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Chapter 10 Water

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Abstract

Expanding access to clean water has been a cornerstone issue for many governments and international agencies for decades, yet over 790 million people still lack access to a sufficient water supply. The stakes of water security are rising as populations increase and climate change continues to exacerbate water scarcity and pollution. We have two central questions regarding the availability of clean water: who and what gets counted in the data and why? This chapter is framed around these key questions, looking first at the historical context of water access in development and the evolution of the global discourse, such as the UN's inclusion of water as a human right in 2010. We clarify the broad terms used in water and examine the available data sources, including the WHO/UNICEF Joint Monitoring Programme and World Resources Institute's Aqueduct 3.0 databases which focus on water access and water stress respectively. We find that both capacity and accountability challenges occur during data collection and reporting, revealing data deprivations and potential inequities in water management and access. Specifically, we observe how household surveys fail to capture seasonality impacts to water access and quality in countries such as Nigeria and India. We highlight how water officials in Flint Michigan failed to act in a timely manner to respond to concerns on water quality as an example of a lack of accountability in water data reporting. To conclude, we discuss innovations to water infrastructure and data collection, including the Multiple Use Water Systems approach and the Household Water Insecurity Scale (HWISE).

1. Introduction to Water and Development

In 2013, city leaders in Flint, Michigan decided to cut costs by switching the city's water supply from the Detroit water system to the Flint River. Authorities failed to adjust the water treatment plans to address contaminants in the new water source and as a consequence, dangerous

levels of lead leached into the water supply and contaminated Flint residents' water.[1] The city and its residents went nearly half a decade with a contaminated water supply. How does a city of 100,000 people in one of the wealthiest nations in the world go without clean water for so long? Flint demonstrates a basic truth of water and development that even rich countries experience problems related to water management and water quality. Flint is only the most recent and well-known example from the United States. There are many more examples from around the world. How do these crises continue to occur? As is the case with most water issues, it's complicated.

Water problems are not unique to the poor or the rural communities nor are they going away anytime soon. Water problems can range from issues of access to quality to political and accountability challenges. Climate change, further discussed in Chapter 13, increases the likelihood of weather events like droughts and floods occurring, further complicating our understanding of water availability and access. Threats of fragmentation due to development, abstraction from agriculture and manufacturing, and pollution from all the above imperil every major river system in the world.[2] These impacts to our water sources will only exacerbate existing inequities in access and availability. Water is an essential component to development that is often not explicitly discussed as such. Water is essential to human health, poverty reduction, food supply, national security, economic prosperity and a healthy environment and still estimated 1 in 3 people globally still do not have access to safe drinking water.[3] Where are these people living, and why do they not have access to water? What does access to sufficient clean water mean, and how do we measure it? How does access to water change over time, whether seasonally or for other reasons, and do we have data to explain these variations?

This chapter frames the discussion around water in development by discussing the history of water management and measurement, as well as the key actors responsible for the dominant water development practices and measurements during different historical periods. Since the conversation around water and development is so broad, we also provide definitions of the

[1] Renwick, Dustin, "Five Years on, the Flint Water Crisis Is Nowhere near Over," National Geographic, April 25, 2019, https://www.nationalgeographic.com/environment/article/flint-water-crisis-fifth-anniversary-flint-river-pollution.
[2] Swarovski and UCLA School of Theater, Film and Television, *Waterschool*, Documentary (Netflix, 2018), https://www.swarovskiwaterschool.com/documentary.
[3] "1 in 3 People Globally Do Not Have Access to Safe Drinking Water – UNICEF, WHO," accessed May 10, 2021, https://www.who.int/news/item/18-06-2019-1-in-3-people-globally-do-not-have-access-to-safe-drinking-water-unicef-who.

major terms used to describe the contemporary landscape of water data in development as well as the indicators used to measure them. Water is inherently linked to sanitation in development, however for the sake of narrowing our focus we limit our discussion to household water uses, mainly drinking water and productive uses, like irrigation. These two water uses prove to be the most dominant in national and international debates and are heavily threatened by droughts and other water scarcity concerns. In our analysis, we find that the indicators used to measure these drinking water and productive water uses can be incomplete and limited by capacity challenges in the data collection process. Additionally, these indicators are frequently subject to political challenges including delayed and misreporting of data by governments and international agencies. These challenges impact the way in which drinking water and productive water uses data is presented and interpreted. As advancements in water data collection and measurement occur, we will look to future improvements in water management to address these concerns. In the conclusion, we explore some of these advancements including the Household Water Insecurity Experiences Scale (HWISE) and Multiple Use Water Systems which look to combat some of these challenges.

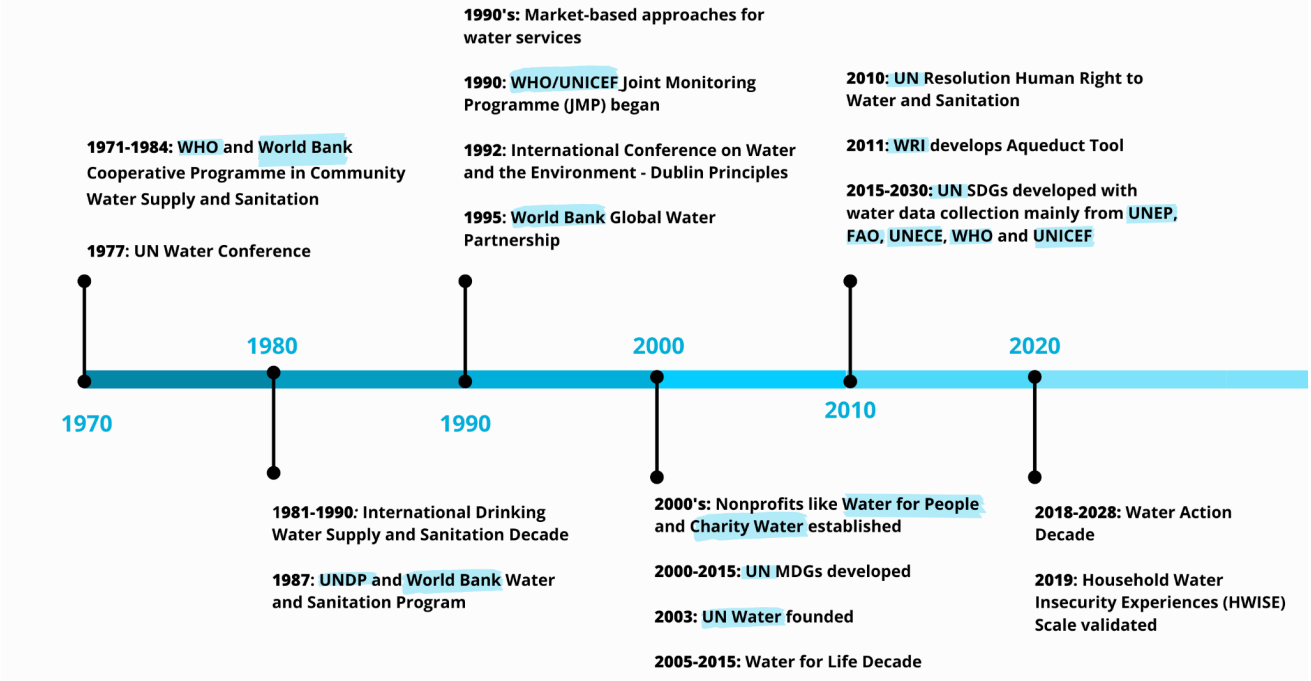
2. Historical Expansion of the Dimensions of Water

One of the greatest challenges of water management is that many of the important decisions directly related to water resources occur outside of the context of the Water and Sanitation (WASH) sector.[4] Dynamic external drivers, like urbanization, natural disasters, power generation, farming, and technological innovation, all heavily impact water sources but are disconnected from the context of water resource management.[5] This section will discuss the more recent history of water resources in the context of the development field and how practitioners have shifted the conversations around water access to support other dominant development goals. Like many other aspects of development, there are a variety of terms used to describe access to water resources. The evolution of these terms over time provides insight into the shifting priorities and of the global water sector.

[4] UN World Water Development Report 2009http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr3-2009/

[5] UN World Water Development Report 2009. http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr3-2009/

Figure 10.1. Timeline of Water and Development



For centuries nations with access to abundant fresh water sources have flourished, underscoring the essential nature of the resource. Yet water was not recognized by major international development institutions as a resource in need of global management, until the first UN Water Conference in 1977. By the late 1970s, the impacts of water on human life and prosperity led many attendees of the conference to highlight the need for a global perspective on water management and its inescapable link to human prosperity. During this time, state ownership of water resources was common in both developed and developing countries. This was especially true for newly independent states who sought nationalization of utilities, like water treatment and supply plants, as a means of separating themselves from their colonial legacy.[6] Thus state ownership and management became a point of pride for newly independent states.

Following the UN Water Conference in 1977, experts on water began to focus on expanding individual **water access**. By 1980 the UN undertook its largest and most ambitious water

[6] Naren Prasad, "Privatisation of Water: A Historical Perspective," SSRN Electronic Journal 3 (September 1, 2007), https://doi.org/10.2139/ssrn.2323431.

initiative, The International Drinking Water Supply and Sanitation Decade (1981-1990), which sought to provide water to all by 1990.[7] Many of the development goals during the decade were spearheaded by prominent international agencies like the World Health Organization (WHO), the UN Development Programme (UNDP) and the World Bank. Domestic **water access** during this period generally referred to an available water source to meet basic needs - mainly drinking water.[8] Other productive uses of water for food production and household uses were not as explicitly emphasized at the time. The WHO and other organizations also focused on ensuring the water was of good **quality** and free of harmful contaminants, like fecal matter, E. coli, and chemicals, to prevent water-related illnesses. This early framing had far-reaching effects. Even now, water access and quality remain at the center of the water development narrative.

Throughout the 1980s, the WHO also developed national and global monitoring systems for water supply and sanitation.[9] The WHO recorded the number of water and sewage connection systems in urban areas and sources in rural space; developing a measurement for the population with access to water.[10] In a cooperative programme with the World Bank and the UNDP, the funding increased for the WHO as well as other international water projects. As a result of these projects, in rural areas of developing countries water access increased from 30 to 50 percent.[11] Despite these efforts, this was still below the intended target and made it clear the Decade would not reach its goal of bringing water to everyone.

At the same time the poor performance of many state-owned enterprises, including water utilities, lead to a shift towards privatization supported by Western economists and political

[7] "Poverty and Water: Explorations of the Reciprocal Relationship (International Studies in Poverty Research) | David Hemson, Kassim Kulindwa, Haakon Lein, Adolfo Mascarenhas | Download." Accessed February 26, 2021. https://1lib.us/book/1093592/9f7ea8?regionChanged=&redirect=191551903.
[8] "International Decade for Action 'Water for Life' 2005-2015. Focus Areas: The Human Right to Water and Sanitation," accessed April 20, 2021, https://www.un.org/waterforlifedecade/human_right_to_water.shtml.
[9] WHO Director-General. "Evaluation of the International Drinking Water Supply and Sanitation Decade, 1981-1990." World Health Organization, November 21, 1991. https://apps.who.int/iris/bitstream/handle/10665/170492/EB89_24_eng.pdf?sequence=1&isAllowed=y. (pp.4)
[10] World Health Organization, "International Drinking Water Supply and Sanitation Decade: Decade Commencement Report" (New Delhi, India, 1983), https://apps.who.int/iris/bitstream/handle/10665/205381/B0059.pdf?sequence=1&isAllowed=y.
[11] Petersen, Paul Erik. "World Health Organization. Organisation Mondiale de La Sante." Community Dentistry and Oral Epidemiology 31, no. 6 (December 2003): 471–471. https://doi.org/10.1046/j.1600-0528.2003.00124.x.

leaders like Margaret Thatcher and Ronald Reagan.[12] By the late 1980s and early 1990s economic policies promoting free trade and limited government spending were dominating international development ideas and the water sector. This ideology was further supported by the UNDP-World Bank Water and Sanitation Program (1987).[13] Thereafter, the World Bank pushed for more water privatization in development projects. **Water privatization**, refers to private sector participation (PSP) in the provision of water. Proponents of PSP argue that, due to the failure of governments to provide water to all, shifting ownership and management of water to the private sector would expand water access, increase investments, and alleviate the budgetary deficits of governments.[14] Chapter 11 provides a detailed discussion of privatization of infrastructure that is closely linked to the movement in the water development space.

Water privatization was further codified in the 1992 Dublin Principles as part of the large International Conference on Water and the Environment, eight years after the WHO and World Bank's cooperative programme came to an end in 1984 and five years after the UNDP's funding of WHO activities decreased and diverted instead to the UNDP-World Bank Water and Sanitation Program. The Dublin Principles addressed the importance of women's involvement in water provision and established water as an economic commodity rather than a social right. The Dublin Principles were progressive in that it emphasized the role of women who were previously viewed as beneficiaries of water access rather than agents of improving water management.[15] Nevertheless establishing water as an economic commodity rather than a social right had negative ramifications. While PSP is helpful when governments cannot efficiently supply, local water projects during the 1990s would prioritize communities that had enough money to fund operation and maintenance of water infrastructure. Thus, small-scale projects initiated during this period did not reach many of the poorest communities who needed water but could not fund their own projects.[16]

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[12] Naren Prasad, "Privatisation of Water: A Historical Perspective," SSRN Electronic Journal 3 (September 1, 2007), https://doi.org/10.2139/ssrn.2323431.
[13] Black, Maggie, "Learning What Works A 20 Year Retrospective View on International Water and Sanitation Cooperation," UNDP-World Bank Water and Sanitation Program 1978-1998", 1998, http://documents1.worldbank.org/curated/en/703661468326369198/pdf/multi-page.pdf
[14] Naren Prasad, "Privatisation of Water: A Historical Perspective," SSRN Electronic Journal 3 (September 1, 2007), https://doi.org/10.2139/ssrn.2323431.
[15] Munck, Ronaldo, Narathius Asingwire, Honor Fagan, and Consolata Kabonesa, eds. Water And Development: Good Governance After Neoliberalism, page 20. Zed Books Ltd, 2015. https://doi.org/10.5040/9781350223899.
[16] Munck, Ronaldo, Narathius Asingwire, Honor Fagan, and Consolata Kabonesa, eds. Water And Development: Good Governance After Neoliberalism, page 20. Zed Books Ltd, 2015. https://doi.org/10.5040/9781350223899.

These inequalities lead critics of PSP to suggest that water should not be left to the market but instead treated as a public good, managed by the state. Most retrospective evaluations for the UNDP-World Bank Water and Sanitation Program focus on financing but there is little in terms of its impact on expanding access to water. Other World Bank programs, including the Global Water Partnership which was founded in 1995, focus primarily on management of water rather than measurement of reliable data.

Box 10.1 The Influence of Colonialism on Water Management

The colonial history of countries greatly influences the water and sewage utility systems seen in formerly colonized countries today. Research shows for instance that former British colonies, like India, water was seen as a human right whereas former French colonies, like Senegal, involved the private sector more frequently. In addition, the extractive and capitalistic motivations of colonizers led to little focus on the sustainable construction of water and sewage infrastructure. These historical decisions directly impact the current problems seen in water management and supply in many cities of formerly colonized countries. As stated in a paper from the UNDP, "In the rapidly growing cities of the global South, the dilapidated or never completed infrastructure systems...have been superseded by a proliferation of alternative networks ranging from tankers for the poor to bottled water supplies for the rich." Wealthy areas of cities were prioritized over lower income areas and the development of connected, sustainable water infrastructure never fully materialized.

Naren Prasad, "Privatisation of Water: A Historical Perspective," SSRN Electronic Journal 3 (September 1, 2007), https://doi.org/10.2139/ssrn.2323431.

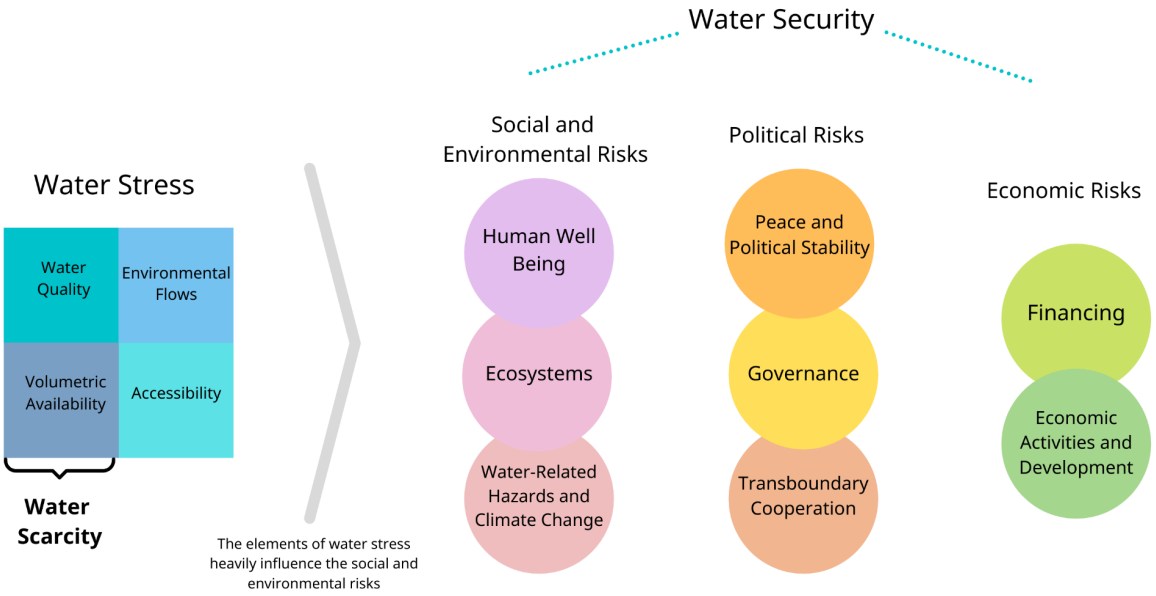
Gandy, Matthew, (2006), Water, Sanitation and the Modern City: Colonial and Post-colonial Experiences in Lagos and Mumbai, No HDOCPA-2006-06, Human Development Occasional Papers (1992-2007), Human Development Report Office (HDRO), United Nations Development Programme (UNDP), https://EconPapers.repec.org/RePEc:hdr:hdocpa:hdocpa-2006-06.

Despite the concerns over proper water management the international water sphere continued to grow. International nonprofits like Water For People (1991) and Charity Water (2006) were established, increasing the visibility of global water and sanitation issues to the general public.

UN-Water was founded in 2003 to help coordinate the efforts of the UN and other multilateral organizations working on water and sanitation issues. UN-Water reports provide insight into the major trends in water use and management. From the UN Water's 2006 report, *Coping with Water Scarcity: A strategic issue and priority for system-wide action*, it was clear that water scarcity was becoming increasingly important for the international community. **Water scarcity** is a term which expresses a lack of water due to *physical shortage* such as failure of institutions to ensure adequate supply or lack of infrastructure.[17] Water scarcity is shown in Figure 10.2 as the volumetric availability of water, if volumetric availability is low then water is scarce. **Water availability** refers to "the water supply [being] sufficient and continuous for personal and domestic uses, including drinking, personal sanitation, washing clothes, food preparation, and personal and household hygiene".[18] The report highlighted efforts to address water scarcity by UN Agencies such as the Food and Agriculture organization (FAO), UNICEF and UNEP as well as UN regional commissions and non-UN Partners such as the Global Water Partnership and the International Commission on Irrigation and Drainage.[19] Increasing scarcity concerns in the early 2000s became clearly linked to climate change, particularly the growing occurrence of droughts and flooding. Additionally, increased water use for food production further heightened worries over water shortage.

[17] UN-Water. "Scarcity." UN-Water (blog). Accessed April 20, 2021. https://www.unwater.org/water-facts/scarcity/.
[18] UNESCO, World Water Assessment Programme (United Nations), and UN-Water. Leaving No One behind: The United Nations World Water Development Report 2019, 2019.
[19] "Coping with Water Scarcity," UN-Water (blog), accessed April 20, 2021, https://www.unwater.org/publications/coping-water-scarcity/.

Figure 10.2
Visualization of Water Scarcity, Water Stress and Water Security



Adapted from UN Global Compact CEO Water Mandate

Concerns over water resources extended beyond physical shortages. Pollution, precipitation variability, natural disasters, over withdrawal and changing climatic conditions increase the *risk* of limited clean freshwater resources and threaten efforts to expand access to water. National governments began incorporating these **water risks** into their policy agendas using terms like **water security** to express the national security threats and risk to stability due to climate change. UN-Water provides a working definition of **water security** as "the capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability."[20] This definition provides the most comprehensive framework for states to evaluate water risks and national security concerns. Figure 10.2 provides an overview of water security and its relation to water stress (a term we will discuss in more detail below). Importantly, Figure 10.2 highlights the quasi-holistic nature of water security as it encompasses the social, political, and environmental dimensions of human security.

From MDGs to SDGs

[20] UN-Water. "Water Security and the Global Water Agenda." Accessed April 20, 2021. https://www.unwater.org/publications/water-security-global-water-agenda/.

The fact remains that water risks were not all fully integrated in dominant development agendas of the new millennium. The water target in the MDGs, target 7.C, focused primarily on access and did not mention water scarcity or security concerns. The positive progress of the MDGs was that the tools used to define access and measure target 7.C expanded considerably. The WHO / UNICEF Joint Monitoring Programme (JMP) became responsible for reporting on drinking water and sanitation coverage towards the MDG. While previous definitions of safe drinking water differed between countries, by the early 2000s safe drinking water constituted access to improved drinking water sources and sustainability was emphasized.

Box 10.2 MDG 7

MDG 7: Ensure Environmental Sustainability

Targets 7.A Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources

Target 7.B Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss

Target 7.C Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation

Target 7.D Achieve, by 2020, a significant improvement in the lives of at least 100 million slum dwellers

Target 7.C of the MDGs went through multiple rounds of revisions, until the final version was approved in 2006. Earlier drafts only addressed drinking water until sanitation was added in 2002. References to affordability and safe water where added, removed and re-inserted through multiple rounds of revisions. The final version included safe water yet ultimately removed references to affordability.

"United Nations Millennium Development Goals" (United Nations), accessed May 10, 2021, https://www.un.org/millenniumgoals/.

MDG 7, along with the creation of UN-Water, brought water access and management back to the forefront of international attention. With growing recognition among the World Bank and others that water privatization could not be a blanket policy across all contexts and without

broader reform outside the water sector, doubts about the privatization of water grew.[21] By 2003, the World Bank acknowledged that there was little incentive for the PSP of water to work towards providing equitable access to water for the poor.[22] As a result, the private sector began withdrawing from water contracts and leases as the international community realized that water should never be treated solely as an economic good, and needs to be emphasized as a human right.[23] In 2002, the UN Committee on Economic, Social and Cultural Rights adopted general comment No. 15 regarding the human right to water. The comment stated, "Water is a limited natural resource and a public good fundamental for life and health. The human right to water is indispensable for leading a life in human dignity. It is a prerequisite for the realization of other human rights."[24] Later, the UN formally recognized the human right to safe water and sanitation in its 2010 Resolution 64/292. This resolution recognized "the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights". This resolution, along with MDG 7C reaching its benchmark three years ahead of schedule, provided a clear mandate to the international community: access to safe water is important and achievable.

Although this achievement was reached, daunting water challenges continued to hinder development. In particular, changing climatic conditions, unsustainable water extraction, and population growth caused some nations to become water stressed. Countries experiencing **water stress** lack the ability to meet the human and ecological demand for water. Water stress is different from water scarcity. Water stress expresses a more holistic approach to water service needs. For example, countries like Egypt are not considered water scarce since there is an abundance of water from the Mediterranean Sea, however Egypt is considered water stressed because there is a limited supply of freshwater for domestic uses. Institutions like the World Resources Institute (WRI) developed the world's first water stress ranking tools, including the Aqueduct tool developed in 2011, to identify and evaluate water risks around the world.[25] This data set gave a more comprehensive and future-facing understanding of water management, even taking into account varying climate and socio-economic scenarios.

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[21] Naren Prasad, "Privatisation of Water: A Historical Perspective," SSRN Electronic Journal 3 (September 1, 2007), https://doi.org/10.2139/ssrn.2323431.
[22] Soul-Searching at World Bank; Privatisation's Biggest Fan Wonders What Went Wrong amid PopularDiscontent', The Wall Street Journal Europe, 21 July 2003,p. M8
[23] "The World Bank Wonders About Utility Privatizations - WSJ," accessed May 2, 2021, https://www.wsj.com/articles/SB105873652571411400.
[24] "General Comment No. 15: The Right to Water," n.d., 18.
[25] World Resources Institute. "About," August 1, 2019. https://www.wri.org/aqueduct/about.

Finalized in 2015, the formation of the Sustainable Development Goals (SDGs) reflected the move toward comprehensive measures of water with Goal 6 aiming to "ensure availability and sustainable management of water and sanitation for all."[26] Importantly, targets for SDG6, shown in the box below, incorporate security, scarcity, access, and risk as dimensions of water. Doing so has brought practitioners from the UNEP, FAO, and UNECE together to provide data and resources for strengthening water management. The JMP plays a major role in monitoring and measuring drinking water access, specifically for SDG targets 6.1 and 6.2, shown below. Beyond that, the indicators used to measure improved water have expanded to consider the amount of time it takes to access water, the quality of the water, and the frequency of water availability. Collaboration across various agencies reflects a larger international goal to enhance water management through coordination on different social, economic and transboundary water concerns. Unlike in the MDGs, water affordability was included in SDG 6.1 though it is not directly measured.

[26] "SDG Indicators — SDG Indicators," accessed May 10, 2021, https://unstats.un.org/sdgs/metadata/?Text=&Goal=6&Target=.

Box 10.3 SDG 6 and Targets

SDG Goal 6: Ensure availability and sustainable management of water and sanitation for all

Target 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all

Target 6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

Target 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

Target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

"THE 17 GOALS | Sustainable Development," accessed May 10, 2021, https://sdgs.un.org/goals.

This multidimensional approach is shown in SDG 6.5 which focuses on the implementation of what is known as Integrated Water Resources Management (IWRM). IWRM is "a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment."[27] Translation: IWRM is an integrated approach and philosophy that looks to holistically manage and address water needs for the environmental and people. IWRM refocuses the conversations around water management on sustainability. In this case, sustainability refers to approaching water use from multiple dimensions (i.e. social, economic, and domestic) to make the resources stretch farther. Emphasis is placed on the needs of water users and the environment and efforts are made to

[27] "What Is IWRM?," Global Water Partnership, accessed May 10, 2021, https://www.gwp.org/en/GWP-CEE/about/why/what-is-iwrm/.

match those needs with knowledge of the water sources available. The water use of farmers, households and industries are all taken into consideration when evaluating, planning and monitoring water resources. It is too early to tell if large scale adoption of IWRM will improve water development and data, though today IWRM remains the most promising way forward for practitioners to measure and promote water development through comprehensive dimensions.

3. Landscape of Global Water Data

World data and the indicators it informs are used to track progress countries have made in providing water for citizens and meeting health standards through water quality. Instead of writing a list full of all the datasets and indicators discussed in this field, we have opted to focus on a few key ones that are the most current and overseen by UN subsidiary international agencies or global non-profit organizations. Table 10.1 below offers a brief summary of the contemporary indicators and datasets we look at, what they measure and who uses the data. These indicators cover the breadth of perspectives from which water can be measured including water access, water quality, water stress, water management and water for irrigation. We focus on indicators and data that track water efforts globally, emphasize access and use, and are incorporated into a variety of development reports, most notably reporting for the SDGs. To help demonstrate how the indicators are conveyed, we will provide the data available from each dataset for two countries: India and South Africa.

Table 10.1 Summary of Indicators for Water and Development

Data Source	**What does it measure?**	**Examples of where the data is used**
WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene	Water, sanitation, and hygiene coverage (national, urban and rural).	Measurement of SDG 1.4, 6.1 and 6.2 USAID Water and Development Strategy report[28] Our World in Data online

[28] "USAID Water and Development Strategy," n.d., 33. https://www.usaid.gov/sites/default/files/documents/1865/USAID_Water_Strategy_3.pdf

		database[29] The Coca Cola Foundation's Water Stewardship Initiative[30]
WHO-Global Task Force on Cholera Control Number of reported deaths from Cholera	Deaths from cholera infections by country.	Gavi Vaccine Alliance Oral Cholera Vaccine Distribution initiative[31]
UNEP-GEMS/Water programme Indicator on bodies of water with good ambient water quality	The proportion of bodies of water with good ambient water quality.	Measurement of SDG 6.3.2 Our World in Data online database[32]
World Resources Institute AQUEDUCT 3.0	Level of water stress by country and province within a country	World Bank Data Catalog[33] Our World in Data online database[34] Companies including P&G, Abbott, Colgate-Palmolive Company, Nissan, And Nestle use for strategic business operations[35]
FAO AQUASTAT Global Information System on Water and Agriculture Irrigation Areas	Areas equipped for irrigation by source of water and areas actually irrigated by water.	FAO AQUAMAPS tool Measurement of SDG 6.4 Our World in Data online

[29] Hannah Ritchie and Max Roser, "Clean Water," Our World in Data, September 26, 2019, https://ourworldindata.org/water-access.
[30]"Water Stewardship & Sustainability," The Coca-Cola Company, accessed May 10, 2021, https://www.coca-colacompany.com/sustainable-business/water-stewardship.
[31] "Oral Cholera Vaccine Support," accessed May 10, 2021, https://www.gavi.org/types-support/vaccine-support/oral-cholera.
[32] Hannah Ritchie and Max Roser, "Clean Water," Our World in Data, September 26, 2019, https://ourworldindata.org/water-access.
[33]"Water Stress | Data Catalog," accessed May 10, 2021, https://datacatalog.worldbank.org/dataset/water-stress.
[34] Hannah Ritchie and Max Roser, "Clean Water," *Our World in Data*, September 26, 2019, https://ourworldindata.org/water-access.
[35] "User Stories," World Resources Institute, accessed May 10, 2021, https://www.wri.org/aqueduct/user-stories.

		database[36]
World Bank IBNET	Database of global water and sanitation utility performance data	World Bank Data Catalog Pacific Water and Wastewater Association[37]

Measurements of Access - WHO/UNICEF Joint Monitoring Programme

The primary goal at the intersection of water and development is increasing individual and household access to water, especially drinking water. In order to measure this, we first need to define what access means and identify specific measures to track that reflect our definition. Measuring access is more complex than it seems because the definition of access changes frequently and can vary across cultures. One example of a distinct type of cultural access mechanism is the use of "Qanat," also referred to as "Karez", systems in more arid regions of the globe like Iran and Pakistan. These systems are ancient underground irrigation structures that help to mitigate the evaporation losses in hot climates.[38] Qanats are a culturally important aspect of water collection, access and use for countries they are found in.

To begin to measure water access, we need to establish a baseline report of the current level of access residents in a country or a region have. Once the baseline is established the important question becomes how do we track progress on an ongoing basis? The most popular dataset for measuring global household water access is the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) data. As mentioned, the WHO and UNICEF began collecting this data in 1990 when they established the MDGS and it has remained in operation since. The JMP provides worldwide data on water access in households, schools and healthcare facilities and is the only drinking water and sanitation monitoring system that allows for intercountry comparisons.[39] JMP's data covers 96% of countries and is used in the UNDP

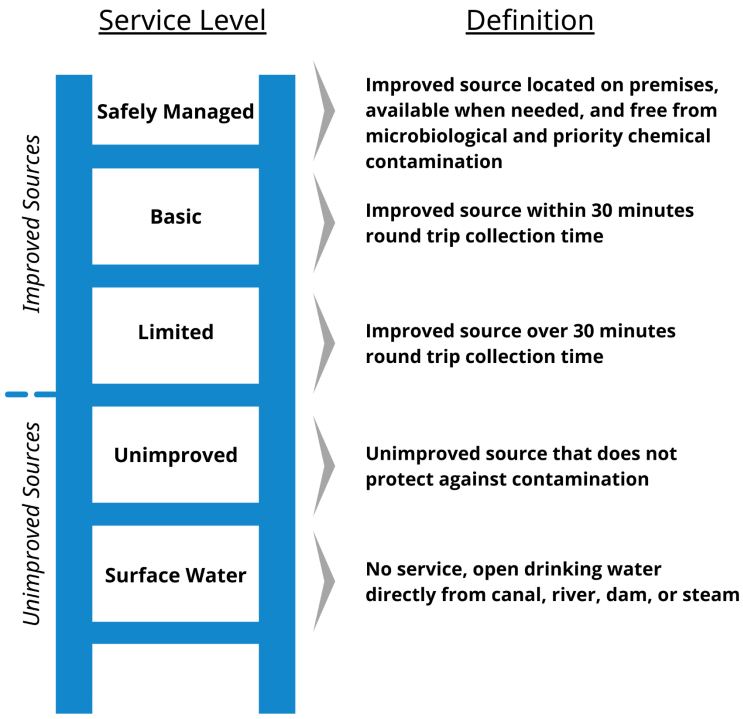
[36] Hannah Ritchie and Max Roser, "Water Use and Stress," Our World in Data, November 20, 2017, https://ourworldindata.org/water-use-stress.
[37] "Membership," accessed May 10, 2021, https://www.pwwa.ws/membership/.
[38] "Harvesting Water and Harnessing Cooperation: Qanat Systems in the Middle East and Asia," Middle East Institute, accessed May 9, 2021, https://www.mei.edu/publications/harvesting-water-and-harnessing-cooperation-qanat-systems-middle-east-and-asia.
[39] "WHO/UNICEF Joint Monitoring Programme for Water Supply Sanitation and Hygiene," UN Water, accessed May 7 2021. https://www.unwater.org/publication_categories/whounicef-joint-monitoring-programme-for-water-supply-sanitation-hygiene-jmp/

Human Development Report, Sustainable Development Report and the World Bank Data Catalog. In addition, JMP data is the main indicator for SDGs 1.4 - Proportion of population living in households with access to basic services- as well as 6.1 and 6.2 shown in Box 10.4. SDG indicator 6.1.1 uses JMP's data for safely managed drinking water to measure target 6.1, which looks to "achieve universal and equitable access to safe and affordable drinking water for all" by 2030.[40]

The JMP combines household surveys and census and administrative data using statistical methods to estimate WASH services.[41] Drinking water services are categorized on what the JMP calls a ladder scale. The levels of the ladder range from safely managed water, the highest rung of the service ladder, to surface water, the lowest rung on the JMP Ladder (see Figure 10.3). Having *safely managed* drinking water is based on high levels of accessibility, availability, and quality.[42] The JMP produces, when the data is available, an estimated proportion of the population with access to drinking water in each service level.

[40]"Goal 6 | Department of Economic and Social Affairs," accessed May 10, 2021, https://sdgs.un.org/goals/goal6.
[41] "Methods | JMP," accessed May 10, 2021, https://washdata.org/monitoring/methods.
[42] Core questions on drinking water, sanitation and hygiene for household surveys: 2018 update. New York: United Nations Children's Fund (UNICEF) and World Health Organization, 2018.

Figure 10.3
SDG JMP Drinking Water Service Ladder



In addition to water access, water quality is also a part of JMP's composite measure for safely managed drinking water. The definition of an improved drinking water source is defined as being "located on premises, available when needed and free from [fecal] and priority chemical contamination."[43] The JMP monitors chemical contaminants such as arsenic and fluoride that produce acute health problems. Additionally, water is tested for the presence of pathogenic strains of harmful bacteria (E. Coli or other types of thermotolerant coliform) to determine that water is free from fecal matter. The JMP strives to collect water quality samples at the point where users retrieve water. When this is not possible, water quality samples are taken at other locations including the main distribution site, or water treatment plant, for piped water supplies.[44]

JMP data can be difficult to understand because of its ladder categorization. For our examples, the JMP data shows in 2017 that 93% of both the population of South Africa and the population

[43]"Drinking Water | JMP," accessed May 10, 2021, https://washdata.org/monitoring/drinking-water.
[44] WHO and UNICEF. "JMP METHODOLOGY 2017 UPDATE & SDG BASELINES" accessed, April 15, 2021, https://washdata.org/reports.

of India have access to *basic* water service nationwide. This seems like a positive indication of access, showing that people don't have to spend more than 30 minutes collecting the water. But if we look at the data for the proportion of the population using *safely managed drinking water* nationally for that year, there is no data for either country. This means neither South Africa nor India has a lot of data on if water is free from contamination and can't tell us the number of people that meet the highest rung on the JMP ladder. This 93% with access to *basic* drinking water tells us little about whether water is safe enough to keep people from getting sick and potentially dying.

Measurements of quality - monitoring pollution and public health concerns

Contamination from chemical and physical pollution as well as fecal matter have the greatest impact on water quality. While the JMP tracks some contaminant levels in water, it does not specifically track cholera. Cholera frequently occurs in countries without a large coverage of sanitation infrastructure and infections are a result of drinking or cooking with water contaminated with the bacterium *Vibrio cholerae*.[45] Because this is a disease that can make people seriously ill and even result in death, the WHO monitors it closely. The WHO Global Task Force on Cholera Control, compiles a count of the number of reported deaths from cholera from all countries. This data can provide insight into the quality of water and sanitation programs globally and within countries. A low water quality level would likely mean more infections and deaths. The data could be used by countries to indicate where services need to be improved or by international private-public partnerships such as Gavi The Vaccine Alliance (Chapter 6 has more on their global health work) to assess where countries need more preventative oral vaccines.

Cholera data is voluntarily reported by national governments and predominantly collected by national health ministries. The WHO notes that the preferred data sources for this indicator are health surveillance systems and the expected frequency of data collection is weekly. According to the WHO data, South Africa reported 57 deaths from cholera in 2009 and 0 deaths from cholera in 2013. India reported 3 deaths from cholera in 2016 and 54 deaths in 2013.[46] The

[45]WHO, "Cholera," World Health Organization, accessed May 10, 2021, https://www.who.int/health-topics/cholera#tab=tab_1.
[46]WHO, "Number of Reported Deaths from Cholera," 2021, https://www.who.int/data/gho/data/indicators/indicator-details/GHO/number-of-reported-deaths-from-cholera.

frequency of cholera infections and or deaths can differ substantially due to floods and other environmental conditions that increase the spread of the pathogen.

Water quality is important for human consumption, but it is also important for healthy aquatic life and ecosystems. These ideas of water quality, although different, are deeply connected as many of the sources used by humans are also essential to the surrounding ecosystem. SDG target 6.3 seeks to achieve improved "water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally."[47] To measure target 6.3, the United Nations Environmental Programme (UNEP) compiles data in the indicator 6.3.2 which measures the proportion of bodies of water with good ambient water quality.[48] "Ambient" is common in water management as a jargon word and can have varying definitions but UN Water refers to ambient water quality as "natural, untreated water that is affected by a combination of natural influences and anthropogenic activities, such as inputs from wastewater or agricultural run-off."[49] Essentially, ambient water is the water in a lake or a stream as you find it. The UNEP defines a body of water as having "good" ambient water quality if at least 80% of all monitoring data collected from the body of water meets the respective targets.[50]

The data that UNEP provides on indicator 6.3.2 is not very robust because it has not been compiled for long, the first real data drive for this indicator occurred in 2017.[51] We still chose to include it because an ambient water-quality monitoring program provides details on the source and extent of individual impacts, as well as trends over time and the effectiveness of measures taken to reduce any impacts observed.[52] We felt like this was important because quality in ecosystems is closely linked to quality of drinking water. Gaps in the data for the indicator can be used to identify countries where monitoring is scarce and help improve development efforts in the future.[53] This is the case for India as they currently report no data on ambient water

[47] UN Department of Economic and Social Affairs, "Goal 6 | Department of Economic and Social Affairs," Sustainable Development, accessed May 10, 2021, https://sdgs.un.org/goals/goal6.
[48] UN Department of Economic and Social Affairs, "Goal 6 | Department of Economic and Social Affairs," Sustainable Development, accessed May 10, 2021, https://sdgs.un.org/goals/goal6.
[49] "Progress on Ambient Water Quality – Piloting the Monitoring Methodology and Initial Findings for SDG Indicator 6.3.2," UN-Water (blog), accessed May 2, 2021, https://www.unwater.org/publications/progress-on-ambient-water-quality-632/.
[50] Ibid.
[51] Ibid.
[52] Ibid.
[53] Ibid.

quality. For South Africa, the UNEP reports 52% of bodies of water have good ambient water quality.[54]

Keeping tabs on water security, water stress and water scarcity

Climate change has and will continue to affect hydrological cycles around the world. The effects vary regionally but typically result in two major phenomena - more frequent drought and more intensified precipitation. This directly affects water availability, quality and access, potentially drying up sources of water or leading to highly contaminated water sources from excess runoff during periods of heavy rain. Climate change is just one aspect that can play into a country's perceived water security, stress and risk.

Though water stress and water security are sometimes used interchangeably as terms, water stress refers more to hydrologic conditions of water and water security encompasses more of the human and economic factors relating to water. Figure 10.2 in section 2, shows a conceptual model of these terms with examples of the major aspects that make up each. Water stress includes water quality, environmental flows, accessibility and volumetric availability. Water scarcity occurs when volumetric availability is low, in other words when water is scarce. Measuring water stress considers volumetric availability as well as other hydrologic factors like groundwater withdrawal, seasonal variability in addition to the basics of water quality and water accessibility.[55] Water security is a multidimensional term that includes social and environmental risks like ecosystems and climate change, political risks like political stability and transboundary cooperation, and economic risks like financing and development. All these aspects make up the potential water risk a country or region can experience.

The most comprehensive indicator to measure water stress is the WRI Aqueduct 3.0 data. This data ranks countries based on their composite water stress and provides disaggregated data by province within countries. Each country and province is given a ranking between zero (0-10%) and four (>80%), with zero indicating low and four extremely high water stress. The percentage measure is a ratio of total withdrawals from a total renewable supply in a country or region. The higher the percentage, the more water users are competing for the same limited supply of

[54] “Indicator | SDG 6 Data,” accessed May 10, 2021, https://www.sdg6data.org/indicator/6.3.2.
[55] CEO Water Mandate. “Driving Harmonization of Water Stress, Scarcity, and Risk Terminology.” Discussion Paper, January 2014. https://ceowatermandate.org/files/Driving_Harmonization_of_Water_Terminology_draft.pdf.

water.[56] Currently, India is a category 4 meaning they have extremely high water stress, more than 80 percent of the water available for agricultural, domestic, and industrial uses is withdrawn annually.[57] South Africa is a category 2, medium to high stress with 20-40% of available water is withdrawn annually.

Agricultural Water Use - Irrigation Indicator

One crucial aspect to understanding water resources and the supplies available is being able to measure water used for agricultural use. Agricultural use of water remains the largest consuming sector globally accounting for about 70% of freshwater water withdrawal and 90% of freshwater water consumption.[58] The FAO provides data in its AQUASTAT program on irrigation that differentiates among land equipped for irrigation, areas actually irrigated, areas equipped for irrigation with groundwater, and surface water and non-conventional sources of water.[59] This data comes from national census data, online databases and special reports from the FAO and World Bank, as well as from other international organizations, and academic literature.[60] An online AQUAMAPS tool is available to explore georeferencing the data. Using that tool will show you for example where the percentage of irrigated area serviced by groundwater is the highest spatially for India and South Africa. As of May 2021, the tool has more data available for India. One important thing to note is that, for most countries, the statistics refer to areas equipped for irrigation, not necessarily to where irrigation is being used. For many reasons, including water shortages, the area actually irrigated may be significantly smaller than what appears in this index.[61] The data is used to report on SDG Indicator 6.4.1 which measures the change in water use efficiency over time[62].

Measuring Services for Water Provisioning

[56] "Water Stress by Country," World Resources Institute, accessed May 2, 2021, https://www.wri.org/data/water-stress-country.
[57] Ibid.
[58] FAO, "AQUASTAT - FAO's Global Information System on Water and Agriculture," accessed April 20, 2021. http://www.fao.org/aquastat/en/geospatial-information/global-maps-irrigated-areas/history.
[59] "Geospatial Information: Methodology," Food and Agriculture Organization of the United Nations, accessed May 7, 2021 http://www.fao.org/aquastat/en/geospatial-information/global-maps-irrigated-areas/methodology/
[60] Ibid.
[61] Ibid.
[62] "Indicator 6.4.1" Food and Agriculture Organization of the United Nations, accessed May 7, 2021. http://www.fao.org/sustainable-development-goals/indicators/641/en/

In addition to the major indicators on water access, quality and stress, there are a number of other indicators or datasets that measure different aspects of water use and management. When investments are made in improving water supply and sewage facilities, whether from the government, international aid or private companies, donors want to know the success of such projects. Currently, the World Bank collects and compiles a global data set on performance of utility programs. The data is collected at the local or national level. Professional water associations usually have members in them that manage and operate utilities so they reach out to their own members to gather the raw data[63]. The data is included in the World Bank's open knowledge reports like the "Blue Book: International Benchmarking Network for Water and Sanitation Utilities (IBNET)" or the online IB-NET database interactive website. There are five categories for benchmarking operations: General, Service Area, Water Service, Sewerage Service, Financial and Tariffs. Each category contains a variety of indicators and datasets within. Examples of indicators include wastewater coverage and quality, water consumption and production, and how much of a household's income is spent on water supply and sewerage services.[64] The IBNET is frequently used to assess the landscape of global utilities, and parts of it can even indicate what costs of services are. There are some indicators in this database that overlap nicely with parts of the JMP such as water-supply coverage (%) or quality of water supplied: samples passing on residual chlorine (%). For our examples we are going to look at the indicator on operating cost coverage. This indicator is a ratio meaning that if the calculation comes out to the number one then revenues coming in for the utility covers the basic operation and maintenance costs exactly. In other words, the utility would be breaking even. If the ratio is less than one the revenue is not enough and the consequences are maybe the utility can't execute the necessary repairs that year. For India in 2009, 28 utilities reported their data to the IBNET and their cost coverage ratio was 0.55.[65] For South Africa the most recent data is from 2017 when 19 utilities reported and the cost coverage ratio was 1. 46[66]. We cannot make a direct comparison since India's data included more utilities reporting and they didn't report for

[63] Berg, Caroline van den, and Alexander Danilenko. *The IBNET Water Supply and Sanitation Performance Blue Book: The International Benchmarking Network for Water and Sanitation Utilities Databook*. The World Bank, 2010. https://doi.org/10.1596/978-0-8213-8582-1. p.13
[64] Ibid.
[65] "Country Profile India" IB-NET DB, accessed May 10, 2021 https://database.ib-net.org/country_profile?ctry=162&years=2020,2019,2018,2017,2016&type=report&ent=country&mult=true&table=true&chart=false&chartType=column&lang=en&exch=1
[66] "Country Profile South Africa," IB-NET DB, accessed May 10, 2021 https://database.ib-net.org/country_profile?ctry=24&years=2020,2019,2018,2017,2016&type=report&ent=country&mult=true&table=true&chart=false&chartType=column&lang=en&exch=1

2017. However, most recently it looks like South Africa is doing a lot better in terms of covering the costs.

We covered a lot of ground in this section to give you an understanding of what data is available regarding water. The most widely used measurement when discussing water access and quality globally is the WHO/UNICEF JMP. When looking specifically at cholera as a water quality issue, the WHO Global Task Force on Cholera Control attempts to track cholera infections. Another framework for thinking about water is through the lens of more comprehensive indicators - think the terms water scarcity, water stress and water security. The WRI AQUASTAT 3.0 data is the most commonly used indicator for quantifying the more abstract concepts like water stress and understanding a country's level of water stress. We couldn't write this section without discussing a few indicators for major aspects of water including irrigation, water as a utility, and private management. The agricultural sector is the greatest user of freshwater and the FAO indicators give us an idea of just how much land is equipped with irrigation in an attempt to quantify this. Finally, as we discussed, water is often provided by a utility, especially in cities, and the IBNET database tracks performance in water and sewage utilities.

4. The Technical and Political Challenges of Water Data

Now that we have discussed contemporary water data, this section elaborates on how indicators are used and examines some of the technical challenges and validity issues that arise when collecting the data. These datasets and additional sources often include data deprivations and sometimes do not represent reliable data. Overall, this appears to be because of a lack of capacity. In evaluating these indicators we see two main concerns - the use and limitations of household surveys and issues regarding the accountability of those who manage and provide water. Although this section cannot possibly cover all the ways in which these datasets meet or fail to meet the demands of development, the goal is to discuss real-life examples of what the data around water is and isn't telling us.

Capacity and Technical Challenges

Many developing countries lack the capacity to collect, report and use data on some of the dimensions of water we discussed. More critically, since water is a public service frequently managed at the subnational level, there is a lot of variation within countries' data capabilities. This includes varying capacity in collecting data, weak capacity for monitoring data, or both.

Below, we demonstrate how capacity challenges lead to missing or inaccurate data in these indicators. We also discuss how there has been little progress toward building capacity.

The data for the JMP is sourced from national and subnational level household surveys, censuses, and administrative data. Each of these sources have their own reasons for limited or missing data, leading to patches of missing data in the JMP. Some of these reasons can include insufficient funds, lack of coordination or limited human resources. Most recently, one of the main findings in the UN Water's *National Systems to Support Drinking Water, Sanitation and Hygiene 2019 Global Status Report* was that, "while most countries have national standards for drinking water and wastewater, institutions tasked with regulatory oversight for WASH service delivery are stretched and unable to undertake the required surveillance."[67] This is reflected in the JMP measure for SDG 6.1, which has more than 100 countries missing data for the proportion of people using safely managed drinking water services. Further demonstrating the extent of capacity issues in data collection, almost 60% of countries do not have data to report for more than four of the 11 indicators for SDG 6.[68] This problem will persist until more focus is placed on increasing funding and human resources to monitor water in developing countries. Increasing resources would not only occur through international organizations but also through domestic resource mobilization and prioritization of such data collection in national budgets.

Disaggregated data is even more of a challenge to collect. For example, SDG 6.1 data is not disaggregated beyond rural and urban access for characteristics like race, income, gender, or caste. This means that most of the time there is no data that can identify whether certain groups of people have more or less equitable access to water. Moreover, since most data is collected in household surveys, it inherently overlooks people who are homeless or nomadic, such as refugees and migrants, as well as other groups like students and temporary workers.[69] Box 10.4 provides an example of how the Syrian refugee crisis has affected water resources in Lebanon. Populations of people like refugees from Syria are examples of those that are most at risk with

[67] "National Systems to Support Drinking-Water, Sanitation and Hygiene: Global Status Report 2019." UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS). Geneva: World Health Organization, 2019. https://apps.who.int/iris/bitstream/handle/10665/326444/9789241516297-eng.pdf.

[68] International Water Association. "Data Is the New Water: Data Revolution to Ensure No One Is Left Behind and Achieve SDG 6." Accessed March 28, 2021. https://iwa-network.org/data-is-the-new-water-data-revolution-to-ensure-no-one-is-left-behind-and-achieve-sdg-6/.

[69] Guppy, Lisa, Praem Mehta, and Manzoor Qadir. "Sustainable Development Goal 6: Two Gaps in the Race for Indicators." *Sustainability Science* 14 (March 1, 2019): 501–13. https://doi.org/10.1007/s11625-018-0649-z.

respect to access to clean water. It is a reality of the process of data collection that the less power someone has, the less they are represented in the data and the less resources they tend to have. If the JMP was to collect more disaggregated data, the complicated story of peoples' water needs could be made more clear to governments and development practitioners.

Box 10.4 Syrian Refugees in Lebanon

According to UN High Commissioner for Refugees (UNHCR), the current Syrian conflict has displaced more than 12 million citizens both internally and across the globe. 1.5 million of these displaced Syrians have sought refuge in Lebanon, increasing its population by nearly 30%. Even before the Syrian refugee crisis, decades of civil unrest has resulted in damaged infrastructure and underinvestment in water to serve the roughly 6.8 million Lebanese citizens. The recent influx of refugees has further increased the demand for water across Lebanon. In response, INGOs, the Lebanese government and water providers have recently focused on collecting disaggregated data to track changing demands for water and identify communities most in need of improved water sources. As a result of this cooperation, the 2017 JMP update for Lebanon included refugee settlements. Efforts to count vulnerable populations and to disaggregate data are crucial for delivering resources to populations that need water the most.

Walnycki, Anna. "Getting Lebanon's Water Flowing: Using New SDG Data in an Urban Crisis." *End Water Poverty* (blog), February 1, 2018. https://www.endwaterpoverty.org/blog/lebanon-water-sdg-data-urban-crisis.
"Syria Emergency." *UNHCR (webpage)*. March 15, 2021. https://www.unhcr.org/en-us/syria-emergency.html.
Vidal, John. "Water supplies in Syria deteriorating fast due to conflict, experts warn." *The Guardian (blog)*. September 7, 2016. https://www.theguardian.com/environment/2016/sep/07/water-supplies-in-syria-deteriorating-fast-due-to-conflict-experts-warn

Capacity challenges do not just mean there are issues preventing data collection, there can also be limited capacity within governmental bodies and international agencies to plan and implement water improvement projects. Even with robust data, if policy-makers are constrained in their capacity to implement projects this data will not influence significant change in the sector. When the JMP was first established as the premier water and sanitation measurement for the MDGs, UNICEF and the WHO did not explicitly aid in the expansion of local capacity for project implementation. Even today, the extent of government capacity for data collection and

program implementation in many countries is unknown, especially in rural areas.[70] The SDGs attempt to address this by including a new indicator in target 6b which calls for countries to "support and strengthen the participation of local communities in improving water and sanitation management."[71] The progress on this target is measured by calculating the proportion of communities with established procedures for local community participation in water projects.[72] Though this target demonstrates intent, critics point out that the new target does not measure or reflect actual planning capacity. Just because governments can collect the data does not mean they have the same capacity to implement projects that could actually improve people's water access.[73]

Box 10.5 JMP Household Survey Questionnaire

Imagine you have been tasked with collecting data for the JMP, to determine water access for the community your evaluating the JMP methodology requires you ask the following questions:

What is the main source of drinking water for members of your household?

What is the main source of water used by members of your household for other purposes such as cooking and handwashing?

Where is the water collected from?

How long does it take to go there, get water and

What are household surveys telling us and what are they leaving out?

As discussed the JMP uses household surveys in its data collection process. Dependence on household surveys as a tool for data collection also generates a distinct set of challenges. By their nature surveys are often quite limited in scope, primarily to ensure that surveys are not too long and thus at risk of not being completed by busy respondents. The JMP develops a set of standardized questions, shown in Box 10.5, for data collectors to use to ensure consistency and

[70] Nelson-Nuñez, Jami, and Elise Pizzi. "Governance and Water Progress for the Rural Poor." *Global Governance: A Review of Multilateralism and International Organizations* 24, no. 4 (December 10, 2018): 575–93. https://doi.org/10/gjkhjd.

[71] Herrera, Veronica. "Reconciling Global Aspirations and Local Realities: Challenges Facing the Sustainable Development Goals for Water and Sanitation." *World Development* 118 (2019): 106–17. https://doi.org/10.1016/j.worlddev.2019.02.009.

[72] Herrera, Veronica. "Reconciling Global Aspirations and Local Realities: Challenges Facing the Sustainable Development Goals for Water and Sanitation." *World Development* 118 (2019): 106–17. https://doi.org/10.1016/j.worlddev.2019.02.009.

[73] Herrera, Veronica. "Reconciling Global Aspirations and Local Realities: Challenges Facing the Sustainable Development Goals for Water and Sanitation." *World Development* 118 (2019): 106–17. https://doi.org/10.1016/j.worlddev.2019.02.009.

comparability globally. But who gets to decide what limited questions are included? Whose data interests and needs are being served by these questions?

One technical challenge in data collection in general is deciding what type of methods best support the end goal of your research. Two common methods for data collection in water are household surveys and observational data. The questions that the JMP and other household surveys ask can potentially result in bias, whether from the surveyor or the respondent, depending on how the questions are framed and interpreted. This bias can lead to instances of under or overreporting. For example, one study observing the frequency of handwashing in the Democratic Republic of the Congo found that when surveyors asked questions versus when they simply observed behaviors, there were different outcomes. Respondents claimed during interview questioning to be washing their hands more than they were observed doing.[74] Studies like this that compare techniques, such as asking questions versus simply observing behaviors, highlight the risk of respondents providing answers that they think will be seen as appropriate, rather than a more truthful response. Unfortunately household surveys are used more frequently in water data collection than purely observational studies which are more labor intensive and costly to conduct.

Another challenge of household surveys is that they are time consuming. This can mean that the data is not collected as frequently as peoples water needs change. If survey questions are framed with the barrier of infrequent surveying in mind, they could potentially mitigate this issue. However, this is not the case for the JMP which only asks about water access within the last month of when the survey is administered, as shown in question 5 of Box 10.5. A question like this would reveal little about the seasonal and varying nature of water resources. For example, in highly urbanized cities like Lagos, Nigeria upwards of 16 households could share a standpipe where water is available only three days a week. If the landlord does not pay on time, which is fairly common, the water service to the standpipe gets cut off.[75] At different times in the year when services are shut off, these households could have to wait in long lines to retrieve water from boreholes or be forced to allocate money for more expensive, temporary water sources

[74] Manun'Ebo, M., S. Cousens, P. Haggerty, M. Kalengaie, A. Ashworth, and B. Kirkwood. "Measuring Hygiene Practices: A Comparison of Questionnaires with Direct Observations in Rural Zaïre." *Tropical Medicine & International Health* 2, no. 11 (1997): 1015–21. https://doi.org/10/cjpkrc.
[75] Du, Jillian, Diana Mitlin, Victoria A. Beard, and David Satterthwaite. "We're Grossly Underestimating the World's Water Access Crisis." World Resources Institute, August 13, 2019. https://www.wri.org/insights/were-grossly-underestimating-worlds-water-access-crisis.

over other household needs.[76] Despite these challenges, according to the framing of the question in the JMP survey these households could still be classified as having access to an improved drinking water source year round.

As infrequent water data collection can fail to reveal the variation in water access, it can also hide seasonal issues of water quality. Geographic conditions, like soil makeup and topography, or meteorological variations, like seasonal rain patterns and droughts, can all affect water quality. These conditions have also been affected by climate change. In one study completed in the state of Tamil Nadu in India, results clearly showed that water quality, particularly for piped systems, fluctuated seasonally in both rural and urban settings. These fluctuations were attributed mainly to higher precipitation during the wet season, creating increased runoff and a greater potential for contamination.[77] People's water access and quality can change throughout the year in response to the shifting environmental conditions they may face. If the JMP dataset, the most widely used indicator for water, doesn't capture these major nuances, how can it provide accurate data on equitable and consistent water access?

Accountability Challenges

In general, the overall lack of political accountability - in both developed and developing countries - has also contributed to challenges within water data. Many water officials at the national level lack the political will to prioritize water development reporting. Likewise, international agencies lack the enforcement mechanisms to ensure clean drinking-water provisions. These drawbacks lead national governments to undervalue water reporting, water sector financing, and the development of national water targets. Without proper accountability tools, countries will continue not to prioritize water and affordability for the poorest and most marginalized members of society leaving these communities vulnerable to water stress.

Different Presentations of the Data: Why Definitions Matter

There are many vehicles used by countries and agencies to report on progress on household water coverage. These include Voluntary National Reviews (VNRs), national ministry reports,

[76] Du, Jillian, Diana Mitlin, Victoria A. Beard, and David Satterthwaite. "We're Grossly Underestimating the World's Water Access Crisis." World Resources Institute, August 13, 2019. https://www.wri.org/insights/were-grossly-underestimating-worlds-water-access-crisis.
[77] Kulinkina, A., Mohan, V., Francis, M. et al. Seasonality of water quality and diarrheal disease counts in urban and rural settings in south India. Sci Rep 6, 20521 (2016). https://doi-org.ezproxy.lib.utexas.edu/10.1038/srep20521

and international agency reports. In these reporting mechanisms, countries do not consistently report based on the newer SDG 6.1 indicator "the proportion of population using safely managed drinking water services," and instead report based on the older MDG 7.C indicator "the proportion of population using improved drinking water services."[78,79] There are subtle yet important differences between measures for water access included in the MDGs versus those in the SDGs. While the MDG target 7.C and SDG target 6.1 both seek to expand access to safe water (see Box 10.2 and 10.3), the indicator for SDG target 6.1 focuses specifically on *safely managed* drinking water service. As shown in figures 10.3 and 10.4, *safely managed* drinking water refers to water that is accessible on the premises, available when needed, and free from contamination. Alternatively, *improved* drinking water services, included in MDG 7.C, is an overarching term which refers to water piped onto household premises and other sources such as standpipes and protected springs. When countries report off the definition for *improved* drinking water, the data does not ensure benchmarks for water quality, timeliness, and reliability of water services are met as it would if they reported on *safely managed*.

Figure 10.3
SDG JMP Drinking Water Service Ladder

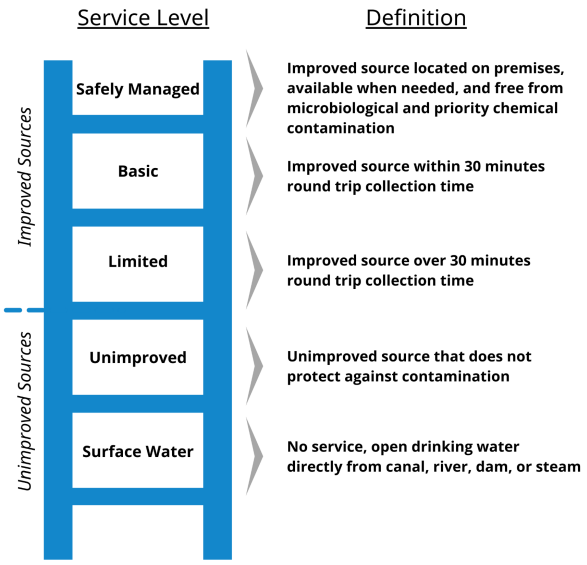
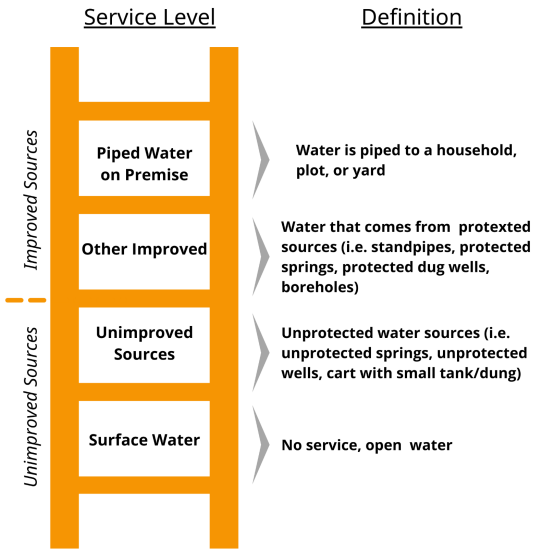


Figure 10.4
MDG JMP Drinking Water Service Ladder



[78]UN Department of Economic and Social Affairs. "Goal 6 | Department of Economic and Social Affairs." Sustainable Development. Accessed May 10, 2021. https://sdgs.un.org/goals/goal6.
[79] WHO. "WHO | MDG 7: Ensure Environmental Sustainability." World Health Organization. Accessed March 27, 2021. https://www.who.int/topics/millennium_development_goals/mdg7/en/.

These inconsistent reporting can be seen at the national and international level. In Bhutan's 2018 VNR, which states submit to the UN to evaluate national and subnational progress towards the SDGs, Bhutan reported that 99.6% of its population had access to *improved* drinking water. This was a 1.3% increase from its 2015 numbers. The report, however, did not discuss the percentage of households with *safely managed* drinking water. However, according to the JMP data, the percentage of Bhutan's population with *safely managed* drinking water remained stagnant at 36% between 2015 and 2017.[80] The difference between the reports is significant. The reporting from the JMP data on access to *safely managed* water is a far more unfavorable statistic, showing that the people of Bhutan have much less access to safe water than the VNR reports. A 2020 study on North Korea further highlights the disparities in water coverage when accounting for *safely managed* water services. When only using the definition of improved drinking water services, North Korea's population had coverage of 93.7%. However, when accounting for water availability, accessibility, and safety this coverage reduced to 92.3%, 78.2, and 74.4% sequentially.[81] Reporting solely on improved water services obscures the health and social dimensions of water access. This misreporting practice is further evident at the international level. Specifically, the UN Secretary-General 2017 report, *Progress towards the Sustainable Development Goals*, which details that 90% of the global population used improved drinking water sources but did not reference any progress on safely managed services or lack thereof.[82] It is unclear what the motivation is for either these countries' or international agency's decisions to report on improved drinking water services versus safely managed, we can only speculate. It could be because agencies are unaware of the new definition for the SDG 6 indicator, are purposely misreporting, or are unable to collect data to support the definition of *safely managed* .

The absence of universal reporting on *safely managed* water service may also point back to a larger capacity issue within governments. Is it possible for all countries to measure both accessibility and quality of water services? The UN-Water Global Analysis and Assessment of

[80] "Bhutan's Voluntary National Review Report on the Implementation of the 2030 Agenda for Sustainable Development." Royal Government of Bhutan. July 2018. https://sustainabledevelopment.un.org/content/documents/19369Bhutan_NSDGR_Bhutan_2018.pdf
[81] Caetano C. Dorea et al., "Safely Managed Drinking Water Services in the Democratic People's Republic of Korea: Findings from the 2017 Multiple Indicator Cluster Survey," Npj Clean Water 3, no. 1 (June 9, 2020): 1–7, https://doi.org/10.1038/s41545-020-0074-6.
[82]"HLPF 2018: Improved Reporting on Safely Managed Water and Sanitation Services," End Water Poverty, accessed May 10, 2021, https://www.endwaterpoverty.org/blog/hlpf-2018-reporting-safely-managed-WASH.

Sanitation and Drinking-Water (GLASS) 2019 Report found that only 52% of 90 observed countries included national targets for measuring safely managed drinking water in urban communities. Additionally, only 39% of observed countries included targets for reaching safely managed services for rural communities.[83] So it's possible that India's 2020 VNR report stating that 96% of the population has access to *improved* water sources instead of *safely managed* is a matter of this limited capacity to report on the rural and urban divide as mentioned in the GLASS.[84] Therefore it is not only a case of trying to use a term that could show more positive progress when in fact there is none, but also a simple result of not being able to collect enough data to accommodate this definition.

Even when data is available, national definitions of what constitutes safe drinking water can still differ from the international standard for drinking water. Consider the estimated drinking water access coverage for Tanzania in 2005.[85] The JMP estimated that 77% of the population had access to drinking water, based on the MDG definition of improved water sources. By contrast, the national data reported by the government of Tanzania showed that only 40% of the population had access to drinking water - a number that clearly indicates there is a serious water access problem.[86] This variation is mainly due to the differences in definitions of drinking water coverage. The international definition at the time considered protected springs and wells as well as neighborhood sales of water to be components of "improved drinking water coverage," while the Tanzanian government did not.[87] We suspect that the Tanzanian government does not include these categories because they can be seen as unsustainable sources of drinking water and the definition for a "protected" spring or well can be left up to interpretation. This variation creates questions as to what the real drinking water coverage is for Tanzanians. It is possible that neither of these data points are accurate and create not only

[83] "National Systems to Support Drinking-Water, Sanitation and Hygiene: Global Status Report 2019." UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS). Geneva: World Health Organization, 2019. https://apps.who.int/iris/bitstream/handle/10665/326444/9789241516297-eng.pdf.
[84] Government of India. "India VNR 2020: Decade of Action Taking SDGs from Global to Local," 2020. https://sustainabledevelopment.un.org/content/documents/26279VNR_2020_India_Report.pdf.
[85] Jamie Bartram et al., "Global Monitoring of Water Supply and Sanitation: History, Methods and Future Challenges," International Journal of Environmental Research and Public Health 11 (August 1, 2014): 8137–65, https://doi.org/10/f6f5db.
[86] Jamie Bartram et al., "Global Monitoring of Water Supply and Sanitation: History, Methods and Future Challenges," International Journal of Environmental Research and Public Health 11 (August 1, 2014): 8137–65, https://doi.org/10/f6f5db.
[87] Jamie Bartram et al., "Global Monitoring of Water Supply and Sanitation: History, Methods and Future Challenges," International Journal of Environmental Research and Public Health 11 (August 1, 2014): 8137–65, https://doi.org/10/f6f5db.

confusion, but could undermine effective program implementation for water management activities.

Delayed action on water quality data: Who's in charge of the water?

Accountability in water data is often also weak because in many countries water governance officials which can include city, regional or state level or national agency employees are unelected and lack the incentives to maintain public transparency. These officials are less accountable to the public since they do not have to worry about reelection. As a result, delays in taking action with the data available can easily occur, hindering appropriate policy actions.

Let's return to the example of the water crisis in Flint, Michigan to illustrate this point. Public water supply in Flint was contaminated, most notably with lead, and resulted in the poisoning of residents. At all levels of command, from the Governor's Office to the city's emergency manager to the Michigan Department of Environmental Quality (MDEQ) to the U.S. Environmental Protection Agency (EPA), those responsible for proper water management repeatedly denied knowledge of Flint's water contamination before finally taking action. A report from the EPA's Office of the Inspector General claimed that the EPA issued an emergency order, "seven months after it had the authority and sufficient information to do so."[88]

During the crisis, the MDEQ excluded two samples taken during a lead monitoring study in a report released in August, 2015.[89] MDEQ officials claimed the samples could not be included because they came from sources that did not meet the federal criteria for locations for extraction. Excluding the two samples skewed the results of the water quality data report, making Flint ineligible for federal action. The city desperately needed federal action to solve the problem. Additionally, after researchers from Virginia Tech conducted independent lead tests in Flint homes in 2015, a spokesperson from the MDEQ dismissed the results.[90] These tests proved that there were much higher levels of lead in the water system.[91] Later MDEQ's task

[88]"Watchdog Says Lack of EPA Oversight Helped Cause 'catastrophic' Flint Water Crisis | CNN Politics," accessed May 10, 2021, https://www.cnn.com/2018/07/19/politics/epa-ig-flint-report.
[89]"Lead-Laced Water In Flint: A Step-By-Step Look At The Makings Of A Crisis," NPR.org, accessed May 10, 2021, https://www.npr.org/sections/thetwo-way/2016/04/20/465545378/lead-laced-water-in-flint-a-step-by-step-look-at-the-makings-of-a-crisis.
[90]Ibid.
[91]Donovan Hohn, "Flint's Water Crisis and the 'Troublemaker' Scientist," The New York Times, August 16, 2016, sec. Magazine, https://www.nytimes.com/2016/08/21/magazine/flints-water-crisis-and-the-troublemaker-scientist.html.

force denied accountability when a report was released by the Flint Water Advisory Task Force concluding that MDEQ and other state actors including the Michigan Department of Health and Human Services had not promptly reacted to the crisis. Instead, the MDEQ task force blamed the emergency managers appointed by Michigan's governor.[92]

As of May 2021, there are lawsuits in progress to address the management issues and the reasons behind them that occurred in Flint. Earlier in the year, the Michigan's Attorney General's Office announced charges for eight state officials involved.[93] Hopefully, it'll become clear to us through the litigation process why there were delays and dismissal of data. However, the message remains that state and government officials make decisions that can dramatically affect what data are collected and reported and then acted upon. Despite Flint now having clean water, the city water system has not regained everyone's trust as many residents still use bottled water for bathing, cleaning and drinking.[94]

Water affordability and privatization: The Burden on The Poor

Through our review of water indicators chosen for Section 3, it is clear that a global indicator focused on the relationship between affordability and privatization of water is missing in developing countries. As previously discussed, the 1990s brought with it increasing privatization of water utilities to increase water access and better management of the resource. However what is rarely monitored is if this water will still be affordable under for-profit management. In 2021, we have a few compiled datasets that talk about privatization and costs within countries independently. For example, the nonprofit advocacy organization Food and Water Watch conducted an investigation into the difference between privately and public owned utilities in the United States. They found that privately owned water services cost households up to 59% more than public water service.[95] This means that communities, living where there is a private-run utility, paid $185 more a year.[96] But we do not have a picture on what this gap looks like

[92]"Flint Water Crisis 'Series of Government Failures' to Blame | Time," accessed May 10, 2021, https://time.com/4269300/flint-task-force-report-water-crisis/.
[93]"Ex-Michigan Gov. Rick Snyder And 8 Others Criminally Charged In Flint Water Crisis," NPR.org, accessed May 10, 2021, https://www.npr.org/2021/01/14/956924155/ex-michigan-gov-rick-snyder-and-8-others-criminally-charged-in-flint-water-crisi.
[94] "It's Been 5 Years. Flint Still Doesn't Trust the Water - Mlive.Com," accessed April 17, 2021, https://www.mlive.com/news/2019/04/its-been-5-years-flint-still-doesnt-trust-the-water.html.
[95] "Water Privatization: Facts and Figures," Food and Water Watch, August 2, 2015, https://www.foodandwaterwatch.org/2015/08/02/water-privatization-facts-and-figures/
[96] Ibid.

globally. This difference is alarming since often in the U.S., a customer does not get a choice in their water supply and simply has to accept whatever utility is in the area in which they live. The same can be said for populations living in lower-income countries. The protests and conflicts that occurred in Cochabamba, Bolivia in 2000 highlight the importance of acknowledging the role privatization plays in changing the affordability of water in developing countries (see Box 10.6).

Box 10.6 Bolivia Water Wars

Conflict over water services in Bolivia began in 1998 when a clause in the country's IMF loan required privatization of all remaining public enterprises. In October of 1999, the Bolivian government privately negotiated a contract that would hand over the municipal water supply in the city of Cochabamba to a multinational private consortium. The same month, Bolivian officials drafted a new law allowing for the privatization of drinking water and sanitation services, making residents pay full cost for water in Cochabamba. Indigenous groups and NGOs responded to the law emphasizing that water was not a commercial good but a right. Rate increases from the new decision led to the doubling and tripling of residents water bills. In January of 2000, protests erupted in Cochabamba in response to these high costs for water, shutting down the city for four days and beginning the "water wars."

With the government failing to take action, La Coordinada a local group organized a peaceful demonstration in Cochabamba's city plaza. The demonstration was met with violence from riot police lasting more than two days. La Coordinada, wanting to emphasize residents' disagreement with the rate increases, held an unofficial referendum finding that 96% of the 50,000 Cochabamba residents disapproved of the privatization of their water supply. Protests spread across the country, representing more than just resentment towards the increased water prices but also high unemployment and economic stagnation. After months of uprisings, an agreement was signed with the Bolivian government returning control of the water supply in Cochabamba back to local control and repealing the legislation requiring the privatization of water. The protests across Bolivia had global implications as thousands of activists descended upon IMF and World Bank meetings in Washington D.C. to call for the cancellation of billions in debt owed by the world's poorest countries. When asked about the Bolivian Water Wars at these meetings in April of 2000, World Bank President James Wolfensohn said "the biggest problem with water is the waste of water through lack of charging" doubling down on the World Bank's position to charge for public services as the only "market efficient" way to manage and provide water services.

Assies, Willem. "David versus Goliath in Cochabamba: Water Rights, Neoliberalism, and the Revival of Social Protest in Bolivia." *Latin American Perspectives* 30, no. 3 (May 2003): 14–36.
PBS. "FRONTLINE/WORLD . Bolivia - Leasing the Rain. Timeline: Cochabamba Water Revolt." Accessed March 27, 2021. https://www.pbs.org/frontlineworld/stories/bolivia/timeline.html.

Nevertheless the little existing data that tracks affordability globally is largely from voluntary reporting and often does not include private utilities reporting. For example, in the methodology listed for the IBNET, the World Bank reveals that the IBNET program relies on voluntary

reporting for calculating the costs of utilities.[97] We can assume the main contributors to these indicators are public, not private, utilities because they often have to have public facing information anyways as part of being a publicly owned facility. Private companies may be hesitant to report data on affordability and costs, perhaps because of the consequences of reporting on water rates. If the rate increases from year to year it could spark large-scale disapproval. As a result, we could have few utilities overall who report on this indicator.

5. Conclusion

Good water data is instrumental to comprehensive water management. Since the UN Water Conference of 1977, a plethora of water concerns including water access, quality, scarcity, security, and stress have been included in water development agendas. Major actors like the UN, WHO, World Bank and UNICEF will need to come together to produce more sound measures of drinking water coverage, water affordability, and water availability to produce better water measures. While the transition from the MDGs to the SDGs expanded the importance of water and included more comprehensive water measures, more work needs to be done. JMP data on SDG 6.1 - access to safe drinking water - suffers from technical and political challenges which hinder the completeness of its data. Namely, the JMP data collectors do not have the capacity to provide the disaggregated data needed to make policy prescriptions. In addition, the JMP's household survey questions do not fully account for seasonality changes in water access and quality which can negatively impact the validity. Politically, countries and international agencies continue to misreport by using the wrong JMP and SDG definition of safe drinking water. Outside of the JMP there are larger accountability challenges which hinder water data; delayed reporting and insufficient data on privatized water affordability limit potential water action.

Despite the challenges in measuring the constantly changing supplies and demands for water, there have been some promising developments in data collection and project implementation. The HWISE Scale is an example of a cross-culturally validated survey to measure water insecurity at the household level.[98] The tool was developed over 2017 and 2018 and tested at 29 sites across 23 low- and middle-income countries. The final 12-item HWISE Scale was

[97] Ibid.

[98]"Household Water Insecurity Experiences (HWISE) Scale – a Cross-Culturally Validated Scale to Measure Water Insecurity at the Household Level," accessed May 10, 2021, https://sites.northwestern.edu/hwise/.

validated in 2019 and included questions addressing feelings of shame or anger relating to a households water situation. The scale has been used to benchmark the prevalence of water insecurity in half the world's population through a collaboration with Gallup, UNESCO and Northwestern University as well used to monitor and evaluate water-related interventions by Oxfam.[99] As mentioned in this chapter, intermittent water access and quality is a major problem in the data. The HWISE scale aims to capture the experiences that everyone in a household has had in the last four weeks regarding water. In 2020, an even shorter version of the scale was developed to complete the survey in under two minutes making it easy to add on to already planned surveys. The HWISE scale is a response to the major issues we raised in this chapter including intermittent water access, seasonal water quality, and household survey capacity issues.

There have also been shifts in thinking regarding how water infrastructure is used and how to best plan for all possible uses. The concept of Multiple Use Water Systems (MUS), developed by the International Water Management Institute (IWMI), is an improved approach to water resource management in which household and agricultural water needs are met with in design and implementation. MUS looks at “water needs and available water resources holistically” “to make more cost-effective and sustainable investments that generate a broader range of health and livelihood benefits than provided by a single use approach.[100] Although not heavily discussed in this chapter, agricultural water needs affect water available for other activities like drinking and household supplies. Although irrigation can create more opportunity for water access for households, the infrastructure is often not designed for such use. In reality, people use built water infrastructure for a variety of purposes which most infrastructure systems were not originally designed to meet. Improvements have been made through the Multiple Use Water Systems approach (MUS) to design and construct irrigation infrastructure to meet the needs on the ground. Instead of constructing a straight irrigation canal, MUS designs infrastructure to also allow for household water uses like bathing and dishwashing and even a trough for livestock. MUS responds to the reality that people use water for all sorts of purposes and their water needs can change on a daily basis. If there is one thing we learned in this chapter, it’s that water access and quality are always fluid and our challenge is to continue to build the data landscape to reflect that.

[99] Ibid.
[100]“Intro to MUS | Multiple Use Water Services Group,” accessed May 10, 2021, https://www.musgroup.net/node/6.

Discussion questions

1. While reviewing the current landscape of water data, what can the data tell us about water supply and availability? What does it not tell us?
2. What are future challenges you foresee impacting the reporting and monitoring of water data?
3. In reading through the prominent terminology in water and development, are there other terms that are missing? Do you think these terms are used effectively?

Suggested further readings

Books

1. Poverty and Water: Explorations of the Reciprocal Relationship by David Hemson, Kassim Kulindwa, Haakon Lein, and Adolfo Mascarenhas
2. Water and Development: Good Governance After Neoliberalism by Ronaldo Munck
3. The Last Drop: The Politics of Water by Marianella Yanes and Mike Gonzalez

Articles / Reports

4. The Measurement And Monitoring Of Water Supply, Sanitation And Hygiene (Wash) Affordability: A Missing Element Of Sustainable Development Goal Targets 6.1 And 6.2 By UNICEF And WHO, 2021.
5. HWISE Scale

Tools

6. IWMI Irrigation Mapping