

Water management: a comparative analysis on water policies between Cape Town (2018) and Monterrey (2022)

Gestión del agua: análisis comparativo de las políticas del agua entre Ciudad del Cabo (2018) y Monterrey (2022)

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Abstract

Despite the importance of water as an essential element for sustaining ecosystems, its shortages in large cities are becoming more common each year due to weak infrastructure. The split between its importance and the lack of resilience measures is worrisome because prolonged water scarcity increases existing inequalities. Therefore, case studies of cities that have experienced water scarcity can provide information on how to prevent this scenario in the future.

Keywords: water scarcity, Cape Town, Monterrey, drought, Day Zero

Resumen

A pesar de la importancia del agua como un elemento esencial para el sustento de ecosistemas, cada año son más comunes los casos donde escasea en las grandes ciudades debido a una débil infraestructura. La disyuntiva entre su importancia y la falta de medidas para la resiliencia es preocupante puesto que la escasez prolongada de agua aumenta las desigualdades existentes. Por ello, el estudio de casos de ciudades que han experimentado escasez de agua puede brindar información sobre cómo prevenir este escenario en el futuro.

Palabras clave: escasez de agua, Ciudad del Cabo, Monterrey, sequía, Día Cero

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Most discussions on water support its importance in any ecosystem and human society. For water “[...] is both a prerequisite for all life and is crucial to economic and social transformations and stable societies. Neither the human nor the natural world can survive without water” (Isaacman & Musemwa, 2021, p. 7). However, with disastrous consequences for human society and the environment, water shortages in large cities have become a pressing issue in recent years. The inadequate management of water resources, combined with the careless impact of human action on the environment, has led to escalating global climate change, massive extinctions, and natural resource shortages (Shepherd, 2019).

This essay aims to provide a comparative analysis of water policies in Cape Town in 2018 and Monterrey in 2022. Specifically, it examines how weak infrastructure is one of the main catalysts of conflict and inequality during periods of water scarcity. By using a risk management analysis and comparing the two cases, this study sheds light on the relationship between the development of both the Cape Town, South Africa, and Monterrey, Mexico crises.

Both cities share similarities in the conditions that lead to water shortages, such as dry weather, weak infrastructure, and growing demand deficits. In 2018, Cape Town experienced a severe drought that resulted in a worrisome deficit between its water storage capabilities and the consumption of the city. The government was forced to take measures to reduce the water demand. More recently, Monterrey also experienced droughts and an increase in weather temperatures for several months, which led to the declaration of a water emergency in August 2022.

Theoretical approaches have described water as either a conflict or a cooperation component. However, this dichotomy fails to capture the complexity of cases. A contextual approach was also used to better understand the inner dynamics of South Africa and Cape Town as a city, as well as the role of Monterrey as an economic driver in Mexico.

The analytical approach section reviews the cases of droughts in both cities with relevant data and actors. By examining the role of weak infrastructure in exacerbating conflict inequalities, this study highlights the need for a comprehensive and sustainable water management policy. Finally, the essay points out the need for effective water management that considers the relationship between water and population, including environmental threats and the role of the private sector, to prioritize the well-being of the population and avoid catastrophic situations, while acknowledging the limitations of focusing solely on water availability.

Theoretical approaches

In recent decades, scholars have recognized the importance of water management in generating conflict between individuals and nations. However, the neo-Malthusian approach of seeing water scarcity as a deterministic conflict catalyst has been criticized for oversimplifying the complex interactions between human beings and their environment (Gizelis &

Wooden, 2010, p. 444). To better understand the relationship between water management and conflict, this section explores different theoretical frameworks, including water as an element of conflict, as a cooperation enhancer, and the role of political institutions and civil society in preventing water-based conflicts.

Conflict can be defined as a struggle or disagreement between two or more parties that typically arises from opposing goals or interests. In the context of water management, conflicts often arise when there is a competition over limited resources or when one party feels that their needs are not met. However, conflict is not always a negative phenomenon as it can also act as a catalyst for change and progress.

Water scarcity has been recognized as a weapon in conflicts between nations and within states (Gleick, 1993; Schillinger *et al.*, 2020; Wolf, 2007). However, the classical approach of highlighting the importance of institutions as conflict reducers has been challenged by cases such as the Cochabamba Water Wars, in which the political institutions were a conflict enabler by allowing the privatization of national waters, causing a rise in costs and subsequent conflicts. On the other hand, academics also argue that water helps the cooperation between actors, describing it as a “[...] multi agency/stakeholder effort or pooling of resources to tackle shared water-related problems that cannot be solved by individual organizations” (Galvez *et al.*, 2020, p. 423). Thus, water can also help in cooperation between actors, promoting joint action to solve water-related problems that cannot be solved by individual organizations. Joint action for water has a positive effect on human lives, improving quality of life, generating jobs and income, expanding the ability to supply water for multiple uses, and stimulating the economy (Tundisi, 2008, p. 11).

However, the literature on this issue presents mixed conclusions and perpetuates a deterministic relationship, ignoring the complexities of human interactions. Water scarcity as a component for conflict or cooperation ignores the complexities of human interactions as this “[...] separation usually means that the less ugly faces of conflict and less pretty faces of cooperation are overlooked, and the political aspects of the interaction are routinely ignored” (Zeitoun & Mirumachi, 2008, p. 299).

To fully understand the role of water management in human society, a more profound understanding of this phenomenon is required. Water management institutionalization in local governments and the role of an organized society are important factors to consider (Gholizadeh & Niknami, 2020, p. 603; Gizelis & Wooden, 2010, p. 444). Political institutions play a significant role in intrastate water-based conflicts; however, in Africa, government institutions exist in a post-colonial historical context where sovereignty remains elusive. This implies that “[...] pre-colonial political authorities lacked the incentive and capacity to project power beyond central cities; colonialism exacerbated the phenomenon, and hence the scope of the contemporary African state is limited geographically. As a result, sovereignty —indeed ‘stateness’— remains elusive” (Bauer & Taylor, 2006, p. 1). Therefore, political institutions in Africa must not be taken as a single indivisible authority but rather as a set of actors with a profound history of colonialism which often repeat those dynamics.

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Civil society is also essential in water governance, as it can demand better policies that fulfill their needs. However, civil society cannot provide a long-term solution to water-based conflicts because “[...] the participation of users, the public, the private sector, and the public sector should be one of the [main] focuses of this governance of water resources in the context of watersheds” (Rogers, 2006 cited in Tundisi, 2008, p. 10). Proposals for the water issues solution must not only consider the role of civil society, which, although it is important as water is a human right, is limited considering the impact that the private sector has on water resources, as well as the government’s ability to regulate it.

Contextual Approach

a) The 2018 “Day Zero” in Cape Town, South Africa

Firstly, South Africa has privileged access to rainfall in the region, with a range of variations depending on the season and location (Calverley & Walther, 2022, p. 6). Nonetheless, the issue of unequal distribution of water resources is a significant factor that harms various actors, including the quality of human lives, regional economic prosperity, and international tensions between neighboring countries (Isaacman & Musemwa, 2021, p. 12-15). The privatization and commodification of water have contributed to this unequal distribution, and as a result, the most marginalized populations have suffered the most because of the lack of services, such as water (Isaacman & Musemwa, 2021, p. 7; Moseki *et al.*, 2010 in Calverley & Walther, 2022, p. 5).



Figure 1: Cape Town Map (2016), retrieved from: https://lad.wikipedia.org/wiki/Dosya:Map_of_the_Western_Cape_with_Cape_Town_highlighted_%282016%29.svg

Secondly, the modern history of South Africa as a nation can be divided into four important phases: “the colonial phase (1652–1910), the post-colonial phase (1910–1948), the apartheid phase (1948 – 1994), and the democratic phase (1994 to date)” (Motlalekgsi 2022, p. 727). The previous divisions allow us to know how the territory stopped being a British colony and became a Nation-State with a post-colonial heritage of institutionalized racial segregation in which it has been recognized as a country both “diverse” and “divided” (Johnston, 2014, p. 23). As explained in the theoretical approach, political institutions in Africa often can repeat colonialist dynamics, which happened in South Africa during the apartheid era, which spanned from 1948 to 1994 and officially enforced racial segregation. The effects of such political structures cause not only discrimination, but also enables the marginalization of certain groups, such as those living in informal housing who lack access to basic amenities, such as water (Johnston, 2014, p. 23).

Thirdly, the recent change in government leadership before the Day Zero crisis also impacted management policies. “President Cyril Ramaphosa took office in 2018, after a series of corruption scandals under the administration of his predecessor, Jacob Zuma” (Cook, 2020, p. 10). Zuma had been in power since 2009, and its presidency has been defined as a “state capture” in which his party controlled the national services and economy, which affected the water management policies during the Day Zero crisis (as it will be described in the analytical approach section). Although the government has tried to move on from their apartheid policies, most of them have been described as limited as one of the groups that is most severely affected is the black population, with a special emphasis on those who live in informal housing, and the government periodically destroys their homes (Cook, 2020, p. 10).

Furthermore, the City of Cape Town has experienced a steady growth in its population, with 4,392,562 citizens in 2019 (City of Cape Town, p. 12), of which 49% were living in poverty (p. 20). Although the city has been one of the greatest contributors to the national gross domestic product (9.8% in 2018), the 2018 drought severely affected the economy (p. 7). Most of its economic output is based on finances (35%), with the rest being community services (17%), trade (16%), and manufacturing (14%) (p. 28). The impacts of unequal access to water due to racial discrimination have been observed in important events such as the 2018 water “drought” in Cape Town in which municipal authorities reported the proximity of the “Day Zero” of water. Experts, such as Calverley & Walther, have stated that this event occurred due to a combination of factors, namely, the lack of rainfall, an increase in the population of 67% from 1996 to 2017, and the lack of proper management of water storage capacity (Calverley & Walther, 2022, p. 9). Due to the disproportion of available water resources and the increase in water consumption in the city, authorities applied policies with the objective of decreasing the water demand in civil society (p. 2). Nonetheless, the effectiveness of those same policies will be further discussed in the analytical approach section.

b) The 2022 water drought in Monterrey, Mexico

The water crisis in Monterrey, Mexico, provides a relevant case study for examining the implications of water management policies and the role of different actors in exacerbating

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or mitigating the water scarcity. By analyzing the theoretical elements presented in the previous sections, it is possible to gain a better understanding of the root causes and potential solutions to the water crisis in Monterrey.



Figure 2: Municipality of Monterrey, City of Monterrey, México, Map, retrieved from: https://uk.wikipedia.org/wiki/%D0%A4%D0%B0%D0%B9%D0%BB:Monterrey_location.png

One of the factors that contribute to the water crisis in Monterrey is its geographical location and climate conditions; in Mexico, some areas have a greater probability of being affected by droughts because of their dry weather, such as the north, central west, and southeast (Arreguin-Cortes *et al.*, 2020, p. 11). This means that the availability of water resources in Monterrey is limited, and water management policies must consider the natural constraints of the region.

Another relevant theoretical element is the decentralization of water management in Mexico. The National Water Law, passed in 1992, aimed to increase the participation of water users in the decision-making process and led to the creation of local water basin organizations (Scott *et al.*, 2007, p. 253). This shift toward regional administration aimed to improve the distribution of water resources and involved different actors in the management process. However, as noted by Silva (2020), the decentralization process also enabled opportunities for corruption and restricted the availability of water quality. This highlights the importance of ensuring transparency and accountability in water management policies to avoid exacerbating crises.

The mismanagement is exemplified by the Monterrey drought of 2022, in which water concessions allowed by federal and state governments have affected its availability. The

industry of Monterrey, the capital of the state of Nuevo León in northeastern Mexico, is “[...] the economic capital of northern Mexico and plays an important role in the economic industrial cluster across Mexico’s border with the United States” (Balán *et al.* in Molina-Perez *et al.*, 2019, p. 1). Two of the sectors that have benefited the most have been the agricultural sector and assembly plants since the 1990s (Scott *et al.*, 2007, p. 253). The agricultural and assembly plant sectors have benefited significantly from this economic growth but have also contributed to environmental issues that have long-term impacts on the region. This highlights the need to balance economic development with environmental sustainability to avoid exacerbating water crises.

Moreover, the growing demand for water in Monterrey has put strain on its water infrastructure and has led to conflicts between different actors. The water capabilities of the Monterrey municipality due to the low annual precipitation and “[h]igh temperatures in the region cause high evaporation from surface reservoirs ” (Molina-Perez *et al.*, 2019). Monterrey water reserves are poorly filled by the rainfall, and most of the reserved water is evaporated. However, most of its water is provided by three main reservoirs: La Boca (Rodrigo Gomez Dam), Cerro Prieto, and El Cuchillo (Oxford Analytica, 2022). The water that is stored is distributed in Monterrey “[...] by Servicios de Agua y Drenaje de Monterrey (Water and Sewer Services of Monterrey), an autonomous public utility under the government of the state of Nuevo Leon” (Scott *et al.*, 2007, p. 253).

During past years, reports have pointed out that the city of Monterrey suffered various vulnerabilities that might worsen due to an accelerated demand growth “[f]rom 1980 to 1990, water demand grew by 13 percent, while, in the ensuing two decades, growth amounted to 20 percent from 1990 to 2000 and fully 25 percent from 2000 to 2010” (Molina-Perez *et al.*, 2019, p. 3). The local government tried to keep up with the growing demand by expanding its water infrastructure in 2014 with a water-transfer project from the Pánuco River in Monterrey, which was criticized for its high cost and the actor’s conflict of interests (Molina-Perez *et al.*, 2019).

More recently, the government proposed a series of projects to increase water availability to supply its growing demand in the municipality; however, the recent drought in 2022 demonstrated its limitations. At the beginning of 2022, most water services were depleted because of La Niña weather phenomenon, which has been worsening due to climate change, leading the local government to issue a state of emergency in February. In June, the authorities restricted the water supply to households, which led to unrest among citizens, and some residents outside the metropolitan area destroyed the pipes that were intended to supply the water supply (Oxford Analytica, 2022). The recent drought has further exposed the limitations of these water management policies and led to unrest among citizens which demonstrates the importance of political institutions to anticipate and adapt to climate change impacts and investing in sustainable and resilient water infrastructures.

Analytical Approach

a) Water management in Cape Town: the Day Zero

The water crisis in Cape Town, also known as Day Zero, was caused by various factors, such as population growth, consecutive droughts, and the lack of racially sensitive strategies (Calverley & Walther, 2022). The population in Cape Town increased by 67% between 1996 and 2017, whereas the dam storage capacity only increased by 15% (Nhamo & Agyepong, 2019 cited in Calverley & Walther, 2022, p. 2). This lack of investment in water storage created an unfavorable environment for the city, which had low resilience to natural disasters.

Furthermore, the Western Cape Water Supply System (WCWSS) provides 95% of the city's water, with six of its fourteen dams providing most of the water supply for agriculture and other municipal services (Calverley & Walther, 2022, p. 5). The official data state that, in a normal year, 60% of the water is used by the city and 30% by local agriculture (City of Cape Town, 2019, p. 29). Despite the heavy reliance on these dams for water supply, their capacities have not kept up with the population growth. Additionally, the large surface area used for water storage results in a significant loss of liquid through evaporation (Calverley and Walther, 2022, p. 12). However, even after the Day Zero crisis, the city has stated that most of its water supply will continue to rely mostly on rain-fed systems, as it is the most affordable option (City of Cape Town, 2019, p. 7). Heavy reliance on a single water supply system increases the city's vulnerability to future droughts, as demonstrated during the Day Zero crisis.

To address this vulnerability, the city proposed the diversification of water supply options, such as groundwater, wastewater reuse, and desalination (City of Cape Town, 2019, p. 7). Investing in medium-term diversification of water supply is crucial for reducing the negative impacts of a single water supply system in the short term. Desalination, although costly in the short term, could be profitable in the future because of the city's proximity to the sea.

During the Day Zero crisis in 2018, water intake was limited to 135 liters per day, the minimum recommended by the World Health Organization (City of Cape Town, 2019, p. 18; Calverley & Walther, 2022, p. 2). Additionally, water management devices were installed to cut off the service, and households that consumed more water were charged higher tariffs (City of Cape Town, 2019, p. 22). However, due to the limitations of capabilities and funding in local governments, water became less of a public service and more of a product allocated to maximize profits, which negatively impacted lower-income groups living in informal settlements (Calverley & Walther, 2022, p. 6). Therefore, although the demand for water was reduced so that it could be supplied based on local capacities, the same management had a negative impact on the well-being of marginalized groups.

South Africa's legacy of colonialism and apartheid politics meant that water management policies during the Day Zero crisis had a more negative impact on the lives of lower-income groups living in informal settlements. These townships "[...] are mostly populated

by poor black and mixed race ‘colored’ inhabitants. Many residents in these areas live in informal housing and often lack legal property ownership, and local governments periodically evict recently settled squatters and destroy their homes” (Cook, 2020, p. 11). This racial discrimination highlights the need for a racially sensitive approach to water management.

The city’s plan to rely on a rain-fed system for the next 10 years and establish restrictions during low rainfall seasons is not only ineffective, but also increases the risk of vulnerability in the lives of the population. Water restriction strategies have also been proven to create social unrest and are not as effective as economic incentives in water-saving, regulatory mechanisms, and infrastructure investment to prevent future Day Zero (Calverley & Walther, 2022, p. 13; City of Cape Town, 2019, p. 53).

b) Water management during 2022 droughts in Monterrey

Geographically, Monterrey is in a region prone to water scarcity, and the national mechanism of water regulation, Conagua, is responsible for providing private concessions for water extraction for agricultural (71% of the total water), public supply (25%) and industrial purposes (4%) (Vera López & Corrales, 2022, p. 329). Most of the region’s water is provided by: La Boca (Rodrigo Gomez Dam), Cerro Prieto, and El Cuchillo (Magaña *et al.*, 2021; Oxford Analytica, 2022). Of the three dams, the most important is El Cuchillo, which was constructed to compensate for the increasing population growth and the 1980s water shortages that caused social and political unrest. It supplies 5 m³/s to the Metropolitan Area of Monterrey, contributing 20% of the water supply (Aguilar-Barajas & Garrick, 2019, p. 1).

The 2022 drought in northern Mexico severely affected Monterrey. The dams that provided water to the city were at a low capacity, with La Boca being 8.22% full and Cerro Prieto being 2.06% full. Like the Day Zero in Cape Town, the drought negatively impacts the city’s capabilities to provide water, thus creating a deficit. Convenience stores and supermarkets sold only half-liter bottles of water (Gómez, 2022). The government enforced measures to reduce water demand, including fines for households that exceeded official limits, and restricted water services from 4:00 to 10:00 a.m. (Gómez, 2022; Nuevo León Government, 2022). Other actions included the bombardment of clouds with silver iodide to force the rain in April 2022 and the management of federal resources to complete the construction of another dam in 2022 (Nuevo León Government, 2022).

Furthermore, the heavy reliance on the private sector in the region has raised a national debate about the priorities of the sectors on water consumption. While people have restricted access to water, the industrial sector continues to extract resources and generate profits. Because of its economic importance, Monterrey’s local government has demonstrated a heavy preference for the private sector. An example of this is the 1906 aquifer, which distribution is 6.4% for agriculture, 4.3% for public-urban use, 1.6% for livestock use, 3.5% for domestic use, 30.9% for services, and 53.3% for industrial use (Vera López & Corrales,

2022, p. 330). Although this aquifer constitutes only a small sector of the Monterrey system, and as has been previously mentioned, most of the biggest factor for water usage is agriculture, it is important to analyze the heavy role that the private sector plays in the region. In Nuevo León, Conagua has granted to Cervecería Cuauhtémoc Moctezuma de extraction rights of 6,985,600 m³ of water, all of which is used for industrial use (Vera López & Corrales C, 2022, p. 327). The massive water intake by the private sector during the 2022 crisis raised a national debate about the priorities of the sectors on water consumption because, while people had restricted access to water, the industrial sector continued to extract resources and generate profits.

During the drought, some researchers commented that Monterrey had reached its Day Zero because of bad management and overexploitation of water resources (Ordoñez cited in Brooks, 2022). Drought was a catalyst for the impending issue that important actors focused primarily on the economic development of the region, without considering the sustainability of the public services of the city (Aguilar Benítez, 2022). Although the city has a strong economy, it is important to create infrastructure that ensures that the population has basic access to water, as well as ensures the economic prosperity of future generations (Ordoñez Díaz, 2022).

c) Water management as a road towards peace building

The water crisis is a complex issue that involves various factors, such as lack of infrastructure, good water management systems, and climate change. The Cape Town Day Zero crisis in 2018 and the Monterrey drought in 2022 serve as examples of how these factors can lead to conflict and social unrest. These events also provide valuable lessons that can be applied in the future. As stated in the conceptual framework of Day Zero, if we continue the current exploitation of natural resources, water being unavailable in major and important cities will become an increasingly common phenomenon.

One of the key elements in understanding and addressing water crises is to incorporate environmental threats into risk planning. The relationship between water and population must be considered, not only in macro-politics but also in the micro-dynamics of everyday life. Effective water management must consider its impact on minority racial groups and lower-income populations (Shepherd, 2019, p. 12). In this way, governments can ensure the well-being of most of the population. It might be difficult to enforce governments, as macro-actions can have a faster effect, even with their negative impacts; however, the Cape Town crisis has proven that macro-actions negatively affect minority racial groups, and during the Monterrey crisis, the private sector continued to make profits, leading to civilian unrest. Water is not an inert resource, which is why effective management considers the relationship between it and the everyday lives of the population. During and after crisis management, governments must ask themselves who they are going to affect with their actions, not to immobilize themselves but to ensure the well-being of most of the population.

In addition to the conscious management of water in government policies, the private sector also plays an important role in any water crisis. As the Monterrey 2022 case has proven, prioritizing the economic prosperity of the region can lead to social unrest in the event of droughts. Therefore, a logical element of prevention for future droughts must be that the water needs of the private sector must not surpass the consumption of the population. However, this recommendation has proven to be difficult to apply as populations continue to grow over time, and economic growth is an element of the well-being of the population.

Conclusions

In conclusion, this essay highlights how a lack of water can lead to conflict and civil unrest in human societies, as evidenced by the Cape Town 2018 Day Zero crisis and the Monterrey water crisis in 2022. The theoretical approach discusses contradictory views on whether water leads to conflict or cooperation. Through these case studies, it became evident that effective water management must consider the relationship between water and population, both in macro and micro dynamics.

The Cape Town crisis revealed the importance of incorporating environmental threats into risk planning to ensure the well-being of citizens while also recognizing the need for racially sensitive approaches to water restrictions. In contrast, the Monterrey crisis highlighted the role of the private sector in water management and the need to prioritize population consumption over economic prosperity. These cases share similarities in their lack of rain as an enabler of the water crisis, emphasizing the need for effective water management in cities worldwide.

Furthermore, this essay acknowledges the limitations of the discussion on water availability, recognizing that water affects various aspects of human life such as hygiene, quality, and waste. As climate change continues to affect cities worldwide, it is essential to implement water management through different theoretical approaches and methodologies to better understand the complexities of this resource. Effective water management is not just about conflict or cooperation but also about avoiding catastrophic situations by prioritizing the well-being of the population.

Finally, this document has largely explored the unavailability of water in Cape Town, South Africa, and Monterrey, Mexico, and acknowledges its limits in the discussion. The focus on water availability, although important, is a major constraint, as this resource affects the lives of human beings in aspects such as water hygiene, quality, and waste. These topics demonstrate that water studies are necessary with the help of different theoretical approaches and methodologies. Climate change due to human activity will affect any city around the world, so this analysis can help as a research starter for more inquiry about the subject in other parts of the world. In the end, effective water management is not only about conflict or cooperation, but also about avoiding a catastrophe.

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