CLEAN WATER

- Reasons of Global Water Crisis

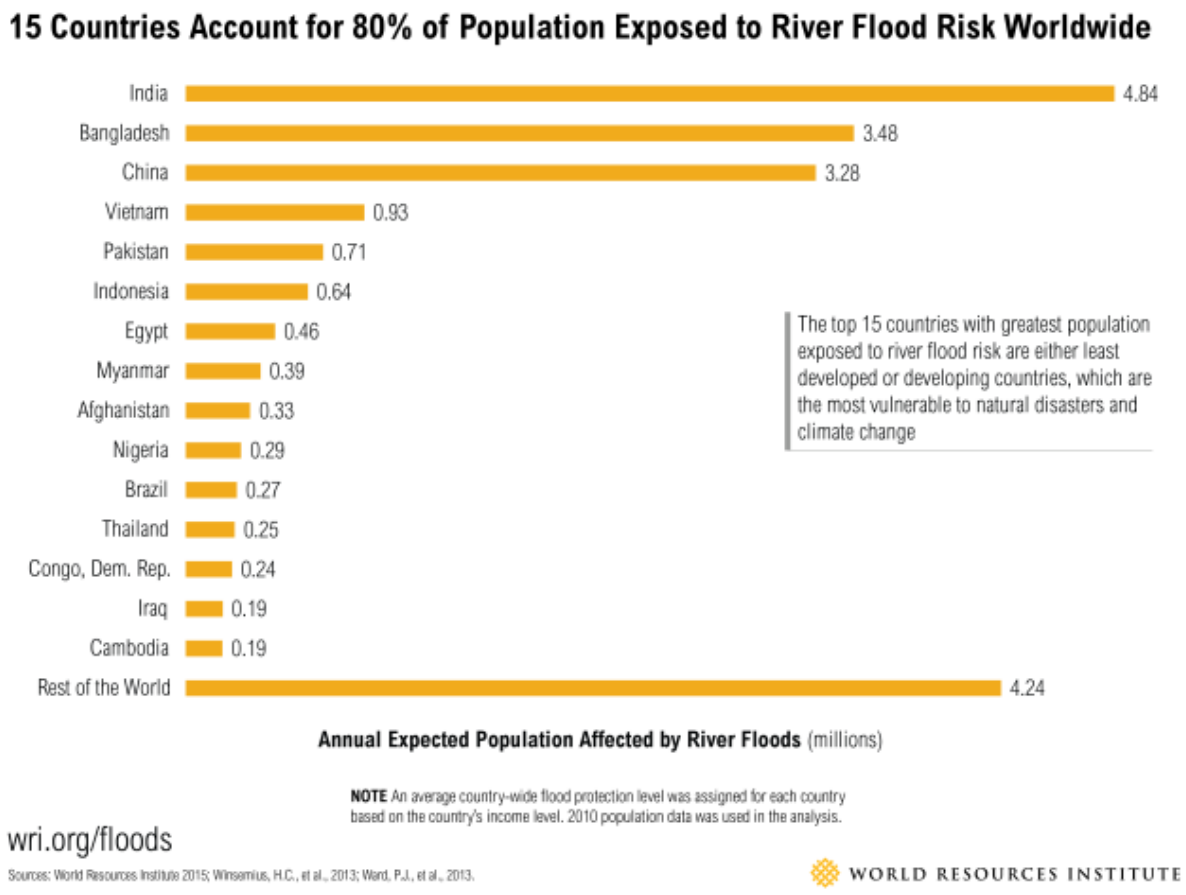
A man sits by the river in Garbahaarey town in the Gedo region of Somalia. Photo by AMISOM Public Information/Flickr.

Droughts in Somalia. Water rationing in Rome. Flooding in Jakarta and Harvey-battered Houston. It doesn't take a hydrologist to realize that there is a growing global water crisis. Each August, water experts, industry innovators, and researchers gather in Stockholm for World Water Week to tackle the planet's most pressing water issues.

What are they up against this year? Here's a quick rundown on the growing global water crisis.

1) We're Changing the Climate, Making Dry Areas Drier and Precipitation More Variable and Extreme.

Climate change is warming the planet, making the world's hottest geographies even more scorching. At the same time, clouds are moving away from the equator toward the poles, due to a climate-change driven phenomenon called Hadley Cell expansion. This deprives equatorial regions like sub-Saharan Africa, the Middle East and Central America of life-giving rainwater.

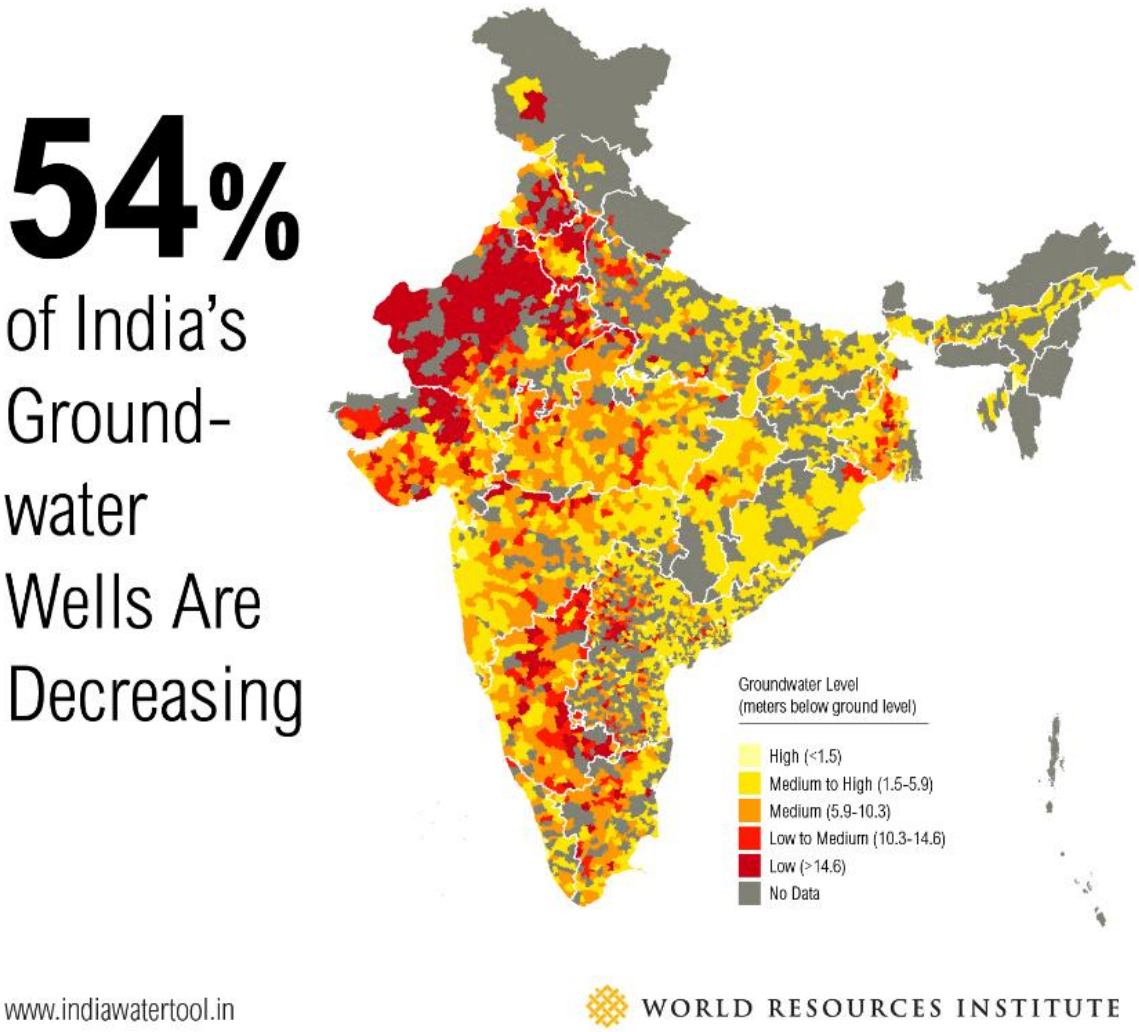


Paradoxically, climate change is also increasing precipitation in other areas, and people who live near rivers and streams have the most to lose. Currently, at least 21 million people worldwide are at risk of river flooding each year. That number could increase to 54 million by 2030. All countries with the greatest exposure to river floods are least developed or developing countries – which makes them even more vulnerable to climate change and natural disasters. This summer, extreme flooding submerged over a third of Bangladesh, claiming over 115 lives and affecting 5.7 million citizens.

2) More People + More Money = More Water Demand.

It's a simple equation: As populations increase and incomes grow, so does water demand. The world's population, now at 7.5 billion, is projected to add 2.3 billion more people by 2050. How can the planet satisfy their thirst? Growing incomes also exacerbate the water problem, because of the water-intensive products—like meat and energy from fossil fuels—that richer populations demand.

3) Groundwater Is Being Depleted.



About 30 percent of Earth's fresh water lies deep underground in aquifers. And it's extracted daily for farming, drinking and industrial processes – often at dangerously unsustainable rates. Nowhere is this more evident than India, which guzzles more groundwater than any other country. 54 percent of India's groundwater wells are decreasing, meaning that water is used faster than it's replenished. Unless patterns shift, in 20 years, 60 percent of India's aquifers will be in critical condition.

Unlike an incoming hurricane or a drained lake, the naked eye cannot see when groundwater reserves in aquifers are declining. Global water supplies are susceptible to this hidden and growing threat.

4) Water Infrastructure Is in a Dismal State of Disrepair.

Having enough water to go around is only the beginning. That water also needs to be transported, treated, and discharged. Around the world, water infrastructure—treatment plants, pipes, and sewer systems—is in a state of disrepair. In the United States, 6 billion gallons of treated water are lost per day from leaky pipes alone. Built infrastructure is notoriously expensive to install and repair, meaning that many localities ignore growing infrastructure issues until disaster strikes, as it did in California earlier this year.

5) And Natural Infrastructure Is Being Ignored.

Heavy machinery removing trees in Ecuador. Flickr/CIFOR

Healthy ecosystems are " natural infrastructure" and vital to clean, plentiful water. They filter pollutants, buffer against floods and storms, and regulate water supply. Plants and trees are essential for replenishing groundwater; without them, rainfall will slide across dry land, instead of seeping into the soil. Loss of vegetation from deforestation, overgrazing and urbanization is limiting our natural infrastructure and the benefits that it provides. Forested watersheds around the world are under threat: watersheds have lost up to 22 percent of their forests in the past 14 years.

6) Water Is Wasted.

Although it's true that water is a renewable resource, it's often wasted. Inefficient practices like flood irrigation and water-intensive wet cooling at thermal power plants use more water than necessary. What's more, as we pollute our available water at an alarming rate, we also fail to treat it. About 80 percent of the world's wastewater is discharged back into nature without further treatment or reuse. In many countries, it's cheaper to receive clean drinking water than to treat and dispose of wastewater, which encourages water waste. This brings us to the next issue:

7) The Price Is Wrong.

Globally, water is seriously undervalued. Its price does not reflect the true, total cost of service, from its transport via infrastructure to its treatment and disposal. This has led to misallocation of water, and a lack of investments in infrastructure and new water technologies that use water more efficiently. After all, why would a company or government invest in expensive water-saving technologies, when water is cheaper than the technology in question? When the price of receiving clean water is closer to its actual service cost, efficient water use will be incentivized. And on the flip side, the poor often end up paying disproportionately high prices for water, stunting development.

- 8 Countries Most Threatened by Water Shortage

Libya

Libya's troubles are twofold in that it is undergoing a period of political upheaval while also suffering from lack of water and other resources.

Libya's local water resources have never been reliable, but the added stresses of regime change have acted to cut off water for much of the country's population, including the capital of Tripoli. Violence and unrest typically rule news about Libya, but the broader fact is that the country goes through frequent and severe stretches without fuel, food and water.

Western Sahara

Often described as the "Disputed Territory of Western Sahara," the colony is home to thousands of Sahrawi refugees who suffer constant food and water shortages due to a decades-long struggle for control between Morocco and the Sahrawi tribal group known as the Polisario Front.

The conflict is unlikely to end due to natural resources located in the area and the possibility of offshore oil, which means the people will continue to go thirsty.

Yemen

Yemen is a hotbed of conflict and a waypoint for terrorists traveling through the Middle East, and as such it is often in a weakened position to receive aid that includes fresh water.

The country has little natural fresh water to use and relies heavily on water from other sources. Political strife in the region often prevents the people from receiving many necessities and water is chief among them. Some experts project the county's capital of Sanaa will be the first major city in the world to run out of water.

Djibouti

Eastern Africa has long been the target of humanitarian aid from familiar acronyms like UNICEF and UNHCR, and Djibouti's legacy as a refugee corridor and strategic military position has always made it a stress point for adequate water supply.

An arid climate that is prone to drought and poor infrastructure does not help, and frequently leaves millions without reliable access to fresh water.

Jordan

Jordan is in the unfortunate position of being located in the arid and politically divided Middle East while lacking the access to valuable natural resources that its equally waterless neighbors enjoy.

This means that it must rely heavily on its own natural water resources, namely the Dead Sea and the Jordan River. Increased desertification and a growing population are acting together to decimate the water supply, and a plan for alternate sources has not been formulated.

India

India's growing population is putting a strain on the country's water resources. The country is classified as "water stressed" with a water availability.

Surface water contamination, due to lack of sewage treatment and industrial discharge, makes groundwater increasingly exploited in many regions of India. This is aggravated by heavily subsidized energy costs for agriculture practices that make up roughly 80% of India's water resource demand.

To illustrate the sheer challenge of improving water quality: in India, 80% of the health issues come from waterborne diseases. Part of this challenge includes addressing the pollution of the Ganges (Ganga) river, which is home to about 400 million people.

Kenya

Kenya, a country of 36.6 million, struggles with a staggering population growth rate of 2.6% per year. This high population growth rate pushes Kenya's natural resources to the brink of total depletion. Much of the country suffers from a severely arid climate, with a few areas enjoying rain and access to water resources. Deforestation and soil degradation have polluted surface water, and the government does not have the capacity to develop water treatment or distribution systems, leaving the vast majority of the country without access to water. This has exacerbated gender politics, as 74% of women must spend an average of 8 hours per day securing water for their families.

Bangladesh

Historically, water sources in Bangladesh came from surface water contaminated with bacteria. Drinking infected water resulted in infants and children suffering from acute gastrointestinal disease that led to a high mortality rate.

During the 1970s, UNICEF worked with Department of Public Health Engineering to install tube-wells. Tube-wells draw water from underground aquifers to provide a safe source of water for the nation. As of 2010, 67% of Bangladeshis had a permanent water source and a majority of them used tube wells.

Available options for providing safe drinking water include deep wells, traditionally dug wells, treatment of surface water, and rainwater harvesting.

• Water Shortage in Cold Areas

More than a sixth of the world's population – over one billion people – rely on meltwater emanating from snow and ice for their main water supply.

If global temperatures rise by two degrees, as current estimates suggest, studies show that there will be less snow and more rain, which will have a knock-on effect on the hydrological cycle – the natural flow of water into and out of rivers and streams as affected by precipitation and evaporation.

This will be especially pronounced in areas where snow is the dominant climate condition, where the supply of water is likely to diminish.

Civil engineers from the University of Bristol are examining this connection between climate and river flow, building on an initial study conducted in 420 areas across the United States,

covering a broad spectrum of regions where snow is key to socio-economic conditions and to ecology.

This study looked at how rainfall, meltwater, river flow and stream flow was impacted by temperature-induced change, based on data captured between 1948 and 2001. It found that on average, less snowfall did indeed result in reduced streamflow.

"This temperature induced shift from snow towards rain will mean that the average amount of available water could go down, which will have implications for drinking water supplies, crop irrigation and hydropower, as well as river ecosystems. In areas where a significant amount of the hydrological cycle comes from snow, people will find it more difficult to get enough water and so will have to find ways to conserve water, to use it more effectively, or develop alternative water sources," says Dr Ross Woods.

The team are now working with colleagues elsewhere to further corroborate their findings, and to expand their investigations to other areas where snow is key to the environment including Austria, Switzerland, Sweden, Norway, Finland, Russia, China, Canada, France and Germany.

"Our studies remain at the scientific level at the moment so it's a little too early to talk concretely about the implications," adds Dr Woods. "But our preliminary findings imply a 10-25% reduction in river flow in snow-dominated areas, which would have very significant implications for water management and for how society might adapt, whether that means alternative irrigation methods, growing different crops or building more water reservoirs to address the water shortages that may arise from temperature-induced changes in the water cycle."

- ## Water Shortage in Cities

Questionnaire

with **Robert McDonald** Lead Scientist for the Global Cities Program at The Nature Conservancy

By 2050, more than 1 billion city dwellers may be doing just that if we don't build new infrastructure or begin new water conservation efforts, according to a new study by scientists at The Nature Conservancy and other institutions. And more than 3 billion in cities may suffer similar water shortages at least one month of every year, says the report. The drivers will be urban demographics and climate change — and the shortages are projected to hit megacities on every continent, from Manila to Johannesburg to Mumbai to Mexico City.

The minimum amount of water the study assumes every person needs daily is minuscule: Less than 100 liters — about 2/3 of a bathtub — for all a person's daily needs. (The average U.S. resident uses 2-5 times that much.)

The study says we can't just build our way out of this crisis with more pipes and aqueducts. Why not? What are the alternatives?

Well, cities commonly transport water longer distances to get around water shortages, and that other strategies include desalinization or unsustainably pumping groundwater. But the problem with all of these strategies is that they cost money. One study estimated that the world will have to spend $180 billion a year to meet its urban water needs.

Whatever the real figure is, there's a serious issue here the world needs to pay attention to. In this paper, we are showing the scope of that problem, and trying to remind planners that there are more ways to solve the problem than just building more dams.

Urban water managers and city planners should look at solutions that involve nature as well as more infrastructure. One solution: more efficient water use by agriculture and industry — two of the biggest users of water worldwide. Payments to farmers to reduce areas of irrigated agriculture might be another partial solution, as well as removal of non-native water-hungry vegetation such as eucalyptus.

The first response that often comes up to studies involving population is "Isn't this just a matter of overpopulation? People should stop having babies, and that will solve the problem." How do you respond to that line of thinking?

It's just a really simplistic way to look at a very complex issue, and kind of a cruel way. Having children is one of the most important, life-defining experiences for most people, and many people would argue it's a basic human right.

You have to look at population growth in the full context of what's called the demographic transition. In very poor countries, the birth rate is high, but so is the death rate. As countries economically develop, there is a tendency for the death rate to fall first, as very basic sanitation measures are implemented. Then, at slightly higher economic levels of development, the birth rate falls too.

If you look at where some European countries are right now, they are actually losing population, the birth rate has fallen so much. So what is happening in the developing countries is that they are simply earlier along in the demographic transition than the U.S. or Europe. At one point, we too had very rapid population growth — we just got past that stage.

Another thing to keep in mind is that there is significant demographic momentum toward increasing population in developing countries simply because there are so many young people in these countries. Even if every young person alive today in developing countries limited themselves to one child/family, overall population would still go up.

Finally, a lot of urban growth has nothing to do with the population dynamics within a city — it's a result of urban to rural migration, millions of people moving to cities in search of a better life. The U.S. and Europe went through this same phase too, just 50 to 100 years ago.

The study says up to 3 billion people could also suffer "seasonal water shortages" — living on less than 100 liters per person per day for at least one month out of each year. That's sounds astronomical, but is this condition as bad as it sounds? I wouldn't want to go through it, but just how damaging to a person is a month out of every year without adequate water supplies?

What we call seasonal water shortages in our paper aren't that uncommon. Many cities in the western U.S. have seasonal scarcity. But cities traditionally get around this by having dams for storing water, or from diversifying their water supplies so they can find water in those dry months. So the big number of potential future seasonal shortages that we calculate in our models show that there are lots of people — billions of people, in fact — who are in cities that will actively have to search for new solutions to seasonal scarcity, either because the city's population has grown or because climate change has affected the seasonal distribution of rainfall.

How does climate change figure into all this? And there are lots of climate change projections — did the disparity in models affect your projections?

Climate change just makes the job of urban planners even harder. It's not just changes in the average precipitation, but changes in the seasonal distribution of rainfall and runoff, which may affect many cities. In some places, the dry months get even drier and the wet months get even wetter.

We did look at several climate change projections, and the exact results do vary among the scenarios. Basically, for some regions of the world, all the different climate change projects are really consistent, and we can make reasonable predictions about what will happen in those places.

For instance, North Africa and the Levant look pretty likely to get less precipitation with climate change, and be drier. Then there are places where the different climate change projections don't agree, and there's a lot less certainty about what will happen. For instance, it's not clear whether Australia will see a decrease in precipitation or an increase.

People can use the Climate Wizard tool (which The Nature Conservancy helped create) to check out the different climate change projections themselves, for their county or city.

- ## Water Needs in Disaster Areas

Safe drinking water provision has been identified as the major tool in limiting loss of life after natural disasters. The two conventional approaches of providing potable water to victims are: (i) boiling and distributing available water, and (ii) packaging and transporting safe water to the site. Distributing water with both approaches is costly and logistically difficult. An alternative approach to provide safe drinking water is the use of efficient point-of-use water treatment technologies. Relevant technologies use ceramic filters, disinfectants, flocculants, membrane filters, sand filters and solar disinfection (SODIS). Currently, used point-of-use technologies are all made up of relative expensive imported devices and chemicals, able at deserving large number of persons. This approach requires or sustains the formation of camps. However, exactly after natural disasters, there is a need to deserve some traumatized victims in their small communities. Within the framework of decentralized safe drinking water provision, the present work advocates for the science of self-reliance in emergencies. Accordingly, water supply from external sources should be limited to the emergency stage. Afterwards every community should produce the volume of water needed for cooking, drinking and irrigation.

Earthquakes

Following are some of the types of damage that an earthquake can inflict on water supply and sewage systems:

- Total or partial destruction of intake, transmission, treatment, storage, and distribution systems;
- Rupture of transmission and distribution pipes and damage to joints between pipes or tanks, with consequent loss of water;
- Interruption of electric power, communications, and access routes;
- Deterioration of the water quality at the source due to landslides and other phenomena;
- Reduction in yields from groundwater sources and flow in surface water sources;
- Changes in the exit point of groundwater or in the phreatic level;
- In coastal areas, inland flood damage due to the impact of tsunamis. Introduction of salt water into coastal aquifers.

Landslides

Effects of landslides to be prevented in areas where water supply and sewerage system components are located include:

- Changes in the physical or chemical characteristics of intake water, which will affect treatment;
- Total or partial destruction of the works, particularly intake and transmission components in the path of active landslides;
- Contamination of the water at surface intakes located in mountainous areas;
- Indirect impacts due to the blocking of roads and the disruption of power and communications;
- Blockage of sewage systems due to buildup of mud and stones.

Hurricanes

The impact of hurricanes on water supply and sewerage systems can include the following effects:

- Partial or total damage to facilities, command posts and buildings, including broken windows, damaged roofs, and flooding;
- Rupture of mains and pipes in exposed areas, such as over rivers and streams;
- Rupture or disjointing of pipes in mountainous areas due to landslides and water torrents;
- Rupture and damage to tanks and reservoirs;
- Damage to electrical transmission and distribution systems.

Floods

The main effects of floods on water supply and sewerage systems are the following:

- Total or partial destruction of river water intakes;
- Damage to pumping stations close to flooding waterways;
- Blockage of components due to excessive sedimentation;
- Loss of intake due to changes in the course of rivers and streams;
- Rupture of exposed pipes across and along rivers and streams;
- Contamination in water catchment areas;
- Power cuts, road blockages, and disruption of communications;
- Intrusion of salt water into continental aquifers, contaminating or reducing the availability of groundwater.

Droughts

The potential impact of drought on water supply and sewerage systems includes the following effects:

- Loss or reduction of surface- and groundwater sources and deterioration of water quality;
- A decline in water levels at intake points and in storage facilities;
- The need to distribute water with water trucks, affecting quality and increasing costs;
- Damage to the system due to lack of use;
- Accumulation of solid matter in sewage systems.

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