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Analysis of nature of water crisis across the world and the possible remedies

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Abstract
The concept of analysis of the Anthropocene's past and future is divided with conflicts over the usage and formulation of natural resources that the beings of Earth have been exploiting to their advantage. Water being the key to humanity and other earthlings' survival has put into perspective the true nature of these abundant yet rare resources that the human race is quickly running out of, or is it? When the water resources of a city or state fall below what is required for its residents and subsequently is forced to make the taps run dry, this is when they are forced to declare a 'Day Zero'. Is this a phenomenon that will become regular or is it an artificial shortage caused by reasons of policy and nature; are the answers we aim to find in the course of the paper. This paper will additionally try to investigate and analyse the structural changes and agility of two of the cities that faced such disaster, how they identified, reacted, and prevented the taps from going dry. The analysis of the above will lead us to discuss possible solutions such as planned communities, lower wastage policies and water taxation.

Keywords: slow catastrophes; anthropocene futures; Cape Town; Chennai; "Day Zero"; water; water taxation

Introduction

Water is a key resource for the biosphere of earth. How humanity has harnessed for its benefit has clearly come at the cost of the other members of the biosphere. The human population which is mainly concentrated around available freshwater has seen in recent years the effects of over-consumption of water. Around one-fifth of this population is now living in areas with water scarcity constantly and about two-thirds of the population have experienced water scarcity at least once in their summer months. (Mekonnen and Hoekstra, 2016) [5]. This seasonal change is about to morph itself into a permanent water shortage within the next five years which in itself is projected to become a major socio-political issue with water scarcity driving wedges between different states. (UNEP, 2016).

The 'zero day' events that were called in major cities of South Africa and India in Cape Town and Chennai have highlighted the real-world implications of the imbalance in the natural replenishment cycle of freshwater sources in metro cities. The imbalance although may have been aggravated by ecological circumstances such as decreased rainfall and extended droughts, but the facts remain that humankind is trying to sustain a higher concentration of society over water sources which it can no longer sustainably maintain. (Sousa, blamey *et al*, 2018) [2] Chennai, a city of 11 million sustains it using only the four reservoirs and monsoon showers, yet remains prone to flooding, this imbalance has led several experts to debate the role of human settlements at the wrong places or the switch of climate structure of earth to a more arbitrary climate which is becoming increasingly difficult to predict. Another aspect affecting the water management in these metropolitan cities are the influences and interests of local leaders and corporates to vow short term change at the cost of long-term harm. (Hervé-Bazin, 2014) [3] Various literature evidently links resource management to micro issues such as powers and politics especially in water-stressed areas such as Chennai and Cape Town. (Spinks *et al*, 2017) [10].

However, the danger of these events and the alleged mismanagement may have been grave but, it's imperative to clarify that the taps of both the cities of Chennai and Cape Town, never went completely dry. The shift in change in behaviour of the local population was largely led by the policy decisions to impose daily limits, as in the case of Cape Town or increased prices of tankers of water being bought by communities, as was the case in Chennai. However, these practises largely affected the lower-income strata of society in both the cities more than those who continued to pay for more daily limits or tankers. Such Socio-political aspects are often ignored while discussing the 'Zero Day' events. The solution to this artificial scarcity is starting to give equal value to freshwater as is given to other resources such as crude oil while ensuring equitable access to Water.

Aim of the Study

- To know the concept of Water Conservation.
- To know how 'Day Zero' events affect the general population.
- To know the concept under different countries.
- To know the prevention techniques to 'day zero' events.

Problem Statement

"What are the key learnings from Day Zero events?"

Hypothesis

H0: There exists an ample amount of water resources for generations to come.

HA: The lack of implementation of learning from previous day zero events is causing irreversible harm to the freshwater resources.

Materials and Method

The researcher has relied on secondary sources of data such as books, journals, e-sources, articles, and newspaper. Due to the nature of limitations of the pandemic, the researcher has been unable to find primary sources such as Interviews and field research. However, the analysis of various texts and their empirical data attach the required data collection for such paper. The research is directed towards the analysis of the crisis and the possible solution for the presented question.

Research Methodology

The Present research is descriptive and conclusive based on a non-empirical method. Qualitative data was used to answer the hypothetical question. The collection of data was based on a research instrument relevant to the present hypothetical. The research was conducted mainly on secondary sources such as books, journals, articles, e-resources, theories, case laws and relevant legislatures.

Limitation of the Study

The secondary sources used in the paper are limited by their nature of being third-parties work. As compared to primary sources, secondary sources such as books and journals fail to deliver the first-hand experience of those directly affected by the hypothesis. The study is also limited in its nature to the present and past analysis of the hypothesis and as such the solutions presented are in time with the present and holds an optimistic view of the management of the crisis.

Literature Review

This section will try to bring out some previous literature for the purposes of this research paper. It includes research papers and academic articles on 'Day Zero' events and Water scarcity.

(Shepherd, 2019) [9] Aimed to analyse the qualitative data arising out of Cape Town's water scarcity. The papers describe the Anthropocene future of the city and the irregular settlement density of the city that has pushed the natural resources to their limits. The author argues that rather than being understood as an inert resource, fresh drinking water is a complex object constructed at the intersection between natural systems, cultural imaginaries, and social, political, and economic interests.

(Sousa, *et al*, 2018) [2] Analyses the environmental factors, specifically the Moisture corridors and the shift observed within these factors. Such factors are heavily affected by not only the gradual heating of the atmosphere but also by the city's settlements and the heat so retained by the concrete structures. It analyses the displacements of the jet stream and South Atlantic storm-track which has imposed significantly drier conditions to the South African coast.

(Trivedi, Chertock, 2019) [12] Describes the social inequality between the classes of society and approves the struggles of such strata of society that have no access to water and for whom every day is a day zero. The paper discusses the Tanker and rationing steps taken by the city governments. It draws a parallel between Chennai and Cape Town and concludes on a cautionary note. The authors aimed to highlight the non-sustainability of such cities.

(Harrisberg, 2020) [2] Analyses the possibilities of future 'Day Zero' events and their increasing frequencies. The author describes the measures adopted by cities across the world as inadequate and predict 80% of another drought-like scenario before the century ends. He highlights the ignorance of the people and analyses the psychological effect of such shortages which induces people to conserve more.

(Sunder, 2021) [11] Mentions the over-reliance of the city of Chennai on the ancient wetlands surrounding the city. It goes on to explain the phenomenon of ample rainfall, flooding and yet the existence of water shortage in the city. The Natural marshlands which usually acts as groundwater recharge and protects the city from flooding have been a victim of urbanisation. The paper discusses the need to restore such natural resources and reduce the rate of urbanisation over these key areas.

The Water Crisis

The Anthropocene of the earth means that the resources once depleted will need an extended period of revitalization. The tragedy from a taken-for-granted resources and its associated infrastructure is that it starts to crack, break down and then becomes scarce. Humans have a notion that a tap that is turned and water flows has become a basic human right. However, in cities such as Chennai and Cape Town, turning the tap and nothing flowing out almost became a reality. To understand the nature of such a crisis, one could argue that water itself is that rather than being an inert resource, clean drinking water is a complex object, constructed at the point of the intersection between natural systems, cultural imaginaries, and social, political and economic forces and interests. (Shepherd, 2019) [9] On the flip side what the masses would say is that those days of 'Day Zero' was a moment of Climate crisis and as such needed a temporary technical response. These came in the form of water rationing or bringing in water from other cities. Such a relation between humans and nature needs to be further explored. What we forget is that the water cycle and the life cycle are one and are intertwined.

There are about four billion people or two-thirds of the world goes through severe water scarcity, the science is clear that such numbers will only keep increasing without immediate action from humanity. (Mekonnen & Hoekstra, 2016) [5] What started as over-consumption in some cities has spread to little or no water coming through the taps of many residents.

While we recognise the role of climate change, it may not be entirely to blame for low rainfall or natural disaster. Case in point, the city of Mexico City. A city that started on an island in the middle of the lake 400 years ago, the powers of urbanisation then started to expand this island by draining the very lake it was standing on, eroding the natural water catchment areas. In the current state, the city has completely drained the lake, and so utilises the natural underground aquifers built up from years ago. However, the city has drained many of these aquifers to over-compensate for the loss of water, resulting not only in increased stress on city officials but also that the buildings in the city have started to sink due to the absence of any water below the soil and thus creating a gap. What stops the city from refilling its aquifers are again humanity's need to place concrete everywhere? The culmination of such events has led to the city starving for water, even though it exists on a river basin and cannot recharge its aquifers due to concretization which leads to frequent floods. The day is close when Mexico City needs to declare a 'Day Zero'. (Bloomberg, 2020) [14].

Then what essentially is the water crisis? It the man-made disaster, being supplemented by Nature's response to such man-made disaster. What is clear is the need to find a fine balance between humankind's thirst for development and an attempt to repair nature's lost flora and fauna.

The Cities of 'Day Zero'

While the above-mentioned Mexico City hasn't yet needed to declare 'Day Zero', Cities like South Africa's Cape Town and India's Chennai declared the day when such declaration would begin. When 'Day Zero' is declared, the city officials cut off the tap water supply and would start daily rationing. It is a structure quite familiar to famines, except the part where famines would kill a lot fewer people than living without water. However, as discussed above, both of these cities kept postponing when exactly 'Day Zero' would be declared and then postponed the declaration indefinitely. To better understand the reaction of city officials and the residents themselves, we will analyse the response of Cape Town and Chennai individually.

1. How did Cape Town handle the crisis:

The year 2017 saw the city of Cape Town come into the limelight, a position that the city residents wished they never had been in. They became the first city to announce intentions to shut off municipal water. The City council termed this as 'Day Zero' and started to implement a six-level water restriction with the seventh being complete cut-off of the water. (Booysen, *et al*, 2018) [1] These restrictions did not slow down the consumption pattern and the city was forced to announce April 12, 2018, as Day Zero. South Africa's constitution, under section 27, enshrines the right to water, but the city had used its water resources in such a manner that there was none left to support it in the future.

Benjamin Franklin has said, "When the well is dry, we know the worth of water." The residents of Cape Town were quick to respond to this declaration of a Day Zero. The driest years on record for the city prompted a social media frenzy, urging residents to conserve water. (Sousa, *et al*, 2018) [2] But in this unequal city, where the divide between the rich and poor was so wide, that the rich got to wash their cars while the poor were lacking water to drink. This was met with fierce opposition and such rich residents were even arrested for wasting water during the restrictions. The shift in behaviour was led by a 50-litre restriction, the fear of actually running of water saved the city from running its taps dry on April 12th.

This recovery was supplemented by ample rainfall that filled up the city's reservoirs and a behavioural change campaign that the city adopted. (McCauley, 2019) [4].

Post recovery, the analyst are of the view that there is a need for a long term solution, for even average seasonal rainfall will not be enough for the city to serve its ever-growing population. (Sousa, *et al*, 2018) [7].

2. How did Chennai handle the crisis

In Chennai, 9,000 public water tankers deliver water to residents daily, even when there isn't a drought. Private companies, often hired by affluent residents, send 5,000 more tankers. During the summer crisis, more tankers were required, from further away, and they often filled up from farms, mines, or unregulated water sources. This distributed water that was sometimes black and looked and smelled like sewage. Chennai saw the participation of women even more than in Cape Town, here these women lined up for hours to fill up their pots. What Chennai did to save itself from the crisis that it itself had created was import water from neighbouring cities and villages. Water meant for farmers went to quench the thirst of the city. Several 'Water Trains' supplied 10 million litres daily to supply the cities piped water system. (Trivedi, Chertock, 2019) [12].

They even engaged in extensive groundwater harvesting, creating problems similar to Mexico City that was discussed above. What is interesting in the case of Chennai is the simple answer of importing water than even trying to implement thought-out water rationing systems. The city dried up its own resources and took away those of the surrounding areas as well.

Possible Solutions

The first mistake is assuming that the past is a guide to the future with regards to water supplies. Why was the public sector surprised by outcomes from a multi-year decline in precipitation and increased demand for water? This pertinent question is valid for all the cities being categorized as water-stressed. The complacency of institutions and residents alike contribute to such 'Day Zero' events. (Sarni, 2020) [8] The assumption that such events are just 'phases' of droughts and the only remedy is a good rainfall is a lie kept to satisfy our need to blame nature for our disasters. Such 'Hope' for a good rainfall or importing water from surrounding areas cannot be solutions that are sustainable. The role of Climate change has shifted the balance scales and makes these water-stressed cities even more likely to experience droughts.

These conditions coupled with an over-allocation of water and holding onto 'business as usual' water management practices, like low water conservation and reuse rates, creates a reactive water management response. Hence, "Day Zero." (Sarni, 2020) [8]

Jennifer Ninihas said "You can't force people to care about our natural environment, but if you encourage them to connect with it, they just might" what is a fool proof solution to such over-consumption is effective communication of the dangers of drought. The residents of Chennai and Cape Town understand this more than others. Such programmes can be run along the lines of what Cape Town did and what the United Nations under its Sustainable development Goal 6 calls for. It is only possible to manage the existing resources with the population by embarking on such awareness campaigns.

Just by protecting our water resources from pollution is not enough, there is a rising need to tax water usage by the income of families. Such taxes will raise revenues for the governments to build up water conservation infrastructures as well as impose a duty on the families to conserve water. The inequality seen in the poor and rich neighbourhoods of Cape Town and Chennai seems against the norm of equality that we yearn for. There also exists a demand from researchers to explore the idea of a water management reward system. Such a system would promote conservation and bring forth innovation in our collective effort to solve the water crisis.

What the Future Holds

When Day Zero looms, cities often implement stopgap solutions. But the main reasons for the crisis may be long-term, such as poor water management, lack of rain and

population growth. Both Chennai and Cape Town built desalination plants and made commitments to build more, but these plants may take years, even decades, to build. There is a lack of long-term funding commitments to improve equitable access. When Day Zero and water shortages affect the middle class, middle-class solutions are presented, such as private company water tankers, shortening showers or otherwise using less water. But often, the poor continue to suffer from water stress and shortages even after the headlines fade. (Trivedi, Chertock, 2019) [12].

These lessons shouldn't just be heeded during a crisis. Cape Town and Chennai should serve as cautionary tales: cities need to act now before city water shortages and drought reach the crisis point.

The Sustainable Development Goals set out an urgent push for countries and cities to create a sustainable, liveable future for everyone. This requires policies and technical solutions that consider equity. As the world becomes more urban, cities must offer efficient, sustainable, and equitable services to all their citizens. Equity is no barrier to urgent action. (Trivedi, Chertock, 2019) [12].

The 'Charting our Water Futures Report' by global consultancy McKinsey predicted that "by 2030, under an average economic growth scenario and if no efficiency gains are assumed, global water requirements would grow from 4,500 billion m3 today to 6,900 billion m3." This translates to 40 per cent above current accessible, reliable supply including return flows, and taking into account that a portion of supply should be reserved for environmental requirements. (Sarni, 2020) [8] In India, The NITI Aayog has, generously enough, talked about only 21 major cities, but if we go according to the projections of the Central Ground Water Board (CGWB), more than 60 tier-1, tier-2 and tier-3 cities are on the verge of water scarcity. (Mishra & Panwar, 2018) [6].

Key Findings

Upon the above-based discussions, the following can be interpreted as crucial findings:

1. The need for equitable access to water and lowering infrastructural wastage.
2. The role of human psychology and the need to grasp this exploit.
3. 'Day Zero' will be an increased threat in the future.
4. The need to better understand the effects of over-populated cities on the local climate.

Conclusion

Meeting Humanity's increasing demand for freshwater and protecting ecosystems is a fine balance act. However, it is directly implied from the above discussions that our species works best in a crisis, maybe the reoccurrence of such events will lead to an unseen innovation. One thing that is abundantly clear is, that from Cape Town's purported "day zero" in 2017 or that of Chennai in 2019 is, that the small behavioural change can shift years of disaster. The lessons learnt from such near catastrophe have on the surface of it, been forgotten already and the balance between maintaining the fresh waters levels sustainably while resolving the chaotic over-population pressuring the city resources are the only way forward. This crisis is not only detrimental to the city population but also the villages who are unaware of such phenomenon but are affected adversely by Climate change.

By comparing the two cities and discussing the policy recommendations, we have been able to establish the co-relation of Climate change, population centres and the imbalance so caused. While Cape Town raised water equity and effective policy issues, Chennai enlightened the need for better infrastructural planning and respecting the wishes of nature. In conclusion, we recognise the rise of water scarcity events across the globe, but the lack of action may be detrimental to the planet and the species alike. The key will be forming a connection with the masses without invoking the feeling of fear, ensuring a smoother move to sustainability. (Booysen, *et al*, 2018,) [1].

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