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Implementation Guides November 2021

How to manage water scarcity and adapt to drought

Adapting to Climate Change | Spotlight On: Nature-based Solutions

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The climate crisis threatens countless cities' water security. Rising temperatures disrupt water cycles, leading to increasingly frequent, intense and long-lasting droughts.[1] Since 2000, there have been 29% more drought-related disasters than in the previous the two decades[2] and at least 79 megacities have suffered from extensive water shortages.[3] The urban population facing water scarcity is projected to surge from 933 million people in 2016 to between 1.69 and 2.37 billion in 2050.[4]

Not only is water critical to survival, but it plays a crucial role in urban life – from energy and industry to food and hygiene. Cities need to adapt to this new climate reality and prepare for a more water-scarce future. Here's how.

Establish collaborative, adaptive governance structures to manage water and drought risk effectively

While drought is a natural hazard, caused by large-scale climatic variability, water scarcity is caused by the long-term unsustainable use of water resources and inadequate infrastructure, as well as a lack of water availability.[5] Impacts can be far reaching. Governance arrangements that enable a greater understanding of impacts and vulnerabilities, as well as an effective response to changing situations, are vital in order to address these risks effectively.[6]

In particular, cities should:

- **Involve all relevant city departments, as well as private companies and civil-society stakeholders.** These agencies and stakeholders should be involved in the assessment of risks and impacts, as well as in the development of strategies to address them. This should include actors involved in managing the public water supply, water-dependent tourism and recreation, buildings and infrastructure (particularly where there is a risk of soil shrinkage), water-intensive industries, parks and environment, food supply, health and welfare and, where relevant, water-based transport and local power generation that relies on water (for example, for cooling).[7] Establish clear mandates for public agencies in the management of water issues.

- **Establish processes to monitor and respond to changing risks.** The governance of changing and emerging drought risks should be iterative and evidence based, with active situational monitoring.[8]

- **Work with national, regional and neighbouring municipal governments.** Water scarcity is typically influenced by factors and decisions made outside a city's jurisdiction, such as upstream water abstraction. This makes it crucial to work with other authorities in tackling these issues.

- **Where relevant, clamp down on corruption.** Corruption can severely impact water-related city services, resilience, infrastructure and revenues, with informal settlements most profoundly affected. In Mumbai, for example, residents in informal settlements pay between 52 and 206 times more for water than those in high-income areas.[9] Procurement corruption is particularly prominent.[10] Solving these issues requires political engagement, participatory assessment of local needs, rights recognition, clarification of responsibilities, dedicated funding and anti-corruption regulation.[11]

Financing effective water management

The Sustainable Water Partnership offers tips for funding water security, aimed at local decision-makers and other actors. The toolkit explains the comparative costs of different types of water security actions and the main ways to fund them.[12] Water funds are a promising financial and governance mechanism: they are organisations that can help to unite public, private and civil-society stakeholders in cities and their watersheds to improve water security, with a focus on nature-based solutions and sustainable watershed management.[13] Read the *Water Funds Toolbox* for advice on how to establish one.

Identify and map local drought risks and impacts

Consider working with research partners, such as universities and/or your local meteorological office, to identify, measure and map drought risks and impacts, including the full expected costs. Local-level risks and impacts can be complex and difficult to model. Alternatively, methods that generate knowledge based on people's understanding of changing conditions can be a means of identifying risks without extensive modelling.[14]

Ideally, an assessment of drought risks and impacts should be conducted as part of a wider climate change risk assessment. Read *How to conduct a climate change risk assessment* for advice and tools. A risk assessment for drought and water scarcity should:

- **Include both direct and indirect risks and impacts.** The main direct effects in cities are a shortage of water for drinking, washing, hygiene, civic amenities and other systems and a deterioration in water quality, which can lead to disease.[15] Indirect impacts can include insecurity in the food supply, higher prices due to agricultural impacts outside the city, a loss of energy from hydropower, increased migration to cities and stress on community services.[16]
- **Consider how multiple, compounding shocks may affect the water system, people and sectors.** Several small shocks can have an extreme composite impact.[17] *How to address infrastructure interdependencies* provides ideas on how to map 'cascading' impacts.

The Sustainable Water Partnership's toolkit on assessing water security risks explains more about how to assess water risks and provides advice on identifying relevant stakeholders and effective governance structures.

Advocate for better national data collection. Around 40% of World Meteorological Organization (WMO) country members do not collect data on basic hydrological variables such as water levels. Data collection is particularly poor in nations in the Global South, where drought risks tend to be highest.[18] These data, at regional or national scale, are vital to the effective management of water resources.

Water availability will fall by 2050

Water availability, measured in annual renewable water resources (ARWR) per capita (m^3), is falling due to climate change and population growth. Water scarcity is defined as ARWR per capita of less than 1700 m^3. By 2050, 87 countries will be water scarce, while the number of countries with 'absolute water stress' (ARWR per capita of less than 500 m^3) is projected to rise to 45 from 25 in 2015.[19, 20]

The map, which shows projected water availability (ARWR per capita) in 2050, shows that cities in the Middle East, North Africa and sub-Saharan Africa will be worst affected.[21]

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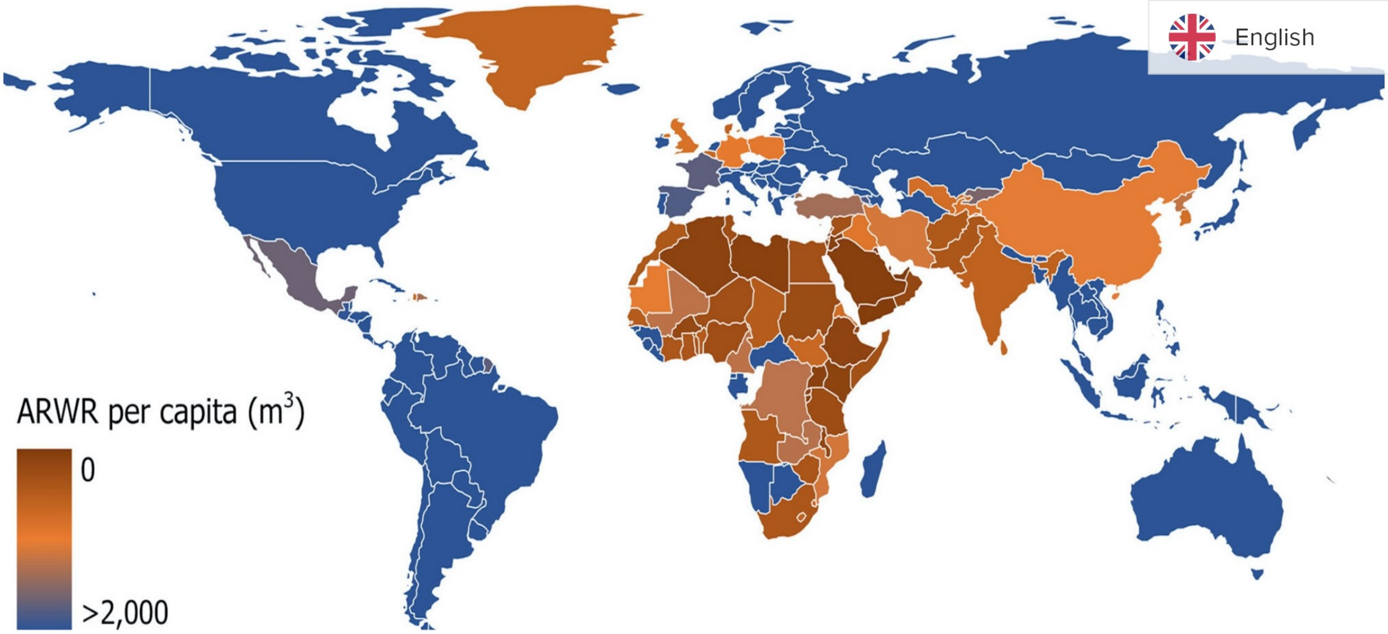

Manage demand for water

Cities facing water stress should promote the wise use of water – not only in times of drought, but in the long term, to reduce pressure on water systems. This can be achieved with behavioural and financial approaches:[22]

- **Behavioural change campaigns.** Manage demand for water through public information campaigns, as well as tools like smart meters, personal notifications, public dashboards and other consumer-centric methods.[23] In Bogotá, for example, daily reports of water consumption are published in the mass media.[24] *Easy Attractive Social Timely (EAST)* presents advice on applying behavioural insights to government policy. Messaging should include the promotion of recycled water, particularly greywater (lightly used water from household or office use, which is free from toilet wastewater), and seek to alleviate residents' concerns about the safety of this water for certain purposes. Between 2004 and 2012, San Diego successfully ran a campaign to improve public opinion on water reuse, with the proportion of people supporting reuse rising from 26% to 73%.[25] Behavioural changes were also critical to Cape Town's drought response in 2018 (see box).

- **Financial subsidies, fines and 'wise-use' tariffs.** Wise-use or block tariffs are volumetric charges where users pay different amounts according to their level of consumption; as water use increases, the tariff shifts to a higher price.[26] This approach, used in Cape Town, Texas and elsewhere, can send price signals to water consumers to encourage conservation. Chile combined water conservation with equity considerations by introducing a two-tier tariff for peak and off-peak users, with means-tested subsidies – part-funded by states and municipalities. This helped around one in eight urban customers in 2018 while reducing water use.[27] If possible, businesses and other organisations with unnecessarily high use should be fined.

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Leading Utilities of the World is a network of successful and innovative water and wastewater utilities that acts as a benchmark for strong performance and provides examples of good practice.[28] City utilities and agencies in Sydney, Singapore, San Antonio, Las Vegas, Phoenix and Denver are recognised for their response to drought and water scarcity, while those in Porto, Dubai, Hong Kong, Philadelphia and Budapest, among others, are recognised in other areas of water management.[29] Visit the network's website to learn more about their activities.

Cape Town's drought response[30]

After three years of low rainfall, in 2018, Cape Town suffered a severe drought and implemented strict policies to reduce demand. Through radio, television, social media and messages from influential people, the city instructed residents to keep showers to less than two minutes and minimise toilet flushing, banned water use for swimming pools, fountains and car washing, and promoted the use of greywater. The city also introduced large fines to discourage high water use, increased water tariffs and used water management devices to limit supply to properties. With the aid of data on household water use, Cape Town successfully restricted residents to 50 litres a day.

The City of Cape Town website still provides extensive information to guide residents on the city's water use and explain ongoing drinking-water restrictions, which change depending on the risk level and are illustrated in the summary table below:[31]

Restriction measures*	Restriction Level				
	No restriction (Water wise)	Level 1	Level 2	Level 3	Emergency response
Watering: hosepipe / sprinklers	Allowed	1 hour (Tuesdays and Saturdays)	1 hour (Saturdays)	Not allowed	Not allowed
Watering: drippers/drip line/soaker hose or bucket / watering can	Allowed	Allowed	Allowed	1 hour[2] (Tuesdays and Saturdays)	Not allowed
Sports fields / parks (sprinklers)	Allowed	1 hour (Tuesdays and Fridays)	1 hour[3] (Tuesdays)	1 hour[3] (Tuesdays)	By exemption only
Swimming pools	Allowed subject to conditions[4]	Allowed subject to conditions[4]	- Topping up allowed subject to conditions[4] - No filling / refilling	- Topping up allowed subject to conditions[4] - No filling / refilling	No topping up No filling
Car washing (privately)	Allowed	Bucket or high pressure/ low volume cleaner	Bucket only	Not allowed	Not allowed
Informal car washes	Allowed	Bucket or high pressure/ low volume cleaner	Bucket only	Bucket only	Not allowed
Commercial car washes	Allowed[5]	Allowed[5]	Allowed[5]	Allowed[5]	Not allowed
Water features	Allowed	Allowed	Not allowed	Not allowed	Not allowed
Other	-	-	-	-	Additional emergency restrictions may be determined
Targeted water pressure[6] (bar)	>2.4	>2.4	>2.4	>1.2	>0.5

Protect and increase the supply of water resources

As well as controlling demand, water-scarce cities can augment supply by harnessing unconventional water resources, improving the productivity of existing land and water resources and encouraging water recycling and reuse.[32] The following approaches have seen success around the world:

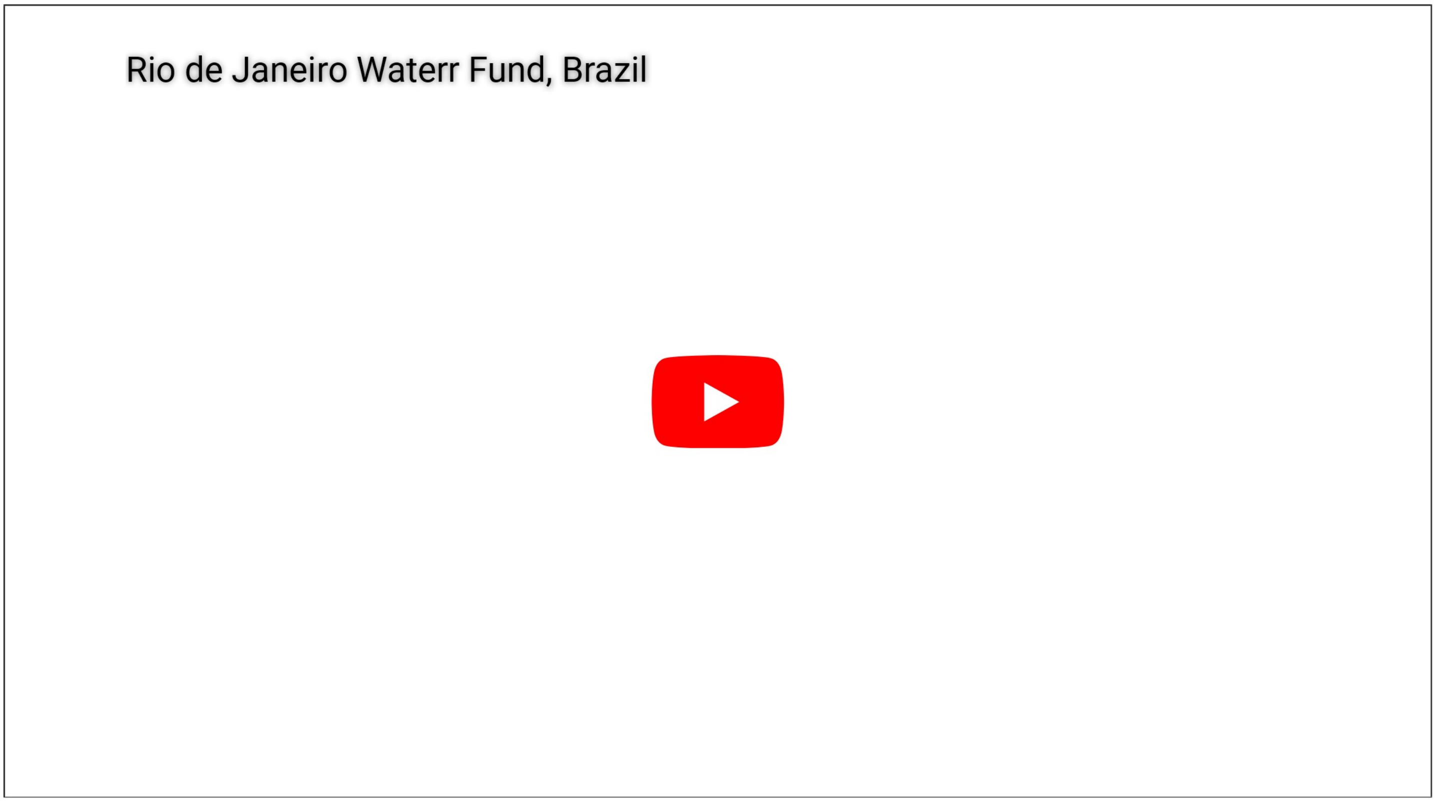
- **Improve the efficiency of water systems through engineering improvements.** Invest in active maintenance, data analytics, quick repair and the use of robust materials to reduce wasted water.[33] Through maintenance efforts to promptly detect and fix leaks, Tokyo more than halved water waste from 2002 to 2012.[34]

- **Reuse or recycle water from the wastewater treatment process** for other uses, such as energy generation or agriculture. Treated wastewater can also generate revenue. The city of San Luis Potosi, Mexico, for example, sold its treated effluent to a power plant for cooling, while in Chicago, recovered phosphorous is sold as fertiliser.[35] By selling treated wastewater to two industrial users, Durban saved enough potable water to serve 400,000 people.[36]

- **Improve water retention and regulate against unsustainable groundwater exploitation.** Measures include rainwater and stormwater harvesting, which can be used locally as well as connected with centralised systems, as in the case of Mexico City; managed aquifer recharge, which sends water underground through injection wells or infiltration ponds; and the reduction of evaporation from freshwater stores.[37] Stormwater runoff is a neglected resource, typically considered waste, so water-stressed cities should integrate strategies to harvest, treat and reuse it into flood management plans.[38] Singapore, for example, has installed structures including gutters, barrels, tanks and reservoirs to capture and use rainwater.[39] In Melbourne's Fishermans Bend, rainwater harvesting and sewer mining are used as alternative water sources for non-drinking purposes.[40] *Water Solutions for Climate Resilience* includes short case studies on both cities' initiatives, among others. Nairobi and Ribeirão Preto, Brazil have stopped urban water-well drilling.[41] Consider embedding water storage requirements in building regulations, as Istanbul has done (see box).

- **Manage land use and pollution sources to protect watersheds and improve water quality, making use of nature-based solutions.** Cape Town has invested in nature-based solutions, such as the clearing of alien vegetation in catchment areas that feed the city's water supply dams[42] and restoring native fynbos shrublands, known for their low water consumption, with a view to reclaiming two months' worth of city water supply.[43] Restoration of the fynbos is also a core part of the city's wildfire risk-reduction strategy and serves to boost its biodiversity. Work with neighbouring municipalities and other levels of government to protect the water supply at the watershed level. In Peru, the government has passed national laws requiring water utilities to invest a portion of customer bills in restoring and protecting watersheds such as high-altitude wetlands and forests.[44] Water funds offer a way to improve watershed management. Watch the short video below to hear about how the Rio de Janeiro Water Fund has improved water supply and water quality in the

Guandu Watershed, which supplies 80% of the water used by residents in the city.



- **Desalination and purification** to use resources like seawater or ‘brackish’ water (usually transitional areas between fresh and marine waters), along with sensors to monitor water quality effectively. However, this process is currently very energy-intensive and expensive.[45]

Istanbul’s cisterns in new buildings[46]

In 2021, Istanbul made cisterns compulsory in new zoning regulations for all new buildings on plots of more than 1,000 square metres. This was in response to very low water storage rates in city reservoirs at the start of 2021 – half what they had been the previous year. Roof- and groundwater will now be collected underground in an approach previously used in the Byzantine and Ottoman eras. The city is also establishing a control centre to monitor the entire water system from source to distribution and reuse.

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