



**HAL**  
open science

# Saturation as urban crisis. Understanding Anthropocene from two flooded cities of the Global South

Sofia Guevara, Romain Leclercq

## ► To cite this version:

Sofia Guevara, Romain Leclercq. Saturation as urban crisis. Understanding Anthropocene from two flooded cities of the Global South. Association of European Schools of Planning Congress (AESOP), Jul 2024, Paris, France. hal-04772723

**HAL Id: hal-04772723**

**<https://hal.science/hal-04772723v1>**

Submitted on 8 Nov 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# **Saturation as urban crisis.**

## *Understanding Anthropocene from two flooded cities of the Global South*

**Guevara Viquez Sofia**

Gef, CNAM, France

sofiaguevaraviquez@gmail.com

sofia.guevara@univ-tours.fr

Orcid ID : <https://orcid.org/0009-0003-6319-6047>

**Leclercq Romain**

IRD, Hydrosociences Montpellier (UMR 5050)

romain.leclercq@ird.fr

Orcid ID : <https://orcid.org/0000-0003-4198-6075>

### **Abstract (up to 125 words)**

The paper proposes to shed light on the articulation of global processes typical of urban trajectories in southern cities and crises at the local scale, based on a comparative analysis in two cities frequently affected by floods, Dakar (Senegal) and San José (Costa Rica). In doing so, the paper aims to clarify the notions of 'crisis' and 'disaster' in urban contexts in the Anthropocene by linking them to that of 'saturation'. We highlight three results. First, using flooding as an example, saturation sheds light on the processes that shape cities and their disasters. Second, saturation highlights the specific ways in which water interacts with urban environments. Finally, the findings touch on the capacity of actors to cope with these crises.

**Key words:** city, floods, crises, Anthropocene, saturation

### **Full text**

#### **1. Thinking crisis through a process of saturation in the Anthropocene**

The crisis refers to a state of uncertainty often linked to an exceptional, accidental but disruptive event that shakes the ordinary up and reduces the time available for decision-making (Godard et al., 2002). The event can be a natural or technological disaster that has happened and damages assets. It can also be an anticipated event that has not yet happen, but that leads actors to take decisions under stress. It might be crisis without an actual event (Tazieff, 1977). The notion is directly related to the capacity of the decision-making process to deal with the extraordinary beyond all fields of expertise or knowledge (Gilbert, 2007; Rey-Thibault, 2022). Some authors will distinguish crisis from rupture, the latter leading to a whole other path, as in the former, the organisational structures are not completely questioned afterwards (Guilhou and Lagadec, 2002). In urban environments, the literature highlights how the concentration of populations and problems, the interconnectedness of networks and overlapping systems of governance can lead to thresholds being crossed (Robert 2012). The notion is related to the suddenness of a probable disruption, implying changes in the ordinary functioning of organisations.

Complementing this work, this paper aims to clarify the notion of crisis and disaster in urban contexts on the basis of the Anthropocene by linking it to that of 'saturation'. The aim is to integrate more systematically the crises that have been neglected by much of the work on the urban and disaster studies, which have focused on exceptional events and leaving aside crisis related to long terms process of accumulation. Within the

literature, notions such as the *neglected disasters* (Wisner and Gaillard, 2009) or the *small disasters* (Gaillard et al., 2014) have pointed this long-term crisis. The first category refers to disasters which, because of their less exceptional and long-term nature (such as drought, environmental degradation and poverty), attract less public and media attention. The second refers to small-scale events that affect a certain type of population on a daily basis and therefore do not evoke earth-shattering responses (Gaillard et al., 2014). More recently, the notion of slow disaster emphasises this long-term *process* by which disaster happen, beyond the event (Knowles, 2020). By amalgaming the notions of “creeping disaster” (Rosenthal, 1998) and “slow violence” (Nixon, 2013), it also points toward the necessity to understand the properties of affecting elements, that are not entirely social construction but also material entities with their own dynamic, to understand disasters. In the context of the Anthropocene, the notions of small, neglected and slow disasters become particularly enlightening. Following these paths, we aim, to shed light on the links between crisis as stated events, and crisis as long-term disasters as the Anthropocene is also the time of “concatenation of both slow- and quick onset events” (Steffen et al., 2021, p. 162). By doing so, we question what has been approached differently in the literature. We also put into perspective the “normal” situation, often characterized by the fragility much more than stability.

Now, the time of the Anthropocene corresponds to a time of critical events, and of uncertainty as to their intensity (Reghezza-Zitt, 2019), but through other related concepts developed by the social sciences, such as ‘capitalocene’ (Moore, 2017) or ‘accumulocène’ (Fressoz, 2020), the Anthropocene gives the opportunity to rethink lifestyles, economic activities and their material emanations deployed at least since the end of the 19th century, which are the material expressions of the anthropogenic geological transformation (Fressoz, 2020). From this perspective, the Anthropocene is also the time for dealing with the materiality that the human species has moved, extracted, burned and agglomerated, and finally inherited in the long term, and with which it must contend in a changing climate. From an Anthropocene perspective, a crisis is not just seen as an exceptional moment, an event, or a catastrophe, as a break with what already exists (Sierra, Gustiaux and Leclercq, 2020). It is not only a one-off disturbance leading to specific practices for dealing with it that are likely to evolve over time (Gueben-Venière and November, 2020). The crises can also be seen as processes of accumulation and transformation of matter, social practices and techniques which allows to consider the (temporal and spatial) continuities between crises. In the context of floods in the urban South, we refer to this process as a process of saturation.

In chemistry, the notion of saturation refers to “the limit of a substance's ability to dissolve or absorb another”. In hydrology, it refers to “the state of a medium [...] whose interstitial voids are completely filled with water”<sup>1</sup>. In its current sense, the concept is used to describe a historical process of accumulation, densification and intensification, leading to a point of discharge by the medium in question, or transformation of the latter (in this case a substance). It seems to us that this notion can be useful for thinking about disasters linked to urban flooding in the Anthropocene for two reasons. First, the notion of saturation emphasises the process rather than the event: to say that a system, substance or environment is saturated is to point toward the historical and

---

<sup>1</sup> Centre National de Ressources Textuelles, 26-07-2023, « Saturation », <https://www.cnrtl.fr/definition/saturation>

material depth of its state. The process of saturation leads to a tipping point at which a gentle return to 'normal' is difficult when not impossible. In this respect, the temporalities involved in the saturation process reflect both the history of the 'forcing' factors that changed environments, and the particular state in which it finds itself at the saturation point: characterised by great (permanent) instability, or by the tipping point into another state. This particular state is the second aspect of the concept that interests us. At the point of saturation, the properties of agents, social forms and relationships are, or could, be transformed depending on the intensity of the pressure, the relationships between actors, and their history. We will see that, in the case of an urban environment, these transformations are far from mechanical processes but include different interactions implying weather, geo-urban landscapes, and ways of leaving and governing these landscapes.

Thus, although the Anthropocene has undoubtedly radicalised the questioning by offering a common spatial and temporal scale, that of the planet, to numerous studies interested in the environment, climate change, forms of pollution and disasters (Bonneuil and Frescoz, 2013). However, the articulation of these scales with those constructed and investigated for a long time by social and environmental scientists remains problematic (Clark, Szerzinsky, 2021). This paper takes the saturation process as a way to investigate urban environments that are both site specific geo-ecological settings, and a global assemblage that produces their own vulnerability (Tsing, 2015).

Moreover, thinking of human collectives as geological forces (Clark, Szerzinsky, 2021) implies articulating an approach to the environment as a social construct to another that sees the material limits of geo-ecosystems (Charbonnier, 2017). In order to do this, saturation appears to be a boundary term capable of characterising these socio-natural milieus that have thus 'entered' the Anthropocene and their disruptions. Using the case of flooding in two cities in the South, Dakar and San José, we will attempt to show what the 'saturation' of these environments poses as a specific problem, and how it impacts the traditional analysis of disasters in urban environments.

## 2. A comparative approach of two flooded cities from the South

One of the challenges posed by the Anthropocene lies in the global nature of a phenomenon whose effects are nevertheless unevenly distributed in time, space and between social groups. In addition, by forcibly or voluntarily bringing all social, political and 'natural' formations into a single space-time characterised by global crisis, the concept has been accused of reproducing the colonial gesture of recalibrating the world on the scale of a Western perception and knowledge regime of its disruptions (Davies, Todd, 2017). Clearly situated in the field of the humanities and social sciences, but at the same time careful to put forward 'other' perspectives, at once situated but capable of complementing, amending or contradicting 'the' global theory, our approach consists of understanding global transformations through comparison, by situating these transformations, in the city and in the South, through ethnography method (Robinson, 2022). The table 1 shows the method declined in different qualitative data collection strategies in each research.

**Table 1. Qualitative methods**

Method	Dakar	San José
--------	-------	----------

Semi-structured interviews	59 (Inhabitants, Local/national practitioners, private actors, ONG, public authorities)	52 (31 inhabitant, 16 practitioners, and 5 private experts)
Immersive observations resulting in notebooks	Total of 2 years living in Dakar between 2015 and 2019 <i>(work with community organisation, following of large scale mitigation projects and municipal mitigation efforts, several month living with municipal flood manager in an impacted neighborhood...)</i>	In total 3 years living in San José between 2014 and 2018 <i>(e.g. observation of public lectures on risk management for public actors and of trainings for citizen participation in risk management; city walks; participation in a citizen early warning system).</i>
Analyses of documents and archives	Documentation of several mitigation projects.  Press review: 600 press articles from 1987 to 2009	Archives of local risk management committees; of the Municipality of San José and of the Ministry of environment.  Press review: 51 press articles from 1944 to 2015.

This approach seems to us to have a twofold interest. The first is heuristic. By comparing situations specific to two urban contexts separated by thousands of kilometres and an ocean, the comparison reveals similarities and differences that are particularly interesting for understanding the dynamics of 'global' phenomena, and for tracing their contours. Thus, the fact that this comparison contrasts two thesis fields (Guevara Viquez, 2020; Leclercq, 2020), carried out by their authors at roughly the same time and using similar methods and questions, not only provides information about their common scientific background, but also provides tools for delimiting, naming, grouping or separating phenomena and categories whose scope sometimes remains relatively vague (Candea, 2016).

Secondly, by situating ourselves in the South and seeking to define what the city as a material, social and political environment produces and reveals in terms of socio-natural disturbances, this comparison responds both to long-standing calls in urban studies (Robinson, 2006), sustainability studies (Hurlings et al., 2020), and more recent calls in Anthropocene studies (Yusoff, 2018), to give an equivalent place in theory to subaltern sites and actors. To do this, we sought to establish equivalences and a *posteriori* comparisons between phenomena and experiences that we approached through qualitative methods in working-class neighbourhoods of Dakar and San José, two cities affected by flooding that is both recurrent and directly linked to their forms of urban planning.

### 3. Results

#### **3.1 Urban landscape formation: waterscapes in global encounters**

The Anthropocene, with the advent of extreme events, rising water levels and droughts, poses problems of water surplus and shortage. We propose to approach the problems of surplus water, accumulation and stagnation, generating floods in cities, which are multiplying, generating specific forms of 'urban waterscapes' (Goh, 2019), modes of inhabiting, and calling for expertise and public responses (Leclercq, 2020; Guevara-Viquez, 2020). These crises result from the accumulation in time and space of practices and techniques aiming to modify, control, orient the behaviours of water. This process of accumulation redefines the temporality of the crisis, not as a moment or an event, but as a material thickness that transforms watersheds.

### **3.1.1 Terraforming the niayes in the Cape Verde peninsula**

On the Cape Verde peninsula, the hydrographic network has been characterised since the Quaternary by the presence of lakes or wetlands, regularly of permanently under water, in the foothills of the sand dunes due to an outcropping water table (Fall, 1986). This network, known as the "niayes", is modified by alternating wind regimes and the accumulation of fluvial sands that shape the dune formations, as well as by the interaction between marine currents and the groundwater network fed by rainfall. Highly dependent on the climate, these particular ecological formations are also very fertile, and provided the Lebus who settled on the peninsula from the fifteenth century with a terrain that was both suitable for cultivation and for resisting the Cayor armies from the 1790s onwards (Sylla, 1992). In 1857, colonial settlers bought land on the tip of the peninsula and developed the Dakar colonial city, which became the capital of French West Africa in 1902 and concentrated most of the country's commercial and industrial activities, attracting a very large population in search of work. Typical of the spatial forms of colonial exploitation, this polarisation led to the rapid expansion of the city across the entire peninsula, reshaping the landscape of the niayes.

Continuing the "sanitation" work begun in metropolitan France, which stemmed from the hygienist movement and involved draining wetlands and "containing" urban fertile lands (Fournier, 2007; Morera and Morgan, 2019), the French colonists drained the "marigots" at the tip of the peninsula. These operations, carried out from the end of the 19th century onwards, were in some cases combined with the installation of wastewater and rainwater drainage networks (Faye, 2017). However, the meagre investments made at the time were never enough to make up for the lack or inadequacy of collective facilities in the vast majority of the urban area. These changes to the hydrographic network were also combined with ongoing drainage work to transform wetlands into market gardens, used by the settlers to separate the French neighbourhoods from the indigenous ones, but also by the Lebus and even by new arrivals from French West Africa as the capital expanded and demanded food.

The expansion of the colonial city was very different from the colonial dream. From the Lebus villages, in the interstices of the colonial city and on its margins, a large number of neighbourhoods developed, described as "irregular", escaping the cadastre and the water and energy networks (Faye, 2017). Accused of contributing to the spread of disease and of 'cluttering up' the urban landscape, their inhabitants were evicted from their homes, sometimes in exchange for building plots located far from the urban centre. This approach was taken up again after independence for urban planning reasons, leading to the expansion of Pikine and Guediawaye, in the north and east of the peninsula. From the 1950s to the end of the 1980s, the servicing of plots of land allocated for building purposes often included a minimal sewerage network, with

residents having to connect to it themselves or install individual sewerage systems. These new centralities systematically gave rise to the production of a new "irregular" town on its flanks and along the roads in a context of exponential population growth throughout 20<sup>th</sup> century. The drought of the 1970s and 1980s in the Sahel had a decisive impact on the urbanisation of the niayes. By contributing to the drying up of certain wetlands, the latter provided fertile ground for regular and irregular urban expansion, and thus prepared the way for some of the flooding that occurred in the 1990s and 2000s, after the drought ended and the rainfall pattern changed (Chagnaud *et al.*, 2022). During this period, the suburban districts started to regularly suffer from stagnant water that displaced entire neighbourhoods, led to a phenomenal rise of hydric and vectorial illnesses, and to major disturbances of social life (school closures etc.). But because it was affecting *waa banlieue*, considered as marginal people, this phenomenon was not considered as a public problem (Leclercq, 2019). It is only during the 2000's, when the rise of water table level and the soil sealing coefficient reached a certain level, that the entire agglomeration started to floods, and that the State authorities and international donors began to handle it.

### **3.1.2 Piping watercourses, soil sealing, and floods in San José**

San José's structuring role in the urban development of the so-called Central Valley starts in the middle of the 19<sup>th</sup> century, and in particular from the end of the 19<sup>th</sup> century related to the development of coffee farming (Carvajal Alvarado and Vargas Cullel, 1983). Commercial activities linked to the agro-export model were concentrated in San José (Quesada Avendaño, 2011). Later, as in many Latin American capitals, the phenomenon of metropolisation starting in the 1950's is reflected in the tertiarization of the productive apparatus, the disappearance of land used for agriculture and the development of the property market and speculation (Dureau *et al.*, 2006; Hall, 1976). The population of the urban-metropolitan area rose from 322,823 in 1950, to 1,105,679 in 1981. Despite the existence of planning instruments, these urbanisation trends continued after 1980, with horizontal urban expansion, without any increase in density, in areas with complex topographies (Hardy, 2005). In the course of this transformation process, the canals built to irrigate the coffee-growing fields became drainage canals for urban water.

San José's sewage system was built at the end of the 19th century (Quesada Avendaño, 2011). Several canals and streams formerly used for agricultural activities were then covered over to become part of the sewerage system (Alvarado Rojas, 2014).

Wealthy neighbourhoods were the first to benefit from the installation of the changes. The working-class districts had to wait a few decades to be connected. (Quesada Avendaño, 2011). The urbanisation process that created the metropolitan area between 1940 and 1970 reproduced these trends and adapted to the coffee strategy. In this process, property developers invade protected areas, underestimate the flow of watercourses and even erase them by levelling the land to build streets and houses on their original axis (DRENACA, 1977).

This process of piping is punctuated by the phenomenon of flooding, which is gradually becoming associated with a problem of urban development (Guevara Viquez, 2020), and not exclusively as problem only related to poor areas (Guevara Viquez, 2019). The floods of the late 1960s and early 1970s marked a turning point. The municipality of

San José commissioned the DRENACA study, drawn up in 1977, which was supposed to result in infrastructure works to increase the drainage.

Along with this process of transformation of basins, city actors tend to forget the watercourses. Mapping of the stormwater network in San José is almost non-existent, even though the lack of information on technical networks is a major challenge for their management in a context of climate change (Denis, Florentin 2022). The managers know only 30% of the network, which is currently being re-registered (Guevara Viquez, 2020). Most rivers and streams are channelled and buried, hidden by buildings. When they are not covered, the watercourses are lined by walls and their beds become very narrow, particularly at bridges, which function like dams during rainfall (Morales Soto, 2012).

Thus, the two cases show the historical accumulation of people, techniques and practices that shape landscapes from wetlands and agricultural lands to two-sided urban “waterproof” area in order to feed the demand of local and global shifting political economy. These processes transform the hydrographic basins into a new entity. The challenge of the Anthropocene is to rediscover urban waterscapes as they are, i.e. urban watersheds made of underground sewer-rivers, working-class swamp districts, polluted streams and urban flood plains. These processes challenge the hydrological knowledge as well as the sociological one needed to deal with the flood crisis. In the South, where hygienist movement and the related process of city canalization has often merged with precarious urbanization, partial urban planning and public services (Bierschenk and Olivier de Sardan, 2014), this allow us to better understand the ways by which some groups and people are becoming vulnerable to different flood manifestations.

### **3. 2 Saturation shaping the living spaces**

#### **3.2.1 Living in a changing hydrographic basin: from slow to flash floods in San José**

This process of transformation can be illustrated at the level of Barrio Luján, a working-class neighbourhood in the old town centre in the south-east of San José. Its development began in the 1920s and intensified in the 1950s. The socio-economic profile of current residents corresponds to craftsmen, blue-collar workers and small shopkeepers with an intermediate level of general qualification<sup>2</sup>. It is a neighbourhood heavily affected by flooding from the *Ocloro*, whose basin has been 100% sealed with the urbanisation process in San José (Guevara Viquez, 2020). This river is 6.85 km long and has a catchment area of 6.196 km<sup>2</sup>. Its flow behaviour and the changes to its bed can be likened to “quebradas”, a type of “gully”, an element of the hydrographic system that operates particularly during heavy rainfall (Metzger and Peltre, 1996), with rapid, even violent overflows. The transformation and coverage of the riverbed at the scale of the neighbourhood is associated to the expansion of a dairy factory from 1950 to the 2000’s, when most of its activities were displaced to the west of the Vallee.

The flooding in Barrio Luján is accentuated by the process of urban sprawl. Many of the residents we met grew up in the district between 1950 and 1970. Their stories take us back to the San José of another era, dotted with fields of fruit trees and pasture,

---

<sup>2</sup> Data collected in February 2017 from the National Institute of Statistics and Census (INEC).



over which the river slowly overflowed without affecting the houses. This overflowing was to the north and not to the south, unlike today:

Bernardo: Let's just say that what was flooding was the little square over there [...] on the other side of the river. And all that [the land near the river] was full of vegetation, where we used to play at the time [...] Let's say the river overflowed but there was plenty of room. [B. Barrio Luján, June 2017]

Heavily affected by the floods of the early 1970s, the district was included in the DRENACA works. The work took until the 1990s to complete. The measures involved covering part of the River Ocloro and building a secondary canal to divert excess water upstream from Barrio Luján. As long as it reduces the impact of overflows, work on the sewerage system is a popular option:

Flooding was continuing and we heard that they were doing a project called DRENACA [...] We could see the difference: it rained and the river hardly overflowed [Beth, Barrio Luján, who moved to the neighbourhood in the 1980s].

Thus, over the course of the twentieth century, the development of the sewerage system in San José was shaped by crises and recurring floods. While the network is being deployed to reduce overflows, it also shapes today's flooding, as we will see in the last part of this paper. The construction and extension of the sewage system has a feedback effect on the crises affecting the city today (Coates, 2022).

### **3.2.2 Accumulation, stagnation, progression of the floods and of the water networks in the suburbs of Dakar**

In the municipality of Djiddah Thiaroye Kao, raised in the 1960's and 1970's from the Pikine resettlement neighbourhood onwards in the suburbs of Dakar, the first floods started at the end of the 1980's. At this time, ancient cultivated "bas-fonds" transformed into houses and courtyards during the drought period, started to fill up again forcing people to live their house during the rainy season. This phenomenon gained in force and intensity during the 1990's, leading the government to consider a first resettlement plan in 1994, that was never achieved because of the opposition of certain households (some of them had already been displaced during the 1960's because of the "clearance" of Dakar "slums"). That "return" of the rains eventually combined with a periodic rise of the level of watertable (Ndao, 2015) - because of the rainfall intensification and beside its general trend decline - led to a very different flood dynamic than the San Jose one. Here, the problem was not the sudden and violent manifestation of water, rather than its progressive accumulation and progression, leading to the progressive abandonment of house, or to the backfilling of others. This dynamic eventually intensified after 2004 and the stop of the pumping of the groundwater-table for the alimentation of Dakar with potable water for sanitary justifications (Leclercq, 2017), leading to its rise, one of the major flooding event at the agglomeration scale, and the intensification of neighbourhood's socio-material transformation.

M. Diop: It started in Leona in 2005. The floods were a bit far away. But it came year after year, it came up towards us. [...] And so it was in 2009 that we [our school] were flooded. The water was almost 1 metre high. [...] So we closed the school, we stopped our activities, and it was only in 2011 that we started again.

But from 2009 to 2011, there was nowhere to go. The neighbourhood was overrun... [...]

Romain: Did that have an impact on your students?

M. Diop: Oh yes! We lost a lot of pupils, a lot! They left. So yes, it had an impact on us. We've lost almost 60% of our pupils. [...] Here now, the population is practically poor... With the flooding, the level of poverty in the town has increased even further. [...] You know, let's talk about the consequences. The abandoned houses. The families who abandoned their homes had the means to do so, so they went and rented somewhere else. Now poor families live in these houses.

*M. Diop - Headmaster of the Léona Franco-Arab school, interview conducted the 27 June 2016 in one of the classrooms.*

2005 was a major outbreak for the entire agglomeration, leading to the forced resettlement of thousands of people during several months (several years for some of them) and to the launch of the first national urban adaptation policy. The point of this paper is not to get back to this policy building process that have been described elsewhere (Schaer, Thiam and Nygaard, 2018; Bottazzi, Winkler and Ifejika Speranza, 2019; Leclercq, 2019, 2023), but to point out the overarching processes that gather our two different cases. As in San Jose, the main response of the public authorities, national and international, had relied on the channelization, and eventually the displacement of flooded affected people. After 2010, the State and the World Bank started a major drainage infrastructure project, that is still undergoing, following the watersheds tops and depressions in order to cover the whole suburban area. But here again, that channelization did not operate in a fixed environment. All along the last two decades, Dakar was also the object of major road infrastructures and pavements projects (Melly, 2017), some of them directly related to the needs of water evacuation through the new drainage networks. As this way of producing the “out of water” city was expanding, inhabitants started to not only backfill and seal their own houses, but also entire roads and neighbourhoods. Far from disappearing, the floods now displace through waterproof roads and sealed neighbourhoods from the top of the dunes to their feet, sometime until the sea, and sometime until the next low lying point where they remain trapped.

In our work, saturation directly refer to the bifid process of channelization on one hand – that had been conducted first as a way to build a “sanitized” city for the wealthier and the dominants – and of overflow, stagnation, choking, accumulation on the other – when the entanglement with very unequal socio-material landscapes produces different types of floods. If the channelization could have been a very specificity of the urban form since ages and in very different contexts (Chwałczyk, 2020), what make it different from the 1950's in some cities of the Global South is that it interacts with a fast and very large process of groups and land transformation, and in a context of huge power imbalance within the city production. The urban demographic explosion, the polarisation of national economies within few city centres, the generalization of grading and levelling, of concrete, cars and the associate infrastructures, and the inequalities reflects into the material production and setting of the city, confronted with very different hydroscaapes. What's interesting here, is that besides these different hydroscaapes and, at the end, different urban-hydroscaapes flooded in different ways, the same solutions

are used, producing the same horizons of an “out of water” city. Defining a process as well as a situation, the saturation/saturated city appears to be produced and reproduced through this power imbalance, that define and redefine who is affected and in what extend.

### **3. 3 Saturation and power reconfigurations: living on the edge**

The notion of 'saturation' offers an opportunity to think both about the limited “capacities” (Tousignant, 2018) of actors living in an uncertain environment, regularly submitted to variable crisis. The question is not really how to transform the environment to stop the flood, but who, where and how the flood will affect (Chahim, 2022). The uncertain nature of water manifestation in saturated urban watersheds is thus pointing toward the different capacities to deal with different behaviours of water at different urban scales.

In saturated urban environments, the attempts of individuals and groups to protect themselves from flooding almost systematically have an impact on the exposure of their neighbours. In the suburbs of Dakar, the backfilling of one house often leads to flooding of the neighbouring other, while abandoning another can lead to the formation of a water accumulation point, degrading the neighbourhood symbolically (the empty space quickly becomes a dumping ground) and concretely (water rises by capillary action in the walls of neighbouring houses, Leclercq, 2022). The ability to take action, on one's house, street, neighbourhood or any other part of the urban space, then depends on the ability to mobilise money, matter, relationships, or to produce and direct public action, making it possible to be on the "right" scale - i.e. the scale that determines the flow, infiltration or stagnation of water within the space to be "protected from water" - using the "right" method - i.e. the method that is best suited to the behaviour of the water that we wish to avoid. However, the scale and method are far from obvious; on the contrary, they are the subject of active research punctuated by trial and error (Leclercq, 2019; 2017) and are intrinsically political.

Whether at local or city level, acting collectively on pumping out a low point (Leclercq, 2019), or on draining an entire catchment area (Leclercq, 2023), produces 'winners' and 'losers' of the city out of water. When a parastatal agency involving the Senegalese government and the World Bank redefined the master drainage plan for Dakar on the scale of the city's catchment area, they chose to fight the accumulation of water by favouring its "natural" flow, determined in part by the topography of the Cape Verde peninsula, and at the same time evicting the inhabitants located along the route of these flows. When neighbourhood organisations succeed in mobilising international NGOs and institutions to resume pumping a water table that has become too high, thereby flooding part of the suburbs (Leclercq, 2017), they make some of the flooded neighbourhoods more or less liveable, and in so doing act on the forms of exposure that structure them. In a saturated hydro-urban catchment area, the ability to mobilise more than human forces - run-off, infiltration and water storage capacities - and to modify the environment in order to do so, depends on urban actors resources (Clark, Szerzinski, 2020). Behind exposure to risk or access to resources lie infrastructures, forms of urban planning and institutions that organise the production and maintenance of a city that produces its own exposure to flooding (Chahim, 2022), and over which certain individuals, groups, and not others have the capacity to act.

In San José, we see these power imbalances in handling the flooding between the historical responses of the dairy products factory in Barrio Lujan, the current responses of the new real estate actor in the neighbourhood, and the inhabitants' responses. Because the phenomenon is long-standing, and the work to reduce it is spread over time, residents have learned to live with it. In the landscape of the district, one can see the handcrafted devices visible in the facades of the houses: the inhabitants erect small walls, concrete or zinc barriers to prevent the entry of water in their houses. When it happens in the streets, flood is undermined, inhabitants live with it, even though they remain isolated. Residents also have permanent watch strategies (Gueben-Venière, November, 2020): they observe the clouds in the distance, listen to the force of the rain or torrent and decide to act accordingly (Guevara Viquez, 2023; 2019). When the artisanal barriers are breached and the water enters the houses, the residents mobilise to demand a response from the public authorities and from the neighbourhood's main employer, the dairy products factory that stayed in Barrio Lujan for over 50 years, which was also affected by the floods. Archives of minutes of meetings between representatives of the neighbourhood and the factory show the discussions of the various nuisances that the factory could generate during the 1990's. Although the company claims to be a victim of flooding<sup>3</sup>, its response to it (to dig canals) gives a glimpse of the resources it can mobilise to deal with the situation, thereby reassuring local residents and easing tensions in the exchanges. Furthermore, the modification of the riverbed was one of the topics of debate back then as it was during the fieldwork: *"Listen, the assistant of the Municipality says to me "but the thing is that you put yourself in the river's natural field of expansion" and me "Damn! We got into the land of the river!", until I said "no", and I started to say "no, madam! Look at this, this, and this!"*. Inhabitants associate the riverbed modification to the floods and hold the factory responsible for it.

Today, these power imbalances concern the use of the part of the riverbank land sold by the factory, which is currently empty and functions as a riverplain zone. A project of three residential towers is to be carried in the area. In order to develop it, the real estate company has to carry out works to increase the river's drainage capacity, widening the riverbed and encroaching on the protection zone<sup>4</sup>. The latter was not respected when the factory buildings were still standing. Since their demolition, this protection zone has been the subject of debate at the Ministry of the Environment, pitting the local residents, the company and the local authority, which supports the project, against each other (Guevara Viquez, 2020).

Far from being only a question of "money", "coordination", "under-equipment" or "resilience", as emphasized by a post-positivist approach of the disaster supported by donors, authorities and a vast majority of engineers and scientists, the floods in those cities challenge the capacity of the channel system itself to evacuate water in an unequal and distributed maintenance regime (Pontille and Denis, 2017), and within a context of self-urbanism (Chioldelli and Grazioli, 2021) and fragmentation of public action (Lavigne Delville, 2017). As the statistic data would eventually show, it is not the deprivation and exposition that generate floods, but its articulation with economic growth and huge urban development projects that characterize a lot of cities of the Global South (Rentschler *et al.*, 2023).

---

<sup>3</sup> One example is the minutes of 10 July 1995.

<sup>4</sup> A ten-metre protective strip along the riverbed that should not be built Law 7575 ("Ley forestal") of 1996.

#### 4. Discussion and conclusions

Based on a situated approach, the paper sheds lights on the articulation of global processes typical of the urban paths in Southern cities and local scales. Through the notion of saturation, we show the processes of accumulation of expertise, practices and their materiality around the idea of channelization that, in interaction with hydroscares marked by a particular pattern of urbanization, generate floods in two cities. In doing so, we propose to point out the temporal and spatial continuities between crises in the context of the Anthropocene. Following Knowles, we believe that these distinctions in time and place are "its self a form of politics, a politics of disaster amnesia, cutting effects from causes, and from futures" (2020, p. 203). Through 'saturation', we call to open the scope to approach crisis and disasters in the Anthropocene.

The common features we raised are however deploying on very different geo-ecological landscapes and timeframes.

In Dakar, the confluence of the city, the *niayes* geological formation and the monsoon regime generates problematic floods due to the slow progression, the stagnation, and the transformation of water, leading to abandonment of houses and epidemic problems. In San José, the process of metropolisation encounter the inter-tropical regime and the morphology of the micro-basins in an intra-montane valley lead to rapid and violent flooding. In contrast with the Dakar case, the problem seems to be the accumulation and the velocity of water. In both cases, however, saturation of the soil and of the networks seems to result from a waterproof-canalised urban planning model that imprinted its path, even if not realised, to the whole watershed.

Second, the comparison reveals a time lag in the public problematisation of the phenomenon. In San José, flooding became a topic of discussion in the 1960s, whereas in Dakar it was not until the early 2000s that the issue was publicly acknowledged, despite the fact that the suburbs suffered from floods since the early 1990's (Leclercq, 2020). This pre-San José approach to flooding might lead one to believe that the problem would have very different temporal characteristics today. What we can see, however, is that the problem is recurrent and persistent, sometime in the same neighbourhoods, sometime displacing from one neighbourhood to another, always taking the form of an unpredictable but persistent threat that targeting specific communities. This "on the edge" situation seems to be a characteristic of the saturated urban landscapes, pointing toward the unequal exposition to this very temporality. As pointed out by various authors using different frames (Nixon, 2013 ; Chahim, 2022), the Anthropocene is here not referring only to the great divide between North and South, but also to shifting temporalities within the cities and the neighbourhoods that put some of their inhabitants at risks more than others, redefining inequalities through this question : who is able to handle the hydro-forces within saturated urban watershed ?

In spite of differences, in both cases we see classic infrastructural responses aiming to tame and channel water, but also to "catch up" the vulnerable city that expanse quickly, both spatially and in term of population growing. If the water channels are considered as a necessity, both by hydrologists, urban planners and inhabitants facing floods, it also reflects a "bottleneck" in urban public policies and their capacity to change in these contexts (Melly, 2017). However, we saw that in saturated contexts,

the different capacities to deal with the water forces has consequences at every scales, and that this power imbalance is the main driver of the reconfiguration of environmental inequalities. In this context, it become crucial to open the black box of water infrastructure in order to ask who is defining, controlling, managing them, how to reach and maintain “at the good scale”, and is this solution the best suited for reducing environmental inequalities at the city scale (Leclercq, 2022).

The limited capacity for public action in the Global South doubles environmental inequalities in the Anthropocene, as the question of power becomes central. Large-scale action depends on resources, but also on the ability of actors to mobilise and exert pressure at different levels (private, local or national). The article thus highlights the importance of addressing the Anthropocene and the challenges posed by climate change not only by strengthening the infrastructure itself, but also by adopting situated approaches. The stakes are high in terms of knowledge of these hydro-urban basins, new urban environments (Hardy, 2005), in order to act in a changing context. Social science approaches can shed light on the long and spatial temporality of material saturation, capturing situated practices, including those of local residents, and thus facilitating the formulation of appropriate solutions beyond the exceptional event.

## References

- Alvarado Rojas, D. (2014) *Síntesis históricos de los recursos hídrico en Costa Rica*. San José, Costa Rica. Dirección de Agua, Ministerio de Ambiente, Energía y Telecomunicaciones.
- Bierschenk, T. and Olivier de Sardan, J.-P. (eds) (2014) *States at work: dynamics of African bureaucracies*. Leiden ; Boston: Brill (Africa-Europe Group for Interdisciplinary Studies, volume 12).
- Bottazzi, P., Winkler, M.S. and Ifejika Speranza, C. (2019) ‘Flood governance for resilience in cities: The historical policy transformations in Dakar’s suburbs’, *Environmental Science & Policy*, 93, pp. 172–180. Available at: <https://doi.org/10.1016/j.envsci.2018.12.013>.
- Candea M. (2016) « De deux modalités de comparaison en anthropologie sociale », *L’Homme*, 218, pp. 183-218.
- Carvajal Alvarado, G. and Vargas Cullel, J. (1983) *Proceso de metropolización en el valle central de Costa Rica: 1940-1980*. San José, C.R.: CSUCA, p. 103.
- Chagnaud, G. et al. (2022) ‘A synthetic view of rainfall intensification in the West African Sahel’, *Environmental Research Letters*, 17(4), p. 044005. Available at: <https://doi.org/10.1088/1748-9326/ac4a9c>.
- Chahim, D. (2022) ‘Governing beyond capacity’, *American Ethnologist*, 49(1), pp. 20–34. Available at: <https://doi.org/10.1111/amet.13052>.
- Chiodelli, F. and Grazioli, M. (2021) ‘Global self-urbanism: Self-organisation amidst regulatory crisis and uneven urban citizenship’, in *Global Urbanism*. Routledge.
- Chwałczyk, F. (2020) ‘Around the Anthropocene in Eighty Names—Considering the Urbanocene Proposition’, *Sustainability*, 12(11), p. 4458. Available at: <https://doi.org/10.3390/su12114458>.
- Coates, R. (2022) ‘Infrastructural events? Flood disaster, narratives and framing under hazardous urbanisation’, *International Journal of Disaster Risk Reduction*, 74, p. 102918. Available at: <https://doi.org/10.1016/j.ijdrr.2022.102918>.
- Davis, H. and Todd, Z. (2017) ‘On the Importance of a Date, or, Decolonizing the Anthropocene’, *ACME: An International Journal for Critical Geographies*, 16(4), pp. 761–780.

Estudios y Proyectos, S.A (1979) *Estudio DRENACA*. Litografía Berenfeld, S. A, México, D. F: IFAM y Municipalidad de San José, p. 111.

Denis, J. and Florentin, D. (2022) 'Des tuyaux qui comptent. Tournant patrimonial et renégociation des relations entre voirie et réseaux d'eau et d'assainissement:', *Flux*, N° 128(2), pp. 32–46. Available at: <https://doi.org/10.3917/flux1.128.0032>.

Dureau, F., Gouëset, V. and Mesclier, É. (2006) *Géographies de l'Amérique latine*. Rennes: Presses Univ. de Rennes (Espace et territoires).

Fall, P.D. (1986) *Du village à la banlieue: l'évolution des villages Lebou du rivage méridional de Dakar*. Paris 10. Available at: <http://www.theses.fr/1986PA100058> (Accessed: 25 January 2017).

Faye, O. (2017) *Dakar et ses cultures*. Paris: Editions L'Harmattan.

Fressoz, J.-B. (2020) '2. L'anthropocène est un « accumulocène »', *Regards croisés sur l'économie*, n° 26(1), pp. 31–40. Available at: <https://doi.org/10.3917/rce.026.0031>.

Fournier, P. (2007) 'La ville au milieu des marais aux XVIIe et XVIIIe siècles. Discours théoriques et pratiques de l'espace', *Histoire urbaine*, 18(1), pp. 23–40. Available at: <https://doi.org/10.3917/rhu.018.0023>.

Gaillard, J.C., Wisner, B. and Nava, B. (2014) 'Petites catastrophes et réduction des risques', *Humanitaire [En ligne]*, 38, p. mis en ligne le 12 septembre 2014.

Gilbert, C. (2007) 'Crisis Analysis: Between Normalization and Avoidance', *Journal of Risk Research*, 10(7), pp. 925–940. Available at: <https://doi.org/10.1080/13669870701504731>.

Godard, O. et al. (2002) *Traité des nouveaux risques: précaution, crise, assurance*. Paris: Gallimard (Folio, 100).

Gueben-Venière, S. and November, V. (2020) 'Crisis management as an evolutive and adaptable infrastructure.' al-02518041.

Guevara Viquez, S. (2019) 'Imaginarios y riesgo de inundación en los barrios del sur de San José: entre banalización y denuncia del desarrollo urbano josefino', *Revista de Historia*, 26, pp. 177–190.

Guevara Viquez, S. (2020) *De l'instabilité de la notion du risque en milieu urbain. Habitants et gestionnaires face aux inondations à Barrio Luján et la Carpio (San José, Costa Rica)*. Doctorat en aménagement. Université Paris-Est.

Guevara Viquez, S. (2023) 'Inondations et ville à San Jose (Costa Rica): la crise comme moteur des réseaux techniques et politiques', *Flux*, N° 132(2), pp. 45–65. Available at: <https://doi.org/10.3917/flux1.132.0045>.

Guilhou, X. and Lagadec, P. (2002) *La fin du risque zéro*. Paris: Eyrolles: Editions d'organisation (Tendances).

Hall, C. (1976) *El café y el desarrollo histórico-geográfico de Costa Rica*. Editorial Costa Rica y Universidad Nacional.

Hardy, S. (2005) 'Environnement urbain des capitales centraméricaines', in Hardy, S. and Medina-Nicolas, L., *L'Amérique Latine*. Nantes: Du temps (Questions de Géographie), pp. 152–175.

Horlings, L.G. et al. (2020) 'Operationalising transformative sustainability science through place-based research: the role of researchers', *Sustainability Science*, 15(2), pp. 467–484. Available at: <https://doi.org/10.1007/s11625-019-00757-x>.

Lavigne Delville, P. (2017) 'Pour une socio-anthropologie de l'action publique dans les pays "sous régime d'aide"', *Anthropologie & développement*, (45), pp. 33–64. Available at: <https://doi.org/10.4000/anthropodev.542>.

Leclercq, R. (2017) 'The politics of risk policies in Dakar, Senegal', *International Journal of Disaster Risk Reduction*, 26, pp. 93–100. Available at: <https://doi.org/10.1016/j.ijdr.2017.09.031>.

- Leclercq, R. (2019) 'L'action publique à l'épreuve des inondations dans la banlieue de Dakar', *Anthropologie & développement*, (50), pp. 31–50. Available at: <https://doi.org/10.4000/anthropodev.813>.
- Leclercq, R. (2020) *Dakar, proie des eaux ? Sociologie de la ville catastrophée*. Université paris 8 - Vincennes - Saint-Denis.
- Leclercq, R. (2022) 'How Does Water Behave? Unstable Milieu and Stable Agencements in Dakar's Flooded Suburbs', *Urban Planning*, 7(1), pp. 21–31. Available at: <https://doi.org/10.17645/up.v7i1.4353>.
- Leclercq, R. (2023) 'Une adaptation (infra)structurelle ? Des ingénieurs face aux inondations dans la banlieue de Dakar', *Critique internationale*, N° 98(1), pp. 95–115. Available at: <https://doi.org/10.3917/cii.098.0095>.
- Melly, C. (2017) *Bottleneck: moving, building, and belonging in an African city*. Chicago ; London: The University of Chicago Press.
- Moore, J.W. (2017) 'The Capitalocene, Part I: on the nature and origins of our ecological crisis', *The Journal of Peasant Studies*, 44(3), pp. 594–630. Available at: <https://doi.org/10.1080/03066150.2016.1235036>.
- Morales Soto, D. (2012) *Micro-cuencas urbanas, Informe*. Programa de investigación en Gestión Urbana. Escuela de Arquitectura, Universidad de Costa Rica.
- Morera, R. and Morgan, J. (2019) 'Les dessèchements modernes : des projets coloniaux ? : Comparaison entre la France et l'Angleterre', *Études rurales*, (203), pp. 42–61. Available at: <https://doi.org/10.4000/etudesrurales.15656>.
- Ndao, S. (2015) "La nappe de «Thiaroye» au Sénégal: une ressource en eau encore utilisable ?" par S. Ndao, E.H.B. Diaw, S. Tamba et M. Wade'. Available at: <https://doi.org/10.58079/V6PM>.
- Nixon, R. (2013) *Slow violence and the environmentalism of the poor*. First Harvard University Press paperback edition. Cambridge, Massachusetts London, England: Harvard University Press.
- Pontille, D. and Denis, J. (2017) 'Beyond breakdown: Exploring Regimes of Maintenance', *Continent*, 6(1), pp. 13–17.
- Quesada Avendaño, F. (2011) *La modernización entre cafetales: San José, Costa Rica, 1880-1930*. 1a ed. San José, C.R: Editorial UCR.
- Rentschler, J. et al. (2023) 'Global evidence of rapid urban growth in flood zones since 1985', *Nature*, 622(7981), pp. 87–92. Available at: <https://doi.org/10.1038/s41586-023-06468-9>.
- Rey-Thibault, C. (2022) *Vivre avec » ? émergence et défis des pratiques intégrées pour faire face aux risques et aux crises localement. Une enquête dans les scènes locales des risques des agglomérations de Nantes et du Havre*. Doctorat en géographie. Université Gustave Eiffel.
- Robert, J. (2012) *Pour une géographie de la gestion de crise : de l'accessibilité aux soins d'urgence à la vulnérabilité du territoire à Lima*. Doctorat en géographie. Grenoble.
- Robinson, J. (2006) *Ordinary cities: between modernity and development*. London ; New York: Routledge (Questioning cities).
- Robinson, J. (2011) 'Cities in a World of Cities: The Comparative Gesture', *International Journal of Urban and Regional Research*, 35(1), pp. 1–23. Available at: <https://doi.org/10.1111/j.1468-2427.2010.00982.x>.
- Rosenthal, U. (1998) 'Future Disasters, Future Definitions', in *What is a Disaster?* Routledge.
- Schaer, C., Thiam, M.D. and Nygaard, I. (2018) 'Flood management in urban Senegal: an actor-oriented perspective on national and transnational adaptation interventions',



*Climate and Development*, 10(3), pp. 243–258. Available at: <https://doi.org/10.1080/17565529.2017.1291405>.

Sierra, A., Gustiaux, R. and Leclercq, R. (2020) '9. La crise : saisir la ville par la rupture', in *Pour la recherche urbaine*. CNRS Éditions, pp. 181–201. Available at: <https://doi.org/10.4000/books.editions-cnrs.37123>.

Steffen, W. et al. (2021) 'The Anthropocene: From Global Change to Planetary Stewardship (2011)', in S. Benner et al. (eds) *Paul J. Crutzen and the Anthropocene: A New Epoch in Earth's History*. Cham: Springer International Publishing (The Anthropocene: Politik—Economics—Society—Science), pp. 145–174. Available at: [https://doi.org/10.1007/978-3-030-82202-6\\_13](https://doi.org/10.1007/978-3-030-82202-6_13).

Sylla, A. (1992) *Le peuple Lebou de la presqu'île du Cap-Vert*. Dakar: Les Nouvelles Éditions africaines du Sénégal.

Tazieff, H. (1977) 'La Soufrière, volcanology and forecasting', *Nature*, (269), pp. 96–77.

Tousignant, N. (2018) *Edges of Exposure: Toxicology and the Problem of Capacity in Postcolonial Senegal*. Durham, NC: Duke University Press (Experimental Futures: Technological Lives, Scientific Arts, Anthropological Voices).

Yusoff, K. (2018) *A billion black Anthropocenes or none*. Minneapolis: University of Minnesota Press (Forerunners: ideas first from the University of Minnesota Press, 53).

Wisner, B. and Gaillard, J.-C. (2009) 'An introduction to neglected disasters', *Jàmbá: Journal of Disaster Risk Studies*, 2(3), pp. 151–158.