

Water-wise Strategies

*A summary of policies, guidelines
& design interventions for water management*





ENVIRONMENTAL DESIGN SOLUTIONS PVT LTD [EDS]

EDS is a sustainability advisory firm focusing on the built environment. Since its inception in 2002, EDS has worked on over 350 green building and energy efficiency projects worldwide.

The diverse milieu of its team of experts converges on climate change mitigation policies, energy efficient building design, building code development, energy efficiency policy development, energy simulation and green building certification.

EDS is committed to sustainability by continuously providing capacity building and training programs on various topics for diverse group of professionals, government officials, students and faculty.

Through the Global Sustainability Education program, EDS is reaching out globally with high quality courses for professional development that are also qualified for GBCI CE credits.



INTRODUCTION

Water is the basis of life. We need water for drinking, for growing food, to generate power and cool our power plants and to maintain ecosystems. While 78% of the planet is covered by water, we rely on only about 3% of this water or freshwater as it's known, for our consumption. Most of this freshwater is locked away in icecaps and it's the small component found in lakes, rivers and groundwater that has met our requirements for billions of years.

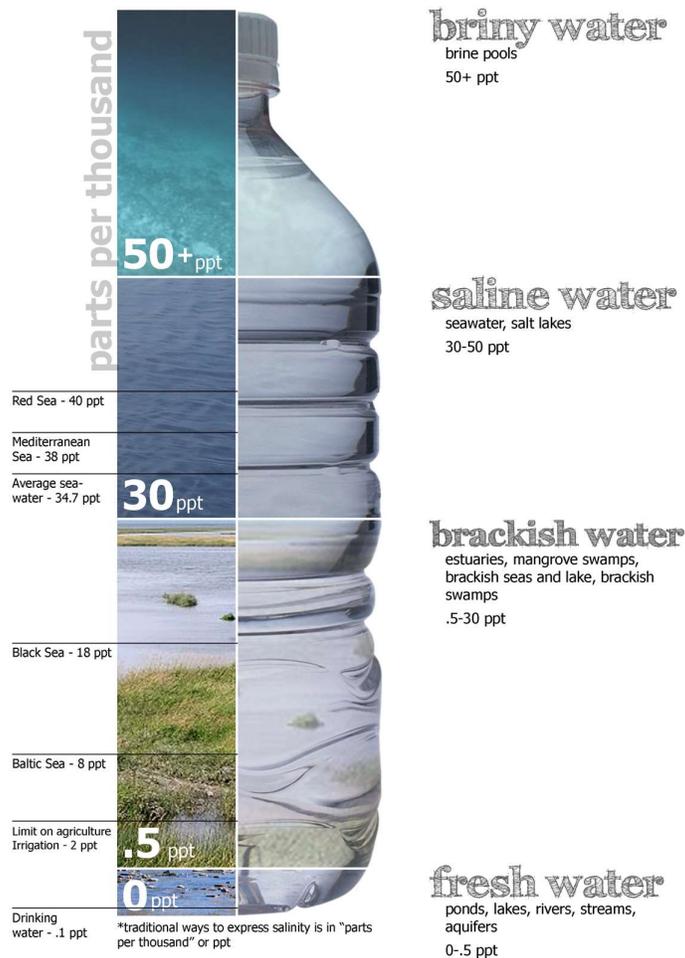


Figure 1: Water distribution on earth

It's also important to understand that the distribution of precipitation and therefore the availability of freshwater varies drastically across the world. In fact, only 9 countries contain more than half of the world's water supply - the US, Canada, Colombia, Brazil, the DRC, Russia, India, China and Indonesia.

Many arid and small island nations have geographic disadvantages in access to freshwater. Often, countries may be rendered dependent on its upstream neighbors. For example, Sudan and Egypt are heavily dependent on the River Nile, which is shared by nine other countries further up the river.

Until very recent times, freshwater was considered a renewable resource as the natural freshwater cycle ensured water reserves were replenished continually. However today, a host of issues like climate change, overconsumption, rampant wastage and pollution are threatening the availability of clean water. The result is a grave water crisis whose impacts extend to all parts of the world.

The water crisis is many-faceted; while some regions are experiencing extreme droughts, others are facing extreme rainfall. Kenya has been facing consecutive droughts for almost a decade. Water pollution is aggravating the problem further, with around 17% of the world's population lacking access to clean water [1].



Figure 2: Water pollution in River Tietê, Salto, Brazil

Water is also linked to many other of the most significant risks, social and environmental, confronting our society today. For instance, the task of providing water for households falls disproportionately to women and girls, especially in rural areas.

In the article ahead, we will look at different global programs and strategies, that seek to improve and manage water supply without impacting the environment adversely. But first, let's investigate the extent of the water crisis affecting the world.

GLOBAL WATER SCARCITY

Water scarcity is the lack of fresh water resources to meet water demand, due to physical shortage, failure of institutions in providing regular supply or lack of adequate infrastructure. Water scarcity is exacerbating rapidly. The most critical factors behind this are rising population, economic growth and poor water management.

Acute shortage of water is termed as water stress. According to the Falkenmark Water Stress indicator, a country or region is said to experience water stress when the annual water supply drops below 1,700 cubic meters per person per year. When a region's water supply further drops below 1,000 m³, it is said to be experiencing water scarcity; and below 500 m³, absolute water scarcity [2].

Water scarcity already affects every continent. Over the last century, global water use has been growing at more than twice the rate of population growth and an increasing number of regions, especially arid ones, are reaching the limit at which water services can be sustainably delivered.

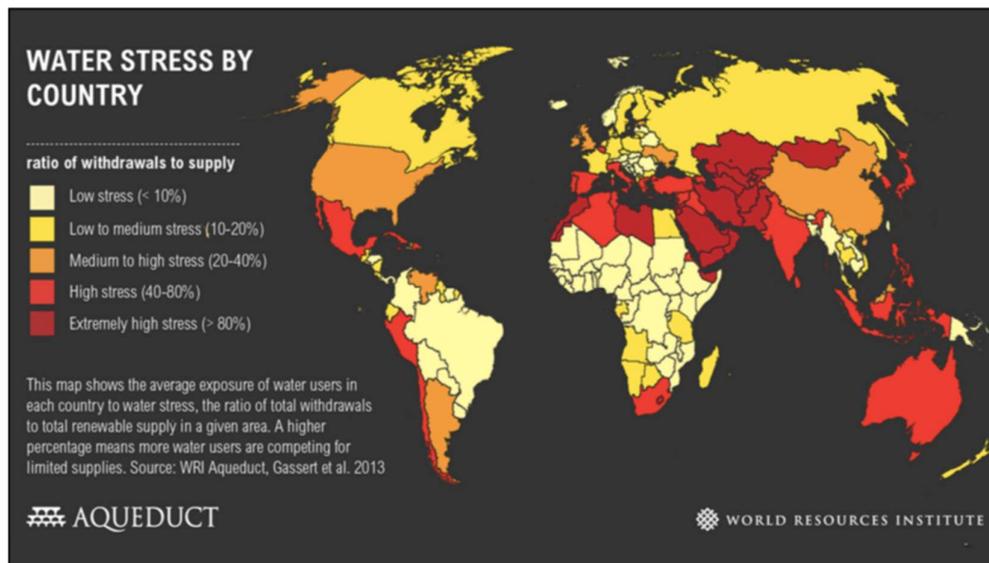
Freshwater withdrawals have tripled over the last 50 years. Every year, the demand for freshwater grows by 64 billion cubic meters. Changes in lifestyles and eating habits in the recent years are leading to more water consumption per capita. The energy demand is also accelerating, with corresponding implications for water demand.

A lot of water goes into land preparation, building and then smooth operation of a building. It is estimated that 2.3% of the total public water supply in United States is used by large commercial buildings.

Climate change and bio-energy demands are also amplifying the already complex relationship between world development and water demand. The production of biofuels, which are now becoming increasingly popular, require between 1,000 and 4,000 litres of water per litre of biofuel.

With the global population rising by roughly 83 million every year, one can only imagine the strain on our water resources in the coming years [3].

Fourteen of the world's 20 megacities are now experiencing water scarcity or drought conditions. As many as four billion people already live in regions that experience severe water stress for at least one month of the year [4].



Almost 80% of diseases in so called "developing" countries are associated with water, causing some three million early deaths. Take the example of the Nigerian state of Lagos, where only 1 in 10 people have access to state-provided drinking water. Public health is also at high risk due to contamination of clean water with sewage. Lack of clean water and sanitation in rural Bolivia has led to growing number of outbreaks of water-borne diseases such as dengue and malaria and in many parts, the child mortality rate is as high as 43% per 1000 live births, far above the rates observed countries where people have access to clean water.

Water shortage impacts food production. Water stressed regions have some of the highest malnutrition cases. According to a UNICEF report released in 2017, 1.4 million children suffer from acute malnutrition in drought-stricken Somalia [5].

Access to quality water is the key to economic prosperity and better living standards. Businesses and schools thrive when there is timely water supply. Manufacturing activities, commercial farms, mining processes all need water to thrive. Effectively, lack of water impacts economic activity.

Wars over access to water sources haven't broken out between countries alone but also between regions within a country. Interstate water conflicts are common in many countries such as USA and India and many regions of the Middle East. In the arid regions of western India, predominantly in the state of Maharashtra, farmers are battling the beverage industry for the protection of groundwater.

Further, water consumption is uneven across different sectors. Agriculture contributes to 70% of the freshwater used, with dairy and livestock farming having the highest water footprints.

This massive water consumption is mainly due to unsustainable irrigation practices. Agricultural runoff is also a major source of water pollution. Use of contaminated water for irrigation can render food toxic.

The destructive impacts of unsustainable water use are becoming increasingly evident. The state of Punjab in India has seen a drastic drop in groundwater levels over a short time. Unsustainable irrigation practices have caused the Aral Sea, once the world's fourth largest lake, to shrink to a mere 10% of its former area.

Next, industry accounts for 20% water use. Industries such as food, paper, chemicals, textile and metal need large amounts of water during their manufacturing processes. Further, many industries do not treat toxic waste water or prepare for safe disposal, contaminating rivers and lakes.

Domestic use accounts for 10% of water use. However, water consumption is not uniform across the world.

Cities use water for sanitation, firefighting, street cleaning and watering public areas such as parks and in fountains. Cities, with their large hard paved cover, do not allow effective percolation of stormwater down the ground. Further, the safe disposal of sewer waters is a matter of concern in many developing nations. Disposal of faecal matter in our rivers or dumping it underground pollutes both water and soil, leading to a variety of diseases.

CONSERVATION STRATEGIES

Water conservation means using less water, using it efficiently, polluting lesser water and recycling dirty water after treatment. The major goals of water conservation are sustainability, energy conservation and habitat conservation.

Water conservation must be addressed at all levels, right from the stage of resource planning to supply and end-user management. Let's look at some successful strategies and programs

Resource planning and management

Water resource planning and management consists of judicious sourcing and assessment of long-term environmental impact. Some strategies to ensure judicious management of water resources include harvesting rainwater or reusing wastewater can further reduce extraction of water resources. In addition, it also calls for fair distribution of water for domestic purposes, agriculture and industrial use.

There are many other issues involved in resource planning. For instance, maintaining political and social peace which calls for discouraging private ownership of water resource.

Public ownership of water resources

There are regions in the world which are bestowed with abundant fresh water but still its people have limited access to water, due to the involvement of the private sector in water supply. Governments involve private organizations, anticipating increased investments, improving efficiency of the system and expanding access. However, it has been observed that after private sector participation, water tariffs increase, and public facilities turn into profit-making commodities. For example, privately managed water systems in Jakarta and Berlin.

This practice is incompatible with ensuring the international human right to water, since it's the poor who suffer the most. As a result, privatizations in Cochabamba, Bolivia, and Dar-es-Salaam, Tanzania were aborted.

Watershed Management

The Rio Grande Water Fund aims to prevent protect the Rio Grande River in New Mexico, USA, the most important river in the region from post forest-fire flooding and contamination. It seeks to protect and restores vital forests upstream in order to ensure a continuous supply of clean water downstream. The whole community is involved in the mission towards building greater water security- businesses, water utilities, conservationists, and local citizens.

Efficient Irrigation

Since agriculture has a 70% of share of water use across sectors, it offers the maximum potential for water conservation. Strategies like increased irrigation efficiencies, shifting agricultural production towards less water-using crop and improving soil infiltration, can help achieve enormous water savings. One way to push for water-efficient agriculture could be rolling back subsidies given to farmers.

These measures can prove profitable to farmers too. After farmers in the drought-affected Flint River Basin in Georgia, US retrofitted their irrigation systems with high efficiency sprinkler heads and real-time soil moisture monitors, they were able to achieve reduced operational costs along with water savings.

Even as the rest of Arizona state in US reels under a 15-year drought, farmers in Yuma have successfully implemented irrigation techniques which cut their water usage by about 20 % over the last 20 years, while increasing crop production by 30 percent.



Figure 3: Efficient Irrigation

Green infrastructure

Further, green infrastructure can help improve water quality as well as prevent floods. For example, after Beijing was hit by a disastrous flood in 2012, the Chinese government launched a mission, the ‘Sponge City initiative’ to reverse the deleterious effects of rapid construction on stormwater flow. Under this, 30 Chinese cities are adopting bioswales, rain gardens, roof gardens, permeable pavements and other green infrastructure to allow at least 70% stormwater to infiltrate or be captured or reused. These cities are aiming for 80% of their built-up area to be able to manage stormwater this way by the year 2030.

Infrastructure should also be also provided for communal harvesting of rain water, and recycling or reusing it for appropriate function. For example, in Chandigarh city, India, most of the rain water collected from the roads via storm-water pipes is used for watering public parks in the city. Rooftop rain water harvesting has been made mandatory for government institutions and other building types in many parts of India.

There are many other innovative ways in which stormwater could be harnessed by cities depending on the needs of the region and residents.



Figure 4: Sponge cities in China

Recycle and Reuse

There needs to be greater focus on use of recycled water. In Israel, which views water as a matter of national security, the Shafdan Waste water treatment facility near Tel Aviv supplies a major portion of nation's agricultural water needs covering over 50,000 acres of land. Israel's water treatment captures 86% [6] of the water that goes down the drain.

Water is essential to architecture and built infrastructure giving us immense scope for water conservation in the building design and execution stages. Some buildings like Microsoft's upcoming campus in Silicon Valley are targeting zero water. A net zero water building (or campus) completely offsets its water uses with alternative water plus water returned to the original water source. Wastewater, like grey water, air cooling condensate, rejected water from water purification systems etc., can be treated and recharged. Stormwater can also recharge the original water source through green infrastructure.

Toilet-to-tap



Figure 5: Reclaimed water to potable standards in Singapore

Water agencies can reuse highly treated effluent from municipal wastewater or resource recovery plants as a reliable, drought-proof drinking water source. Advanced purification processes allow waste water to be treated to meet all applicable drinking water standards.

Singapore's stringent policies encourage national level conservation measures, including recycling blackwater to potable standards under the NEWater program. For now, most of the water is used for industrial purposes. About 40% of its water needs are met through efficient 'toilet-to-tap' processes, significantly reducing the pressure on fresh water sources.

Supply management

Proper supply planning and management involves planning water allocation amongst industry, farms and domestic uses such that the domestic user is not water stressed.

Supply should be made available at nominal charges but metered, so that water consumption patterns can be tracked allocations revised, if necessary.

In Australia, water is priced, making it tradeable commodity, helps in implementing measures that have halved business and residential water use. It has been observed that metering water leads people to use it judiciously Supply lines should be frequently checked for leaks or faults and rectified immediately

Covered water supply and storage systems would lessen water wastage via evaporation. In the 1980's, the Massachusetts Water Resources Authority took active steps to fix leaking pipelines to reduce the water supply losses in Boston city. These early efforts paid off over the long run too- despite a rising population, the city's water supply have stayed significantly low since then.

States in the US like California have mandated the use of low-flow fixtures in buildings. Some states have even adopted outdoor-water scheduling methods. City councils can also offer rebates and other incentives for replacing lawns with water-efficient landscaping to cut down outdoor-water use. For example, Dallas permits two watering days in a week.

CONCLUSION

Water connects to every aspect of life. As its supply is now facing a crisis of epic proportion, governments, international agencies, local communities and citizens must work together to help realize basic universal access to water. There is a growing need for sensitizing everyone on the need for water conservation, so that our future generations have access to adequate resources of water.

References

- [1] W. E. Forum, "Global Risks," 2018.
- [2] "www.globalwaterforum.org," 2012. [Online]. Available: <http://www.globalwaterforum.org/2012/05/07/understanding-water-scarcity-definitions-and-measurements/>.
- [3] U. DESA, "World Population Prospects: The 2017 Revision,," 2017.
- [4] M. M. Mekonnen, "Four billion people facing severe water scarcity," *Science Advances*, vol. 2, no. 2, 2016.
- [5] UNICEF. [Online]. Available: https://www.unicef.org/somalia/SOM_sitrep13_31Aug2017.pdf.

FURTHER READING

1. A detailed explanation of different water stress Indicators
<https://www.caee.utexas.edu/prof/maidment/giswr2015/TermProject/Ruess.pdf>
2. A study of sustainable water projects across the world
<https://islandpress.org/books/replenish>
3. The comprehensive plan for water management under the Rio Grande Water Fund
http://www.nmconservation.org/RGWF/RGWF_CompPlan.pdf
4. Urban Water Management in China's Sponge Cities
https://www.mdpi.com/journal/water/special_issues/Sponge-Cities
5. California's new law regarding water-saving toilet retrofits
<https://www.car.org/-/media/CAR/Documents/Industry-360/PDF/1056171/1057129/January-2017---Conservation-Flyer.pdf?la=en&hash=EE061B73F75AC70E45E3562379D6C1C79B9817AC>
6. Programs in Singapore aimed at reducing water imports
<https://www.pub.gov.sg/watersupply/singaporewaterstor>