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Impacts of floods in Rio Grande do Sul on urban life: land use and occupation and housing

Abstract

Environmental disasters have a significant impact on urban life; floods and landslides force the relocation of a relevant number of residents and damage urban infrastructure in southern Brazil in April and May 2024. The destruction of green areas reduces leisure spaces and affects biodiversity and air quality. This paper aims to discuss the impacts on urban territory to promote an environmental planning integrated with risk management plans and masterplans. Presenting the territorial dimensions in the different impacted contexts, this summary seeks to discuss the socio-environmental and economic dimensions. The reconstruction process can lead to a disorganised changes in land occupation; thus, it is crucial to develop public policies to mitigate these negative effects, taking river basins as the basis for urban planning.

Keywords: flood, climate change, natural disasters, urban planning, risk management

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Introduction

According to the IPCC (Intergovernmental Panel on Climate Change), warming of 1.5°C will be exceeded in the coming decades, accentuating extreme weather events, and action must be taken in this decade to significantly reduce the level of emissions and avoid the consolidation of an even more catastrophic scenario.[1,2]

The population of cities is expected to grow by 2.5 billion by the year 2050, the difficulty of accessing basic services in urban areas could reduce the economic productivity of populations.[3] Even with a fall in the decrease in the global poverty rate, there is an increase in the poor population in urban areas, with 70% of the population of emerging cities in Latin America, Africa and Asia lacking access to housing, water, energy and transport at reliable levels.[3] In Brazil, it is estimate for 29 million more inhabitants by 2050, with 90 per cent of the population living in urban areas.[4] Therefore, actions that will impact the built environment in the long term need to be implemented now to meet the growing demands in urban centres and establish resilient human habitats.

No region on the planet will be immune to the effects of climate change, and increases in fires, droughts, floods and other events will have an impact on infrastructures such as energy and transport, causing economic and human costs that will exceed the actions that can be taken.[2]

In the US, weather events were responsible for 78% of supply interruptions from 1992 to 2010, as well as reducing the useful life of infrastructure.[5] The energy sector can be affected by climate variables, with water being a key element, as not only hydroelectric plants but also other sources that use water in their processes can be affected by changes in temperature, precipitation, irradiation, among others.[6] Insecurity in relation to the resilience of basic infrastructures in the face of climate events will cause damage to the economy and society, as well as jeopardising response conditions in extreme situations.

In addition to these challenges, some of the effects of climate change will not be reversed and will be exacerbated as emissions increase. Redefining the means of consumption and production of goods and how we use the land is necessary to establish a zero emissions level, considering that the natural environment will still take time to re-establish itself after the definitive reduction in emissions.[2]

Topics such as the growth of cities, access to and management of water, energy, food production, mobility, waste collection and recycling have a significant impact on the planet's future by 2050. Actions taken today, or not implemented now, must have an impact on quality of life, social equity and the natural environment, within a context of accentuated climate change. It is therefore necessary to build solutions in various fields and areas of activity, as well as to introduce these questions to society in general.

Based on the continuous changing of climatic events, with severe intensity and impact, all regions of the planet have suffered, in this case on the state of Rio Grande do Sul, located in the southern Brazil, in a strong event between April and May 2024. The socio-environmental effects of intense rainfall (exceeding 200 mm per day) in a short space of time, which led to 800 mm in 5 days, leads short and long-term impacts on all sectors of society in Rio Grande do Sul. The disruption of ecosystem services had a significant impact on the soil and its different uses and forms of occupation;[7] to understand this serious disaster, a multi- and transdisciplinary assessment is essential.

Regarding to the impacts on urban life and land use and occupation, the analysis begins with the territorial configuration of the state in terms of the geological and geomorphological structure and the hydrographic regions. Based on these original conditions, the process of city occupation is closely related to the availability of water resources and the geographical situation on the water dividers, as in the case of Passo Fundo,[8] or in the valleys, such as Lageado and Muçum, some of the most impacted cities by the recent floods.

The process of urban expansion and growth over time has maintained a close relationship with watercourses. However, with the advent of the climate crisis, this relationship has become fragile and unsafe for the entire population, highlighting the social and economic vulnerabilities of the affected cities and their regional, state and federal impact. The high rainfall rates directly impacted a population of 2,398,255 inhabitants (corresponding to 21.56% of the state's population) and the territorial extent of the flooding and mass movements affected almost all the state's municipalities - 96.36%, declared to be in a state of emergency or public calamity.[9]

Understanding the combined factors that led to the most severe flood in Brazil's history is a prerequisite for developing decision-making guidelines for defining strategies for coping with state

reconstruction and adapting to the future, which go beyond simple resilience or mitigation. It means, various actions have been taken at all levels of local institutions; this knowledge must be maximised, consolidated and put into practice effectively.

Land use and occupation deserve new perspectives, with new planning challenges based on river basin territory and Nature-Based Solutions.[10]

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Conflicts of interest

The author declares there is no conflict of interest.

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