approach; (2) the green and blue approach can bring higher levels of land value appreciation for households in the area, which helps to finance public investments via land value recovery; and (3) the green and blue approach also improves the environmental treatment of runoff discharge, improving water quality at the mouth of the stream.

4 Urban Drainage Public Policies: an overview of alternatives for planning

This section aims to explore the repertoire we currently have available to deal with urban flooding. A special focus is given to cases of flooding in river cities that are on the banks of medium-sized rivers, a typical case on the Brazilian coast. In engineering, in these cases, there are structural solutions: upstream dams, river

diversions and dikes. These options are expensive and generate the risk inherent to dams. Porto Alegre (RS) and Pouso Alegre (MG) are protected by a dike. In Pouso Alegre, it is not very visible. In Porto Alegre, it is more evident in the central area and more discreet downstream of the Guaíba. As can be seen daily on national television during April and May 2024, the lack of maintenance of this dike had a decisive influence on the flooding that inundated a large part of the central area of Porto Alegre, in addition to several neighborhoods. Munich (Germany) is also protected by a dike, which is well integrated into the urban design, and the river plain where flooding is most frequent was preserved. In very narrow valleys, such as the Rio dos Sinos (RS), it is more difficult to build a dike.

When the valley is opener, with a wider floodplain, a cheaper structural solution than a large dam can be adopted. Small sills are installed in the river, upstream, to cause flooding in areas with lower losses and flood disturbances, floodplains, pasture and agricultural areas. The idea is to temporarily store excess water and avoid flooding areas where losses will certainly be greater.

In addition to these construction options, there are many so-called non-structural solutions. Some of these are diffuse measures that focus on the basin, such as increasing green cover, preserving forests, controlling erosion, creating terraced crops and agroforestry. These measures tend to reduce the risk of frequent flooding (e.g. ten-year return period). From a governance perspective, they are more difficult, as they involve many stakeholders, although they can bring many environmental benefits. These are long-term actions, so the investment can be more diluted over time and the basin agencies, although they have very low investment capacity in Brazil, could co-finance these initiatives.

There are measures for dealing with floods. One traditional measure is flood forecasting and warning, as is the case of the Rio Doce, which has a system of this type. There is a problem with the suboptimal use of this system by municipalities. For example, forecasting and warning must be accompanied by precise mapping of flood-prone areas, vulnerability analysis of the population and exposed assets, a robust participatory process and efficient flood contingency planning. Belo Horizonte (MG) has been trying to do this, under more difficult conditions, since the time for warning is short, since floods occur quickly due to urbanization and natural conditions. The Civil Defense issues warnings that are sent via SMS to registered cell phones according to the residence's zip code.

In the middle and lower reaches of large and medium-sized rivers, it is possible to have more than 24 hours' notice to organize the evacuation of the areas and, if necessary, to remove higher-value assets. At this point, it is worth mentioning that the National Water Agency – ANA created an application (“HIDROWEB”) for smartphones that allows access to telemetric data collected by the National Hydrometeorological Network – RHN, gathering data on river levels and flows and rainfall throughout the national territory.

Some European countries and the USA also adopt solutions called flood proofing. These solutions can be combined well with forecasting and warning. The aim is to protect the parts of buildings most affected by flooding by changing the coverings, raising electrical and plumbing installations and household appliances, installing floodgates on doors and windows, etc. This can be done in commercial and service facilities as well as in homes. In Brazil, field experience suggests that the

population has been adopting these measures informally. At this point, actions could be done better, with a more structured and financially supported policy.

Flood insurance is also complementary to non-structural measures. In Brazil, there is no national flood insurance system. Two countries that are interesting in this regard are the USA and France. A national system is important to reduce premium costs and to guide control measures.

Within the non-structural areas, there is significant potential in the Cities Statute that has not yet been explored. A classic measure is risk zoning based on flood risk maps and vulnerability analysis. With this, the municipality can control the occupation of risk zones and, when possible, remove the most vulnerable facilities such as hospitals, schools, centers with large crowds, and transport terminals. The progressive removal of occupation from areas of greater risk, with the implementation of green areas and parks in these locations, is an alternative as a long-term policy, without the need for very large investments all at once. In integration with urban planning, proposals for extensive linear parks have been suggested, such as the one proposed in the case of the Metropolitan Region of Belo Horizonte in its Macro zoning plan and which became known as the “Trama Verde e Azul”, inspired by the French experience in Nord-Pas-de-Calais (OLIVEIRA; COSTA, 2018). At the intra-urban scale, a wide repertoire of alternatives has been developed under different names, such as Green and Blue Infrastructure – GBI and Sustainable Urban Drainage Systems – SUDS (see DRUMOND, 2023).

In recent research, Nascimento et al. (2022) and Drumond, Almeida and Nascimento (2023) showed that the inclusion of economic incentives in master plans, by exchanging the purchase of additional building rights for sustainable devices in new buildings (green roofs, catchment boxes, draining gardens, etc.), is a measure that can generate sufficient incentives for the construction industry to include these techniques in areas highly valued by the real estate market. However, outside of these high-income areas, this type of public policy is not sufficient, according to the scenarios simulated by the authors, which suggests that these devices must be widely adopted across urban areas to reap the benefits — notably, the ‘flattening’ of the peak flow curve, reducing flooding in densely occupied urban areas. Thus, the authors point out that measures to mitigate and adapt to climate change in the Global South require more direct government intervention, such as the construction of new linear parks and the adoption of green roofs in public buildings.

At the federal level, the National Civil Defense and Protection Policy (PNPDEC) was created by Federal Law No. 12,608/2012. It assigns the duty of the Union, states, Federal District, and municipalities to adopt measures necessary to reduce disaster risks (prevention), as well as to establish that the uncertainty of the disaster will not constitute an impediment to the adoption of preventive and mitigating measures for the risk situation (precaution). The PNPDEC must integrate information to support the bodies of the National Civil Defense and Protection System (SINPDEC) in predicting and controlling the negative effects of adverse events on the population. The inclusion of this issue in the Brazilian legal system was an important step forward, despite the succession of crises that the country faced between 2015 and 2022, which possibly hampered the implementation of public policies, either due to a lack of financial resources or a lack of personnel in the ministries and related bodies. In general, the literature that sought to evaluate this federal policy found that, although

sectoral legislation clearly plays its role in disaster situations, the lack of integration and coordination between the agencies involved is still evident. The distribution of resources and the lack of training for both managers and the population stand out as the main obstacles for states and municipalities. Additionally, the lack of instruments that facilitate the monitoring and follow-up of risk-addressing actions continues to hinder the achievement of goals for the development of more resilient cities (FERENTZ; GARCIA, 2020).

It is important to highlight that the National Civil Defense and Protection Policy has brought significant advances, and the programs and plans outlined by the federal government seek to provide a better organization of the issue. However, the context in which the policy was formulated may have been excessively influenced by the landslides in the mountainous region of Rio de Janeiro in 2011. As a result, neither the text of the national policy nor the federal government initiatives were sufficiently comprehensive, missing the opportunity to adopt a broader perspective on disaster risk management in the country. In view of this, challenges remain to be overcome, such as the transition to adopting the river basin as the unit of analysis and planning for the prevention of disasters related to bodies of water, instead of defining isolated actions by municipalities. In addition, there is a need for greater coordination between the different agencies and sectors involved in actions related to disaster risk management. This coordination represents the first step towards more efficient monitoring of actions, allowing for an integrated assessment that strategically reflects the advances in the sector (FREIRE, 2014).

It is still too early to assess with greater precision, but there is preliminary evidence that the federal response given after the 2024 flood disaster in RS represented a new milestone in terms of responses to climate disasters in Brazil. In about a month, more than R\$10 billion were allocated to deal with the effects of the floods. A ministry was created in the federal government exclusively to deal with the reconstruction of the state. High-frequency economic data (measured and released with great regularity, such as days, weeks and months) already suggest that by July 2024 some sectors of activity had already returned to pre-flood levels⁵.

5 Considerações Finais

The formulation of expectations about the future — futurities (RANDOLPH, 2022) — plays a crucial role in planning. In the most generic sense of planning, when faced with uncertainties about the future, either a plan is drawn up or one surrenders to the domain of improvisation (MATUS, 2006). Planning, in turn, affects the cyclical processes of modulating the territory, according to the needs and desires of each *zeitgeist* (spirit of the time).

In the current context, after the pandemic and, in the case of Brazil, after several crises, there is a growing consensus on the urgency of plans to combat climate change. This opens the way for a resumption of planning, now on a different basis than that of the developmentalism that marked Brazilian industrialization in the 20th century. The aim is now to reconcile economic, social and environmental

⁵ Disponível em: <https://valor.globo.com/brasil/noticia/2024/07/16/atividade-ja-sinaliza-retomada-em-parte-da-economia-do-rs.ghtml>.

aspects, often reflected in the terms of sustainability and responsibility for future generations.

Futurities play a crucial role in shaping property prices, as they incorporate future expectations and uncertainties, such as the risks associated with climate change. As property markets respond to new demands and challenges, such as the need to adapt to climate change, property prices reflect not only locational advantages but also the perception of future risks, such as flooding. This relationship makes property tax management essential for local revenue collection, which underpins the financial viability of new adaptive infrastructure.

A variety of federal, state, and municipal public policies are being tested, along with community-based and social initiatives (as discussed in the previous section). Without profound, urgent, and vigorous changes, the future marked by climate change becomes a disturbing presence.

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