Not a drop to spare

Droughts and water shortages have threatened urban centres before, but Cape Town captured the world's attention to the spectre of a full-scale shutdown. The lessons to be learned go beyond precipitation modelling to institutional organization, technological infrastructure, and social behaviour, and every world city should prepare before it's too late.

The international headlines were suddenly omnipresent towards the end of January 2018, signalling in just a few days to the world what Cape Town had known and feared for months: that a major world city was about to run out of water with a literal countdown to so-called Day Zero that was scheduled for 15 April.

At the time of writing, Day Zero has been postponed thanks to further rationing by the city's residents and late summer rains that have kept enough water in the reservoirs to keep going until the main wet season starts in earnest in the eastern Cape of South Africa. But the lessons, and the fear, will be a lasting legacy of this scare, as Cape Town will probably not be the last city to experience fears of a sudden end to the most valuable resource of all.

A *Nature Sustainability* editor landed in Cape Town International Airport at the beginning of December and was immediately greeted in the passport control hall with the large mural pictured here. In the central business district, posters hanging from the sides of skyscrapers implored residents to conserve water; decals were plastered above every public bathroom sink reminding people not to use any more water than necessary to wash hands; letters in hotel rooms informed visitors of how many toilet flushes and how long a daily shower is allowable under the recently imposed Level 5 water restriction, which mandated only 87 litres of water per day per resident compared with the 235 litres used by the average South African (the typical American uses over 300 litres daily, while a resident of drought-conditioned Melbourne is encouraged to use 160 litres a day; https://go.nature.com/2GAf5T8). When the Level 5 restrictions failed to properly alleviate the stress on existing water resources through a blazing summer — with reports of many residents ignoring or dismissing claims of impending water cutoffs — the city then moved to mandate only 50 litres of water per day. City officials warned that on Day Zero, municipal water access would be shut off except for hospitals, schools and other necessary services, and rationed water would be only be available at 200 access points for residents to fill jugs with up to 25 litres a day per person. As wealthy residents stockpiled bottled water, the city struggled over the finer details as to how such rationing should work, how unequal access could exacerbate existing economic and social disparities, who would control the access points meant to serve 200,000 people, and how to even get water from natural springs to those points at all (https://go.nature.com/2GyMiCk). Also unexplained, and unknown, was how shutting off water might affect the water and sewage infrastructure; recent events in Flint, Michigan, testify to how even changing the water supply can dramatically affect the physical condition of the pipes for the worse.

Credit: Ryan Scarrow

Those water restrictions were put in place as the scale of the two-year drought became more and more evident to city officials, the result not just of nearly unprecedented lack of precipitation (according to the head of the South Africa National Biodiversity Institute at Kirstenbosch, the eastern Cape received only 500 ml this past winter instead of the usual 1,500–1,600 ml winter rainfall), but also a failure to manage existing water resources in Cape Town's reservoirs, which were full as recently as 2014 while the city was winning awards for its water-conservation programmes (https://go.nature.com/2Jk90fi). How it all came apart so quickly will be a critical research topic not just for South African officials — who were reportedly slow-footed in responding to the emerging drought — but for politicians, water engineers, and researchers in every major city around the world. What Cape Town has experienced is unlikely to be a one-off event, but will undoubtedly challenge cities of all sizes and locations for the rest of the century.

The first issue of this journal featured research from Martina Flörke and colleagues on the increasing urban demands on surface water availability (*Nat. Sustain.* **1**, 51–58; 2018), calculating a global deficit under climate change models that could see over a quarter of major world cities exceed their current water resources. Such demands will put cities in conflict with agriculture, as has happened in South Africa; similar tensions were developing between farms and cities in California during its recent five-year drought. Flörke's research suggested that

agricultural efficiency could help alleviate urban water deficits, but the political economy of water is as much a question of power as engineering or precipitation. In addition to agriculture versus urban demands, California also struggled with the burden of water costs and conservation being unequally distributed between the poor who could not afford to pay higher rates for water and the rich who could afford to pay those rates plus additional fines for excess usage; Athens, Greece, struggled with the same inequality during a sudden drought in 1991 — yet these were places with extensive social and technological infrastructures set up, unlike many developing nations.

The spectre of 'water wars' remains just that for the time being; while droughts do challenge cities around the world — Sao Paulo, Brazil was saved by rain in 2015, and ongoing shortages in the Middle East continue to intensify political and social unrest — engineering feats and economic resources have helped keep water flowing to growing populations in ways that would not have been possible just a few decades ago. Technological solutions can only do so much though, especially in the face of feedback loops of how individuals and societies respond to abundance and scarcity; more research will be necessary on the hydrological, engineering and social dimensions of urban water, and their intersections in cities large and small. Water shortages and droughts may be local in scale, but their effects and consequences are increasingly, and unavoidably, global. ❐

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