

# Scorched Earth

## The impact of drought on 10 world cities

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**Cover:** New Delhi, India-June 25 2021: Children and women filling water from a tanker during shortage of drinking water. Shutterstock.

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## Introduction

Urban areas make up just 1% of the earth's surface yet more than 55% of the world's population live in them and by 2050 nearly 68% of the world will call them home.<sup>1</sup> This will be partially driven by climate change as people are forced to move because their locations become unliveable or they lose their livelihoods, especially in rural areas.

The impact of climate change on cities is becoming increasingly important as more and more people live in them. In Bangladesh, around 2,000 people move to the capital Dhaka every day.<sup>2</sup> The International Organisation for Migration estimates that 70% of Dhaka's slum-dwellers moved there fleeing some sort of environmental shock. One of the most severe impacts which is already starting to bite is cities running out of water.

In 2018, after extended drought, Cape Town came within days of becoming the first major city in the world to run out of water. 'Day Zero', when the taps for 4 million inhabitants would be turned off, was averted after emergency measures were implemented to cut the city's water usage by 50% before rains arrived to refill reservoirs.

The close call was a vision of a worrying future. Charlene Pepler, a Cape Town resident, said: "There were these photos of how we'd have to queue for water at places guarded by the military with guns. It was very scary."<sup>3</sup>

For residents of the Chilean capital Santiago, water rationing became a reality in April 2022 as city authorities try and respond to a 13-year drought which has seen water reserves running dry. The government estimates that the country's water availability has dropped 10% over the last 30 years and could drop another 50% in northern and central Chile by 2060.<sup>4</sup>

Announcing the plan, Santiago Governor, Claudio Orrego, said: "This is the first time in history that Santiago has a water rationing plan due to the severity of climate change. It's important for citizens to understand that climate change is here to stay. It's not just global, it's local."

Without action to cut global greenhouse gas emissions, growing city populations will put ever greater stress on water resources in the coming years meaning some of the world's major cities could face the prospect of running out of water like Santiago.

## Water is key to urban society

Despite covering more than 70% of the earth's surface, only 3% of the world's water is fresh water, suitable for drinking.<sup>5</sup> And 70% of this fresh water is locked in glaciers and ice caps. Less than 0.01% of all fresh water worldwide is available for human use in lakes, rivers, reservoirs, and easily accessible aquifers.<sup>6</sup> Over the course of the 20th century, global water use grew at more than twice the rate of population increase.<sup>7</sup>

The availability of water has shaped the wealth and prosperity of cities and nations. Water is not just valuable for domestic and industrial consumption, it is a vital component for food and energy security, as well as maintaining important ecological functions. In urban areas, critical services like healthcare, food supply, transportation, energy provision, schools and retail, all depend on a reliable water supply.

Half a billion people already face severe water scarcity all year round.<sup>8</sup> Some cities, such as Amman, Melbourne and Cape Town could experience declines in fresh water availability by between 30% to 49%, while Santiago may see a decline that exceeds 50%.<sup>9</sup>

## The poor suffer most from water shortages

Low water quality and availability can cause major health problems for city dwellers, especially the poorest, and most often women and girls. Seventy per cent of the 1.3 billion people living in poverty are women. In urban areas, 40% of the poorest households are headed by women.<sup>10</sup>

According to the UN, lower-income residents can pay up to 50 times more for a litre of water than their wealthier neighbours because they often have to buy from private vendors.<sup>11</sup> Poverty often means people are faced with a choice between drinking untreated water or going thirsty. Water shortages and poor water quality frequently result in dangerous health implications such as diarrhoea, which claims 2.2 million lives every year. Rising temperatures and floods also result in increased risk of water and vector borne diseases.<sup>12</sup>

Cities in poorer countries are also far more vulnerable than those in richer countries as they have fewer resources to adapt to the water shortages. The lack of state funds and infrastructure makes it harder to import water and ensure it reaches those that need it. Urban drought is yet another example of the injustice of climate change impacting most the people who have done least to cause it.

## Loss and damage

Urban drought is an often-overlooked issue when it comes to 'loss and damage', the impacts that can't be adapted to that are caused

by climate change. The issue of loss and damage has risen up the agenda at international climate talks as it has, and will continue to, harm vulnerable communities and countries which contributed least to the climate crisis. These countries are demanding finance for the losses and damages caused by rich country emissions. Loss and damage are the negative consequences of climate change that go beyond peoples' ability to adapt.

Most of the discourse around loss and damage focusses on rural impacts such as the loss of farmland to desertification. However a recent study found a number of incidents of loss and damage caused by water shortages in seven major Asian cities.<sup>13</sup> Among the tangible impacts were the degradation of groundwater quality and quantity, the closure of local industry, economic losses, saltwater intrusion, increased disease outbreaks, the loss of wetlands and a rise in water prices. The less tangible impacts included a psychological burden, especially among women, to find and collect water, the rise of a water mafia and increased public conflicts over scarce resources, including regional conflict between urban and rural dwellers.

The UN's Special Report on Drought 2021 found that for the period 1900–2019, an estimated 2.7 billion people worldwide were directly affected by droughts, leading to an estimated 11.7 million deaths.<sup>14</sup>

## Conflict

Peter Gleick, head of the Oakland-based Pacific Institute, has spent the last three decades studying the link between water scarcity, conflict and migration and believes that water conflict is on the rise. He said: "More and more people are dying from contaminated water or conflicts over access to water."

Gleick's team are behind the Water Conflict Chronology: a log of 925 water conflicts, large and small, stretching back to the days of the Babylonian king Hammurabi.<sup>15</sup> It is not exhaustive, and the conflicts listed vary from wars to small scale disputes. But they show that the relationship between water and conflict is interlinked in multiple ways.

They categorised water conflicts into three groups.

- 1) As a 'trigger' of conflict, where violence is associated with disputes over access and control of water
- 2) As a 'weapon' of conflict, where water and water systems are used as weapons in conflicts, such as building dams to withhold water or flood downstream communities
- 3) As 'casualties' or 'targets' of conflicts, where water resources, treatment plants or pipelines are targeted during conflicts.

Their findings show that conflicts over water, both within countries and between countries, are sharply increasing.<sup>16</sup> The average number of water-based conflicts per year in the 59 years between 1900-1959 was 0.37. In the 29 years between 1960-1989 there was



1.27 per year. But in the 27 years between 1990-2007 there was 4.61 per year.

## Case study: Crimea



*Ayanskoe Reservoir in  
Crimea is running dry*

Before Crimea was annexed by invading Russian forces in 2014, it received 85% of its water from the North-Crimea Channel. But once it was under Russian control, Ukraine diverted this water source in protest at the illegal invasion. The new Russian-backed administration had few ideas or solutions and relied on natural reservoirs and drilling more wells. This short-sighted approach was enough to get by until 2020 when drought struck the region, many of the reservoirs dried up and Crimeans' water was rationed. Sometimes they wouldn't have any water in their taps for up to 5 days in a row.

So desperate were the water problems in Crimea that Russia had even dangled the offer of returning Russian-controlled parts of the Donbas if Ukraine restored the water supply. The unresolved water issue stoked tensions in Russia and has been suggested that it contributed to prominent politicians like Konstantin Zatulin calling for a more aggressive foreign policy towards Ukraine in defence of pro-Russian citizens living in post-Soviet states.<sup>17</sup>

Crimea and the region are vulnerable to climate change. A North Eurasian Climate Center 2020 report indicates that for the past ten years the amount of precipitation in the Russian South, the East of Ukraine, and in Moldova decreased between 5 and 14%.

On June 6, 7 and 8 2020 the temperature in Simferopol broke three all-time records, rising to 32.6° C, 32.3°C and 34.4°C respectively. The average temperature at the time was 7-8 °C higher than the norm.<sup>18</sup>

# 10 cities that are running out of water

## London, UK



*Burgess Park during a heatwave in 2018. Malc McDonald*

The idea that London could run out of water in the famously rainy UK might sound incredible to many people. Yet the CEO of the Environment Agency, James Bevan, warned that within 25 years London and the South East of England could run out of water.<sup>19</sup> The cost of a severe drought to London's economy is estimated by Thames Water to be £330m per day, and would have severe economic, social and environmental consequences.<sup>20</sup> Bevan added that by 2050 some rivers will see 50%-80% less water during the summer months.

London already receives less rainfall than you might think – it averages just 620 millimetres a year - which is about half the amount of rain that falls in New York City<sup>21</sup>. Most of this rain falls in the autumn and winter and soaks into rocks underneath the city. Water companies then extract and use this groundwater during the drier summer months. However, climate change will increase the frequency and intensity of droughts in the South-East of England. Combined with a growing population, this could place serious stress on London's ageing water supply system. If the world warms by 4°C, there might not be enough water available to supply London's inhabitants, even if measures are taken to fix leaky pipes and reduce the amount of water that households consume.<sup>22 23</sup>



## Harare, Zimbabwe



In 2019, two million residents of Zimbabwe's capital, Harare, were left cut off from running water as a year's long drought took its toll. Only 50% of the city's 4.5 million people had access to the municipal water supply leaving the rest to find private water merchants, open wells, streams or boreholes. The use of these polluted water sources led to outbreaks of disease such as typhoid. Dr Jean-Marie Kileshye from WaterNet said: "Water-borne diseases linked to these boreholes are on the rise, but people have had to take in their own hands water supply because the utility has failed to provide water."<sup>24</sup>

*Harare. Erik Törner*

Harare obtains its water from four dams: Harava, Seke, Chivero and Manyame. Harava and Seke ran completely dry which led Harare city council to decommission the Prince Edward water treatment plant, which is fed by those dams. The city's water system was designed to cater for just 300,000 people with the last upgrade back in 1994.<sup>25</sup> The country's ongoing economic challenges, like many developing countries, have prevented authorities from investing in improvements. Zimbabwe is vulnerable to climate change through hotter temperatures, and it can expect to face similar water crises in future as droughts get worse.<sup>26</sup>

## Case study: Janet Zirugo



In Zimbabwe, drought and erratic rainfall have made growing food a yearly challenge. Janet Zirugo, 70, has experienced the impact of climate change first hand. She said:

“We have a challenge of rainfall, and a challenge of hunger. There will be no good crops in our fields. There would be no water to water our gardens. For our livestock to get drinking water, they won’t get it. The biggest change is on rainfall patterns. Long back we used to know that when the rains fall in October, we would know that the rain season has started for sure. We then went to the fields to plough. Nowadays we have to wait either we plough in November or December.”

She said drought has been a major driver of hardship and hunger for her children:

“When I made the meal I gave it to children, then remove the dog’s share and put it down for the dogs. Children would pick the dog’s meal from the ground because they were not full. We ate things which could not be eaten in normal times. These challenges had been brought about by the drought. Rains had not fallen, these things I cannot forget. Because if you see a child picks dog’s food, the situation had reached unbearable proportions.”

## Cape Town, South Africa



In early 2018, Cape Town's City Council announced that there were 90 days left before the city ran out of water. Drastic measures were taken to stop the taps running dry. Each household was limited to using 50 litres of water a day, which is about one bathtub full of water. Thankfully, reservoirs filled up during the winter rainy season and 'Day Zero' never arrived. However, Cape Town could face similar and more extreme water shortages as the climate changes. An increasingly hot, dry climate could reduce surface water supplies by as much as 20% by 2100, relative to 1971-2000 levels. Longer droughts and dry spells are also expected, along with more intense rainfall, which runs straight into rivers without filling up groundwater supplies. Without efforts to reduce global heating and to adjust to the impacts of climate change, 'Day Zero' could become a reality for Cape Town.<sup>27 28 29 30 31</sup>

*Cape Town. Daniel Case.*



## Phoenix, USA



*Phoenix, Arizona. Photo:  
Melikamp*

The desert city of Phoenix in the US state of Arizona is in a crucial swing county with mid-term elections due this year. A growing water crisis made worse by climate change could play a key role in how its citizens choose to vote. Phoenix normally pipes in water from the Colorado River, which is 200 miles away. Yet a 19-year long drought and low river levels have forced water companies to turn to groundwater to keep the taps running. As the drought continues, Phoenix's inhabitants are pumping the wells dry and climate change will only make the situation worse. A shrinking snowpack in the Rocky Mountains, higher temperatures and drier soils mean that flow of the Colorado River could decline by between 35% and 50% by the end of this century. Without careful management of groundwater supplies, Phoenix could face serious water shortages in the coming decades.

A 2021 report by the Center for Water Policy at Arizona State University quotes Thomas Maddock, Professor Emeritus Hydrology and Atmospheric Sciences, University of Arizona, who said: "The thing you have to remember is, we're pumping water that's 7,000 to 8,000 years old in many cases. As soon as the water's gone, we don't have another ice age to re-establish it."<sup>32</sup>

The report concludes: "If Arizona is to prosper into the next century, our focus needs to turn to what is essential for our future: The preservation of our groundwater and our increasingly fragile aquifers. Our own survival is at stake."<sup>33 34 35</sup>

## New Delhi, India



*New Delhi, 2019. People queue for taking water from Delhi Jal board tanker in the early morning. Shutterstock.*

According to a report by the think tank NITI Aayog in 2018, New Delhi is the most water stressed city in India. With India's urban population expected to reach 600 million by 2030, the capital city already struggles to supply its inhabitants with drinking water as people move to the cities in search of a better life. Climate change will only worsen an existing water crisis created by population growth and the depletion of groundwater supplies for irrigating crops. In a heating climate, surface water evaporates much more easily. This is expected to increase the frequency and intensity of droughts during the dry season.

In March 2022, India experienced its highest temperatures in 122 years with rainfall running a quarter to a third below normal. New Delhi only received 0.01 inch of rain in March and April when the usual average is 1.14 inches.<sup>36</sup>

Water managers stress the urgent need for the Indian government to regulate the extraction of water for irrigation and upgrade its supply system to prevent New Delhi running out of water in the coming decades.<sup>37 38 39</sup>

## Beijing, China



*Beijing. Photo by: cattan2011*

Rapid urbanisation, combined with a dry climate and the overuse of water to irrigate crops, has put severe pressure on Beijing's water supply. Faced with empty reservoirs and dwindling groundwater resources, in 2002 the Chinese government started building a huge system of canals to transport water from southern rivers to cities in the drier North. The South-North Diversion Project will divert 44.8 billion cubic metres of water, or 179, 200,000 Olympic sized swimming pools full of water, every year to Beijing and other Northern cities. Yet climate scientists are concerned that even one of the world's largest construction projects might not be able to solve Beijing's water crisis. Under more extreme climate change scenarios, higher temperatures and more extreme droughts will increase demand for water in Beijing. Less rainfall over the rivers that flow into the South-North Diversion project will also reduce the amount of water that Beijing can take from elsewhere in China. Without further efforts to conserve water, Beijing might struggle to keep the taps running in the coming decades.<sup>40 41 42 43 44 45</sup>



## São Paulo, Brazil



São Paulo

In 2015, São Paulo, the 5<sup>th</sup> largest city in the world, had less than 20 days of water left for its 22 million inhabitants. An unprecedented 2-year long drought meant that the city's reservoirs had fallen to 5% of their normal capacity. In February 2015, it started to rain again and São Paulo's 'Day Zero' never arrived. However, scientists are concerned that climate change will make events like the drought of 2014-15 more common. Less rainfall, along with more evaporation from higher temperatures, mean that there will be less water available to fill up São Paulo's reservoirs. When combined with a growing population and the mass planting of particularly thirsty eucalyptus trees in the surrounding countryside, São Paulo could face serious water shortages in the future if steps are not taken to reduce demand and to secure more sustainable sources of water.

Climate change driven drought also threatens the country's energy provision as 70% of Brazil's electricity mix comes from hydropower dams.<sup>46</sup> Drought struck again in 2021 with the Government rationing energy. At the time, Energy Minister Bento Albuquerque said: "Brazil is going through the biggest water crisis of the past 91 years." As climate change worsens, threats to Brazil's power sector are likely to increase with knock on effects to the national economy.<sup>47 48 49</sup>

## Cairo, Egypt



This year, Egypt is hosting the United Nations' climate summit, COP27, at the Red Sea resort of Sharm-el-Sheikh. Flowing through the Sahara Desert is the River Nile which supplies Egypt with 96% of its water. This means that Egypt's farmers and the 21 million inhabitants of the capital city, Cairo depend on the world's longest river for drinking water and for growing crops. However, water demand for irrigation, industry and domestic consumption already exceeds the supply of the River Nile, forcing Egyptians to extract water from non-renewable sources of groundwater. Climate change will only worsen the existing water crisis. Increased temperatures and less rainfall during the wet season in Ethiopia could reduce the flow of water downstream in Egypt. This will produce water shortages and reduce crop yields in a country that already imports most of its food. Water shortages are also damaging relationships with Sudan, Ethiopia and other upstream countries who contest Egypt's extraction from the Nile's flow. Ethiopia's Grand Renaissance hydroelectric dam is under construction and will take up to 7 years to fill from the Nile. Egypt fears a reduction of water availability due to the filling of the reservoir and a permanent reduction because of evaporation from it.

Climate change therefore not only poses a threat to Egypt's water supply, but also to agriculture and the political stability of the wider region.<sup>50 51</sup>

*The River Nile. Cairo. Photo: Fakharany*

## Kabul, Afghanistan



According to the United Nations, 95% of Afghanistan's population currently does not have enough food to eat. An ongoing drought meant that farmers lost much of last year's crop, leaving them without enough grain to feed themselves during the winter or seeds to sow this spring. Yet moving to the capital Kabul does not guarantee a safe or secure water supply. Eighty five per cent of the city's population relies on shallow, polluted wells for water and groundwater levels are falling rapidly. Climate change will only worsen existing water and food shortages. Temperatures are rising, reducing snow cover, snow melt and water supplies for the growing city. Rainfall is also becoming more erratic, producing severe droughts that ruin agriculture and deplete supplies of groundwater. Kabul may struggle to supply its inhabitants with enough food to eat and water to drink if sustainable sources of water are not found in the coming decades. <sup>52 53 54 55</sup>

*Kabul. Photo:  
Olgamielnikiewicz*



## Sydney, Australia



*Sydney. Photo: Diliff*

Between 2017 and 2020 a severe drought halved the amount of water in the reservoirs that supply Sydney with most of its water. With less and more irregular rainfall, higher temperatures and drier soils expected in the coming decades, many politicians and water managers are asking questions about whether enough is being done to keep the taps running. A draft water strategy published by the New South Wales government last year concluded that ‘future climate risks and extreme events mean we cannot meet our water needs by only using traditional water supply approaches’. If the Australian government fails to invest in rainfall-independent sources of water, such as recycled wastewater, Sydney could run out of water when the next drought hits.<sup>56</sup>

## Recommendations

Climate change is leading to more cities at risk of running out of water; the worse climate change is, the more city-dwellers will be affected by a lack of water. The fact cities will increasingly be home to a bigger majority of the world underlines the urgency for Governments to act.

- It is vital that emissions in the richest and most polluting countries are slashed as a priority. Many developed economies, such as the UK, have set Net Zero target dates but the vast majority lack the policies to enact them, and these targets are currently not on course to be met. Policies to reduce emissions from energy, transport, housing, industry and agriculture need to be introduced.

- Much more needs to be done to help people adapt to drought. The finance available to support adaptation to climate change is woefully inadequate, particularly in the Global South. The promise made at COP26 to double adaptation finance must be fulfilled and at least 50% of all climate finance globally should be allocated to adaptation activities. This finance must be grants-based and accessible to the poorest communities. Beyond this, an ambitious new post-2025 stand-alone goal for increasing adaptation finance must be established with a clear plan for delivery.
- A Loss and Damage Finance Facility to pay for loss and damage needs to be established to address the impacts which poorer communities around the world have not been able to adapt to. Providing support for people who have faced permanent losses and damages is essential for a fair and just response to the climate crisis and will also help to relieve the pressure on cities from rural to urban migration.
- More sustainable approaches to urban design and city planning need to be adopted to maximise water usage and naturally cool urban centres. Impervious surfaces, like concrete, seal the soil. Surface water can't filter down to recharge the groundwater. Instead, rainwater goes into the storm-water system. Concrete, tarmac and masonry raise the temperature of built-up areas. Green open spaces mitigate this so-called urban heat island effect. Integrating this 'blue-green' infrastructure into cities is one of the solutions to urban droughts.

## End notes

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