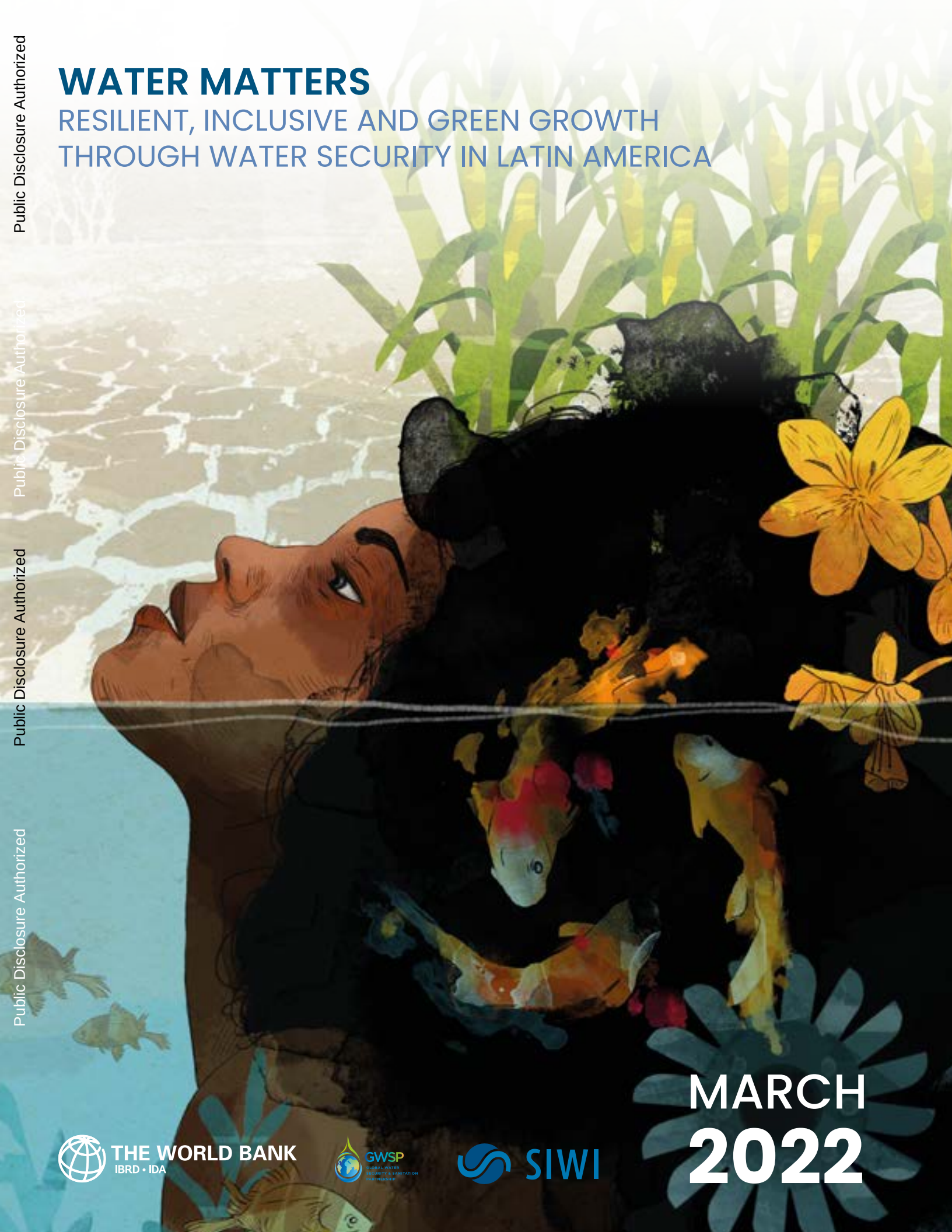
WATER MATTERS

RESILIENT, INCLUSIVE AND GREEN GROWTH THROUGH WATER SECURITY IN LATIN AMERICA



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FOREWORD

Water security is a matter of increasing concern across the world and Latin America and the Caribbean (LAC) is no exception. With rapidly growing demands for water and increasing variability due to climate change, ensuring water access to all users and mitigating water-related risks should be at the center of national and regional adaptation strategies.

With nearly a third of the world's water resources, the LAC region's development has been inadvertently driven by water. This rich water endowment has allowed LAC to position itself as the world's largest net food-exporting region and greenest in terms of electricity production through hydropower. Water has played a fundamental role in reducing poverty, preserving LAC's natural wealth, and accelerating economic growth. More importantly, access to safe drinking water and sanitation services has contributed to improve the health and living conditions of millions of people.

Despite this progress, there are urgent water sector challenges that threaten the region's sustainable development. Access to water and sanitation services is inequitable, with greater gaps in rural, indigenous, and peri-urban communities. In addition, water-related extremes such as floods and droughts are becoming more frequent and severe, having negative effects in lower-income communities. These gaps are more likely to be broadened by unsustainable water management practices, growing demands by competing water users, increasing pollution, and climate change impacts. In LAC, inadequate infrastructure results in a lack of storage and limited investment reduces the capacity of institutions to achieve integrated water resources management and improve service provision.

Therefore, we believe that it is crucial to overcome these shortcomings in water sector performance, governance, funding, and infrastructure that hinder the region's socio-economic development. Moreover, managing water- related risks should be at the core of climate change adaptation and mitigation strategies to reduce vulnerability and build resilience across LAC. A greater collaboration between regional stakeholders and water practitioners is needed to bolster the sector's capacity to address current and future water security challenges.

As we approach the halfway mark of the 2030 Agenda for Sustainable Development, the World Bank is committed to continue working with client countries and lead the pathway to increase water security in the LAC region. The World Bank work supports national governments through investment lending, technical assistance, and analytical work to create an enabling policy, regulatory, and institutional environment and enhance the sector's institutional capacity and financial viability that contribute towards the improvement of water management practices and service delivery.

The Stockholm International Water Institute (SIWI) conducts research, convenes multistakeholder dialogues, builds institutional capacity, and provides policy advice to water decision-makers. Focused on improving water governance, we aim to contribute to more prosperous and inclusive societies. With our stable presence in the region through our office for Latin America, we will continue to support LAC countries in their journeys to realizing water security through our bespoke water governance support services.

We hope that this work raises awareness of both the challenges that need to be addressed to move the water agenda forward and the potential for increased cooperation among development partners as we invest our efforts in pursuing a more resilient, inclusive, and sustainable, and water-secure development for all.

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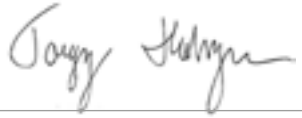

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Executive Summary

Water Matters: Benefits and Challenges Linked to Water in Latin American and the Caribbean

1. The Latin America and Caribbean Region's (LAC) economic and social growth achieved in past decades is increasingly at risk. Driven largely by high commodity prices, economic growth in the region reached an average annual rate of 3.8 percent over the period 2003-12, which contributed to poverty reduction and expansion of the middle class. This translated into a reduction in inequality and the proportion of people living in poverty. The share of Latin Americans living on less than US$5.50 per person per day fell from 44.7 percent to 26.7 percent; the proportion of people living in extreme poverty (US$1.90 per person per day) was cut in more than half from 12.7 percent to 4.6 percent during the same period. Yet, that progress was followed by a more stagnant period during 2013-19, when the region's gross domestic product (GDP) contracted by 2.7 percent, and, in 2019, social tensions exploded in several countries as a result of the difference between social expectations and economic realities. LAC is the region hardest hit by the COVID-19 pandemic, facing drastic social and economic impacts. It is estimated that in 2020 alone, the region's GDP has declined by eight percent on average, pushing four million people into poverty that year. This crisis will have a lasting impact on the region, driven by shocks to human capital and employment, reduced future earnings, and high levels of debt.

2. Most of the region's social and economic development and growth has been fueled by water, which, if adequately managed, is a centerpiece of the region's vision for greener and more inclusive and resilient sustainable development. Increased access to water supply and sanitation services have resulted in a drop in water-borne diseases (diarrhea, enteric infections, malaria, and intestinal illnesses) and hence an improvement in the living conditions of a large part of the population, especially those living in urban areas. LAC is the world's largest net food-exporting region, where water is so essential. LAC is also the greenest region in the world in terms of electricity production, thanks to the large share (45 percent) of hydropower in its electricity generation matrix. Water resources fuel the growth of industrial and mining sectors and compose a fundamental element of growing the region's businesses, not to mention further developing its tourism and river navigation potential. Moreover, water is key to sustain LAC's biodiversity richness. LAC is one of the most biodiverse regions in the world.

3. The vision for a greener, more inclusive, and resilient sustainable development is possible thanks to region's water endowment. LAC is one of the most water-rich regions in the world, home to important international rivers and aquifers, including two of the five largest river basins and two of the ten longest rivers in the world. The region accounts for 29 percent of the planet's terrestrial precipitation and 10 percent of the world population, putting the water availability at 21,300 m^3 per person per year, four times the world average. Progress on sustainable development goal (SDG) 6.4.2 related to the monitoring of water stress, has not been given much attention across the region when in fact countries like Chile, Mexico, and parts of Peru, Brazil, and Argentina are highly water stressed. This

complacency, together with the fact that the region has indeed a high temporal and geographical variability in the distribution of water, has run its course and now requires a paradigm shift in managing water resources for current and future generations across the region.

4. However, this natural capital is fragile. Today, unsustainable management of water resources, growing water demands, pollution, and climate change, translate into large service gaps impacting people, the environment, and the economy, putting the region's socio-economic progress at risk. Access to safely managed water supply services is still missing for 166 million people; and 24 million still do not have access to even basic services. Most of these people are located in rural areas, which are clearly falling behind. Access to water services is inequitable, with service access lagging for marginalized groups such as Indigenous people, who comprise 60 percent of the poor population, and Afro-descendants, who comprise 50 percent of the extreme poor in Brazil, Uruguay, Panama, Ecuador, and Colombia combined. For many of these groups, this service gap has impacted their access to education and jobs and widened the gender gap, further marginalizing them. Moreover, an even greater 69 percent of the population lack access to safely managed sanitation services, with the corresponding volume of untreated wastewater increasing the burden of disease and adversely impacting the environment and the ability of other users to use the water. Irrigation services, which constitute more than 70 percent of water withdrawal in the region, are also inefficient and sometimes precarious, with most of the farmed land not having a reliable irrigation service. Coupled with this, drainage services on farmlands area are usually missing, reducing productive farmland as a result of water logging and salinization. These service gaps are likely to be broadened by climate change and increasing water demands, diminishing service reliability for people.

5. As of 2019, about 150 million people in LAC live in extremely water scarce areas. Water scarcity can have detrimental economic and social impacts, with an overall reduction in GDP. In Colombia, for example, the impacts of water scarcity are estimated to reduce between 1.56 and 2.31 percent of GDP because of the decline in agricultural crop yields, employment contraction, reduction in production due to water rationing, and lack of water supply, sanitation, and hygiene (WASH) access. Water scarcity disproportionately impacts the rural poor and marginalized groups such as Indigenous people, whose livelihoods derive from the agriculture sector, leading to lower income and further reducing their resilience against future climatic shocks. In the LAC region, the economic damage from droughts alone over the past 40 years stands at a total of US$24 billion, while milder water scarcity shocks have other discernible economic impacts.

6. Water scarcity is exacerbated by the increase in pollution, which limits freshwater availability for human consumption and productive usages and damages the environment. The discharge of untreated effluents from municipal use, agriculture, industries, and mining into rivers, lakes, and aquifers places pressure on water resources as well as damaging public health and ecosystems. In South America, approximately 40-60 percent of drinking water comes from aquifers that are facing ever-growing pollution from over-mining and agriculture.

7. At the other extreme, recurrent flooding equally disrupts livelihoods, adversely impacting economic activities and infrastructure, and posing an additional risk to sustainability and growth. From 1980 to 2019, there have been more than 900 major flooding and landslide events in the LAC region, affecting a total of 73 million people. On average, this comes down to affecting more than 1.8 million people per year, with economic damages in the order of US$1.7 billion per year.

8. While the effect of water security gaps on regional economies are not always evident, recent studies have quantified the impacts as high as 2.2 percent and up to 3.1 percent of national GDP on an annual basis, respectively.

Stress Factors

9. Climate variability and change will further exacerbate water scarcity, enhance pollution problems, and increase the magnitude and frequency of droughts and floods. The Intergovernmental Panel on Climate Change (IPCC) trend analysis and climate change projections suggest a general increase in temperature and evapotranspiration, potentially varying rainfall, and runoff patterns in the LAC region, with rainfall forecasts varying depending on the geographical region. While decreasing rainfall is expected in Central America and the Central Andes, an increasing trend has been identified in southeastern South America leading to greater runoff in the La Plata basin. As approximately 60 percent of the terrestrial area in South America is found in transboundary basins, (and approximately 40 percent in Central America), the impact from climate change will increase the need for transboundary cooperation.

10. Climate variability and change are also affecting water supply systems and the different productive uses of water. Climate change is increasing the uncertainty on agricultural yield—primarily in rainfed agriculture—but also increasing the pressure on irrigated systems. Climate change also adds more uncertainties for hydropower developments, triggering some countries in LAC to change their energy matrix composition back to more fossil fuel dominance. If concrete actions are not taken, increased variability, along with the fast-growing demands in all productive sectors, will place further pressure on water resources, increasing competition and likely conflicts among water users. In addition, as different water services are also contributors to greenhouse emissions, the water sector has a great potential in the region for climate change mitigation.

As approximately 60 percent of the terrestrial area in South America is found in transboundary basins, (and approximately 40 percent in Central America), the impact from climate change will increase the need for transboundary cooperation.

11. Water storage capacity in LAC is decreasing. The Andean glaciers—essential natural water regulators to guarantee water availability during dry seasons—are retreating faster than anywhere else in the world. Valuable natural buffers against variability such as the Colombian Paramos or groundwater recharge zones are being subject to increasing pressures. These alterations in regulatory functions, together with less predictable rainfall patterns, are triggering a rethinking in the way water is managed in this region with considerations of new surface water storage and transfer hydraulic infrastructure underway. The lack of adaptive actions in this regard could affect the livelihoods of millions of people.

12. Countries are increasingly acknowledging the importance of water security as a fundamental factor in their national determined contributions (NDC). While most LAC states noted high per capita abundance of water, most noted that climate change impacts will be channeled through changes in the hydrological cycle, increasing sub-national water insecurity challenges. NDC´s show a high level of commitment to pursuing basin or watershed management and the importance of having a mechanism for water resources allocation that can be easily adapted to varying climate change conditions. Additionally, many NDCs recognize nature-based solutions (NBS) as a policy and operational instrument for achieving both climate change mitigation and adaptation priorities. While several countries had previously noted the importance of similar approaches like ecosystem-based adaptation, or the role of managing ecosystem services, played in meeting their commitments in their first NDC's, many countries view NBS as an important tool for addressing climate change adaptation and

mitigation, as well as addressing ecosystems and biodiversity challenges that are being exacerbated by climate change.

13. In addition, new risks brought by the COVID-19 pandemic have emerged, unveiling the relevance of water supply and sanitation services and the need to maintain water services for ensuring supply chains. Clean water, handwashing with soap, and good hygiene practices are critical to preventing the spread of disease. However, in the LAC region, the gaps in water sector services pose urgent risks in the face of future pandemics - especially in informal urban settlements, healthcare facilities, schools, and other public spaces, where proper water supply and sanitation services are not always available. In addition, the impact of COVID-19 hit water service providers, revealing a lack of financial and operational resilience against external shocks.

14. Rising social concerns around inequality are increasing the demand for better and more equitable access to water services. These concerns have been further heightened following the COVID-19 pandemic, which has had a disproportionate impact on poorer, marginalized communities. Equitable access to basic services further requires increasing transparency in water allocation, accountability from institutions, and a greater civil society engagement. Moreover, the changes or attempts to reform existing water access/allocation mechanisms can influence the existing high inequalities in the region, as secure water can be a transformational factor when addressing social and economic vulnerability conditions. Conversely, the inability to close the gaps between the urban and rural populations faster—14 percent of urban dwellers live without access to basic water and sanitation services as opposed to 30 percent of the people living in rural areas—will increase social tensions, unrest, and the risk of conflict. The same happens with the regional inequalities in water access within and across countries (e.g., North of Argentina or Northern and Northeastern Brazil), or across ethnic groups, as Indigenous people and Afro-descendants are among the groups with lower access rates. Water security is thus integral to counter conflict and fragility.

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Key Constraints to Overcoming Challenges

15. The key constraints to overcoming these challenges are contained in two different dimensions: the significant performance gaps observed in the LAC countries in managing water resources, delivering services, and mitigating risks; and the causes behind these performance gaps related to infrastructure-funding and governance.

Performance Gaps

16. Despite recent efforts in most LAC countries, sector institutions are facing key performance issues rooted in the lack of political relevance for water resources management. Despite growing competition for water resources, the need to establish and professionalize water resources management institutions while developing sound water resources management principles is not yet a priority in most LAC countries. Existing institutions lack funds to cover their operating costs as well as professionals who can manage water resources adequately. Moreover, there has been little effort to benchmark performances and create sound indicators to push these institutions forward.

17. Service provision performance is falling short in water supply and sanitation. Water utilities have high levels of non-revenue water (physical and commercial losses) —estimated at 38 percent based on data obtained from 11 countries— coupled with high production and consumption rates, more than double the international standards. Service quality is still sub-par in most medium and small cities, towns, and rural areas. Common problems affecting service provision include lack of potability due to the presence of fecal matter and chemical pollutants, lack of sufficient pressure to ensure the arrival of water to upper floors, and lack of continuity in the service with long periods of water outages. These problems limit supply options and sources or increase costs of treatment before delivery. The financial sustainability of water utilities is also low. Although the average operating cost coverage ratio (operating revenues over operating costs) in the region is greater than one (1.17), there are countries such as Argentina or Panamá that do not cover operation and maintenance (O&M) costs with own revenues, and with few exceptions, full cost recovery levels from tariffs are far from being reached. Even in cases when electricity represents a high percent of the O&M costs, services providers do not advance in improving energy efficiency.

18. Lagging performance issues are also observed in the provision of irrigation and drainage services. In the case of irrigation and drainage service providers, the situation is similar. In most cases, the inability to cover the O&M costs of collective systems leads to deferred maintenance and degradation of services. This often results in the need to rehabilitate irrigation and drainage systems on a recurrent basis through significant public subsidies. The potential for efficiency gains and water productivity is considerable, but the challenge is to improve irrigation performance without compromising on sustainability.

19. An assessment of the performance of the region in mitigating hydrological risks reveals several deficiencies. First, high levels of exposure and vulnerability to floods are due to the lack of proper risk planning and enforcement. Second, the rapid unmanaged land use changes, such as deforestation, expansion of the agricultural frontier, and inadequate agriculture practices, are altering water balance and increasing flood and drought exposure in rural areas as well. And third, insufficient monitoring and forecast capability, together with poor or non-existing coping mechanisms to deal with droughts and floods, contribute to the poor performance.

Infrastructure and Funding Gaps

20. Although important water infrastructure projects securing water supply, flood protection and energy production have been developed across the region in the last decades, in many countries there is a large untapped potential for the development of green and gray storage infrastructure to increase levels of water security. On average, surface storage capacity in relation to renewable resources in LAC is in the order of seven percent, which is significantly lower than, for example, the United States (24 percent) or China (29 percent). While an analysis at the national scale inevitably masks regional storage aspects, it also points to a potential lack of water storage which is critical for ensuring water supply during dry periods.

21. Most countries show low levels of investment for water infrastructures at the national level, failing to secure revenue from users and cover the O&M costs. In fact, the funding gap for large water infrastructure is considerable. As an example, investments for the rehabilitation of existing hydropower dams have been estimated at US$33 billion across the region, but access to financing remains a key bottleneck across LAC. The public sector has played a major role

in these interventions. However, in the development of dams, public funding often comes with concessional loans from multilateral donors. Private investors are often reluctant to invest in water infrastructures due to the perception of high risk caused by numerous uncertainties associated with climate change and another factors.

22. To achieve SDGs 6.1 and 6.2 on access to safely managed water and sanitation services, water supply should be expanded for 166 million people and sanitation systems should be expanded for 443 million people. Sanitation is the greatest challenge as the majority of the facilities are still considered basic. The associated funding gap to reach universal access by 2030 is estimated at US$14 billion per year. This means that the region is off-track to achieve SDGs on water supply and sanitation access by 2030. If SDG 6 cannot be achieved, this will negatively impact progress towards the other SDGs since water connects to nearly all SDGs.

23. Overcoming the funding gap for water supply and sanitation requires a great effort to maximize public funds and find other sources of funding. In the absence of targeting strategies and clear criteria for allocating public funds, expenditure efficiency in the water sector decreases. This leads to low predictability in funding streams for utilities that ends up affecting their planning capacity and performance. Moreover, the fact that poor performing operators present low levels of creditworthiness also constrains the implementation of bankable projects and the participation of the private sector.

24. Investments to increase irrigation efficiency are also significant. In Argentina alone, investments are estimated at almost US$2 billion, only to compensate for the impacts in existing irrigated crops due to decreased water availability caused by climate change. These needs are likely to increase if investment efforts in the sector are not considered a priority and the costs associated with water security gaps will be higher, mostly because of the effects of climate change.

Previous regional studies estimated that the region needed US$33.6 billion to reach 85 percent of the pluvial drainage needs, including renovation by 2030.

25. Drainage and other flood mitigation infrastructures have been traditionally underfunded. Previous regional studies estimated that the region needed US$33.6 billion to reach 85 percent of the pluvial drainage needs, including renovation by 2030. These types of works tend to be publicly funded, hence, administrations struggle to find sustainable ways to cover O&M costs. There are good examples in other regions where a portion of water tariffs is defined to finance drainage infrastructure, but these schemes are not commonly found in Latin America (mostly in Mexico). Flood early warning systems (FEWS) are still incipient in LAC. Thus, both national and regional administrations fail to secure funding for an adequate O&M, but also for modernization and expansion of these infrastructures.

Governance Gaps

26. Poor sector performance and insufficient funding in the sector are interlinked as a result of poor governance. Sector governance is asymmetric across the region, with areas such as Central America where water is less prioritized compared to other subregions. Despite the existence of consolidated water resources management institutions like the National Water Commission (CONAGUA) in Mexico, the National Water and Basic Sanitation Agency (ANA) in Brazil, and water institutions in some Argentinian provinces, and the development of consolidated water rights systems over the years, several LAC countries are still lacking the basic enabling environment (e.g., laws, regulations and institutional frameworks) and tools for decision-making to support water

resources management at different scales, especially at the basin level. Lack of inter-agency coordination and cooperation with other policy sectors, including urban and land-use planning, and natural resources, precludes integrated water resources management. Lack of hydrological information impedes the development and implementation of adequate water allocation regimes, a common cause of conflicts among water users. Moreover, despite the vast number of shared resources, Latin America is also among the lowest ranking regions in terms of transboundary cooperation, making it challenging to manage water resources holistically. This limits the ability of national governments to manage the basin or aquifer in a strategic way that optimizes both economic and environmental benefits for the region. In addition, water in general is politicized in parts of the region, making water governance not only challenging but also very sensitive.

27. Corporate governance practices in water supply and sanitation utilities are still not fully widespread across the region. Corporate governance principles in public water utilities contributes to resolving agency conflicts, to strengthening accountability mechanisms, and to making investment decisions that create economic value. Most water utilities in the region do not have corporate governance structures that separate ownership and business control that could reduce political interference in utility management. In addition, most countries have not adopted guidelines for nomination of water utility board members that promotes the accountability of utility management and investment decisions. Since lenders demand the stability and autonomy in utility management that corporate governance structures provide, these challenges limit the ability of utilities to access commercial financing.

Most water utilities in the region do not have corporate governance structures that separate ownership and business control that could reduce political interference in utility management.

28. Incomplete or dysfunctional decentralization processes in the region are often the causes of poor utility performance. A common problem is the lack coherent financing policies when local levels are responsible for the provision of services but have no capacity to invest, and central levels are the main investors. Also, fragmentation of water supply and sanitation service provisions, resulting from incomplete decentralization processes, is a challenge as performance problems are common in small operators with less capacity and resources. Regulators in the region with high decentralization of service provision are not promoting more efficient governance structures where a single utility can serve multiple regions or localities to take advantage of economies of scale. Regulators' performance is also improvable in areas such as accountability and transparency; the tools and capacity to develop their functions are also limited.

29. Concerns around the fairness of water allocation have been brought forward by social protests and political movements in 2019 in Chile and Mexico; issues around transparency of water allocation, hoarding of water rights, and corruption have been topics for debate in recent time in Chile, Mexico, and Peru. Corruption is a persistent challenge for the water sector in LAC, impacting the efficiency and effectiveness of water services. There are certain characteristics in the water sector that make it vulnerable to unethical practices, such as the fact that the water service is a natural monopoly, has a high level of public sector participation and requires large-scale investment for water resources infrastructure. Corruption and lack of transparency also have a role in explaining the low levels of implementation of risk reduction measures.

30. Community participation and gender inclusion have a wide room for improvement. Participation and sense of ownership of the water system is essential to maintain the systems' functionality, but also to ensure inclusion, accountability, and successful community management approaches in rural

areas. In the LAC region, 71 percent of countries reported that they have less than 50 percent of the financial resources needed to support participation of users and communities in rural sanitation and drinking water services. Women are still not well integrated in water governance at the local, national, and regional levels in dealing with natural resources, thus excluding them from water and related natural resource decision-making. Although LAC is doing relatively well in terms of representation of female employees compared to global averages, women still comprise a small part of the water utility workforce, particularly in technical and managerial roles. Utilities in LAC are still far from reaching gender parity.

31. Governance gaps in managing water-related risks are primarily due to unclear budgetary mechanisms, low technical capacities and community awareness, and water preparedness being underprioritized at the political level. Policies still focus on disaster relief responses as opposed to overall preparedness, mitigation, and other risk reduction measures. Capacities are low and consequently there are technical gaps to developing operational protocols and manuals, or to carry out proper maintenance of the systems. General strategies in the region to involve communities in disaster preparation have failed to incorporate this essential approach effectively, perhaps also influenced by the poor coordination mechanisms within and across sectors, lack of full engagement and clear responsibilities of all other stakeholders.

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What Can Be Done Differently

Managing Water Resources

32. Implementation of integrated water resources management (IWRM) principles should be done based on a sound prioritization of the country's most pressing needs to avoid cumbersome reforms or the implementation of a multiplicity of IWRM tools that will not yield tangible results. IWRM principles has been promoted for decades in LAC but its implementation has been slow as shown by the monitoring of SDG 6.5.1. This is partially because implementation of IWRM basic principles and tools requires long-term political commitment, together with a steady improvement of institutional capacity-building. To avoid losing political interest, these long-term reforms should first address the strengthening and implementation of key water resources management (WRM) functions that tackle the countries' issues (i.e., focusing on few key reforms instead of sector-wide transformations).

33. Developing metrics that allow for benchmarking and performance monitoring of WRM institutions is important. Unlike the water supply and sanitation (WSS) sector, WRM institutions are seldom benchmarked and there are no common performance indicators that track institutional progress in this area. Developing such metrics could better allow for steering future institutional reforms and assessing recent reform efforts.

34. In addition, LAC still needs to work on three main institutional challenges. First, in setting up basic water resources management institutions, primarily in Central America. Second, in modernizing existing institutional frameworks to improve technical autonomy, accountability, transparency, resilience, and efficiency principles. And third, on empowering and strengthening river basin institutions.

35. Modernizing basic WRM management tools such as information and planning. Efforts to collect, systematize, monitor, and share data on the availability, quality, uses, and demands of water resources, need to be increased to ensure that basin plans can more accurately identify the problems, establish and budget for measures that address the problems, and evaluate their implementation. Basin planning instruments are key and should be recognized as essential territorial development and environmental management tools, noting that in some cases can even be legally binding in terms of compliance. Both information and planning tools can benefit from the incorporation of new approaches that have been successfully tested in recent years. They include the integration of remote sensing technologies, the use of drones to complement information systems, and the introduction of new planning methodologies that incorporate a risk management approach to better understand system uncertainties in the basin (i.e., the decision tree methodology).

Delivering Water Services: Water Supply and Sanitation

Expansion policies need to give more importance to access in rural areas and small towns, but also to Indigenous populations and Afro-descendants, respecting local worldviews and preferences.

36. Speeding up access to reliable water and sanitation services and improving existing levels of service is essential for reducing vulnerability, increasing efficiency and resilience, and reducing inequalities in LAC. The path to achieving this goal is not trivial. It requires: (i) finding sustainable mechanisms to quickly expand and modernize water supply and sanitation (WSS) services in the context of a macro-economic crisis; (ii) increasing financial efficiency as well as operational and energy efficiency of service providers, which would lower operation and maintenance costs; (iii) adapting regulatory frameworks to incentivize efficiency and adoption of circular economy approaches by defining adequate tariff structures and promoting sound planning through the use of key performance indicators; (iv) promoting institutional sustainability through corporate governance in water utilities, establishing accountability mechanisms and incentivizing compliance with the application of corporate governance principles that help minimize the risk of political capture and corruption; (v) setting targets for greater resilience to climatic and non-climatic shocks and promoting diversification of sustainable water supplies; and (vi) speed up modernization by harnessing innovation and digital technologies.

37. Connecting the unconnected in marginal and poor urban areas is central, but also complex. Utilities must find ways to speed up and maximize connectivity in these areas. From the financial point of view, one of the most efficient ways to spend public funds is by subsidizing connection costs in low income areas. Yet this strategy gets more complicated when considering large informal urban spaces, lacking not only water and sanitation but also other public services. Thus, providing services in these areas often demands integral and complex "slum upgrading" processes involving a wide array of institutions that require effective coordination mechanisms. Performance-based approaches are also being used to reach the last mile.

38. Rural areas should not be left behind in terms of access to WSS services, requiring consolidating strategies for a stronger participation of users in the design, construction, and operation of WSS systems. Expansion policies need to give more importance to access in rural areas and small towns, but also to Indigenous populations and Afro-descendants, respecting local worldviews and

preferences. Therefore, expansions need to be implemented in parallel to citizen engagement approaches in service provision where different ways of active participation are explored.

39. Access to sanitation needs to increase faster and in a more sustainable manner. In doing so, there are several strategies that could be followed. First, the debate on how to better close the funding gap needs to include investments in sanitation. But also, the sector needs to overcome traditional expensive solutions and diversify the range of affordable options to maximize service expansion. Utilities need to see sanitation as an opportunity rather than a burden. The adoption of circular economy principles provides an additional opportunity for water utilities to benefit from waste-to-resource opportunities, advancing resource efficiency, mitigation, and resilience. Covering sanitation costs and financing circular economy initiatives also require a careful consideration of adequate tariff structures and smart subsidies.

40. The COVID-19 pandemic has magnified the water security crisis, serving as a reminder of the urgent need to increase resilience to a wide range of shocks beyond climatic, by expanding services faster and in a resilient manner. In this sense, resilience and innovation should be part of the efficiency concept, aiming to have the necessary tools to adapt to change. These tools could include Emergency Prevention Plans, financial tools for resilience, or adaptative construction features in water supply and sanitation infrastructure. Flexibility should be a concept to introduce in planning instruments as an essential approach to deal with increasing uncertainty.

Ageing hydropower projects require improving dam safety across the region by building regulations, institutional capacity, and directing investments into the implementation of dam safety procedures during all phases of a dam project.

Irrigation

41. Increase access to irrigation and drainage services while considering the economic, financial, and environmental viability. IIncreasing access to irrigation and drainage is a central element of broader climate change adaptation strategies that address the increased frequency and severity of water shortages and flood on agriculture, but can also further the role of the region in global food security. However, this should be done with care. Several factors need to be considered when examining irrigation expansion. First, the viability of new developments should pass different check points such as financial and environmental sustainability, farmer interest, and availability of water, which requires a profound knowledge of water dynamics in the area/basin, including existing water uses. Second, guaranteeing the existence of adequate communication and logistic infrastructure for the swift delivery of products to markets. Lastly, innovative forms of financing are essential to mobilize private sector funding. The role of the public sector is again key to facilitating the enabling environment.

Hydropower

42. The priorities are to invest in renovation of ageing infrastructure, and to factor in climate change as a new source of uncertainty in new hydropower developments. Ageing hydropower projects require improving dam safety across the region by building regulations, institutional capacity, and directing investments into the implementation of dam safety procedures during all phases of a dam project. In addition, to secure sustainability of infrastructure projects and avoid energy imbalances due to droughts, hydropower projects need to be screened against climate change risks and conceived within a basin planning approach to

avoid conflicts with competing users. Moreover, the development of hydropower projects should be screened in a wider energy policy discussion which is not in scope for this report. The creation of the International Hydropower Association's Hydropower Sustainability Tools and the World Bank's (WB) Environmental and Social Framework offer new tools and guidance around dam safety that can be used to develop new opportunities for hydropower and dam development.

Mitigating Water-related Risks

43. The approach to dealing with the impacts of hydrometeorological extremes should focus on reducing vulnerability and increasing resilience. This requires improving reliable information; incorporating green and gray infrastructure; and building financial preparedness and contingency planning for water services providers, water resource managers, and users. In addition, specific recommendations are provided for floods and droughts.

44. In the case of floods, despite efforts to reduce exposure to hazards and make assets less vulnerable, there always remains a residual risk. Thus, it is critical to improve people's and service provider's ability to cope with flood risks, reducing their vulnerability and increasing their resilience, through: (i) revenue diversification for households; (ii) financial inclusion; (iii) market insurance; (iv) adaptive social protection; and (v) disaster risk financing. These are complementary to other ex-ante measures, such as developing and expanding early warning systems, contingency planning, and flood protection infrastructure with special attention to NBS.

45. In the case of droughts, monitoring systems, contingency plans, water harvesting, and increased multipurpose storage are fundamental for system robustness. In addition to monitoring, information systems should also be able to predict drought severities through a system of specific/targeted indicators (e.g., agriculture, drinking water supply) at the basin level. Drought resilient strategies also need increasing and diversifying water storage strategies, optimizing the use of natural buffers (i.e., groundwater, snowmelt). A better knowledge of groundwater resources can also optimize the use as reservoirs, thus promoting conjunctive surface-groundwater use. Also, water authorities need to advance planning to address the changes in dynamics of glacier and snowmelt that are currently happening. The important regulatory role of these natural buffers needs to be replaced— probably with other types of storage. Contingency plans should also contemplate adaptive and flexible allocation and operating rules for existing water systems.

A Call for Regional Action

46. Rebuilding a more resilient, inclusive, efficient, and greener growth path for LAC through water security will require collective action from water practitioners, development partners, and governments at the regional level. This requires focusing on: (i) elevating water security issues to higher levels in the national development dialogue; (ii) incorporating water security goals as part of the NDCs and the adaptation plans; (iii) boosting the generation of water-related information and most importantly, sharing it, to fill existing monitoring gaps; (iv) advancing the transboundary water management agenda as regional issues become more relevant; and (v) aligning policy priorities among development partners to avoid overlaps and joining efforts to support the prioritization of water in national and regional agendas.

Introduction

1. In the first decade of this century, Latin America' middle class grew by 50 percent, due to job creation and growth reaching 30 percent of the population. Access to quality education and reliable basic services and safety nets played an important role in lifting Latin Americans out of poverty and into the middle class, with Colombia, Brazil, Chile, and Perú among the Latin America's top middle-class advocates (World Bank 2012). Infrastructure investments also increased significantly during the first decade of the century contributing to economic growth and employment (ECLAC 2016).

2. This development contributed to poverty reduction. The proportion of people living in extreme poverty, as measured according to the international poverty line of US$1.90 per person per day, was cut in more than half during the period 2003-2012, from to 12.7 percent to 4.6 percent. Similarly, the share of Latin Americans living in higher absolute poverty lines of US$3.20 and US$5.50 per person per day fell from 24.7 percent and 44.7 to 11.7 percent and 26.7 percent, respectively (World Bank 2021e). However, declines in commodity prices and turmoil within financial markets have spurred fears of crises and growth stagnation in emerging economies. With a growth of less 1.1 percent, countries in LAC have been particularly affected by decelerating economic growth during the period 2013-2019, further jeopardizing the previous gains on poverty reduction and growth (World Bank 2020f). The vulnerable people—the population not considered poor but not yet within the middle class—continued to be the largest group in the region, reaching 38.9 percent in 2014 (Baez, Fuchs and Rodriguez-Castelan 2017).

The proportion of people living in extreme poverty, as measured according to the international poverty line of US$1.90 per person per day, was cut in more than half during the period 2003-2012, from to 12.7 percent to 4.6 percent.

3. After several years of slow growth, the LAC region's economy is facing a new setback because of the COVID-19 pandemic. Latin America has become the region hit hardest in the world by the pandemic. The region has fallen into an economic crisis after what had already been a period of disappointing growth and limited progress on social indicators, as well as social unrest in some countries at the end of 2019. Unemployment rates have increased across the LAC region— substantially in some countries. Surveys suggest that the impact of the crisis is not only severe, but potentially long-lasting (World Bank 2021).

4. The COVID-19 crisis has widened LAC region's inequalities (World Bank 2021c). LAC is one of the most unequal regions in the world with a quarter of fiscal income accruing to the richest one percent of the population (WID.world 2021). However, inequality does not affect everyone in the same way. Combined, Indigenous people and Afro-descendants represent about one-third of the population, but well over two-thirds of these populations lives in extreme poverty. In about one-fourth of the population in the bottom, 40 percent lives in households with family members with disabilities. Sexual and gender minorities are also overrepresented among the poor and excluded, and they remain problematically absent from most statistics. Historically excluded groups, who are also more likely to remain poor over time, have lower levels of human capital accumulation and shorter lifespans (up to 30 years shorter for some Indigenous people and nearly 40 years for transgender people).

5. In addition to this ongoing crisis, climate change is one of the major risks to the region. The region is under constant threat of floods and droughts. In the Caribbean region, at least one country is hit by a strong hurricane on an annual basis. The Central America Dry Corridor —a region covering parts of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama— is affected on a yearly basis by severe droughts (Baez, Fuchs and Rodriguez-Castelan 2017). The United Nations Environment Program (UNEP) 2019 Global Environmental Outlook stated that the changes in global climate imposing pressure upon the region's systems are only expected to worsen. In the Caribbean region, climate change already contributes an additional US$1.4 billion to average annual losses, equivalent to

1.8 percent of GDP. Moreover, studies about the anticipated consequences in Brazil also suggest that the increase in the intensity and frequency of extreme weather events will affect all economic sectors, with agriculture at the top of the list (Castro, Spolador and Marin 2020). It is estimated that climate-related consequences could send an additional five million Brazilian people into poverty by 2030 (World Bank 2020c).

6. The Governments and local communities' ability to sustain LAC's precious natural capital will be key to overcoming these economic and social setbacks. LAC is the world's largest producer of ecosystem services, and home to an exceptional variety of ecosystems. It is also one of the most biodiverse regions in the world[1] with great river biodiversity. Water resources management is important in sustaining this environmental capital, which plays a key role in supporting livelihoods, achieving food security, sustaining productive sectors, and maintaining the region's biodiversity.

Rationale, Objectives, and Audience

7. This report is intended as a call for regional action to give water a more strategic role in the region's long-term socio-economic development and COVID-19 economic recovery; and to recognize water as a connector to both climate change adaptation and mitigation. Social protests for fairer water allocation in Mexico and Chile in 2019, recent political reforms in Brazil, Colombia, Dominican Republic, and increasing investments in Argentina, Perú and Central América, show that in the LAC region, there is an increasing social and political awareness of the fact that sustained socio-economic progress cannot co-exist in the presence of significant water security gaps. Water security is equally critical to the COVID-19 economic recovery. The associated deep economic and financial crisis caused by the pandemic is increasing already existing inequalities in the region. Water security in turn can also support efforts on both mitigation and adaptation to climate change. Without enhancing water security, the region will not be able to adapt, decarbonize, and be resilient to climate change and other stresses and shocks.

8. To this end, the report aims to answer three main questions: (i) why water matters, in terms of the positive and negative outcomes linked to water; (ii) what are the causes of water-related challenges; and (iii) what can be done differently to shift gears and close water security gaps. Chapter 1 of the report on "why water matters" highlights the benefits that water has brought to the region in terms of socio-economic development during the last decades, but also provides an overview of the current and potential future water security challenges that remain to be addressed. It goes on to explain the causes behind these challenges, assessing trends in the region and benchmarking progress in closing water security gaps. Chapter 2 addresses the "key constraints to closing water security gaps," summarizing the performance of water institutions in managing water, delivering services and mitigating risks, but also going deeper to analyze the causes of such performance gaps by evaluating LAC's water infrastructure stock and associated funding. It concludes with an assessment of key governance issues, to help understand what needs to be changed. And Chapter 3 of the report, "what can be done differently," ends with a series of general recommendations and reforms to increase the region's water security,

[1] Natural Resources Defense Council (NRDC), 2020. According to UNEP around 60 percent of global terrestrial life, and diverse freshwater and marine species, can be found within LAC.

aligned with the idea of "building back better" and with the aim of contributing to a more inclusive, sustainable, and resilient future. Often these reforms point to a change in paradigm needed to unlock old bottlenecks resulting from traditional conceptions in the water sector.

9. The intended audience for this report includes both national governments and regional stakeholders, as the report has a dual focus. First, it provides a series of recommendations to tackle common issues that need to be addressed at each country's national level. Second, the report intends to be a "call for regional action" for regional stakeholders, such as multilaterals and regional non-governmental organizations (NGOs) working in water to increase collaboration and create synergies in analyzing, advising, and supporting efforts that could help tackle core water security challenges and promote a stronger cooperation across the region.

Methodology

Understanding the broad dimensions of water security, defined as "the availability of an acceptable, affordable, and sustainable supply of water for health, livelihoods, ecosystems, and production; that is made available in ways that address adverse impacts on other users including future generations, the economy and the environment"— is at the core of a country´s sustainable development" requires a clear methodological approach.

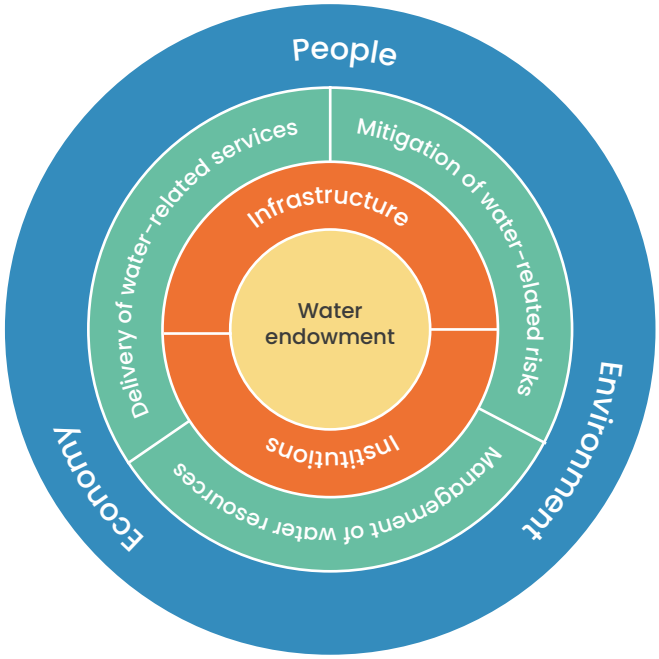
10. To answer key questions, the report draws upon the water security framework, designed by the WB to perform a comprehensive assessment of the main challenges in the LAC water sector, while providing meaningful insights for action. Understanding the broad dimensions of water security, defined as *"the availability of an acceptable, affordable, and sustainable supply of water for health, livelihoods, ecosystems, and production; that is made available in ways that address adverse impacts on other users including future generations, the economy, and the environment"*, requires a clear methodological approach. This report uses the Water Security Diagnostic Framework defined by the Bank and already applied, or being applied, in several countries (Argentina, Colombia, Indonesia, Pakistan, Peru, and Vietnam) and in the Middle East and North Africa Region.

11. The WB Water Security Diagnostic Framework is an assessment designed to analyze the economic, social, and environmental outcomes (costs and benefits) and explore their determinants (figure 1). The diagnostic of the water sector performance considers: (i) the management of the water resources; (ii) the delivery of water services; and (iii) the mitigation of the water-related risks. The performance of a country in terms of water security depends on the capacity of the sector architecture (institutions and infrastructure) to deliver enough and safe water of good quality for all users, given its natural endowment, and to protect the economy and people from water-related risks.

12. The geographical scope of this report entails the majority of the Latin America and the Caribbean region. Country scorecards are included in the Appendix for 25 countries of the LAC region,[2] where it was possible to get sufficient data on the key performance indicators related to water. These sheets indicate key challenges for each country and proposed recommendations based on the WB's involvement in the country. However, for many of the partial assessments and analysis related to the different dimensions of water security included in the main report, it was only possible to use a selected sub-set of such countries, which is variable depending on the metric evaluated. Where possible, a range of examples are provided within the region, and appropriate recommendations targeted to the specific group of countries are provided.

[2] Argentina, Belize, Bolivia, Brazil, Barbados, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Guyana, Honduras, Haiti, Jamaica, Mexico, Nicaragua, Panama, Peru, Paraguay, El Salvador, Suriname, Trinidad and Tobago, Uruguay and Venezuela.

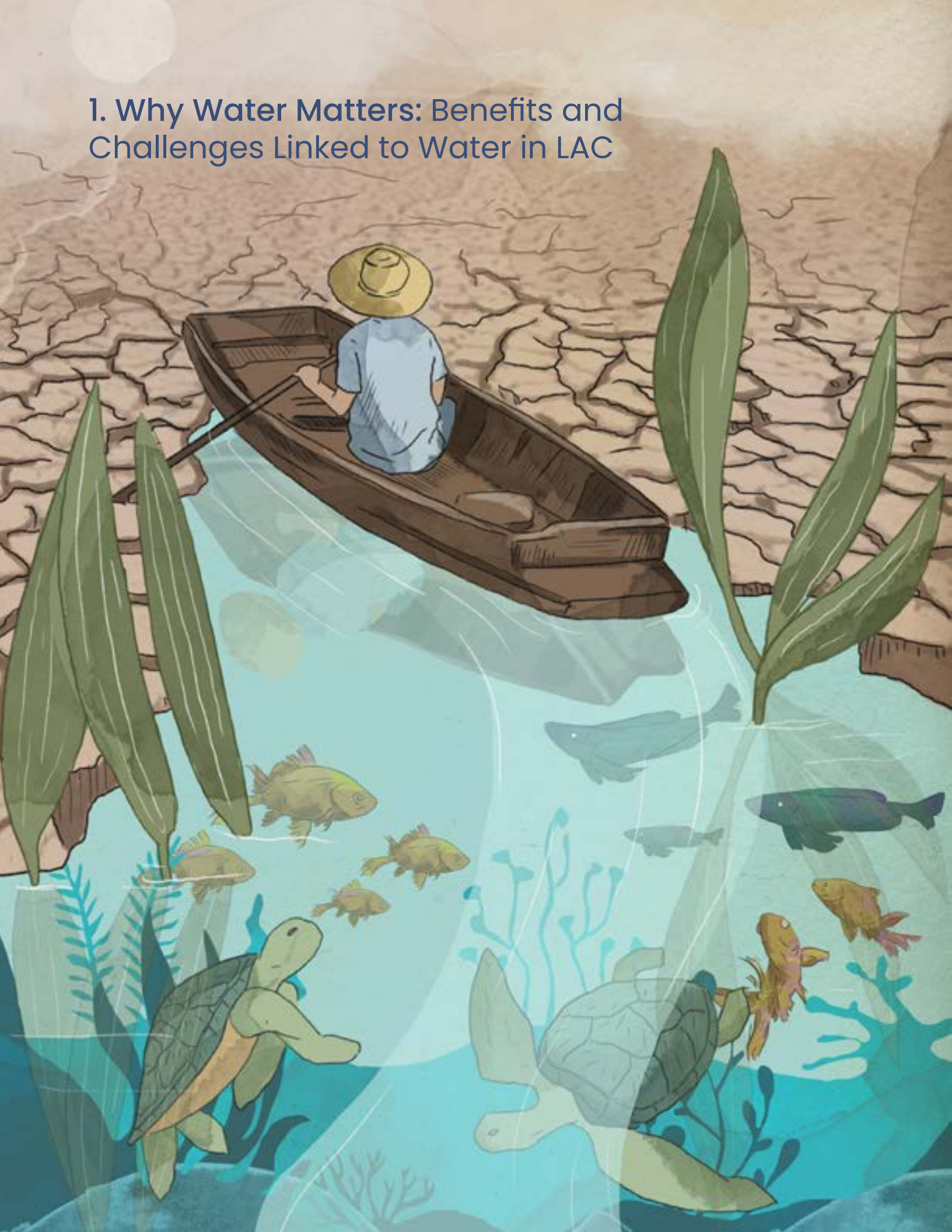
Figure 1.
Water Security Diagnostic Framework



Source: World Bank, 2021

13. This report is based on national water security assessments conducted by the WB in Argentina, Colombia, and Peru, as well as from other relevant analytical work from the Water Global Practice and the Sustainable Development Unit in Latin America. It also captures findings from studies in Bolivia, Brazil, Central America, Chile, Dominican Republic, and Mexico as well as from regional thematic analysis including "From Waste to Resource" and "Foodscapes: Re-Imagining Agriculture in Latin America," and those at the global scale such as the "Quality Unknown" and "Unchartered Waters." The report has also received valuable contributions from The Stockholm International Water Institute and a multidisciplinary team of WB staff from different Global Practices. In addition, the report acknowledges the recent and timely-relevant literature from other multilaterals and regional organizations.

1. Why Water Matters: Benefits and Challenges Linked to Water in LAC



Key chapter takeaways:

LAC region's economic growth and social wellbeing depend heavily on water.

Securing access to water in past decades has greatly contributed to the region's human capital (health, education, productivity).
Thanks to the vast amount of water endowment across the region, water-related ecosystems provide a wide range of environmental services, water and climate regulation, air purification, soil productivity, nutrient recycling, and recreation.
Having the second largest irrigation expansion potential in the world, LAC's strategic role as a food producer contributes to the region's economy, generating up to 15 percent of employment.
Hydropower provides 10 percent of the regional energy and over 45 percent of the electricity matrix (three times the world average), representing 85 percent of renewable electricity.

Important water security gaps are hampering the region's socio-economic development.

Water scarcity, alongside extreme droughts, constrain growth in Central America, Northeast Brazil, and the Andean region through economic shocks, mainly in the agricultural sector.
Pollution from domestic, industrial, and agricultural sources reduce water availability in areas of high competition for the resource.
There is a large gap in access to safely managed water supply and sanitation services, particularly in peri-urban and rural areas, resulting in recurring social concerns around inequality.
Existing irrigation and drainage services face problems of reliability and efficiency due to increasing climate variability and competition for water resources.
Existing surface water storage and hydropower infrastructures require urgent investments in rehabilitation to enhance productivity and safety, taking into consideration environmental and social trade-offs.
Floods are the most frequent hazard in LAC, affecting the most vulnerable and unprotected populations.
There are two recent stress factors that exacerbate these challenges: climate change and the COVID-19 pandemic. While climate change gradually impacts water availability patterns (seasonally and geographically), the COVID-19 pandemic has shed a light on existing water security challenges against future shocks.

14. Home to 646 million people (World Bank 2021e), LAC has achieved important economic and social progress in past decades. Economic growth reached an average annual rate of 3.8 percent over the period 2003-12, followed by a more stagnant period of growth during 2013-19 (World Bank 2021e) and a crisis triggered by COVID-19 in 2020. Early development contributed to poverty reduction and expansion of the middle class, more than halving the proportion of people living in extreme poverty between 2003 and 2012. The share of the LAC population living below the poverty line of US$5.50 per person per day also fell from 44.7 percent to 26.7 percent (World Bank 2021e). Today, these economic and social gains have been put at risk by recent crises and require rethinking development paradigms to construct a more resilient and sustainable society.

15. A large part of the population in LAC remains vulnerable to poverty. Many Latin Americans escaped poverty during the decade of strong economic growth in the early 2000's, but still remain vulnerable to poverty. Most of the new non-poor did not move directly to the middle class and face economic insecurity putting them at risk of experiencing spells of poverty in the future. Moreover, the COVID-19 pandemic has increased inequalities and many of those who escaped poverty are prone to fall back into it (World Bank 2020f). When taking all the LAC countries into account, the economic contraction across the region implies that unemployment could reach an estimated 47 million people (ECLAC and ILO 2020).

Water has played an important role in improving minimum standards of health and enhancing productive activities. The improvement of water supply and sanitation access during the last three decades had a direct impact on reducing water-borne diseases and deaths of children under five.

16. Water has had an important role to play in the development of the region. Water has played an important role in improving minimum standards of health and enhancing productive activities. The improvement of water supply and sanitation access during the last three decades had a direct impact on reducing water-borne diseases and deaths of children under five. Access to water resources has also fueled LAC's agricultural, industrial, and power sectors, making the LAC region responsible for 14 percent of the global agricultural production (OECD/FAO 2019), and is the world's largest net food-exporting region (World Bank 2020b). Moreover, over 45 percent of the region's electricity matrix (IEA 2021) is generated through hydropower, a percentage that is greater than the world's average of 16 percent (EIA 2021), promoting low carbon growth.

17. If not managed well, water can become a limiting factor to social and economic betterment in the region. It is estimated that approximately 166 million people in LAC still do not have access to safely managed water supply and 443 million do not have access to safely managed sanitation systems[3] (WHO/UNICEF 2017). As of 2019, 150 million people in LAC live in high water scarce areas[4] where competition for water is high among the different uses. With over 70 percent of untreated wastewater discharged and limited control on agrochemicals, pesticides, and industrial effluents, water pollution in the region is increasing, further limiting the availability of water for domestic and productive sectors and hindering LAC's valuable biodiverse capital. In addition, floods affect more than 1.8 million every year and droughts cause significant economic damage, impacting people's livelihoods and assets and increasing their vulnerability.

[3] Safely managed drinking water services are those located on premises, available when needed and free from contamination. Safely managed sanitation services means that excreta are safely disposed of in situ or treated off-site.

[4] Water withdrawals are higher than 40 percent of available water, based on the World Resources Institute (WRI)'s Baseline Water Stress Indicator. Water withdrawals include domestic, industrial, irrigation, and livestock consumptive and non-consumptive uses. Available renewable water supplies include the impact of upstream consumptive water users and large dams on downstream water availability.

18. Most importantly, climate variability and change are an increasing constraint to the region's inclusive and sustainable development. Historic climate data trend analysis shows increasing scarcity and higher variability in different geographical regions within LAC. Future projections, with a moderate climate change scenario signal a lower rainfall, which lead to strong reasons to worry if adaptation plans are not in place or not implemented in time with the expected increase in demands (Chapter 1).

1.1 Water's Role in a Socio-economic and Environmental Context

Water as a key asset for the Region's Development

19. Water services play a critical role in wellbeing and economic development. Access to water and sanitation is closely tied to the World Bank's Human Capital Index (figure 2), which is considered a measure for a country's development potential.[5] A reliable and safe drinking water supply and sanitation services improve public health and increase capacities for education and economic activities. As opposed to deficient water services, which have a negative effect on wellbeing and hamper development.

20. Increased access to water supply and sanitation services over the past three decades has resulted in a drop in diarrheal diseases, improving the living conditions of a large percentage of the population, especially in urban areas.[6] Productivity ratios measured as the disability-adjusted life year (DALY) due to WASH diseases between 2010 and 2019 over the entire life expectancy are still low in countries with higher incidence of diarrhea (as shown in the graph below). Nevertheless, there have been reductions in productivity losses attributed to WASH.[7] In addition, the WASH-related neglected tropical diseases (NTD) across the 18 countries are estimated to account for 9.2 million DALYs (IHME 2015). Chagas, dengue, dracunculiasis, echinococcosis, foodborne trematodiases, human African trypanosomiasis, onchocerciasis, rabies, schistosomiasis, soil-transmitted helminthiases, cysticercosis, trachoma, and yaws are WASH-related NTDs.

21. Having a reliable supply of water, in adequate quantity and quality, is fundamental for all economic sectors in LAC and reduces investment risk. These include agriculture, energy, manufacturing, mining, and tourism, which rely heavily on the availability of water supplies in various degrees. Many sectors have small demands for water but offer high value-added. Thus, water is critical for supporting economic growth prospects.

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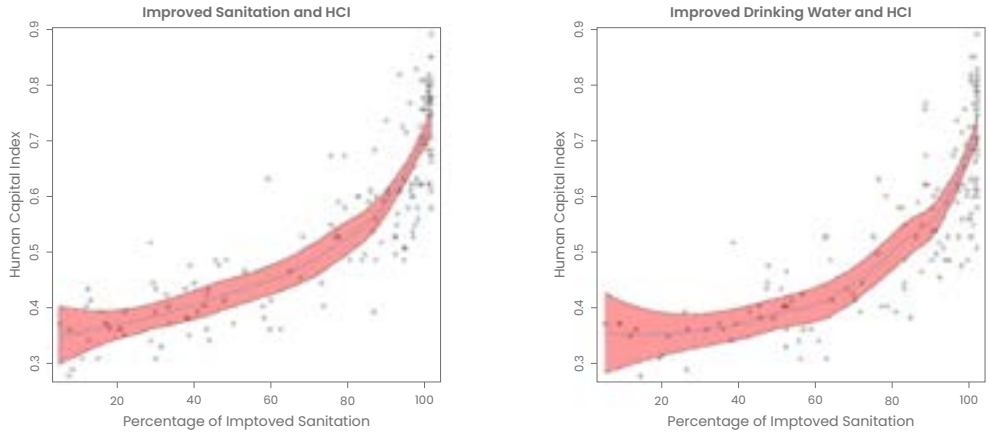
[5] The Human Capital Index is a measure of a country's development potential. It combines five measures of human capital into a single index to quantify the contribution of health and education to the productivity of the next generation. The five measures are the percentage of stunting of children under age 5, percentage of children surviving past age 5, expected years of schooling by age 18, harmonized test scores, and percentage of 15-year-olds who survive until age 60.

[6] Own analysis from Joint Monitoring Program and WHO data shows that 10 points of basic coverage in drinking water and sanitation services in LAC implies an increase each year of 126 years of life per 100,000 inhabitants.

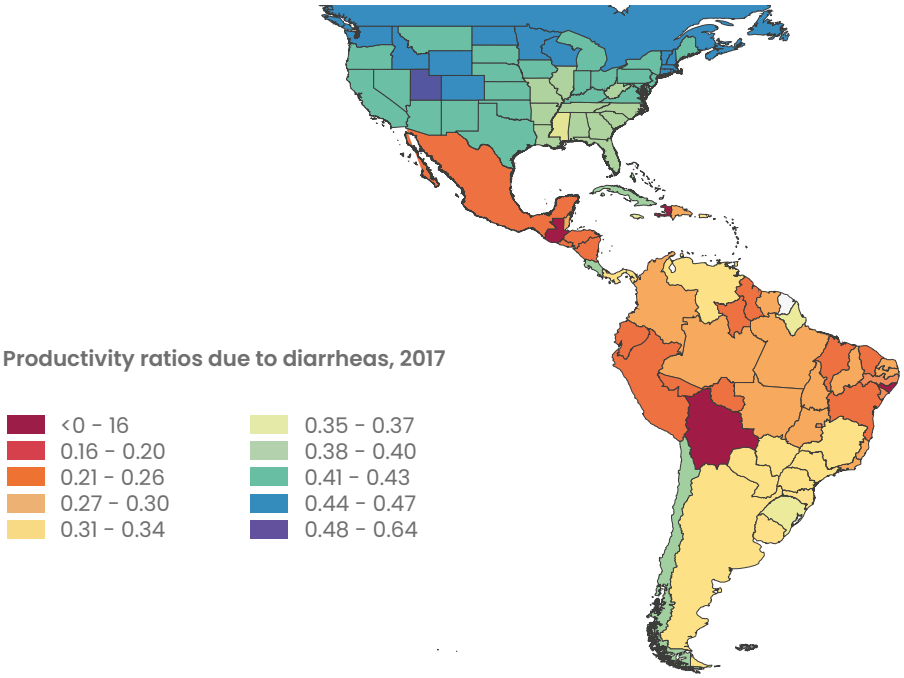
[7] The potential productivity gains in due to a decline of WASH-related DALYs are in part attributed to improvements in WASH coverage. A study conducted in The Lancet (2017) showed that in the majority of LAC countries, WASH-related DALY reductions were induced by: (i) an increase of WASH coverage, (ii) a reduction in malnutrition rates, and (iii) changes in underlying causes of WASH-related diseases (e.g., better healthcare). Other factors such as population growth and aging also play a role in shifting this indicator over the last 10 years.

Figure 2.
Human Capital Index: Coverage of Improved Sanitation and Improved Drinking Water



Source: Andres et al. 2018; Human Capital Index from World Bank 2018; improved sanitation and improved drinking water from Joint Monitoring Programme, 2015. (Andres, et al. 2018)
Notes: Left: Human Capital Index and the coverage of improved sanitation. R2 value for the linear regression model is 0.6898. Right: Human Capital Index and improved water supply. R2 value for the linear regression model is 0.6201.

Figure 3.
Productivity Loses Due to Diarrheas



Source: Own calculations estimated based on GBD 2016 Disease and Injury Incidence and Prevalence Collaborators, 2017.
Notes: Higher number means less productivity losses. Countries like Haiti, Bolivia, Guatemala, Peru, Guyana, and Honduras experienced a decline in productivity ratios predominantly due to increases in life expectancy. Other countries like Brazil, Ecuador, Paraguay, Mexico, and Colombia showed a decline in productivity loss due to both an increase in life expectancy and a decline in WASH-related DALYs. Most Caribbean countries showed mixed results in terms of changes in DALY, life expectancy and productivity ratios due to WASH diseases.

22. Water is critical for food security, locally and globally, with the LAC region being a major agricultural producer. Millions of households in LAC depend on agriculture for their income, as well as their subsistence. Inland freshwater fishing is also an important source of income and food for many people. Agriculture accounts for 13.5 percent of total employment and 4.7 percent of the GDP in the LAC region[8] (World Bank 2021e). If jobs from derived food industries are considered, the contribution of this sector to employment accounts for an additional 10 to 15 percent of all jobs (World Bank 2020b). In total, 173 million hectares in the LAC region are cultivated and 536 million hectares are used as pastures (FAO 2017). Irrigation plays an important role in supporting agriculture, with approximately 25 million hectares of land equipped for irrigation, a significant increase over the last decades (FAO 2017). Irrigation is particularly important for boosting productivity, and for supporting exports and employment, contributing substantially to the productivity of drier lands, especially in the regions of western Argentina, Chile, North and Central Mexico, and Peru (World Bank 2020b). In Chile, for example, 11 percent of the total exports in 2019 were mainly due to irrigated agricultural products, and 20 percent of the country's GDP is mostly linked to agrobusinesses[9] that rely on irrigation systems and water access. In Argentina, irrigation represents five percent of the cultivated area but accounts for 30 percent of agricultural production (FAO and PROSAP 2015). In Dominican Republic, irrigated agriculture represents 26.8 percent of the cultivated area and accounts for 5 percent of the agricultural value to GDP; in Peru 53 percent of the cultivated area represents 7 percent of the agricultural value to GDP (See Regional Water Security Diagnostic World Bank 2021).

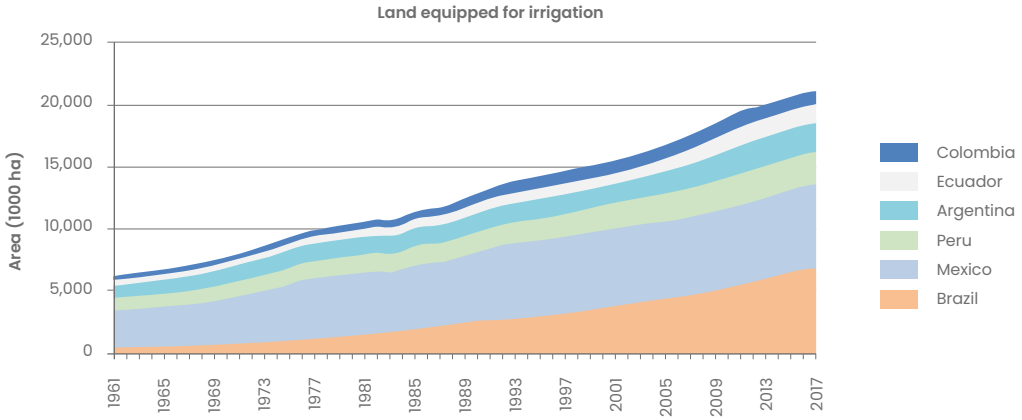
Between 2010 and 2050, the harvested irrigated area in LAC is projected to increase by 35 percent. In comparison, irrigated area is projected to increase by 12 percent in Eastern Asia and the Pacific, by 22 percent in the Near East and North Africa, by 30 percent in Southern Asia, and by more than 100 percent in Sub-Saharan Africa

23. The potential to scale up irrigation in the LAC region is the second highest in the world, just behind Sub-Saharan Africa. Between 2010 and 2050, the harvested irrigated area in LAC is projected to increase by 35 percent. In comparison, irrigated area is projected to increase by 12 percent in Eastern Asia and the Pacific, by 22 percent in the Near East and North Africa, by 30 percent in Southern Asia, and by more than 100 percent in Sub-Saharan Africa (FAO 2020). Despite this potential, growing tensions often arise as water use for agriculture competes with water supply for human consumption and other activities. In Chile, for example, water users enjoy proprietary rights, which allows them to allocate water resources for different purposes, mainly for irrigation. However, these competing interests have often resulted in conflicts over the resource across agricultural, industrial, and mining sectors.

24. Water is not only a critical input for industrial production, but also important for smaller businesses and firms, critical for creating jobs and achieving sustainable growth. On average, firms in LAC experience a 14 percent water supply insufficiency (figure 5). Productivity and sales in firms, particularly small and informal businesses, is impaired by unreliable water services. According to Damania, et. al., 2017, "water outage in a typical month results in an average loss of 8.7 percent of sales in a formal firm, and 34.8 percent in informal firm." Many firms in LAC are experiencing water insecurities affecting their productivity and competitiveness. In Peru, a one percentage point increase in access to improved water supply generates a 3.8 percent increase in the global competitiveness index; a one percentage point in access to improved sanitation services generates an increase of 2.3 percent in the same index.

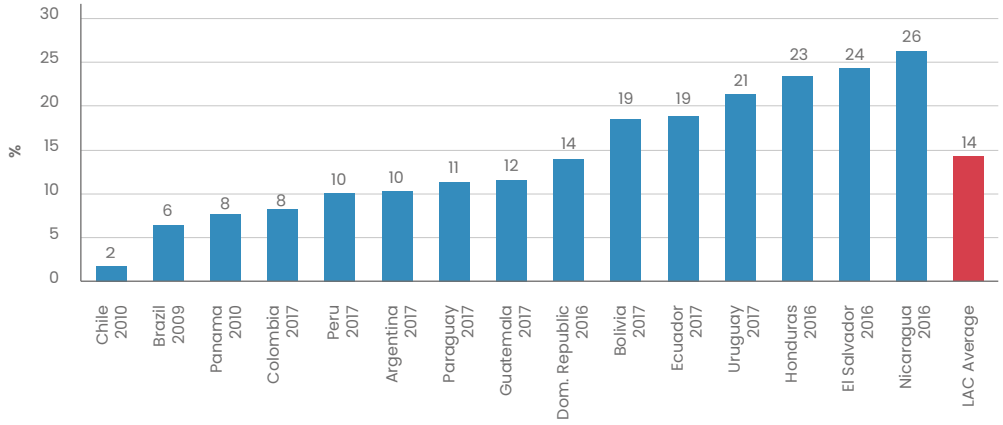
[8] Accounts for agriculture, forestry, and fishing value-added (percentage of GDP) in LAC. Also available in https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=ZJ accessed in January 2021.
[9] This figure includes the contribution of processed fruit, juices, salmon, wine, paper, and chemicals.

Figure 4.
Evolution of Land Equipped for Irrigation in Major Irrigation Countries



Source: FAOSTAT, 2017

Figure 5.
Percentage of Firms with Water Insufficiencies

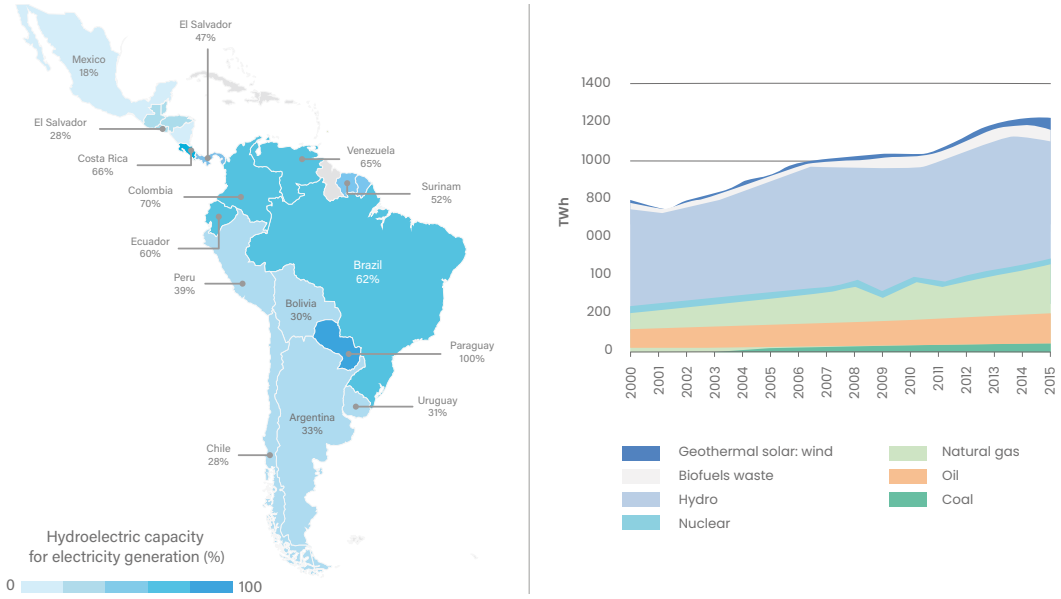


Source: World Bank estimates, 2020.

25. In addition, the LAC region is a world leader in hydropower generation. Hydropower accounts for 45 percent of the total electricity supply in the LAC region, which is significantly higher than other regions.[10] Brazil has just surpassed China as the country with the largest electricity produced from hydropower with a total 70 percent of the country's energy generation coming from hydropower. Hydropower is also the main reason why the region has more than one-quarter of its primary energy coming from renewables, twice the global average, making LAC one of the greenest regions, with the lowest greenhouse emissions of the planet in absolute and per capita terms (World Bank 2021d).[11]

[10] Africa 16 percent, Asia 16 percent, North America 13 percent, and Europe 17 percent (IHA 2020).
[11] TInternational Renewable Energy Agency (IRENA), available in www.irena.org/lac accessed in January 2021; and Inter-American Development Bank (IADB), 2018, confirmed by world carbon dioxide emissions 2019 data, available in www.statista.com/statistics/205966/world-carbon-dioxide-emissions-by-region/ accessed in January 2021.

Figure 6.
Hydropower Installed Capacity as a Share of Total Electricity Generation and Electricity Generation by Type



Source: Left: Ubierna, Alberti and Alarcon Rodriguez, 2020; Right: IEA, 2021.

26. It is estimated that LAC has developed approximately 25 percent of its hydropower potential, which has been assessed by some sources at more than 600 gigawatts. This represents about 18 percent of the world's hydroelectric potential. In fact, Venezuela, Colombia, Ecuador, Peru, and Bolivia account for three-quarters of this potential.[12] However, most of the LAC countries have developed only between 10 and 30 percent of their hydroelectric potential (Rodriguez and Daniel 2018). Hydropower can complement different sources of renewable energy such as solar and wind, strengthening the overall system's resilience through flexibility and storage services. It not only provides grid stability services, but its capacity to respond rapidly to any electricity demand fluctuation plays a critical role in pushing the green energy transition forward (Rodriguez and Daniel 2018) (Rodrigez 2019). Despite the growth potential in the LAC region, upholding the use of hydropower as a base source of energy across LAC continues to decline and more relevance is being given to solar, wind, or gas. This is because hydropower projects, especially large ones, can have important social and environmental impacts, and sometimes face opposition opposition from social and environmental groups. They also require very large investments that are not always viable in contexts of economic and financial instability. Furthermore, uncertainties linked to climate variability exacerbates these challenges.

27. In LAC, dams are mostly used for hydropower; the second highest purpose is irrigation (Table 1). The potential to increase hydropower capacity in the region is significant (Figure 7). What remains interesting is the increasing need to consider multipurpose developments aiming to provide other benefits such as

[12] Ubierna, Alberti and Alarcon Rodriguez 2020, based on data from the Latin America Energy Organization. This reference clarifies that "this potential value should not be taken as absolute, but as a reference order, since the potential estimates of some countries may be more precise than others, depending on the degree of study, and the methodology used for the inventory of the hydroelectric resource."

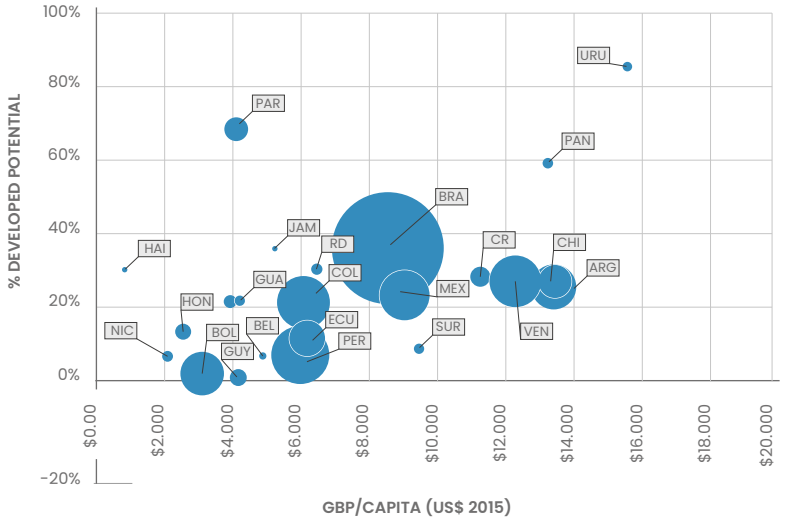
flood control, water for irrigation, water supply in urban areas and river transport, and job generation. The agenda of multipurpose dams has large room for development in many LAC countries (World Bank 2021b).

Table 1.
Distribution of Dams by Purpose and Region

Primary	East Asia and Pacific	Europe and Central Asia	Latin America and the Caribbean	Middle East and North Africa	North America	South Asia	Sub Saharan Africa	Total
Irrigation	7,104	2,192	769	1,032	1,118	4,921	1,133	18,269
Hydropower	1,496	2,447	1,048	51	1,893	170	131	7,236
Water supply	720	1,532	265	138	1,657	65	344	4,721
Flood control	1,023	448	74	135	2,770	4	7	4,461
Other	50	351	336	119	2,951	-	50	3,857
No data	19,198	140	141	32	46	221	196	19,974
Total	29,591	7,110	2,633	1,507	10,435	5,381	1,861	58,518

Source: Left: Ubierna, Alberti and Alarcon Rodriguez, 2020; Right: IEA, 2021.

Figure 7.
Hydroelectric Potential by Country



Source: Ubierna, Alberti and Alarcon Rodriguez, 2020.

28. Water is also an essential resource for mining activities in LAC, but mining and exploration activities need to be monitored to avoid negative environmental and social impacts. The LAC region produces 45 percent of worldwide copper, 51 percent of silver and, in general, more than 25 percent of metals (Willaarts, et al. 2014); it has 61 percent of the reserves for lithium, necessary for the development of electric car batteries (ECLAC 2018), thus creating high demands for water. In some LAC countries, mining—one of the largest users of water—is responsible for high contributions to GDP, accounting for over 10 percent of GDP in countries such as Venezuela, Ecuador, Bolivia, Venezuela, and Chile (Buytaert and Breuer 2013). In Chile alone, it is estimated that for every million dollars of investment in new mining developments, approximately one liter per second of additional

water resource is required (Peña 2006). Although exploration and mining are subject to sharp economic cycles, there is still the prospect of further growth, given the increasing demand for raw materials. At the same time, studies point to an increase in conflicts associated with mining operations since 2000, especially given the general rise in large-scale protests globally associated with land, environmental, and social issues (Andrews, et al. 2017).

29. Water resources compose a fundamental element of developing the region's sustainable tourism potential. Tourism represents significant shares of the GDP and employment in LAC. In 2019, this sector accounted for 42 percent and 10 percent of goods and services in the Caribbean and Latin America, respectively (Mulder 2019). Since tourism activities rely heavily on natural resources, ensuring access to drinking water, adequate sanitation, and wastewater treatment, as well as preserving water bodies for recreational activities, are critical conditions for spurring tourism that will fuel the region's economy.

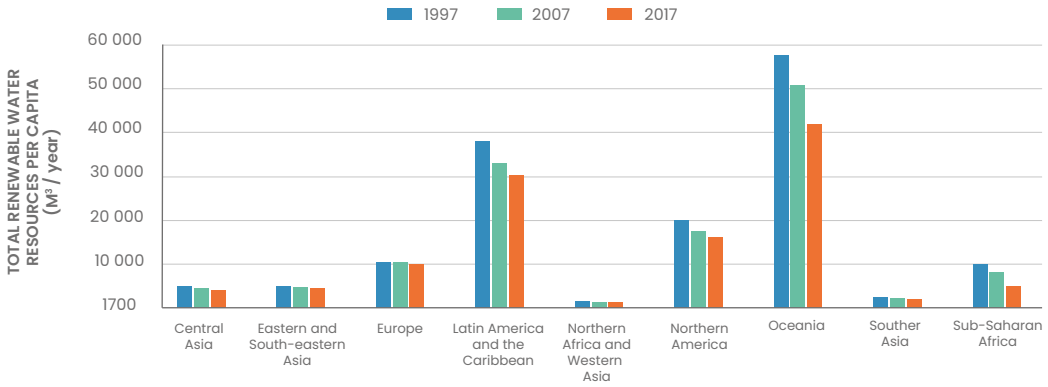
30. Water resources are integral to sustaining ecosystem services and biodiversity, which provide fundamental value to human welfare, play a critical role in shaping global weather patterns, and are increasingly important for coping with expected effects of climate change (World Bank 2020b). Latin America is one of the most biodiverse regions in the world[13] with a complex tapestry of natural contrasts. The region contains close to 800 million hectares of forested areas, 570 million hectares of wild savannas, and 700 million hectares of productive lands (Siikamäki, et al. 2015). Latin America also has great river biodiversity, as it is the third region after Asia and Africa in number of inland fish species, with close to 1,000 (IUCN 2010). Inland fishing contributes to local economies in many of the LAC countries. While inland fisheries account for only 5.12 per cent of the catch worldwide and have a relatively lower importance compared to other regions, they contribute to food security and create employment and income, supporting the livelihoods of the rural populations, in particular the Indigenous people[14] who live along major rivers and lakes.

[13] NRDC, 2020. According to UNEP around 60 percent of global terrestrial life, and diverse freshwater and marine species, can be found within LAC.
[14] E.g., the establishment of the Alliance of Central American Indigenous Fishers in 2018 in San José, Costa Rica.

1.2 Latin America and the Caribbean's Rich Water Endowment

31. The large benefits from water previously illustrated could not have been achieved without LAC´s great water endowment. LAC is one of the most water-rich regions in the world, accounting for 15 percent of global land area, 10 percent of world population and 29 percent of the planet's precipitation. LAC countries receive an average annual precipitation of 1,780 millimeters (mm), which is approximately two-to-three times the precipitation of the United States (715 mm) or China (645 mm). Consequently, water availability per person in LAC is 21,300 cubic meter per person per year (m³/person/year, four times the world's average (5,700 m³/person/year) and more than 10 times the threshold considered for water stress (1,700 m³/person/year) (Figure 8).

Figure 8.
Total Renewable Water Resources per Capita

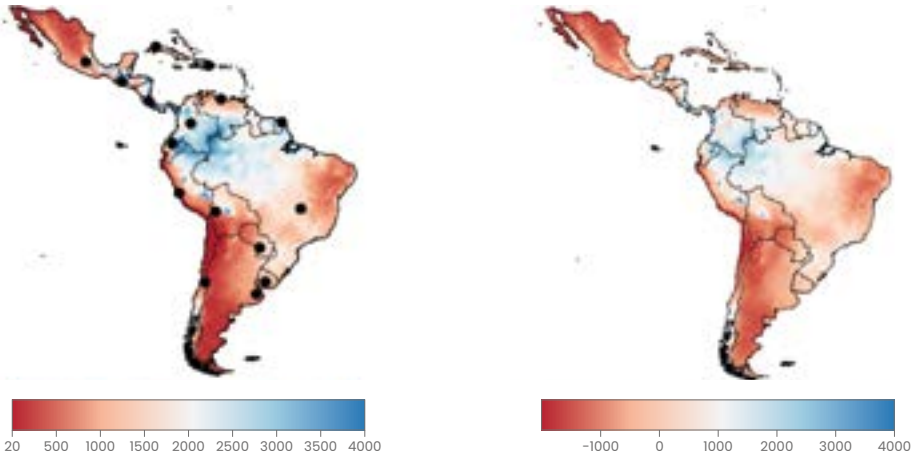


Notes: Average renewable freshwater resources per person are measured in cubic metres per person per year. Population data refer to the World Population Prospects: The 2019 Revision from the United Nations Department of Economic and Social Affairs (UN DESA). Oceania includes Australia and New Zealand.
Source: FAO elaboration based on FAO. 2021 and UN DESA 2019

32. However, water resources are unequally distributed in space and time. The general rainfall abundance can mask areas at the subnational scale where there is high water stress, and there is significant seasonal variability in many areas of the region.

Geographical variability: Several important cities and areas of intense economic activity are located in regions with limited water resources. Comparison of water availability and water demand at a catchment scale shows significant baseline water stress in western and northern Argentina, central Chile, the coastal regions of Ecuador and Peru, the Dominican Republic, Cuba, and central and northern Mexico. Regional hot spots include coastal Peru, north-east Brazil, Mexico City, western Argentina, and La Paz and El Alto in Bolivia (Figure 9). In addition, there are significant imbalances between the demand for water and water resources availability (box 1). The catchments of Valle de Mexico, South Atlantic and Río de la Plata, for example, concentrate around 40 percent of the region's population but only 10 percent of the water resources. In the case of Peru, 65 percent of the population lives in areas which have only 2 percent of the nation's water resources (Cosgrove and Rijsberman 2000).

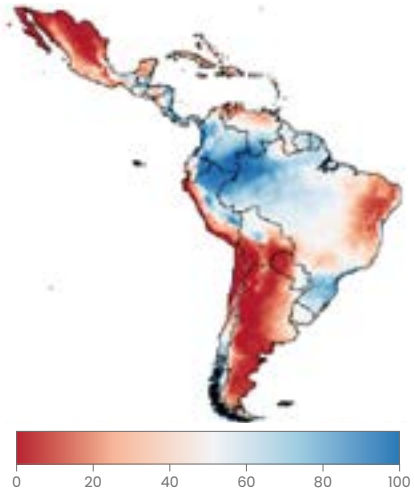
Figure 9.
Average Annual Precipitation and Hydrological Balance



Source: Own calculations based on TerraClimate data.
Note: Left: Average annual precipitation (millimeters). Right: Basic hydrological balance (precipitation-potential evapotranspiration) (millimeters, annual average, 1961-2019).

Temporal variability. Rainfall distribution is very irregular during the year in most areas of the region, and 36 percent of the area in the region is considered arid. Analyzing the percentage of months per year with net hydrological deficit shows that there are large areas where scarcity lasts more than 80 percent of the time, e.g., Mexico, coastal areas of Peru and Chile, and large areas in Argentina (Figure 10). The region comprises the driest desert in the world with zones practically devoid of precipitation. In the case of the Central America Dry Corridor, intra-annual seasonal variability can pose a threat to over 1.9 million small scale farmers.

Figure 10.
Percent of Months with Hydrologic Balance Deficit



Source: Own calculations based on TerraClimate data, 1961-2019.
Note: Areas in red with Potential Evapotranspiration (ETP) greater than Real Evaptoranspiration (ETR) imply that natural water available is not sufficient to meet plant demands.

Box 1. Water and Population Asymmetries: Mexico, Peru, and Venezuela

Many Latin American countries show a significant disparity between water resources availability and the population distribution. For example, in Mexico, 77 percent of the population, 84 percent of the economic activity and 82 percent of the irrigated land is located in the central and northern plateaus, some 1,000 metres above sea level. In contrast, 72 percent of water availability occurs in the south and below that altitude. Another example is Venezuela, where 90 percent of population and economic activity is located in the north of the country with less than 10 percent of water availability. However, most of the water availability is found south of the Orinoco River away from the northern coast. And Peru has the most startling case. Rainfall in the Peruvian part of the Amazon basin, which is home to 30 percent of the country's population, accounts for 97.5 percent of the country's surface water. Conversely, the Pacific basin hosts 65 percent of the population and produces only 1.8 percent of the country's water resources. Rainfall in the capital city, Lima, is 10 millimetres per year or lower. This asymmetry makes the most economically dynamic regions of Peru severely water stressed (Willaarts, et al. 2014).

Importance of Transboundary Resources

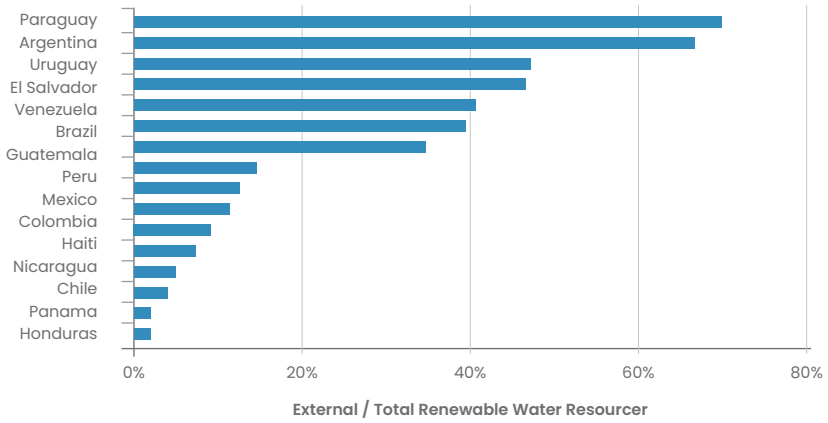
33. Two of the five largest river basins on earth and two of the 10 longest rivers are in LAC. The region also comprises three of the world's 12 biggest transboundary aquifer systems (Amazonas, Guarani and Yrendá-Toba-Tarijeño). The Amazonas River alone generates about 50 percent of the region's total runoff, with net mean annual water availability of about 6695 km³ (Figure 11), and a continuous discharge over 200,000 m³/s.

Figure 11.
International River Basins and Transboundary Aquifers

Source: Left: International river basins adapted from UNEP-DHI and UNEP, 2016; Right: Transboundary aquifers IGRAC and UNESCO-IHP, 2015. (2015)

34. For many countries, external water resources represent an important share of the total renewable water resources, making transboundary water resources management a matter of growing importance, especially under the future climate change threats. For example, the share of external water resources to the total renewable water resources for Paraguay, Argentina, and Bolivia is as high as 70 percent, 67 percent, and 47 percent, respectively (figure 12).

Figure 12.
Dependency Ratio: External Total Renewable Resources



Source: FAO Aquastat, 2016

LAC's Water Sensitive Assets

35. Surface water bodies include sensitive hydrological environments such as wetlands, paramos, and glaciers. Across the LAC region, 210 Ramsar Sites[15] are protecting 600,000 km² of wetlands with a variety of ecosystems such as mangrove forest, swamp forest, flooded savannah and forests, marshes, and peatlands (Ramsar 2020). Wetlands play a major role in the water cycle by receiving, storing, and releasing water, regulating water flows and connecting other water ecosystems (Ramsar Convention on Wetlands 2018). Despite the high ecosystem services and economic values estimated for wetlands, they are extremely threatened and at risk of disappearing (Navarro, et al. 2020).

36. Glaciers play an important role in the hydrology of the Andes, especially in arid and semi-arid regions. They do so by storing water during colder periods and releasing meltwater during drier periods, acting as an important buffer for human settlements and natural ecosystems (Buytaert, et al. 2017). Glacial meltwater is a critical water resource, especially in the Andean highlands of Bolivia, northern Chile, and southern Peru,[16] which are hotspots of water stress

[15] The Ramsar Site Network brings together those wetlands considered of international importance within the framework of the Convention on Wetlands.
[16] The tropical Andean encompass some major population centers, such as Cuzco in Peru and La Paz and El Alto in Bolivia. An estimate of the monthly maximum contribution of glacial melt water to available water supply during a normal year found that glacier melt contributed to 5 percent of available water supply in Quito (Ecuador), 61 percent in La Paz (Bolivia) and 67 percent in Huaraz (Peru), whereas the monthly maximum contribution during a drought year to available water supply would increase the dependency to approximately 15 percent in Quito, 85 percent in La Paz and 91 percent in Huaraz (Buytaert, et al. 2017).

because of their semi-arid climate and marked seasonality (Schoolmeester, et al. 2018). Glaciers in the Andean region will continue to retreat, leading to a long-term reduction in dry season river discharge from glacierized catchments (Vuille, et al. 2018). The most rapid retreat is especially pronounced in the low altitude small glaciers in the Tropical Andes (Venezuela, Colombia, Ecuador, and Peru) (Rabatel, et al. 2013). These changes, that in the tropical Andes are added to natural El Niño-Southern Oscillation (ENSO) variability (Veettil, et al. 2017), have the potential to increase water resources scarcity and make availability more unpredictable, having far-reaching consequences for the environment and livelihoods of millions of people in the Andean region (Schoolmeester, et al. 2018).

Figure 13.
Population and Water Risk in Andean Countries

Source: Schoolmeester, et al., 2018.

37. In addition to surface water resources, groundwater resources offer the potential to make water supply systems more resilient against natural variations of availability. However, regulation and better information are needed to avoid over-abstraction and pollution of groundwater. Groundwater storage is particularly attractive given its low seasonal variation and is comparatively better protected from domestic, agricultural, and industrial pollution sources compared to surface water. The conjunctive use of surface water and groundwater increases the reliability of water supply systems, as surface sources can be used when available while groundwater can be used during dry periods. Groundwater, when properly managed, is also a resilient resource that offers the potential for storage, and for maintaining supply during emergency situations, such as during extreme droughts.

38. At present, groundwater resources have not yet been sufficiently developed or managed in many of the LAC countries, given the general lack in groundwater monitoring and technical studies. This has led to important knowledge gaps around natural recharge, rate of abstraction, water quality and flow dynamics, which together with inadequate governance have consequences including overexploitation and pollution of aquifers and conflicts between different water uses. For example, in arid areas of the Andean Region —constituted by coastal Peru, northern Chile, south-western Bolivia and north-western Argentina— groundwater abstraction not only takes place to supply the mining industry that extracts metal ores and brine in salt lakes ('salares'), but also for middle-sized agricultural production, often causing social conflict among farmers.

In the last three decades, water abstraction has doubled across LAC at a rate much higher than the world average. In this region, the agricultural sector (especially irrigated agriculture), uses most of the water, accounting for 70 percent of extractions (consumptive and non-consumptive uses).

39. In Mexico, for instance, 102 of the nation's 643 aquifers are overexploited because they comprise the main sources of water for 65 percent of the population. Meanwhile in Central America, over-exploitation remains a major problem in multiple metropolitan areas because groundwater is used primarily by municipal providers due to the low quality of surface waters caused by land-use changes, poor urban planning and the lack of water storage (Ballestero, Reyes and Astorga 2007). This situation is more evident in Guatemala, parts of Honduras, and El Salvador, where the indiscriminate use of energy subsidies deeply affect groundwater management and aquifer levels drop at a rate of one meter per year. The large amounts of water withdrawal further exacerbate land subsidence in places like Mexico City.

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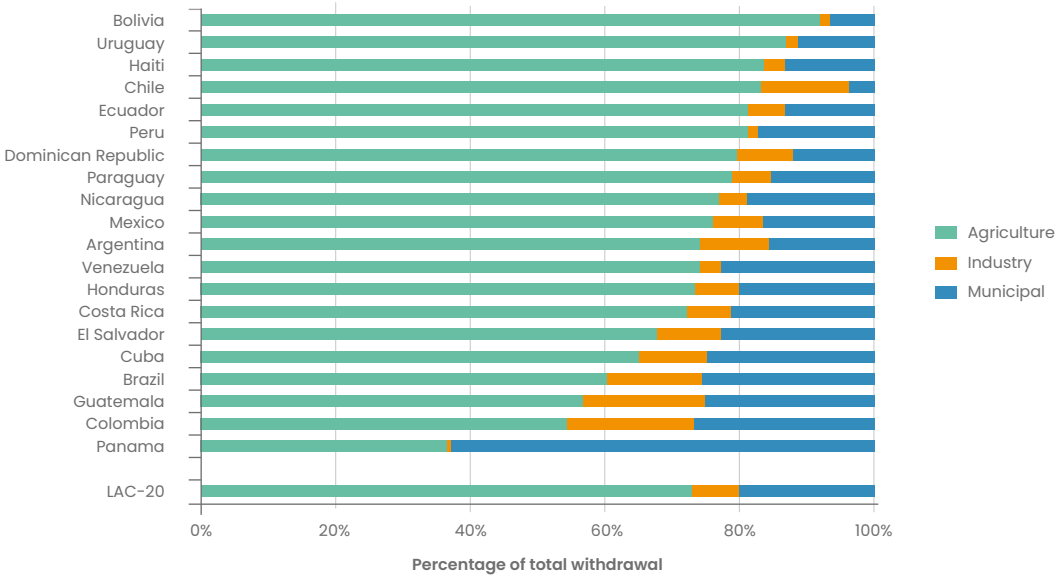
40. Groundwater depletion and saltwater intrusion also lead to degradation of surface water sources. In some coastal regions, aquifers experience lateral and vertical saline intrusion, reducing the overall availability of freshwater. To make matters worse, this affects the sustainability of small springs and groundwater sources that sustain human settlements and places of significant ecological value, such as the high-altitude wetlands ('bofedales') (Willaarts, et al. 2014). Thus, the protection of source water in diverse ecosystems is an important step towards implementing better regulations that promote groundwater conservation across the region.

1.3 Water Capital at Risk: Security Challenges and Costs

1.3.1 Growing Water Demands

41. Pressure over LAC's water capital is mounting as demands from competing users grow. In the last three decades, water abstraction has doubled across LAC at a rate much higher than the world average. In this region, the agricultural sector (especially irrigated agriculture), uses most of the water, accounting for 70 percent of extractions (consumptive and non-consumptive uses). This is followed by extraction for domestic use, which is 20 percent, and industry (including mining and hydropower), which is 10 percent (FAO 2019).

Figure 14
Water Withdrawal by Use



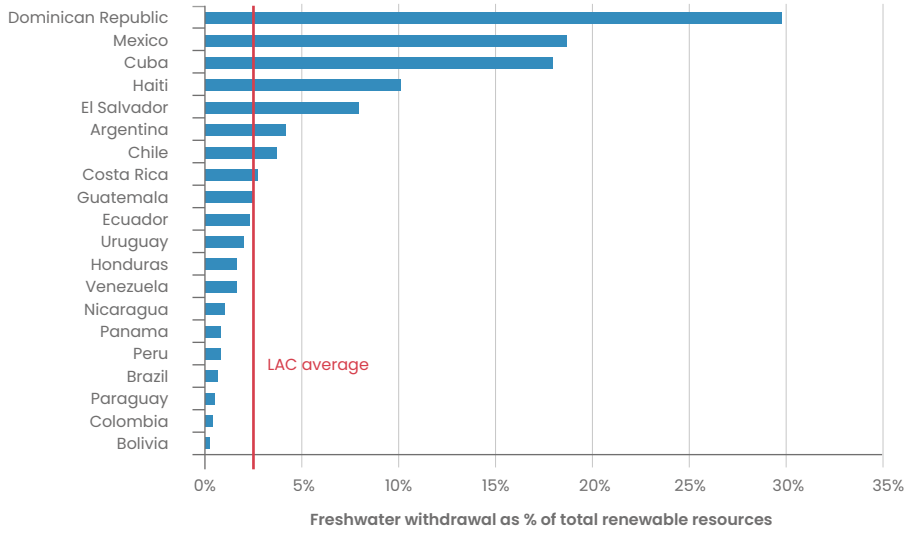
Source: FAO Aquastat, 2016

42. Irrigation is by far the largest water user, and surface water the most common source. As in many other areas of the world, water for irrigation is the largest consumptive water use in the region. This is the case for all the countries except Panama, where domestic water and the Panama Canal are the predominant users.

43. Although LAC countries are using only a small percentage of their total water endowment on a national scale, the real challenges arise at subnational and temporal scales. The average percentage of freshwater withdrawal (2.4 percent of available resources) is significantly below the general threshold of initial water stress (25 percent) and much lower than the percentage of withdrawal of other world regions (Southern Asia, 71 percent, Western Asia, 54 percent, North America, 19 percent). The countries with the highest withdrawal rates are the Dominican Republic (30 percent), Mexico (19 percent) and Cuba

(18 percent). Yet the problems of scarcity arise at the subnational scale in several regions of the continent and are further exacerbated by seasonal and inter-annual variability

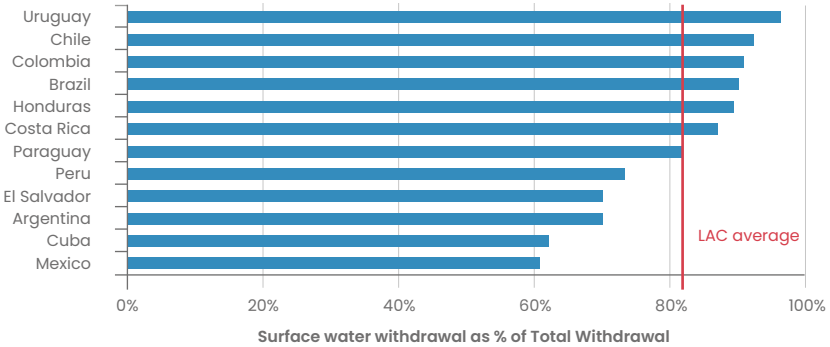
Figure 15.
Freshwater Withdrawal as a Percentage of Renewable Resources



Source: FAO Aquastat, 2016

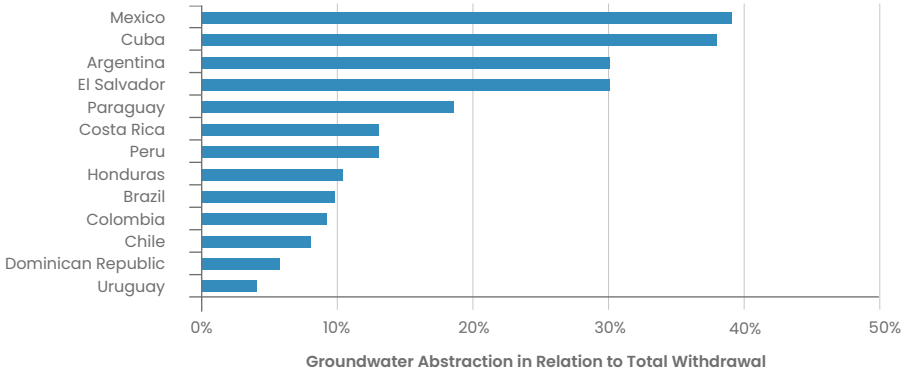
44. While LAC countries rely predominantly on surface water for their water supply (83 percent), the share of groundwater is growing as is the share of water from unconventional sources. The countries with the highest groundwater withdrawal rates in relation to total withdrawals are Mexico (39 percent) and Cuba (38 percent), followed by Argentina and El Salvador (both 30 percent). Unconventional resources like desalination and reuse of treated wastewater play only a minor role at present. However, desalination is being increasingly considered as an option for ensuring water supply during drought periods and several projects are underway in Colombia, Chile, Mexico, and Peru.

Figure 16.
Surface Water Withdrawal as Percentage of Total Withdrawal



Source: FAO Aquastat, 2016

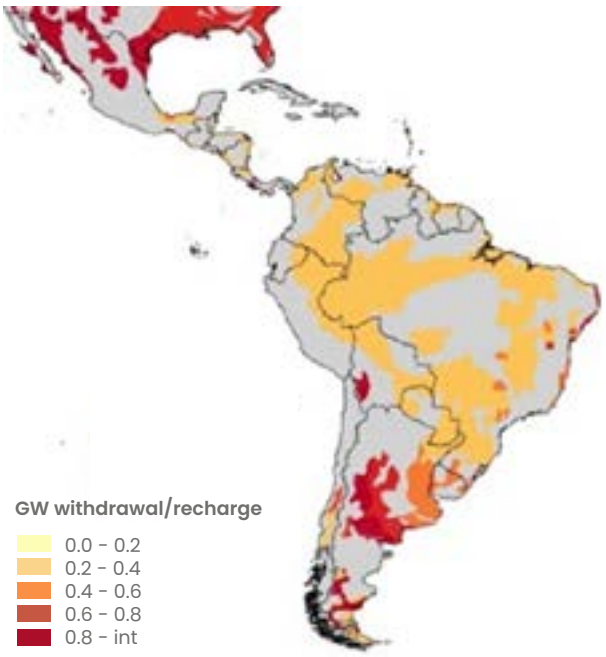
Figure 17.
Groundwater Abstraction in Relation to Total Withdrawal



Source: FAO Aquastat, 2016

45. On a subnational scale, zones with significant groundwater withdrawal rates are found in central and western Argentina, the western part of Bolivia, and the coastal region of Brazil and northern Mexico. In Argentina, groundwater accounts for 30 percent of total withdrawals. In Chile, groundwater accounts for two-third of water used for mining purpose and one-half of water used for domestic water supply. In both Costa Rica and Mexico, 50 percent of industrial demands, 70 percent of urban domestic water supply, and almost 100 percent of rural water supply come from groundwater sources (Willaarts, et al. 2014).

Figure 18.
Groundwater Withdrawal Rate

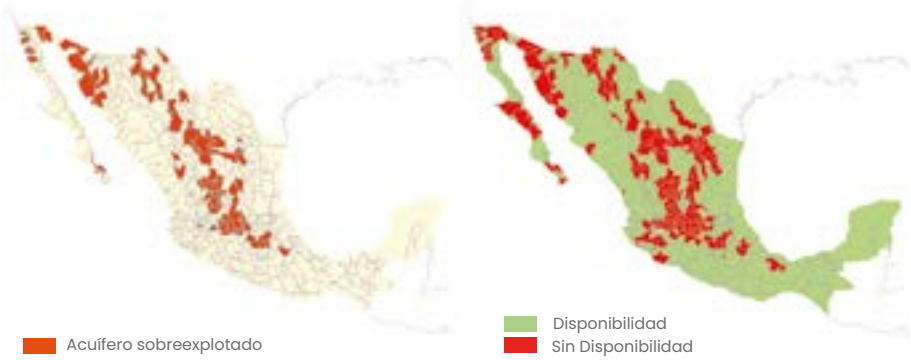


Source: WRI Aqueduct, 2019
Note: Higher values point towards greater unsustaible use of groundwater sources.

Box 2. Overexploitation of Groundwater in Mexico

Mexico is the country with the highest percentage of groundwater use in Latin America, with groundwater accounting for 39 percent of all withdrawals (CONAGUA 2018). Of its 653 aquifers, 448 aquifers are being used, 105 aquifers are overexploited, 18 aquifers have marine saltwater intrusion, and 32 aquifers are subject to soil salinization or high natural salinity.

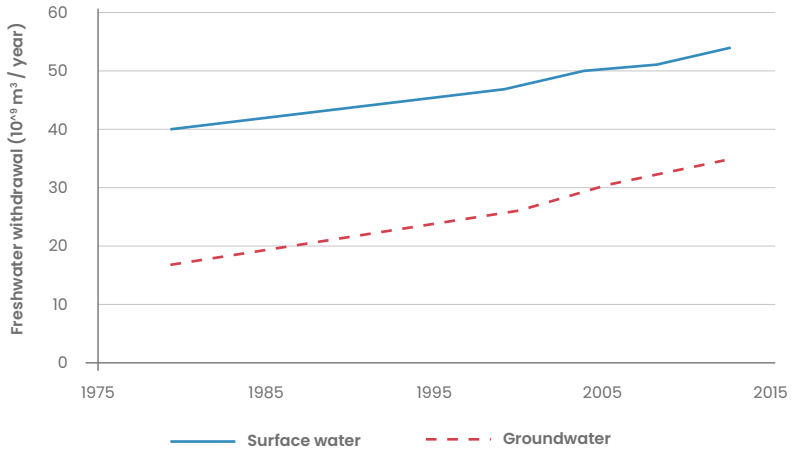
Aquifers in Mexico, 2017



Source: CONAGUA 2018

In Mexico, both surface and groundwater abstractions have increased significantly over the last decades. While average annual growth in surface water abstractions during the period 1980-2017 have been around 0.8 percent, groundwater abstractions have increased at a rate of two percent per year.

Freshwater abstraction in Mexico, 1980-2017



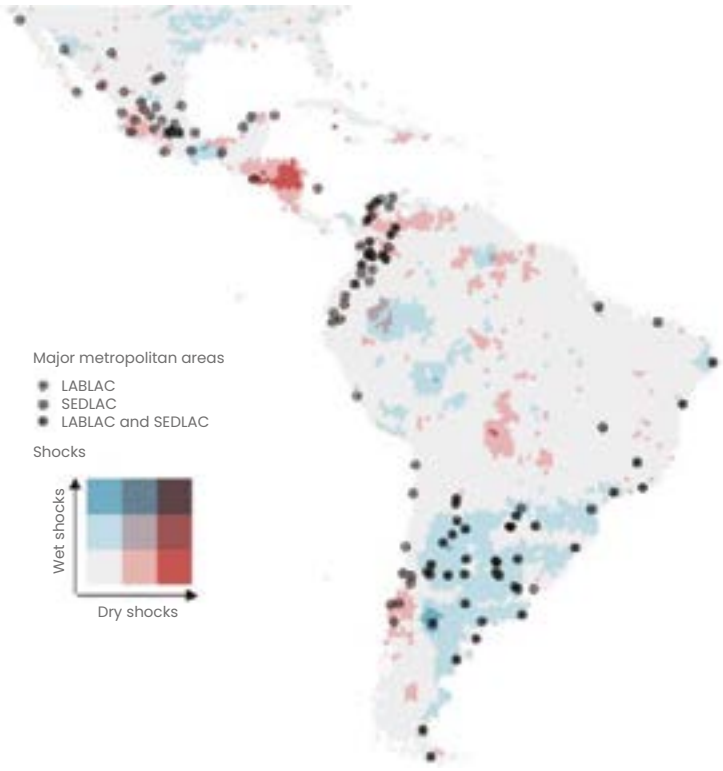
Source: FAO Aquastat, 2016

1.3.2 Scarcity and Droughts

46. As of 2019, 150 million people in LAC live in high water scarce areas,[17] where competition for water is high among the different users. However, it is necessary to distinguish this high competition in water scarce areas from the effects of extreme drought events, which are unusual dry events regardless of average water availability in certain regions. Such regions can then suffer if they are not well equipped with the infrastructure to store water.

47. In Latin America, losses in income caused by a dry shock are four times greater than that of a wet shock. Drought records are difficult to interpret because the start and end of a drought event, the severity, and the geographical extension are not easily defined. Moreover, there is no common methodology for reporting drought events among countries, so it is difficult to assess their impact. In the cities of Latin America, moderate dry rainfall shocks can already have discernible economic impacts. These tend to affect vulnerable workers, causing an estimated income loss of US$40 per worker per month, equivalent to about 10 percent of their mean monthly income (Damania, et al. 2017).

Figure 19.
Wet and Dry Shocks



Source: Damania et al., 2017
Note: Data reflected for 1990-2013.

[17] Defined as withdrawals that are higher than 40 percent of water available (based on Aqueduct data 2019).

48. In rural areas, droughts are impacting agricultural and livestock production and farmers livelihood, forcing people to migrate. This relationship is evident in the Central American Dry Corridor where between 54 and 67 percent of the 1.9 million small-scale farmers in Central America work. When extreme weather events such as droughts create situations of water scarcity, financial and economic losses will follow and drastically impact household livelihoods. Here already are vulnerable populations as many rural residents include Indigenous communities. For example, in Guatemala, where 61 percent of basic grain producers are Indigenous, a farmers' income from basic grain crops is not enough (even with the contribution from other family members) to put their families above poverty lines in the region. As a result, almost 10 percent of farmers families suffer from undernourishment and live with limited infrastructure and services. This puts them in an increasingly vulnerable situation when factors are exacerbated by climatic changes.[18] As a result of an El Nino Southern Oscillation (ENSO) in 2009, FAO estimated between 50-100 percent of grain crops were lost; an ENSO in 2015 aggravated existing drought damages, which affected around three million people impacted by food insecurity and two million requiring emergency assistance.[19]

49. National water assessments conducted in Argentina and Colombia confirm that the impacts of dry shocks are high. In Argentina, 91 percent of the economic losses in agricultural production resulting from climate variability were due to droughts, whereas only nine percent were due to floods. In addition, droughts in Argentina are expected to have down-the-line effects on the economy, especially given the importance of agricultural exports as a source of foreign currency. In fact, these dry shocks have caused a maximum annual increase of 2.3 percent in inflation. In the case of Colombia, impacts of drought were estimated to be between 1.56 and 2.31 percent of GDP, including a decline in agricultural crop yields, employment contraction, reduction in production due to water rationing, and lack of water and sanitation services (World Bank, 2020d).

In the last three decades, water abstraction has doubled across LAC at a rate much higher than the world average. In this region, the agricultural sector (especially irrigated agriculture), uses most of the water, accounting for 70 percent of extractions (consumptive and non-consumptive uses).

[18] Agronews, Agricultural news from Latin America and the Caribbean, "Chronology of the Dry Corridor: the accelerator of resilience in Central America," (June 1, 2017).
[19] ibid.

Box 3. Impacts of Droughts on Human Capital in Colombia

A recent report called "Turning the Tide: Improving Water Security for Recovery and Sustainable Growth in Colombia" shows that individuals who are exposed to adverse rainfall as early as gestation, suffer poorer health, as do their mothers (World Bank, 2020d). Micro econometric analysis demonstrated that significant increases in mortality occur when rainfall declines below 600 mm per year, with particularly strong effects below 400 mm. Specifically, a drought during gestation increases infant mortality by 3.3 percentage points–more than 10 percent of mean infant mortality. Worsened health of the mother due to water scarcity during pregnancy is associated with worse birth outcomes and increased child mortality from infectious diseases in the first months of life, given the increased immunological fragility of the newborn.

The same study revealed that early exposure to adverse rainfall can affect individuals' education and future earnings. On average, a child exposed to one month of high ENSO rainfall/drought in the third trimester in utero and for five months in early childhood will experience a 2.7 percent fall in the probability of adequate grade progression and a 12.1 percent decline in the probability of high school completion. Moreover, the rate of illiteracy among individuals experiencing a 100 percent prenatal exposure to normal rainfall is 0.46 percentage points lower than among those exposed to abnormal rainfall conditions in utero. This is about 5.4 percent at the mean illiteracy rate, which is a similar magnitude of the progress made in literacy rates over a five-year period. The evidence also emphasizes that prenatal exposure to normal rainfall results in higher employment rates. The estimated coefficient indicates that individuals who spent 100 percent of their prenatal period under normal rainfall conditions are 1.74 percentage points more likely to work in adulthood.

1.3.3 Water Quality and Pollution

50. Water quality is a matter of growing concern in many LAC countries, with severe pathogen pollution[20] estimated to affect approximately a quarter of Latin American river stretches (UNEP 2016) and serious concerns around heavy metals and chemicals. The discharge of untreated effluents from municipal use, industry, and mining, and diffuse pollution from agriculture, livestock, and agroforestry end-up in rivers, lakes, and aquifers, putting further pressure on water resources and increasing the chances of damage to human health and ecosystems, with detrimental costs to downstream users and impacts on coastal

[20] Where monthly in-stream concentrations of faecal coliform bacteria are greater than 1000 colony forming unit/100ml.

and marine ecosystems. Taking into account the fraction of population that is likely to come into contact with surface waters, it is estimated that between eight and 25 million people are at risk in Latin America (UNEP 2016). This makes progress on SDG 6.3.2 challenging.

51. Indicator 6.3.2. illustrates the proportion of bodies of water (rivers, open water bodies and groundwater) with good ambient water quality. LAC is the worst performing region, having only 57 percent of water bodies with adequate water quality, when compared to Australia and New Zealand (87 percent), Europe and Northern America (76 percent) and Sub-Saharan Africa (71 percent) (UN-Water 2020). Nevertheless, the region presents great dispersion within its member countries' results, varying from 87 percent in the case of Chile to its lowest value of 18 percent in Argentina.

52. Anthropogenic sources for pollution include untreated wastewater and unregulated discharge from industry, agriculture, and mining. The largest source of pathogen and organic pollution (loadings of fecal coliform bacteria and biochemical oxygen demand) in Latin America is domestic wastewater coming from sewers; the largest anthropogenic source of salinity pollution (loadings of total dissolved solids) is industrial discharge; and the largest source of anthropogenic phosphorus discharges to major lakes are livestock wastes and inorganic fertilizers (UNEP 2016). Mining —particularly illegal mining— is another activity that affects the quality of freshwater through the heavy use of water in processing ore, and through water pollution from discharged mine effluent and seepage from tailings and waste rock impoundments. While some large mining companies recycle and treat their discharge, most small-scale and artisanal mining firms do not have the resources or capacity to treat the effluent.

53. In addition to overexploitation problems, major aquifers in Mexico, Central and South America are being threatened by pollution, raising the cost of production. In South America, 40-60 percent of the water that comes from aquifers is becoming increasingly polluted from over-mining, agriculture, untreated wastewater and urban drainage, as well as salinization, particularly in coastal overexploited aquifers (Campuzano, et al. 2014).

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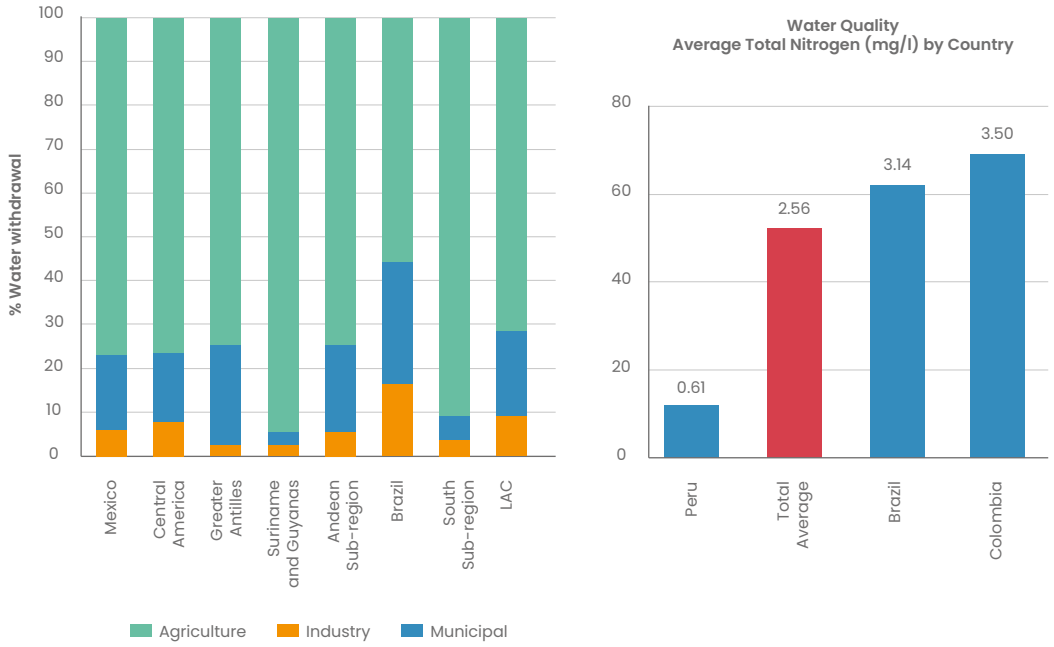
54. Progress in the implementation of wastewater treatment programs has been slow as currently about 66 percent of LAC population is connected to sewage systems and only 31 percent has access to treated wastewater (WHO/UNICEF 2017). Additional challenges arise due to irregular monitoring of discharge, the lack of enforcement of water discharge standards, the lack of definition, monitoring and enforcement of source water quality standards, and partial enforcement of water discharge regulations in most countries. While in many countries, priority is given to controlling industrial discharges over municipal and non-point source pollution, in the case of Latin America, the relevance of urban sources for total pollution and the degree of urban concentration requires addressing municipal wastewater treatment as a priority. This also has implications beyond the basin or aquifer. Sources of marine pollution are primarily influenced by the size of the populations living along coasts and in watersheds draining into the ocean, and the level of wastewater treatment.[21]

55. In addition, persistent pollutants are becoming a growing trend. Gomez-Olivan 2019 show that the indiscriminate use of chemical substances in industrial processes and anthropogenic activities have resulted in the release of these

[21] See: http://documents1.worldbank.org/curated/en/482391554225185720/pdf/Marine-Pollution-in-the-Caribbean-Not-a-Minute-to-Waste.pdf

compounds into aquatic ecosystems through municipal, hospital and industrial discharges, producing various undesired effects on the environment and on species of ecological interest. These compounds, such as metals, pesticides, emerging pollutants, and other substances are persistent and susceptible to biotic and/or abiotic transformations, yielding metabolites that can be more toxic than the original compounds. The authors exemplify these challenges with experiences in countries such as Argentina, Brazil, Colombia, and Mexico (Gomez-Olivan 2019).

Figure 20.
Water Uses by Country and Nitrogen Pollutants.



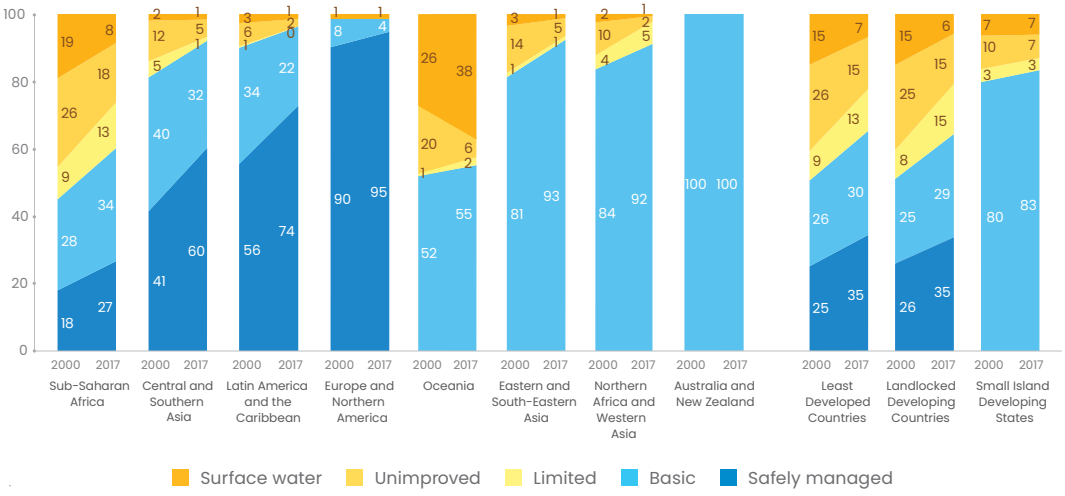
Source: Left: UNESCO and GEMS, 2016: http://ihp-wins.unesco.org/ and https://geoportal.bafg.de/
Note: Left: Distribution of Nitrogen Pollution in Water across LAC, 2016; Right: water uses by country and nitrogen pollutants by selected countries, circa 2015.

56. Finally, natural occurring contaminants also pose a risk to human health and reduce water availability for economic activities. The surface waters of the Bolivian Altiplano rivers are unsuitable for human consumption because of their high content of heavy metals and natural contamination by arsenic and boron (INTESCA, AIC & CNR, 1993). In Nicaragua, one problem of great concern is water quality in relation to health due to high natural concentrations of arsenic (As), which affect the quality of groundwater and, consequently, the health of the populations that use it for consumption. Some studies have found groundwater with arsenic problems, mainly in the northwest and southwest regions of Nicaragua, caused by extinct volcanism, mainly where tectonic structures part. In Peru, arsenic and boron are also an issue in rural communities.

1.3.4 Water Supply and Sanitation Gaps

Despite progress in improving drinking water supply and sanitation over the last decades, the sector is still far from providing reliable water and sanitation services for all. Between 2000 and 2017, "basic" drinking water coverage in LAC improved from 90 percent to 97 percent. However, progress in achieving "safely managed" drinking water supply has been slow, with only Chile and Costa Rica on track to reaching their targets of safely managed supply by 2030 (Figure 22).[22] In other countries, progress has been sluggish with annual growth rates in the order of 0.2 to 0.5 percent (WHO/UNICEF 2017). Of the 24 million people in LAC with still no access to basic water services, 74 percent of them live in rural areas.[24] This indicates that fundamental problems remain unresolved, particularly in low-income urban areas, informal settlements, and in rural communities. Slow progress in public service provision remains an obstacle to improving living conditions and realizing economic potentials and if not resolved, risks to cause popular discontent and protests.

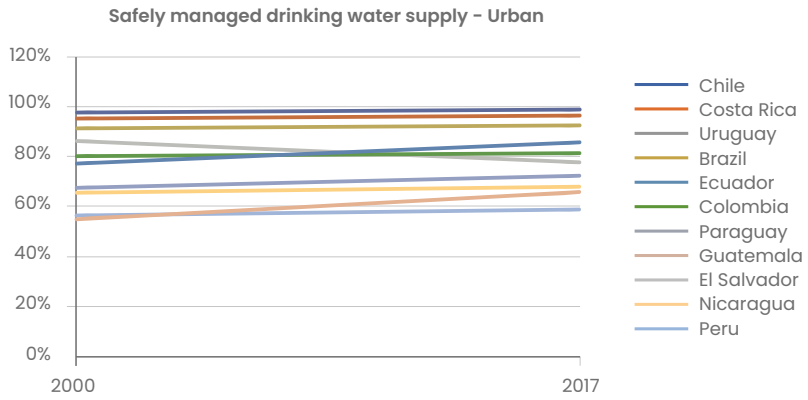
Figure 21.
Evolution of Drinking Water Services Coverage



Source: JMP 2017 (WHO/UNICEF 2017)

[22] 'Basic access' is defined as: drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip (an improved source includes piped water, boreholes or tubewells, protected dug wells, protected springs, and packaged or delivered water. 'Safely managed' means using an improved drinking water source (the indicator used for MDG monitoring) which is located on premises, and available when needed, and free of fecal and priority chemical contamination (WHO/UNICEF 2017).
[24] No data exists on access to safely managed water for rural areas in LAC.

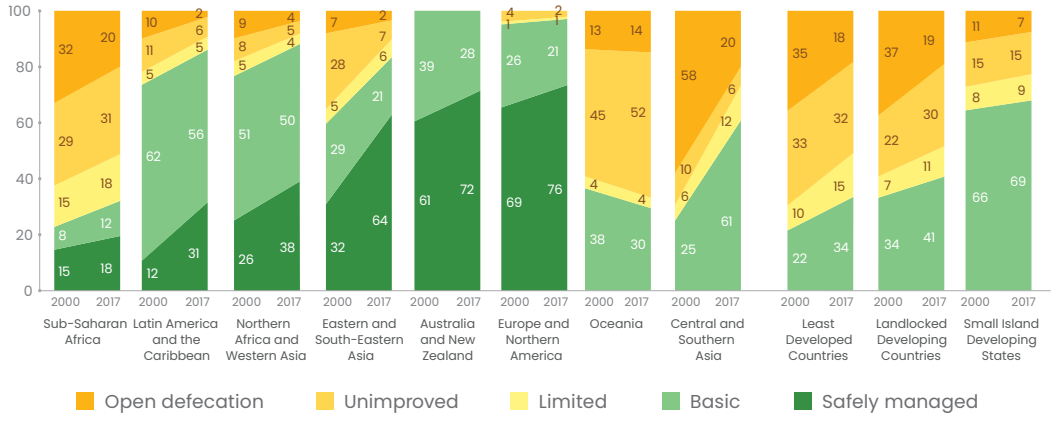
Figure 22.
Progress in Safely Managed Drinking Water Supply - Urban



Source: JMP 2017 (WHO/UNICEF 2017)

57. Only 31 percent of the total population in the LAC region has access to safely managed sanitation facilities.[24] In most rural areas, records about properly managed sanitation are almost non-existent. In fact, 70 percent of the rural population is using basic sanitation facilities with nine percent still practicing open defecation.

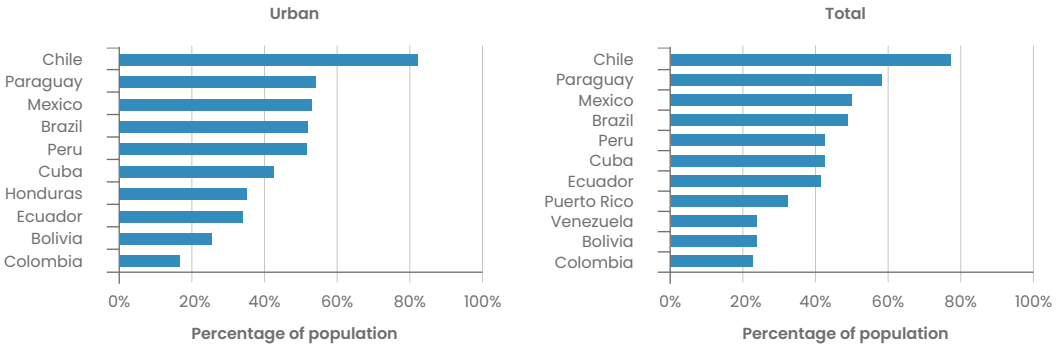
Figure 23.
Evolution of Sanitation Coverage



Source: JMP 2017 (WHO/UNICEF 2017)

[24] 'Basic sanitation' means the use of improved facilities which are not shared with other households. 'Improved facilities' are those designed to hygienically separate excreta from human contact. 'Safely managed sanitation' means the use of improved facilities which are not shared with other households and where excreta are safely disposed in situ or transported and treated offsite. Source: JMP.

Figure 24.
Share of Population with Access to Safely Managed Sanitation by Country

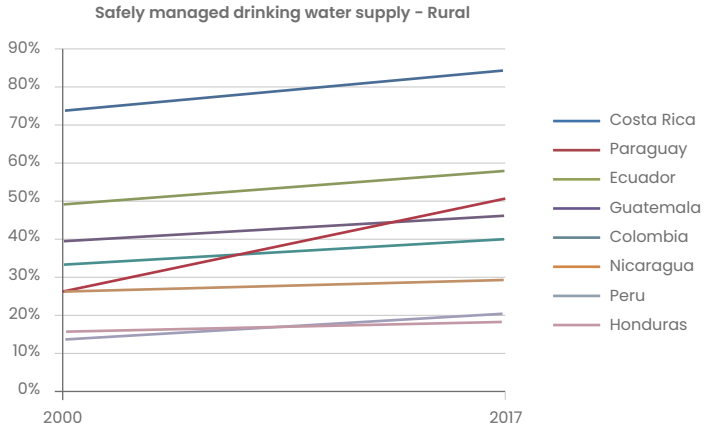


Source: JMP 2017 (WHO/UNICEF 2017)
Note: Selection of countries as per WHO-UNICEF Joint Monitoring Program data availability on safely managed sanitation.

58. Water supply and sanitation access gaps in urban areas often occur in informal settlements where 25 percent (166 million people) of the urban population in LAC countries live. These settlements are often a result of cities growing too fast and public services not being able to keep up. It is estimated that 75 percent of the housing built annually in the LAC region is informal which means that these dwellings lack property titles and access to basic infrastructure (Terraza 2017). Most of the urban poor live in these informal settlements.

59. Even though the situation of rural areas has improved significantly in all LAC countries over the last decades—both in percentage of population and in absolute numbers—many countries continue to have low ratios (i.e., less than 60 percent) of the population with access to a safely managed water supply. For example, in rural Nicaragua, Peru, and Honduras, only 20-30 percent of the population has access to safely managed drinking water. This is due to the difficulty of providing public services in low-density and low-income areas.

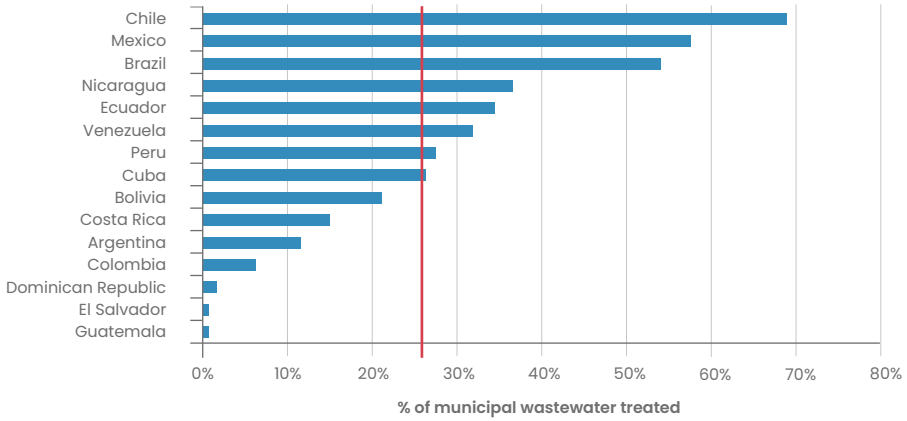
Figure 25.
Safely Managed Drinking Water Supply in Rural Areas



Source: JMP 2017 (WHO/UNICEF 2017)

60. Even when there is access to some sanitation services, collection and treatment is still lagging, posing risks to environment and human health. On average, only 77 percent of the urban population has access to sewer and 37 percent to wastewater treatment. Across the region, the highest percentages of wastewater treatment are reported for Chile, Mexico, and Brazil with 69 percent, 58 percent, and 54 percent, respectively.

Figure 26.
Percentage of Municipal Wastewater Collected and Treated (regional averages in red line)

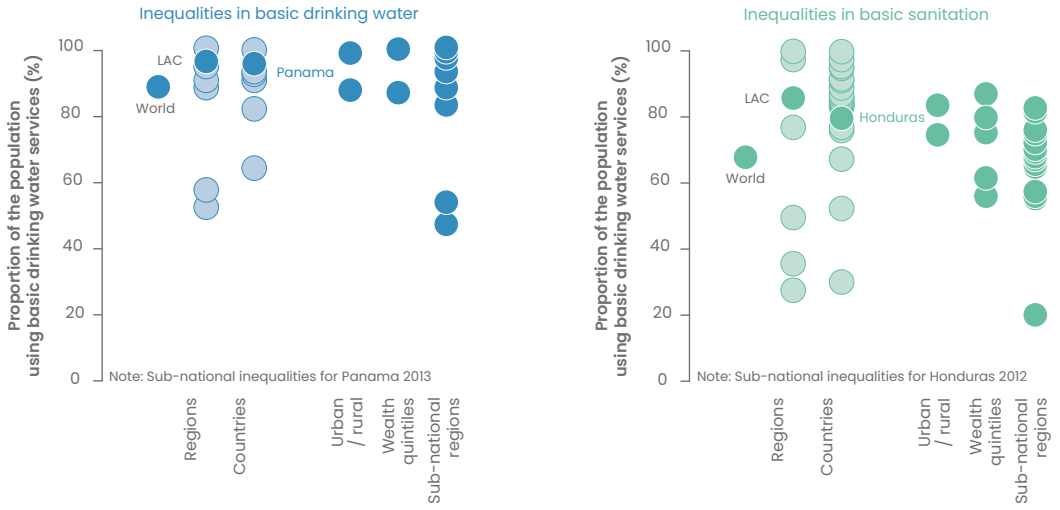


Source: JMP 2017 (WHO/UNICEF 2017)

61. Reaching the target for universalization translates into a growing request to reduce inequality in access and improve quality of service for all. There are large access gaps between the urban and rural populations; 74 percent of the people without access to water supply and sanitation live in rural areas. Only 80 percent of the population in the lowest income quintile has access to drinking water, while almost 100 percent of population on the highest income quintile has access to reliable water services (Figure 27). In addition, there are regional inequalities in water access within and across countries. For example, Chile has over 90 percent of the population using safely managed water services, while in Mexico, Peru, and Nicaragua less than 50 percent of the population use safely managed water services (WHO/UNICEF 2017). In Colombia, national water access is 97 percent, but there are eight departments[25] with coverage below 60 percent (MVCT, 2019).

[25] Amazonas, Choco, Guainía, Guaviare, La Guajira, Putumayo, San Andrés, Vaupés.

Figure 27.
Inequalities in Access to Basic Water and Sanitation Services



Source: JMP 2017 (WHO/UNICEF 2017)

Socioeconomic Impacts of the Lack of Access to Safely Managed Water Supply and Sanitation

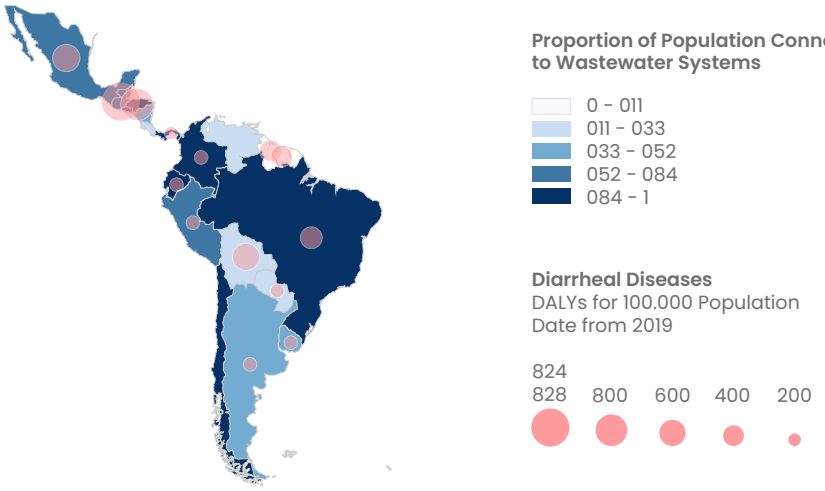
62. The high health burden from poor WASH practices fall disproportionally on children and lower income populations. Among WASH-induced illnesses, diarrheal diseases, enteric infections, malaria, and intestinal illness account for more than 50 percent of the variation in mortality rates. The vicious cycle of diarrheal diseases is intrinsically connected to reduced nutrient absorption, malnutrition, and ultimately, increased susceptibility to new infections.

63. Waterborne diseases are an important cause of illness and premature death in LAC countries. Diarrhea caused by inadequate water, sanitation, and hygiene is estimated to cause over 3,000 deaths of children under the age of five per year, making diarrheal diseases the sixth cause of death for children in the Americas. Considering the entire population, diseases attributed to exposure to unsafe water, sanitation, and hygiene, coupled with malnutrition, cause approximately 10,000 deaths per year in the LAC region, equivalent to a mortality rate of 1.59 per 100,000 population. The highest mortality rates occurred in Haiti (24 deaths per 100,000 population), followed by Guatemala and Bolivia. The main causes of deaths are intestinal infectious diseases and other conditions associated with malnutrition such as diarrhea, malaria, measles, acute respiratory infections, and neonatal deaths. There is a clear relation between access to safely managed sanitation and disease, morbidity, and mortality.

64. Poor WASH conditions adversely impact the health, education, and working lives of individuals, especially in the poorest populations. This triggers long-term impacts on the economy and development, through excess national health spending on preventable diseases and a decrease in labor productivity. In Colombia, the economic cost of WASH-related diseases is estimated between

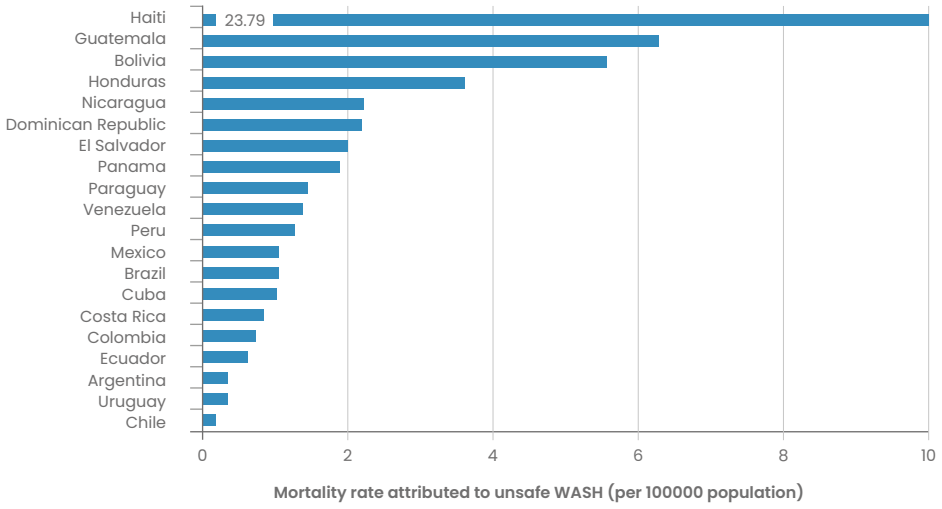
0.7 and 0.9 percent of GDP.[26] This shows an opportunity to address the coverage gap to increase access to clean drinking water and basic sanitation, unlocking more resources for the LAC economy.

Figure 28.
Relationship Between Proportion of Population Connected to Wastewater Systems and Diarrheal Diseases



Source: Own calcultions based on IHME, 2019, JMP, and World Bank, 2019 data.
Note: Figure charts LAC, 2017.

Figure 29.
Mortality Rate Due to Unsafe water, Sanitation, and Hygiene all age groups, 2016



Source: World Health Organization, 2016
Note: Graph reflects all age groups, 2016. The world average is 12.6 deaths per 100,000 people.

[26] Turning the Tide: Water Security for Recovery and Sustainable Growth in Colombia. World Bank, 2020.

65. Deficiencies in water supply disproportionately affect the poor. This is because the poor tend to live in areas where the water supply is worse; they in turn have fewer means of tapping other sources of supply (private wells, trucks), and the cost of alternative solutions represents a higher percentage of their budget.[27] Poor people pay between 1.5 and 2.8 times more for their water than non-poor families in real terms,[28] and a much higher percentage of their income for water. The quality of the water received by the poor is also much worse, increasing the risks of diarrheal diseases that could endanger their health and the health of their children while increasing the likelihood of suffering from other difficulties such as access to health services or malnutrition. Unreliable water supply and bad water quality particularly affect vulnerable groups like women, children, and the elderly.

Access to Water and Sanitation Services in Indigenous Populations

66. Among the poor, Indigenous populations are often left behind in terms of safe access to water and sanitation services. There are approximately 60 million Indigenous people in Latin America (FAO and FILAC 2021), and in the LAC region, they account for 60 percent of the poor population. Moreover, most countries lack comprehensive data about Indigenous people's access to water and sanitation services, not to mention have a poor understanding of their institutions, worldviews, governance, and value systems. This results in less effective, inclusive, and sustainable water and sanitation provision to these groups. Even though governments and development organizations recognize the importance of working in a culturally sensitive way, this recognition is not always translated into practice. The plurality of worldviews, rights, and value-systems are not present in the ongoing efforts to generate specific intercultural strategies for water and sanitation that take an inclusive approach to water governance. As a result, many countries have specific institutions to support Indigenous people, but lack the capacity to do so, despite the groups' important role in water stewardship and water security (Jimenez, Cortobius and Kjellen 2015).

67. Other marginalized groups that experience unequal access to water and sanitation services are Afro-descendant populations. The water and sanitation access gap between Afro-descendant and non-Afro-descendant households in LAC varies significantly across countries. For instance, access to water services for Afro-descendant and non-Afro-descendant populations in Ecuador is 79 and 85 percent, respectively, whereas access for Afro-descendant and non-Afro-descendant populations in Nicaragua is 15 and 65 percent, respectively.[29] Access to sanitation service shows even wider gaps in the region. While countries like Uruguay and Venezuela portray one of the highest sanitation access rates for Afro-descendant populations, Nicaragua and Brazil remain the two countries with the lowest access.

[27] E.g., in Buenos Aires, households which do not have access to tapped water and buy bottled water instead, pay up to 460 percent more than households with water connection to the local service provider (World Bank 2021a).
[28] World Water Council 2018, available in https://www.worldwatercouncil.org/ accessed in January 2021.
[29] World Bank, 2018a. Afro-descendants in Latin America: Toward a Framework of Inclusion.

Access to Water and Sanitation Services and Gender

68. As in many other parts of the globe, women in LAC suffer more than men from the impacts of not having access to water. Nationally representative findings from the Multiple Indicator Cluster Surveys (MICS) administered in El Salvador, Mexico, Panama, and Paraguay show that females bear a larger share of the burden of collecting water. This has broader implications for social equality, as women's ability to gain skills, pursue education, earn income, and establish enterprises is clearly restricted (Borja-Vega and Grabinsky 2019). Also, women are more likely to be in charge of water collection in poorer households (Borja-Vega and Grabinsky 2020).

69. In addition, schools in rural Latin America often lack the adequate sanitation facilities and hygiene supplies for girls. Peru's first School Infrastructure Census in 2013 showed that two out of three schools did not have access to adequate water supply and sanitation services. This figure is significantly higher in rural areas, where an astonishing 83 percent of schools had inadequate services or did not have any water supply and sanitation services at all (Basckovich and Uijtewaal 2019a). Similarly, a qualitative gender assessment in Haiti found gaps between girls and boys in education, influenced by weaknesses in WASH in schools. Adolescent girls left school when they experienced menstrual symptoms. Absence of doors meant absence of privacy in toilets. This, combined with the lack of water, was a constraining factor preventing their full participation during the school day (World Bank 2017a).

Women and girls in Latin America face sexual harassment and gender-based violence when collecting water and using public sanitation facilities.

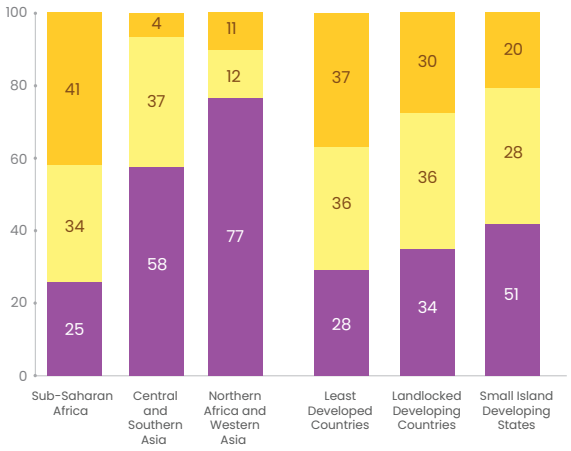
70. The lack of safe access to adequate water and sanitation facilities increase the vulnerability to violence of women and girls in Latin America. Violence against women affects one in three women in LAC countries as they must travel long distances in search of a water source and do not have facilities with adequate privacy. Factors perpetuating this type of violence are intertwined with gendered and other sociocultural aspects in the context of WASH within institutional frameworks and norms (World Bank 2020a). This carries an economic cost of between 1.6 percent and 6.4 percent of GDP.

1.3.5 Equity and Hygiene

71. Rising social concerns around inequality are increasing the demand for better and more equitable access to basic WASH services. The "new rurality" in LAC portrays the new trends, which are altering the urban-rural landscapes (Baskovich and Uijtewaal 2019b). The demand for water —alongside food and energy— increases with the growth of population, economic development, and changing consumption patterns (Fukase and Martin 2017). Even though cities are catalysts for economic growth and development, urban areas often become more unequal than rural areas. Therefore, to secure access to an equitable access to basic water and sanitation services in the face of rapid inorganic urbanization, it is important to understand the links between climate change, health, and inequality.

71. Hygiene has received more attention with the COVID-19 pandemic, given that handwashing with soap and water contributes to reducing the spread of the infection.[30] The JMP hygiene baselines for LAC before the pandemic showed that there was insufficient data to estimate the proportion of households with a handwashing facility with soap on premises, as well as the proportion of health care facilities that have functional hand hygiene facilities with soap and water or hand sanitizer. Estimates for hygiene facilities at schools were available for 14 countries in the region and showed that two in five schools do not have handwashing facilities with soap and water available to students (WHO/UNICEF 2020).

Figure 30.
Global Handwashing Coverage, 2017



Source: : JMP 2017 (WHO/UNICEF 2017)

Violence against women affects one in three women in LAC countries. This carries an economic cost of between 1.6 percent and 6.4 percent of GDP.

72. While some data on hygiene policies, plans, targets, budgets, and expenditures do exist, data needs to be improved worldwide and in LAC (WHO 2020). Only twelve countries in LAC have provided data on whether national targets for hygiene have been set, with only Belize and Jamaica reporting having targets approved. The lack of national targets will contribute to the limited policy attention given to hygiene and low budget lines dedicated to hygiene. Figure 31 below shows that only seven countries— Bolivia, Chile, Colombia, Haiti, Honduras, Panama, and Peru— have formally approved national hygiene policies. Additionally, only Belize, Chile, Honduras, Mexico, and Trinidad and Tobago, have approved and fully implemented national hygiene implementation plans. Data on hygiene expenditure is limited.

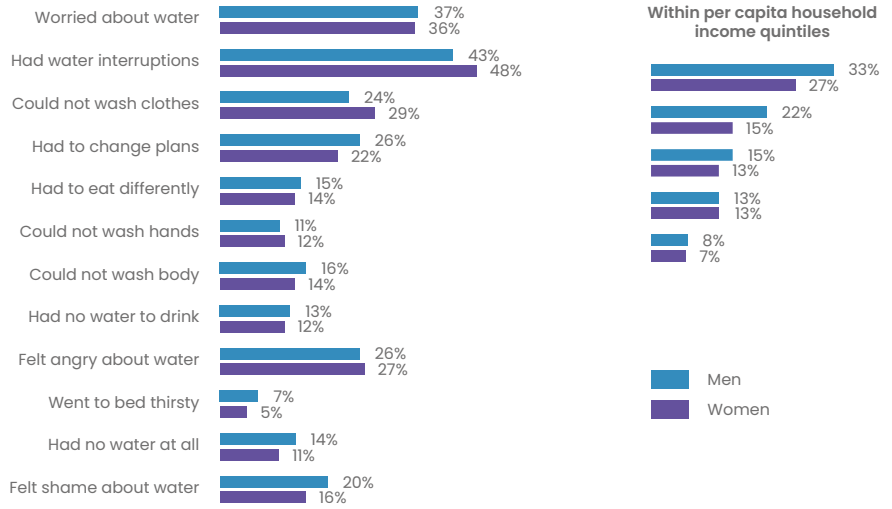
[30] Hygiene is a wider topic that can include safe water management, hygienic use of sanitation facilities, food hygiene, menstrual hygiene, and other context-specific behaviours. The lack of an internationally agreed-upon definition of hygiene provides challenges for reporting on and comparing hygiene data. Without an agreed-upon definition of hygiene globally as well as for the LAC region, it is often unclear what is included in data on hygiene. In this report, hygiene is referred to only handwashing.

Figure 31.
National Hygiene Policies in LAC

Source: (WHO, Hygiene: UN-Water GLAAS findings on national policies, plans, targets and finance 2020)

Box 4. Water Security at the Household Level

The concept of water security at the household level considers that water security exists when water is readily available, accessible, and sufficient for the household (figure A), for different consumption needs in a safely manner. The Household Water Insecurity Experiences (HWISE) was designed to measure the degree of water security at the household level. It is comprised of 12 items that query the frequency of experiences of problems with water-related activities related to both consumption (drinking, cooking) and hygiene (handwashing, laundry) in the prior month. Brazil is the first country in Latin America for which data is available. In Brazil, 16 percent of the population was water insecure, and this did not differ by gender. The most common experiences of water insecurity were having water supply interruptions and worrying about water (figure B).



Source: Young, et al. 2021.
As expected, water insecurity was less prevalent as household income increased, but did not disappear completely in the highest quintile.

1.3.6 Water for Productive Uses

Irrigation and Drainage

73. The main challenges that the irrigation sector faces relate to (i) the low quality of services, in terms of reliability, uniformity, and efficiency, (ii) coping with increasing climate variability and competition for water use, and (iii) constraints to expand irrigation and drainage services to increase resilience to climate change and to boost agricultural productivity to meet growing demand for local and global markets. First, Latin America, along with Western Asia and Sub-Saharan Africa, has the largest water productivity gaps for most crops (FAO 2020). Low irrigation efficiency, among other factors (i.e., soil and water management, crop varieties, climate variability), help explain this gap.[31] The average water use efficiency is 40 percent (IICA 2017). Second, climate change increases temperatures and evapotranspiration, so crops demand more water that must be supplied through irrigation. This challenge is interlinked to low efficiency rates. Third, expanding irrigated areas to respond to increasing food demand can be a complex endeavor involving competition with other uses, the adequacy of the water rights system, and the farmer's access to financing, among others. Lack of drainage networks causes waterlogging and salinization, resulting in soil degradation and serious environmental damage (Lajaunie, et al. 2013).

Hydropower

74. There are challenges that limit the potential of hydropower development, including, (i) the environmental and social impacts of dam projects, (ii) substantial uncertainty for the future operation of hydropower dams associated with climate change, and (iii) ageing infrastructure and dam safety issues. First, the social and environmental impacts of dam projects (Andrade Navia and Olaya Amaya 2021) are seen as perhaps the greatest limiting factors to hydropower development. From an environmental point of view, major dam developments are still unable to facilitate fish migration, and important disruptions in fish biology have already been reported in the region (Rodrigez 2019) (Ali and Llamas 2020). With the work of the World Commission of Dams (WCDs), the approach to dams has changed to options assessment and more participatory decision-making (WCD, 2000). Hydropower projects that are sited, planned, and executed in accordance with recognized international good or best practices in sustainability can have positive wider non-power impacts on local communities, including, but not limited to, water supply, social investment, economic growth, irrigation, and flood and drought protection. The creation of the International Hydropower Association's Hydropower Sustainability Tools and the World Bank's Environmental and Social Framework (ESF) offer new opportunities for hydropower and dam development. Second, climate change poses additional uncertainty factors in the conception, design, construction, and operation of large new hydropower developments. This adds to many other uncertainties, therefore increasing risks that are intrinsic to these types

[31] 'Water productivity' refers to the measure of total output (crop mass or value) divided by the water input (water applied or transpired during production); whereas 'water productivity gap' is referred to as the difference between the maximum attainable water productivity and the current achieved water productivity at the field scale (Zheng et al. 2018).

of projects (financial, geotechnical, among others). Third, over 50 percent of the installed capacity in Latin America is over 30 years old (Alarcon 2019), and, despite substantive progress in setting up regulatory frameworks on dam safety in many LAC countries, this important agenda remains underdeveloped.

Box 5. Dams and Indigenous Rights

The lack of recognition of Indigenous rights have far too often ended in disputes, particularly linked to large-scale projects. A study on water-related conflicts between Indigenous people and industry reviewed 384 situations during the period 1960–2014 (Jiménez, Molina and Le Deunff 2015), and found that mining and hydropower development were the most conflict-ridden projects. Of the conflict events reviewed, 48 percent took place in LAC. The assessment revealed that the most frequent impacts from hydropower and water allocation infrastructure and other industrial activities were violating previous consultations with communities and degrading their groundwater and surface quality. In only three percent of the cases had the parties reached the stage of formal cooperative agreements. In almost two-thirds of the cases, there had been a violent phase at some time. The results from this study can be corroborated by data from recent years. In 2019, 212 land and environment activists were killed, 40 percent of them Indigenous (Global Witness 2020).

1.3.7 Floods

75. Floods affect more than 1.8 million people every year.[32] Latin America is the second most vulnerable region in terms of disasters, where floods affect more than 1.8 million people every year. The countries most exposed to floods are Brazil, Argentina, and Colombia in absolute numbers, and Dominican Republic, Bolivia, and Argentina in terms of percentages of population. During the period 1980-2019, more than 900 major flooding and landslide events were recorded in the LAC region, affecting 73 million people, and killing almost 60,000. In 1999, one single flood and debris flow event in Vargas, Venezuela, caused 30,000 deaths. According to the UN, storms in Central America and the Caribbean are becoming more powerful and frequent, leaving shorter recovery windows in between catastrophic events. Countries that have shown greater impacts due to storms have been Cuba, Mexico, and especially Haiti, where 85% of the deaths in the last 20 years have occurred.[33]

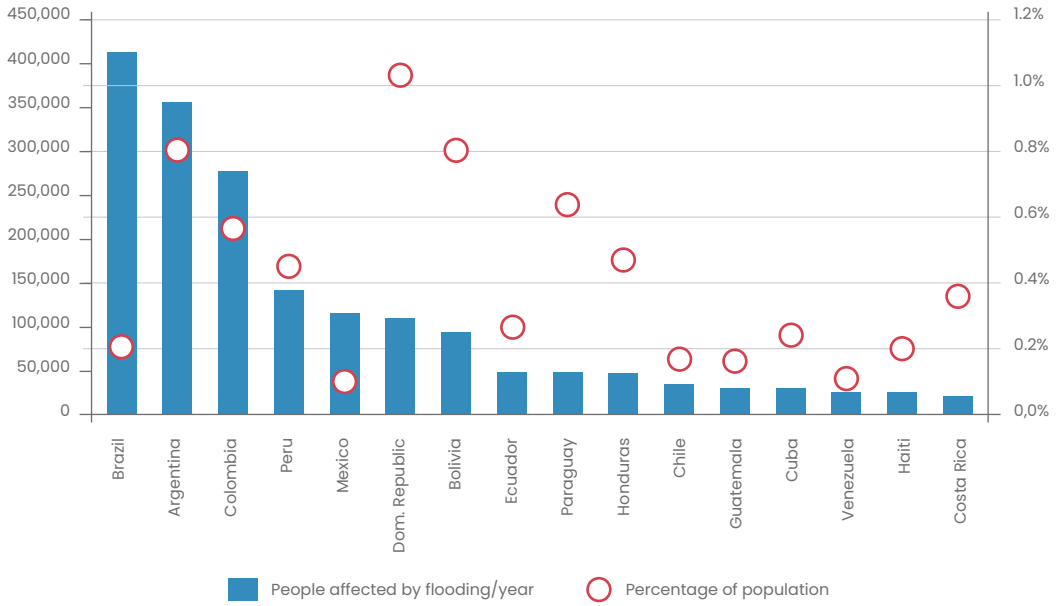
[32] There are also references indicating that LAC is the most vulnerable region in the world to natural disasters (IADB, 2013), with the world's highest median economic damage and 0.18 percent of GDP per event as per EM-DAT database.
[33] Centre for Research on the Epidemiology of Disasters (CRED) launched the Emergency Events Database (EM-DAT). Available in https://www.emdat.be/ Accessed in January 2021.

76. Across Latin America, the evidence suggests that poorly functioning land markets, urban sprawl, and poor transportation at the edge of cities pushes low-income households to settle in risky urban areas. In Medellin, Colombia, the informal settlements that house most of the city's informal population are perched on steep slopes and near water bodies at the periphery of the city (Restrepo Cadavid 2011). These informal settlements are more exposed to floods and landslides because of their location and more vulnerable because of the low-quality materials used for housing. This leads to the notion that weaker and less intense storms can be as harmful as strong and powerful ones. In 2015, tropical storm Erika reached the Dominican Republic failing to acquire sustained winds beyond 80 km/h. However, adverse conditions manifested in flash flood and landslides, affecting almost 40 percent of the population. The total damages caused by Erika resulted in 90 percent loss of the country's GDP.

77. Accordingly, there is a clear correlation between vulnerability to natural hazards, including floods, and populations living in slums. People in slums with makeshift housing and poor infrastructure, often in areas which are particularly exposed to flooding or landslides, are more likely to suffer from natural hazards.

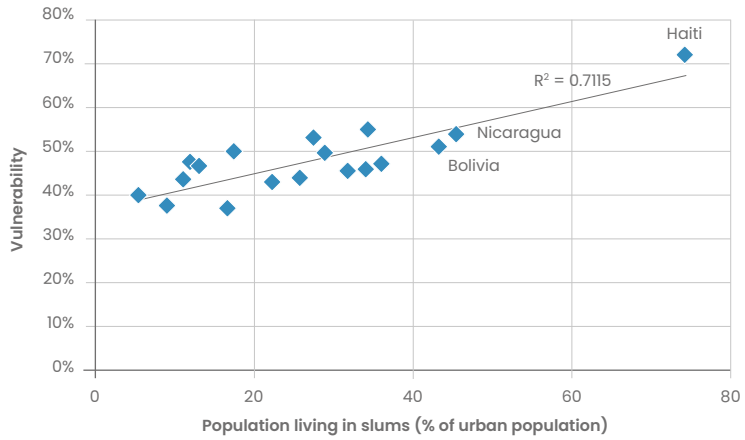
78. Floods can affect women and men differently. Research on flood impacts on low-income communities in Buenos Aires found that women were affected differently and more adversely than men because they bear the primary responsibilities for restoring their family's housing and livelihood, as well as undertaking domestic tasks and care for children and the elderly. Women were also found to be first responders, and often assumed leadership roles in high-risk situations despite serious gender gaps in education and economic opportunities (Kristoff, et al. 2020).

Figure 32.
Number of People Affected by Flooding Per Year (From 2000-2019).



Source: CRED, EM-DAT

Figure 33.
Correlation Between Vulnerability to Natural Hazards and Percentage of Population in Slums



Source: World Risk Report, 2016, and World Bank

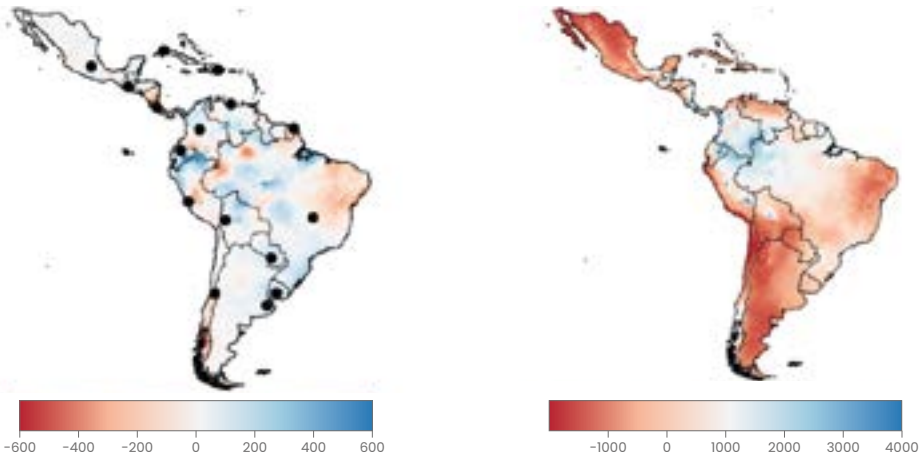
1.3.8 Climate Variability and Change

79. Climate variability and climate change have been a reality for LAC in past years and future changes will further impact its water resources. Historic climate data trend analyses have identified several impacts for different geographical regions within LAC. According to the 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) over the period 1950-2008, annual rainfall has been increasing in southeastern South America at a rate of 21.9 cm/year over 50 years. Meanwhile, a decreasing trend of rainfall —36.5 cm/year for over 50 years— has been identified in Central America and central-southern Chile. Rising temperatures have been detected throughout Central and South America (0.7°C to 1°C /40 year since the mid-1970s), except for a cooling along the Chilean coast of about -1°C /40 year. Increases in temperature extremes have been recorded in Central America and most of tropical and subtropical South America, while more frequent extreme rainfall has been identified in southeastern South America favoring the occurrence of landslides and flash floods (Magrin et al. 2014).

80. In addition, precipitation and available water resources have shown a downward trend over the years; there are also changes in seasonal variability that impose additional stress. Although in recent years precipitation has not decreased in general, when assessing annual averages, the increase in temperature has generated higher potential evapotranspiration rates, so that the general trend is an increase in the water deficit in practically the entire region, evidenced in basic balances (precipitation - potential evapotranspiration), and in their evolution, in comparing the periods 1961-80 and 2000-2019 (Figure 34). In addition, changes in seasonal variability add increasing stress. These are related to a concentration of rainfall events (shorter duration and more intensity), and longer dry spells and shorter wet seasons overall. Following high-intensity and short duration events, most of the precipitation is lost as runoff and discharge and not captured in storage (Filippo Giorgi 2019).[34]

[34] IPCC:https://www.ipcc.ch/site/assets/uploads/2018/03/ar5_wgII_spm_es-1.pdf and https://link.springer.com/article/10.1007/s00382-018-4225-0

Figure 34.
Differences in Average Annual Precipitation and Basic Hydrological Balance



Source: Own calculations based on TerraClimate Data, 1961-2019
Note: Left: Differences in average annual precipitation (2000-2019 vs 1961-1980). Right: Differences in basic hydrological balance (annual average millimeters, 2000-2019 vs 1961-1980).

81. In the near future, water availability is expected to decrease even under the moderate climate change scenario (RCP 4.5) by 2040 (table 2). In general, future projections show a trend towards lower rainfall and higher evapotranspiration. As a result, the water available in the rivers and for aquifer recharge (precipitation - real evapotranspiration) is likely to decrease in all countries and in most relevant basins.

82. These climate change effects will hinder LAC's sustainable development agenda in unprecedented ways. The IPCC highlights the risk of water supply shortages as a result of precipitation reductions and evapotranspiration increases, affecting water supply for cities, hydropower generation, and agriculture (Magrin et al. 2014). Climate variations will manifest across physical, biological, human, and managed systems (Figure 35). With higher temperatures, the hydrological cycle is more likely to be disrupted by glacier retreats and changes in important river flows, making it difficult for countries to develop effective and all-encompassing adaptation strategies. Every country is compounded by differences in their local context, from their unique geographic characteristics to socioeconomic conditions, meaning that climate impacts will differ from one region to another (Willaarts, et al. 2014).[35]

83. A substantial number of people, land, and infrastructure will be exposed as sea levels rise in LAC. Recent research (Borja Reguero 2015) estimates that with both extreme sea levels rising and populations increasing, exposure to 100-year flood events in LAC will increase from today's 7.5 million inhabitants to 8.8 million by mid-century, with this number being closer to 9.9 million inhabitants living along the coasts, if historical trends in storm activity are included. When contributions from ENSO phenomena are also added, there is an increase of flood risks in the Pacific coast countries of the region (mainly Peru and Ecuador), and the likelihood of them happening sooner than previously anticipated.

[35] Refer to the World Bank´s Climate Change portal for additional information at the country level: https://climateknowledgeportal.worldbank.org/

Table 2.
Mean Annual Precipitation Volumes and Net Available Water

	Precipitation km³/year		Precipitation - real evapotranspiration km³/year	
Country	**1961-2019**	**2021-2040**	**1961-2019**	**2021-2040**
Brazil	12271	10745	5413	4714
Colombia	2448	2117	1412	1196
Peru	1708	1438	867	696
Argentina	1539	1405	197	182
Venezuela	1397	1255	549	505
Mexico	1322	1156	256	222
Bolivia	1039	932	288	258
Chile	777	669	502	428
Ecuador	407	361	238	212
Paraguay	374	341	58	56
Guyana	329	291	123	112
Suriname	251	219	98	84
Nicaragua	229	200	97	85
Uruguay	219	191	57	49
Guatemala	212	186	103	91
French Guiana (France)	178	155	91	79
Honduras	163	143	50	44
Panama	159	139	84	74
Cuba	131	111	22	15
Costa Rica	117	102	66	57
Dominican Republic	58	50	12	9
Belize	38	34	14	13
Haiti	35	29	11	7
El Salvador	32	28	13	11
Jamaica	17	14	5	4
Puerto Rico (US)	14	12	4	3
Bahamas	12	10	2	1
Falkland Islands (UK)	8	7	1	1
Trinidad and Tobago	8	7	2	2

Source: Own analysis based on TerraClimate Data and RCP 4.5 scenario using an ensemble-based on 15 models (CMIP 5).

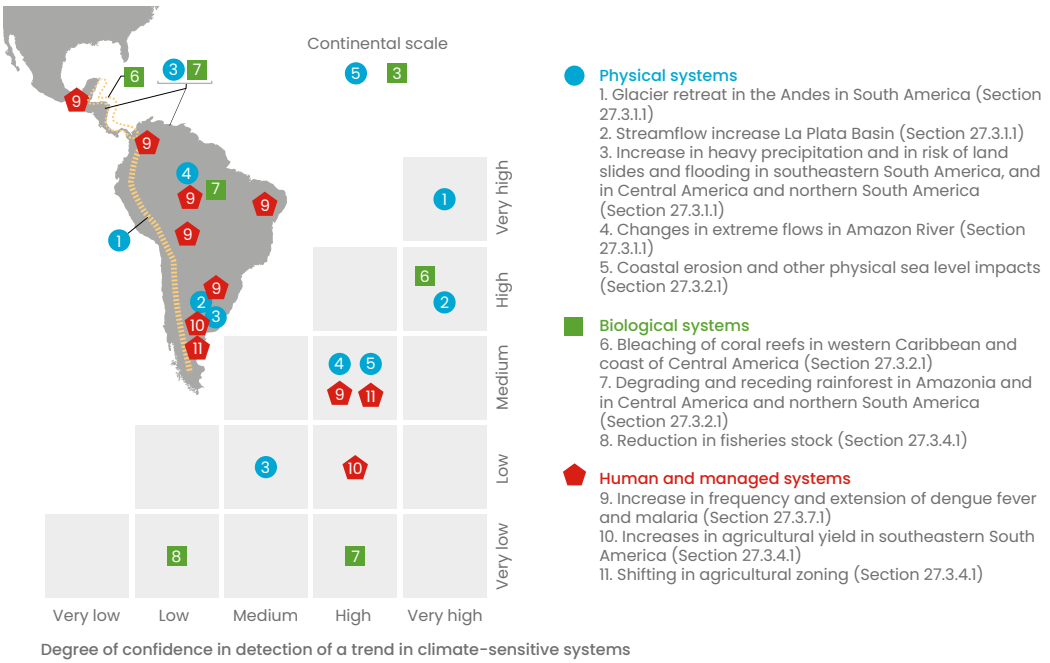
Table 3.
Rainfall Resources and Available Water by Basin

	Precipitation km³/year		Runoff+aquifer recharges (km³/year)		percent TOTAL	
Basin	**1961-2019**	**2021-2040**	**1961-2019**	**2021-2040**	**Prec.**	**Runoff**
Amazonas (Brazil, Peru, Colombia, Ecuador, Bolivia, Venezuela)	12856	11635	6784	6695	48.64	56.45
La Plata-Paraná (Argentina, Bolivia, Brazil, Paraguay, Uruguay)	3598	3387	967	884	13.61	8.04
Orinoco (Colombia, Venezuela)	2164	2019	1108	1030	8.19	9.21
Tocantis (Brazil)	1568	1455	710	675	5.93	5.91
Región Hidrográfica Atlántico Noreste (Brazil)	1207	1109	539	511	4.57	4.48
Región Hidrográfica Laguna Merin/Atlántico (Uruguay, Brazil)	994	924	313	287	3.76	2.61
Sur de América Central (Guatemala, Honduras, Nicaragua)	839	766	385	371	3.17	3.20
Región Cono sur Sur de Chile (Chile)	707	634	467	461	2.67	3.88
Río Sao Francisco (Brazil)	597	545	143	134	2.26	1.19
Magdalena (Colombia)	529	493	193	187	2.00	1.61
Caribe Sudamericano (Colombia, Venezuela)	520	482	202	192	1.97	1.68
Caribe (Runs through 23 countries across the Caribbean)	331	293	60	69	1.25	0.50
Grijalva – Usumancita (Mexico)	289	265	136	130	1.09	1.13
Río Grande-Bravo (USA, Mexico)	232	209	13	15	0.88	0.11
					100	**100**

Source: Own analysis for this publication based on TerraClimate Data, 1961-2019.
Note: Grid identifies total rainfall resources by basin (historical average – climate change predictions); total available water (runoff + aquifer recharges) by basin; and comparative weight of basins (in terms of total precipitation).

84. Furthermore, the Global Climate Risk Index estimated the cumulative climate-related damage in LAC is US$11 billion per year. In the past two decades, the damage to energy and transport-related infrastructure averaged US$2 billion a year. This has contributed to an additional annual loss of US$95 billion due to infrastructure disruption both to households and businesses. The resilience indicator toolbox, which measures socioeconomic resilience in 117 countries, highlighted that nine of the top 20 countries to suffer climate-related losses as a percentage of GDP are in LAC. On average, 1.7 percent of annual GDP has been lost in LAC countries due to climate-related disasters during the last two decades. In the Caribbean, this proportion is larger, reaching three percent of GDP. Countries such as Grenada, Bahamas, and the Dominican Republic have endured hurricanes in recent years that generate insurance-declared losses that can exceed their entire annual GDP (PNUMA-CAF 2020).

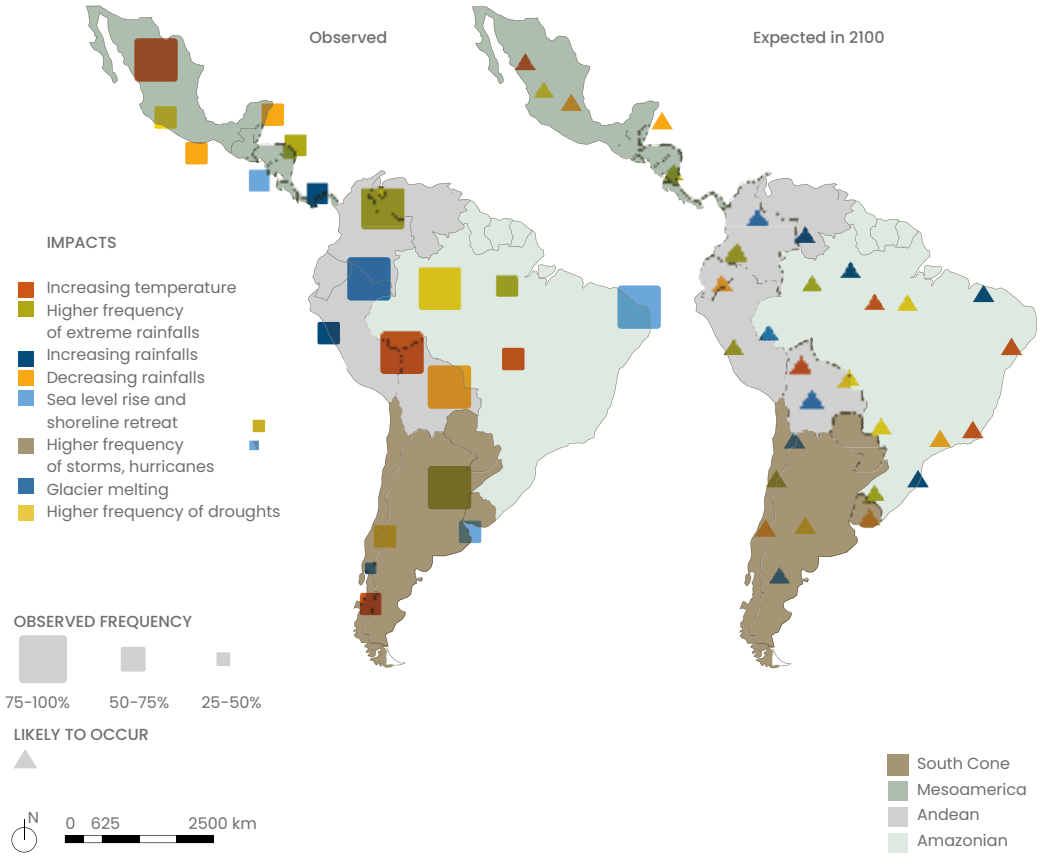
Figure 35.
Impacts of Climate Variations and Attribution of Causes to Climate Change in Central and South America



Source: Magrin et al. 2014, IPCC 2014: impacts, adaptation and vulnerability, Part B: Regional Aspects

85. The impacts of climate change affect women and men differently. Women's roles as primary caregivers and providers of food and fuel make them more vulnerable to reduced water availability, loss of agricultural productivity, and emergence of new vectors of disease. Women also experience disproportionate impacts from climate change due to inequitable gender roles, division of labor, and access to resources (ECLAC 2021). Indigenous women are heavily impacted by climate change because they are responsible for routine labor in horticulture which entails working in open fields under rising temperatures which lead to crop failure, lower yields, and the need to replant failed crops. Children's illnesses and malnutrition pose an additional burden on women (Kronik and Verner 2010).

Figure 36.
Present and Future Climate Scenarios, 2014



Source: Willaarts and De Stefano, 2014

Impacts on water supply and sanitation

86. Climate change introduces shocks and variability, which places additional stress on water supply and sanitation services, making planning more challenging. Severe weather and climate events like droughts and flooding not only put infrastructure at risk if not properly designed, but they also lead to pollution of water resources, especially in areas with low sanitation coverage, or make water a scarcer resource, which necessitates better protection and management. For example, in March 2017, Lima's water supply was interrupted for four consecutive days due to severe rainfall, which led to severe landslides that filled the river with mud (World Bank 2018). As a result, the main water treatment plant could not deal with the resulting turbidity and suspended solids levels. Meanwhile, utilities and planners will face the added difficulty of planning under uncertainty, due to the inability to accurately predict future weather and water availability. In many ways, climate change impacts reduce opportunities for optimization approaches. Overall, there needs to be either increased redundancy across water infrastructure (e.g., alternative water treatment options already on standby) or modularity that can be acted upon very rapidly. This is of course difficult when still addressing basic infrastructure needs. On another hand, climate change can also be seen as an opportunity to trigger gains in efficiency.

Box 6. The Costs of Not Considering Climate Risks in Lima, Peru

"In Lima, the potable water and sewerage service of Lima (SEDAPAL) developed a US$2.6 billion infrastructure investment plan in 2012 to secure the city's supply to 2040. The investments aimed to prepare the city to provide reliable service under one scenario of population increase and economic growth, without any sensitivity analysis around what would happen if the population did not grow as expected, or if climate varied (Kalra et al. 2015). Yet, socioeconomic changes may take different turns than expected: industries may move in or out of the town based on surrounding infrastructure (e.g., ports, taxes). Although on average wealthier people consume more water, the right conservation education program may lead people to start consuming less and introduce water saving measures in their households. Climate models for Lima show a wide range of plausible precipitation changes, from plus 40 percent to negative 20 percent from the historic mean. A joint study by the WB and SEDAPAL (Kalra et al. 2015) finds that if climate were a little drier than the current one, the foreseen investments would not be able to meet the projected demand. And if demand were higher than the projection used, even a wetter climate would not be able to secure reliability. In other words, the costly plan has turned out not to be robust to future changes. Planning for a narrow vision of risk therefore may lead to stranded assets, budgetary lock-ins, and avoidable political tensions."

Source: Building the Resilience of WSS Utilities to Climate Change and Other Threats—A Road Map, page 5.

Climate projections show that the two largest-hit regions are Central America and the Southern Cone, which would see a "consistent decrease in mean hydropower capacity factors due to the decline in mean precipitation and runoff" Despite these trends, only six countries in LAC have included climate impacts on hydropower development and suggested actions in their national adaptation plans.

Impacts on Agriculture and Irrigation

87. As temperatures rise and dry spells are more frequent and intense, rainfed agriculture will suffer. It is estimated that productivity losses associated with changes in climate can reduce agricultural GDP between 3 and 17 percent in some countries of the region (ECLAC 2012) mainly due to productivity reduction or loss of crops. In Argentina, average losses due to recurrent dry spells are around US$3.0 billion on an annual basis (World Bank 2021a). One of the main strategies to overcoming these impacts in rainfed agriculture is the expansion of complementary irrigation systems that could inadvertently put more pressure on surface and groundwater sources.

88. But irrigated agriculture will be affected as well. As temperature and evapotranspiration increase, water demand by crops also rises. Therefore, to maintain yields for the same area of irrigated land, it is necessary to increase the amount of water supplied through irrigation and increase its efficiency. The estimated losses in Argentina's irrigated cropland if no action is taken to increase the supply of water to crops is about US$840 million annually (World Bank 2021a).

89. Findings of recent studies (Sangkhaphan and Shy, 2020; Khan et al 2019) show that limited resilience of water and irrigation infrastructure systems generate losses that differ in terms of affected commodities groups and type of disaster across regions and countries. Such differences should be taken into

consideration when developing plans for the agriculture and food security sectors that measure targets, monitor risks, and improve the resilience of the sector. For this reason, the collection, systematic reporting, and in-depth analysis of data on the impact of disasters such as floods and droughts on agriculture are essential to support context-specific planning for risk reduction and should become a central priority of national governments and the international community.

Impacts on Storage and Hydropower

90. Climate change and natural disasters hamper the ability of existing infrastructure to deliver water services across the region. Climate change adds a new source of uncertainty in all stages of a water project, from investment decisions into design, through construction and operation. For instance, increased climate variability that drives higher extreme discharge, may result in dams having to improve and expand their outlets and spillways to protect against future extreme floods.

91. The regional mean hydropower capacity factor in LAC over the period from 2020 to 2059 is likely to decrease by around eight percent on average (IEA 2021). Climate projections show that the two largest-hit regions are Central America and the Southern Cone, which would see a "consistent decrease in mean hydropower capacity factors due to the decline in mean precipitation and runoff" (IEA 2021) and (World Bank 2021a).[36] Despite these trends, only six countries in LAC have included climate impacts on hydropower development and suggested actions in their national adaptation plans (IEA 2021).

92. The effects of glacier and snow cap melt due to climate change in the Andean region is disrupting the water cycle dynamics with consequences on local livelihoods. As glaciers are natural water buffers that help regulate water flows throughout the year, their gradual disappearance will trigger serious disruptions in water resources management, impacting the lives of millions of people in the Andean zones. Yet, when there is an increase in the need for water storage in the medium-long term, water availability can increase in the short medium term due to glacier melt which, if stored and managed properly, could be good news for hydropower production in certain areas such as the northwest coast (Colombia, Ecuador, and Peru). For other parts of the region, such as Brazil, Venezuela, Paraguay, and Uruguay, a progressively lower hydropower capacity factor is expected, although further studies are needed to confirm this, given the differing results from climate models for future conditions in this sub-region.

93. Climate change can also be an influencing factor to enhance siltation, one of the major problems of dams. Worldwide, siltation processes are the main threat for dams. This process is enhanced by erosion, worsened at the same time by climate change-induced events (droughts or intense rains) coupled with land degradation processes (deforestation, bad agricultural practices, over herding, or urbanization). On many occasions, the siltation problem is not well monitored, and the magnitude of this issue is unknown. This is therefore a key factor to consider in dam safety.

Worldwide, siltation processes are the main threat for dams. This process is enhanced by erosion, worsened at the same time by climate change-induced events (droughts or intense rains) coupled with land degradation processes (deforestation, bad agricultural practices, over herding, or urbanization).

[36] Maurer et al. (2009) refer to a potential reduction in the Lempa river of 33 to 53 percent by 2070-2099. A similar decrease (35 percent) is mentioned for the Sinú-Caribe basin in Colombia where in spite a projected increase in precipitation runoff is expected to decrease due to greater evaporation (Ospina Noreña et al., 2009). On the other hand, an increase in precipitation and electricity generation is expected in the largest hydroelectric scheme in Ecuador, the Paute river basin (Buytaert et al., 2010). Also in southern Brazil in the Paraná river basin, studies have identified a slight potential for an increase of production; in the rest of the country, production is expected to decrease, especially in northeastern Brazil (de Lucena et al., 2009).

Impacts on River Navigation

94. Climate change is the main threat to river navigation, as inland waterways can be very vulnerable to droughts. Inland navigation services are affected by reduced water levels, making operators reduce their vessel load or even making waterways non-navigable (Christodoulou, Christidis and Bisselink 2020).[37] On the other hand, erosion and sedimentation processes also affect navigation, as higher sedimentation loads in navigable rivers increase the operation and maintenance costs due increased dredging needs (Guerrero, et al. 2013). These processes can be enhanced by extreme rainfall, coupled with other natural factors such as topography or geology, and by other anthropogenic ones such as deforestation or inappropriate land management practices.

95. Extremely low water levels were observed in the Paraná waterway in 2019 and 2020 that affected river navigation (Paoli 2020). According to the Binational Commission for the Development of the Upper Basin of the Bermejo River, about 23 million tons of sediment need to be removed each year to maintain the navigability of the La Plata waterway channels (COBINABE 2010). Although most of this load is naturally generated, inadequate soil management practices and aridity have contributed to its generation.[38] Sedimentation affects the structure and functioning of ecosystems, limits the capacity of waterways and ports, and modifies the quality of their waters, causing significant maintenance costs (World Bank 2021a).

[37] In the drought in the Southeast region of Brazil, the waterway Tietê-Paraná was closed since May 2014, generating a loss of more than 30 million during that event (Toloi, et al. 2016).
[38] Source: Regional Commission of the Bermejo River (COREBE), available in http://corebe.org.ar/web2015/problematica-de-los-sedimentos-en-la-cuenca-del-rio-bermejo/ Accessed in January 2021.

Box 7. Water in the National Determined Contributions

As of February 28, 2021, a total of 12 LAC countries had either submitted their first National Determined Contribution (NDC), their enhanced first NDC, their second NDC, or communications that confirmed their previous commitments, to the United Nations Framework Convention on Climate Change (UNFCCC) within the previous 24 months (see annex 1).

Based upon recently updated NDC's, several trends can be discerned. The first key trend is the increased importance given to water security. While most LAC states noted a high per capita abundance of water, most also noted that there could be significant sub-national challenges with dry corridors or regions. Water resource management and improvements to water security have been given considerable amounts of support in the updated NDC's, with Colombia, Panama, Peru, and Ecuador leading the way.

The second trend was the high level of commitment to pursuing basin or watershed management. Many LAC countries, including Colombia, Panama, Costa Rica, and Chile included measures and targets around preparing and implementing basin-led planning processes and plans.

The third trend was the high prevalence and recognition of nature-based solutions (NBS) as a policy and operational instrument for achieving both mitigation and adaptation priorities. While several countries had previously noted the importance of similar approaches such as ecosystem-based adaptation or the role of managing ecosystem services in meeting their commitments in first NDC's, some countries view NBS as an important tool for addressing climate change issues as well as addressing ecosystems and biodiversity challenges that are being exacerbated by climate change. Additionally, there have been commitments towards providing technical guidance over the next 2-3 years, including guidance that supports climate-proofing infrastructure and human settlements, implementing NBS, adapting water concessions in drought conditions, and in basin planning.

Finally, while water and water-related provisions are a common feature of climate adaptation sections, there is limited attention to the role of water in climate mitigation. The main exception to this trend is the recognition of the role that wetlands (including coastal), peatlands, and other ecosystems such as paramos play in emissions reduction, and mitigation in the wastewater sector in countries such as in Costa Rica, Colombia, and Chile.

1.3.9 Adapting to Risks: The COVID-19 Pandemic

96. In 2020, the COVID-19 pandemic presented a major global health and economic shock that underscored the importance of the water sector to public health and the need for institutional, business, and community resilience. When the pandemic emerged, it quickly became clear that clean water, handwashing with soap, and good hygiene practices are critical to preventing further spread of disease, alongside proper sanitation, and wastewater treatment. However, in LAC, existing gaps in reliable access to water sector services remain a challenge against future pandemics —especially in urban informal settlements (slums), health care facilities, schools, and other public spaces, where proper water services remain unavailable. At the same time, water supply and sanitation utilities during the pandemic faced challenges to effectively respond to shocks, and yet remain financially sustainable and resilient.

97. Beyond triggering a global health crisis, the pandemic has affected all sectors of the economy with compounding implications in the water supply and sanitation sector. To reduce virus transmission and gain time to equip hospitals with additional intensive care units (ICUs), most governments in LAC introduced strict lockdowns during the first months of the pandemic. Lockdowns and the economic downturn that followed, forced water supply and sanitation service providers to operate under a whole new set of conditions. First, water supply and sanitation utilities had to guarantee service provision to all, as most governments instructed utilities to reconnect customers in arrears and reach vulnerable population segments that previously did not have access to water supply. To achieve this, utilities had to employ alternative means of provision such as water trucks. Second, utilities needed to make arrangements for vulnerable staff to work from home, while developing new channels to interact with their customers and minimize person-to-person contact. This translated into fewer staff working on the ground and the need to develop technological solutions to customer service. Third, consumer behaviour changed, particularly in terms of consumption and payment culture. Most utilities saw large drops in non-residential water demand, as well as cash collections. Despite these limitations and risks imposed on WASH services and operations, the pandemic has also shown opportunities for a transformation to more sustainable management of water and sanitation for all.[39]

In LAC, existing gaps in reliable access to water sector services remain a challenge against future pandemics — especially in urban informal settlements (slums), health care facilities, schools, and other public spaces, where proper water services remain unavailable.

98. In response to the pandemic, governments and decision makers, regulators, and utilities implemented a myriad of measures, initiatives, and actions to secure water and sanitation services for all. The World Bank's Water Global Practice and the Stockholm International Water Institute have been monitoring the public policies on water supply and sanitation that governments in LAC introduced since March 2020.[40] These included emergency decrees, new regulations,

[39] Stockholm International Water Institute (SIWI) & United Nations Children's Fund (UNICEF) (2021). Socio-economic effects of COVID-19 on water, sanitation, and hygiene: a comprehensive review.

[40] For more information on the World Bank monitoring exercise, see 'Securing Access to Water & Sanitation Services in Times of COVID-19: Monitoring Responses in LAC', available in www worldbank.org/en/topic/water/brief/monitoring-responses-in-lac#1. The objective of this monitoring effort is to support regional sector knowledge and facilitate official information through the recording of sector measures and their evolution considering the COVID-19 pandemic. Tracked measures under this monitoring exercise are compiled periodically and can be accessed through a user-interactive platform: Water supply and sanitation: Responses to COVID-19 Dashboard, available in https://app.powerbi.com/view? r=eyJrIjoiNGI5NGY5ZTktZGVkMC00NDdiLTkwNGMtYzcxYzAwZjQxMWRlIiwidCI6IjMxYTJmZWMwLTI2NmItNGM2Ny1iNTZlLTI3OTZkOGY1OWMzNiIsImMiOjF9. Sector responses are monitored across 19 LAC countries at the national level, with a zoom-in on Brazil to also monitor responses at the state level.

mandates by the regulators, and official government announcements.[41] In an effort to respond to the global health pandemic as it was evolving in real time, government efforts in the region have included inter-alia: (i) measures and approaches to ensure access to a minimum daily volume of drinking water, basic sanitation, and increase awareness of good hygiene practices —with a focus on the consumer and community; (ii) bill payment assistance measures, especially targeting the most vulnerable population segments; (iii) direct support to water supply and sanitation utilities to continue the provision of services while reducing the exposure of workers and customers to the virus; and (iv) financial support to service providers to cover water supply and sanitation service fees and increased costs, among others. An overview of the main measures and actions identified in LAC during the March 2020– January 2021 is provided below (table 4).

99. The changes seen in consumer behavior had a negative impact on utilities' average tariffs and operating revenues. The pandemic had a direct impact on the utilities' income. In 19 utilities studied in LAC, the total losses due to the COVID-19 pandemic in 2020 were estimated at US$79.8 million. These losses represent 5.2 percent of the utilities' projected revenues for the same period. COVID-19 also had a stark effect on the utilities' collection and, therefore, on cash flow. On average, cash flows in the 19 utilities surveyed fell by 49 percent between March-December 2020.[42]

The pandemic had a direct impact on the utilities' income. In 19 utilities studied in LAC, the total losses due to the COVID-19 pandemic in 2020 were estimated at US$79.8 million. These losses represent 5.2 percent of the utilities' projected revenues for the same period.

100. Short-term liquidity issues may have a longer-term impact on financial sustainability for utilities operations because of possible deferred investments and maintenance. Cash-strapped utilities could have delayed capital investments and periodic maintenance to guarantee operations during the pandemic. Although data on capital expense deferral across utilities in the region is insufficient at this time, some utilities assessed in LAC have acknowledged deferring some of their planned capital investments. For instance, five utilities surveyed in Colombia expected to delay some investments in 2020. These utilities reported plans to defer between 18 percent and 43 percent of the total capital investments scheduled for that year. Reports of delayed investments were also provided by sector authorities in Bolivia, Brazil, Ecuador, and Mexico.

101. Initiatives providing financial support to utilities have been shown to be weak and limited in some cases, with very few operators having received support to guarantee operation of services. To alleviate the financial burden on service providers, some measures were taken to counter bill payment mandates that were reducing cash flows. Some countries allowed sector utilities to tap into contingency funds which were previously earmarked for other purposes, such as in Peru and Colombia. Other countries, such as Chile, allocated new funding to the service providers to provide a financial cushion during the pandemic and ensure service continuity. Some measures provided specific support to rural and community service providers, albeit with very limited scope. Measures to allow softening the financial burden on service providers included tax breaks and cancelling of loan installment payments for providers, such as seen in Brazil and Costa Rica. However, a preliminary analysis by the WB is showing that some of these funds have not been near enough to meet the financial needs of the utilities.[43] Figure 37 shows the changes in cash flow projected in 10 utilities

[41] Giné-Garriga, et al. 2021. COVID-19 water, sanitation, and hygiene response: Review of measures and initiatives adopted by governments, regulators, utilities, and other stakeholders in 84 countries.
[42] World Bank financial impact study, 2020.
[43] World Bank financial impact study, 2020.

surveyed in Brazil, Costa Rica, Honduras, and Colombia. The figure shows the percentage difference between monthly cash flows reported or projected for 2020, and the monthly cash flows that would have been expected for 2020 without the pandemic (non-COVID scenarios).

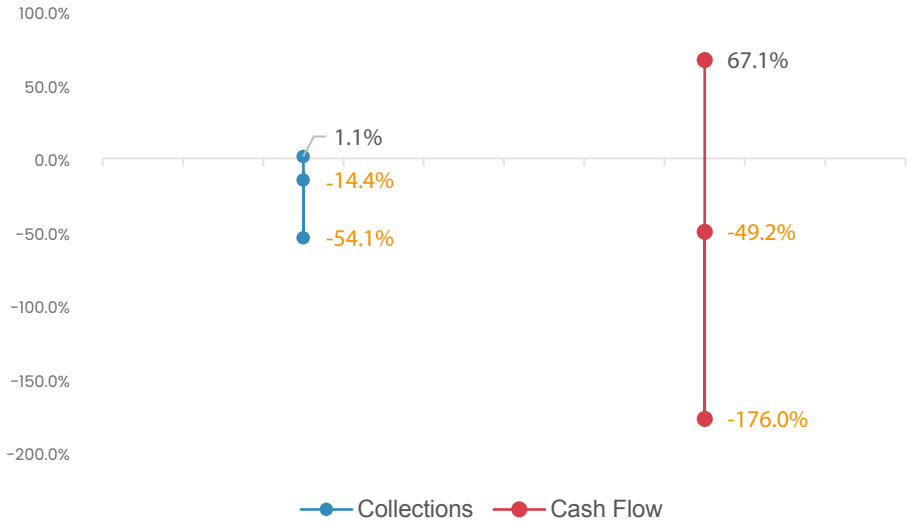
102. Few government interventions provided other solutions to secure the continuity of WASH services. For instance, with a few exceptions, no significant measures were taken to ensure electricity access to utilities to perform their operations and very little was done to ensure continuity of the supply chains for materials needed for these operations. Additionally, only a few countries, such as Peru, seem to have provided additional technical assistance programs through an online capacity-building program to service providers within the context of the pandemic.

Table 4.
Pandemic Measures and Actions Identified, March 2020 – January 2021

Target	Key response blocks	Examples of identified measures and actions
Water users and general public	Measures and approaches to ensure access to a minimum daily volume of drinking water and basic sanitation and increase awareness of good hygiene practices – with a focus on the consumer and community.	• Protect clients and water supply and sanitation workers by closing offices and installations to the general public. • Closing customer service desks and providing alternative communication channels through the fostering of smart and digital solutions for customer services and bill payment. • Promoting behavior-change population-wide initiatives and awareness-raising campaigns for hand washing, stay at home campaigns, and the rational use of water at the household level. • Setting-up handwashing stations (by water supply and sanitation service providers) in public spaces and COVID-19 hotspots • Distributing free water to unconnected areas or to regions with scarcity problems.
	Measures and approaches to facilitate bill payment – with a focus on the consumer.	• Allowing the waiving and/or deferral of water bill payments for certain population groups. • Freezing tariff rate increases. • Suspending the disconnections of services despite non-payment.
Water supply and sanitation service providers and sector institutions	Measures and approaches that provide direct support to water supply and sanitation service providers to continue operations and provision of services.	• Mandated work-from-home to vulnerable staff and providing additional attention to this group (staff over 60 years of age, staff with certain medical conditions, etc.). • Suspending non-essential meetings and to encourage isolation. • Mandating home-based work for administrative staff. • Introducing rotating schedules for operational and technical staff. • Providing tailored transport modalities, accommodation, and personal protective equipment (PPE) for essential staff. • Ensuring additional cleaning of offices, ensuring increased hygienic measures. • Maintaining all staff informed on COVID-19 strengthening infection prevention and control (IPC). • Boosting the implementation of automation and remote-control processes. • Ensuring needed technical capacities for utility staff through the launching of new (online) capacity building programs.
	Measures and approaches that provide financial support to service providers to minimize the financial impact and ensure service continuity.	• Introducing modalities though which utilities can access financial resources and/or to allocate emergency funds to water supply and sanitation service providers. • Providing financial relief to utilities, such as through tax breaks.

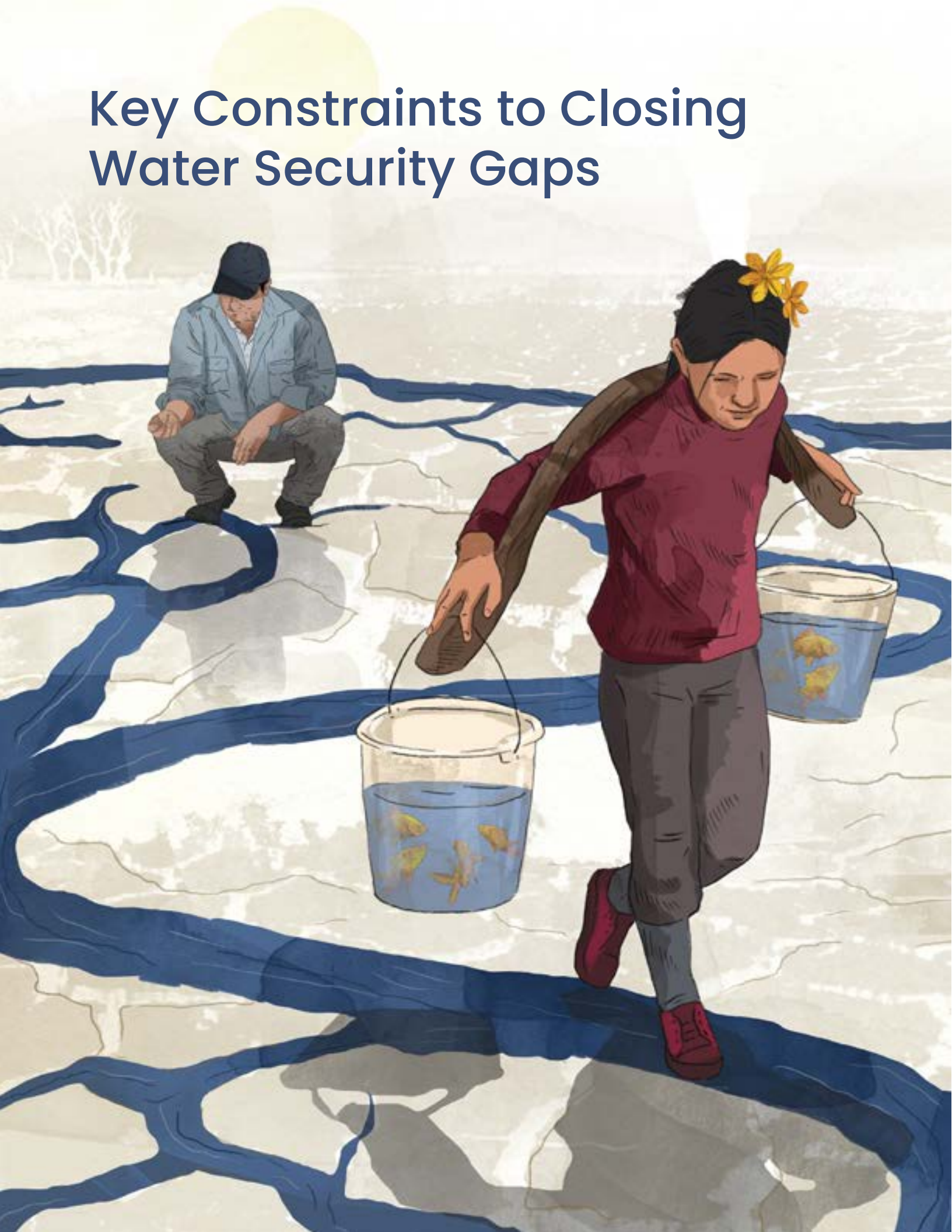
Source: World Bank, 2020
Note: Measures and actions dentified in LAC during the March 2020 – January 2021 period.

Figure 37.
Impact on Collections and Cash Flow



Source: Own calculations based on data provided by utilities.
Notes: The graph shows the maximum and minimum percentage change between the monthly values reported or projected for 2020 and the monthly values expected for 2020 without the pandemic. These changes are the top and bottom values shown in each bar. The average change in the utilities selected is shown in the middle value of each bar. Ranges for collections are based on data and projections from 11 utilities in Brazil, Colombia, Costa Rica, Honduras, and Peru for March-December 2020. Ranges for cash flow are based on data and projections from nine utilities in Brazil, Colombia, Costa Rica, Honduras, and Peru for March-December 2020. These utilities were selected from the study's utility pool based on their data availability.

Key Constraints to Closing Water Security Gaps



2. Key Constraints to Closing Water Security Gaps

Key chapter takeaways:

Constraints are linked to inadequate performance in conducting essential functions for managing water resources, delivering services, and mitigating water-related risks. Other limitations include poor infrastructure, lack of finance, and deficiencies in the governance system.

Performance

Managing water resources

- LAC is the worst performing region with respect to implementation of integrated water management principles, and the region that has made the least progress in the period 2017-2020.
- Most countries in Central America still lack basic institutions and regulatory frameworks, while countries with more advanced institutional set-ups continue to underperform, mainly due to poor monitoring, lack of decision-support tools, and low river basin planning.
- Cost recovery is weak as only a few institutions establish fees for water use or pollution discharge aimed at managing water resources.

Delivering water services

- Water supply and sanitation utilities face operational and financial challenges, resulting in high O&M costs, greater consumption levels, and water loss.
- Utilities are far from full cost recovery.
- Low water productivity contributes to efficiency, reliability, and equity issues in collective irrigation systems.
- There is a lack of cooperation between public and private sectors to restore, expand, or modernize irrigation systems. Water user organizations still face capacity issues across the region.

Mitigating water-related risks

- High levels of exposure and vulnerability to floods are due to the lack of proper risk management.
- Land-use changes are often unmanaged, which also modify water balances.
- Insufficient monitoring and forecast capability, together with poor or non-existent coping mechanisms to deal with droughts and floods, are also common across the region.

Water sector architecture

Infrastructure and financing gaps

- **Storage:** Since there is still a large untapped potential to develop hydropower capacity, the region is well positioned to think through multipurpose projects.
- **Water supply and sanitation:** During 2008-2016, public investment in the water supply and sanitation sector was US$5.2 billion annually in 2019 prices. However, the annual investment needed is estimated to be more than US$20 billion per year to achieve the water supply and sanitation (WSS) targets under SDG 6.

- There is not sufficient information to estimate the financing gap for flood mitigation infrastructure. Gray infrastructure remains mainstream, with unexplored opportunities to develop green infrastructure.

Governance

- Several LAC countries lack institutional frameworks and regulation tools for decision-making that support water resources management, especially at the basin level.
- Policy coordination with other sectors, including urban and land-use planning, precludes pragmatic approaches to manage water resources.
- Hydrological information is limited, impeding the implementation of adequate water allocation regimes, and causing transboundary conflict.
- Corporate governance practices in water supply and sanitation utilities are weak across LAC. Decentralization processes remain dysfunctional and sector policies do not facilitate service provision with adequate funding.
- Many Central American countries tend to focus on disaster responses rather than preparedness and mitigation. Key institutions lack technical capacity to assess water-related risks, especially in hydromet services.

2.1 Key Water Sector Performance Issues

103. Despite ongoing government efforts, water management agencies, water service providers, and institutions in charge of mitigating water risks in LAC are still facing key performance issues.

2.1.1 Performance Issues

104. Performance of water resources management institutions has not been systematically tracked or assessed. Growing competition among water users, groundwater overexploitation, and water quality issues are all indicative of the poor performance of water resources management institutions in the region. However, no specific indicators that track institutional performance have yet been developed. Proxy indicators include SDG 6.4.1[44] which measures water efficiency and SDG 6.5.1 which, through qualitative questionnaires, partially assesses the implementation of the main functions of water resources management. Both indicators show a dire situation for LAC.

[44] The SDG indicator 6.5.1 tracks the degree of integrated water resources management (IWRM) by assessing its implementation though four key components: enabling environment, institutions and participation, management instruments, and financing. This indicator considers the different users and uses of water with the aim of promoting positive social, economic, and environmental outcomes at national and subnational levels (UN 2015).

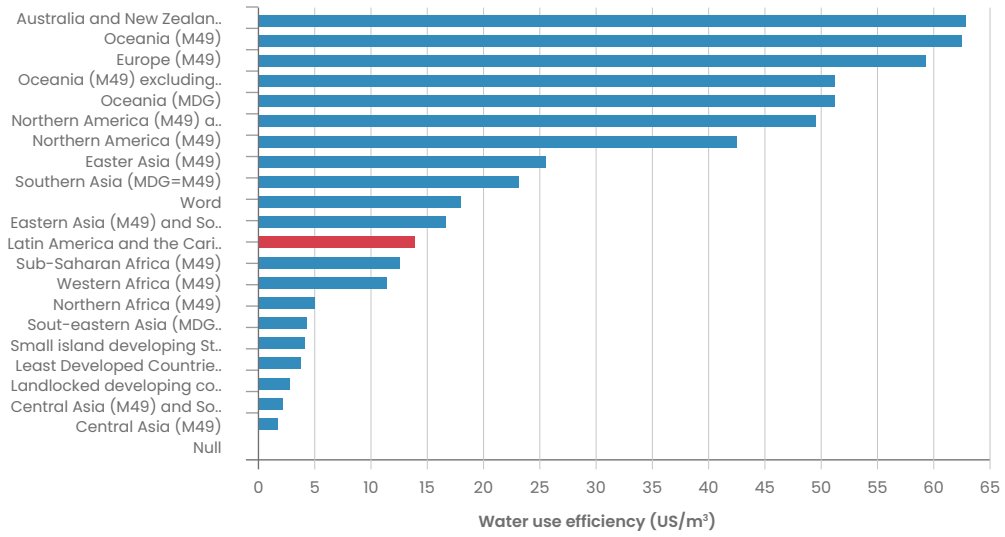
Box 8. Key Water Resources Management Functions

- Granting, registration, and regulation of water rights
- Monitoring of water use
- Promoting user participation in water resources management
- Managing information for water resources management
- Managing groundwater resources
- Measuring Water quality
- Managing water risks and climate change adaptation
- Development of hydraulic infrastructure and dam safety
- Managing financing mechanisms for water resources management
- Promoting planning mechanisms for water resources management
- Conflict resolution
- Management of transboundary waters

Source: Own analysis based on UN Environment 2018

105. The proxy for water resources management performance is water use efficiency, which can be tracked through SDG indicator 6.4.1. This indicator measures efficiency in water use measured in US$ per cubic meter of water used, reflecting the impact of economic growth on the use of water resources, and essential to guarantee water availability for the future generations. In the world, the efficiency of water use increased from 12.58 US$/$m^3$ in 2000 to 18.17 US$/$m^3$ in 2017. LAC is the only region that has decreased overall efficiency in this period.

Figure 38.
Water Use Efficiency by Region

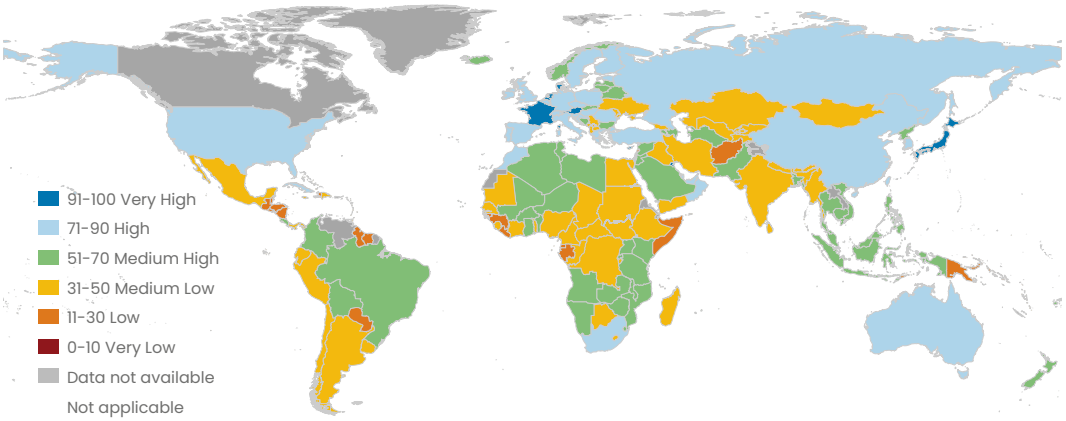


Source: United Nations statistics, 2017

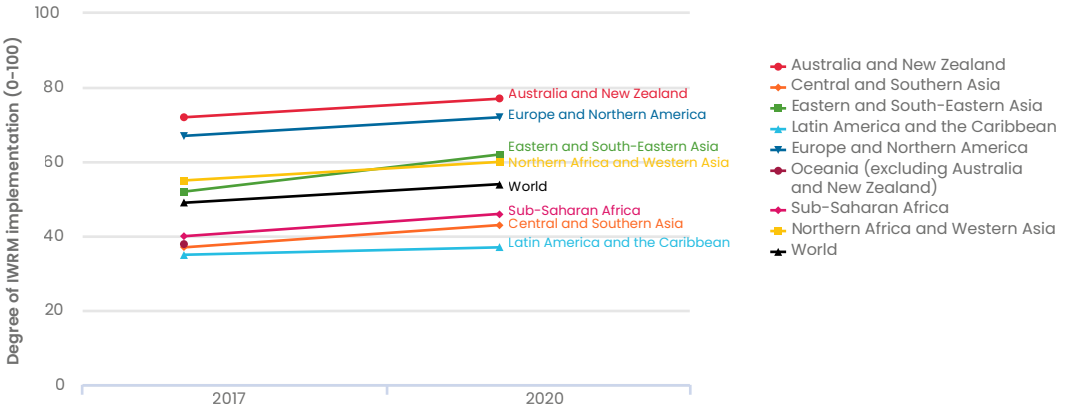
106. The monitoring of SDG 6.5.1 shows that LAC is the worst performing region with respect to IWRM implementation and the region, which has made the least progress in the period 2017-2020. Some of the key issues identified by the SDG monitoring exercise are the lack of planning at the basin level, data sharing, pollution control, aquifer management, and the funding of water resources management (including national budget for investment, budget to cover recurrent costs and revenues raised from users).

Information about groundwater dynamics and volumes extracted by different users is often missing, which means many water governments do not have reliable information to allocate water resources and control its use in terms of quantity and quality.

Figure 39.
SDG Indicator 6.5.1



Progress over time of indicator 6.5.1 Degree of integrated water resources management implementation (0-100)



Source: UN water monitoring SDG 6 on water and sanitation, 2020
Note: SDG indicator 6. 5.1 on integrated water resources management implementation is measured on a scale of zero to 100 based on UNEP methodology available at http://iwrmdataportal.unepdhi.org/currentdatacollection.

107. As evident from monitoring SDG 6.5.1, the region experiences important gaps in reliable information about water resources and water use. In many cases, hydrological monitoring programs are only partially functional; monitoring networks are in a precarious state; data sets are dispersed and/or unorganized; and many of the information products are not yet designed bearing user needs in mind and are not well disseminated.

108. Important information gaps exist particularly in relation to water quality and groundwater, hindering the ability of governments to carry out basic water resources management tasks. Information about groundwater dynamics and volumes extracted by different users is often missing, which means many water governments do not have reliable information to allocate water resources and control its use in terms of quantity and quality. The application of conjunctive use policies of surface and groundwater—a potentially robust strategy in areas of high competition and stress—is therefore difficult to implement, and key functions such as planning, allocation of water rights and issuing of licenses cannot be fully developed.

109. Lack of information is not always the main problem. Sometimes information exists but it is not accessible by other institutions or to the public. Many reasons are at the heart of this issue including: i) lack of institutional willingness to share information due to the sensitive nature of it (this often happens for water quality information); ii) lack of clear responsibilities among institutions and competing institutional responsibilities (i.e. competition among hydromet services and water resources management institutions that often have overlapping duties regarding information generation; iii) lack of open data regulations; and iv) lack of a sense of information product service that results in ill designed information that is not useful for the target audience. Some of these challenges explain why water resources are being used and managed without a full understanding of the consequences in terms of potential overexploitation, impact on water quality, and implications for other users and ecosystems. Moreover, it makes it difficult for water resources managers to establish the use of analysis tools in the decision-making process and for decision makers to convey difficult decisions to other stakeholders.

110. Water resources planning is only partially carried out on a catchment scale. Water resources planning is a first essential step for adequate water management. However, river basin management plans, if they exist, tend to be isolated studies rather than useful water resources management instruments linked to environmental and territorial planning. Without a wider analysis and planning context, there is limited ability to consider broader system linkages and assess current and future risks. In LAC, the main gaps in conducting this key function are as follow:

- Water programs are often planned and developed under infrastructure projects without embedding them in a wider analysis and planning context, which requires rigorous consultation or through a consensus-building process. Consequently, concerns raised by the local communities and interest groups are often not taken into consideration, resulting in solutions that oversee the affected populations and ultimately lead to the rejection of public schemes and conflicts over water resources.
- Water plans and programs do not establish criteria for capital investment prioritization, and thus, it is not possible to generate comprehensive and rational project pipelines.
- River basin plan methodologies are usually out-dated without a forward-looking analysis, missing the incorporation of climate and non-climatic uncertainties, and excluding other metrics such as adaptability/flexibility, robustness, resilience, or consideration of circular economy opportunities in the basin. In countries like Colombia and Peru, plans are prepared and consulted. They are not properly enforced according to the established legal frameworks. This is often because plans cut across different sectors or jurisdictions, and institutional coordination is complex. For instance, in these countries, municipalities' territorial plans are rather opportunistic and do not evaluate the limitations imposed by water plans.

Box 9. Water Resources Planning at the basin level, a new approach

The typical geographical scale of a river basin management plan is the river basin. Its purpose is to carry out a comprehensive analysis of all relevant topics under a framework, discuss issues, coordinate with stakeholders (different branches and levels of administration, users, productive sectors, interest groups, and population) and agree on measures to be adopted. The key outcomes of a river basin management plan are, on one hand, the allocation of water resources to different uses and environmental purposes, and on the other hand, a program of measures (structural and non-structural) to be implemented by different stakeholders, in accordance with the objectives defined in the plan. The planning process is an important instrument to establish a common understanding of issues, coordinate stakeholders, and build consensus about the policies and measures to be adopted. Traditional planning approaches have focused on a predict-then-act methodology that fails to incorporate future uncertainties in the planning process in a systemic manner. The WB has been promoting a new approach to river basin planning, incorporating traditional participatory approach metrics to include risk and uncertainty analyses that looks at a system performance, including efficiency measures, robustness, and reliability among others. Examples of this efforts can be found at: https://openknowledge.worldbank.org/handle/10986/22544.

111. In addition to these issues, WB engagement in the region has demonstrated that despite the government's efforts to implement well-functioning water rights allocation mechanisms, the efficient management and allocation of water rights[45] remains a key performance challenge. Argentina, Chile, and Mexico have a well-established tradition of water rights allocation mechanisms with established rules and a registry system. Despite these examples, the characteristics of water rights and the responsibility of water users vis-a-vis these rights are not often clear in national regulatory frameworks. On one hand, some countries are still struggling to reconcile their national regulations to include basic principles of water rights such as effective and beneficial use, reasonable utilization, forfeiture, or revocation for violation of conditionalities, financial charges, obligation to inform, and requirement for registration. On the other hand, even if these principles are clearly regulated, government institutions are still struggling to keep updated records of water rights that can reflect actual water use. Water rights record systems are often outdated and the granting of water rights is not usually done based on river basin water balances, leading to mismatches between the administrative and the basin reality. Countries like Chile have made an effort to bridge this gap through a digitalization process and the use of drones and remote sensing technology to match actual water use to administrative registries, but the gap remains large.

[45] Water concessions, water permits, and water licenses for use refer to the water allocation granted by the government to private users for its use.

112. The financial dimension of water resources management remains a primary concern for most LAC countries. Investment in IWRM is, in fact, one of the key shortfalls that hinder the performance of institutions as well as the capacity to manage water resources in a sustainable manner. The 2021 United Nations Environment Programme's (UNEP) SDG 6.5.1 indicator report shows that the region continues to rank as low/very low in terms of national investments in IWRM implementation.

113. In LAC, only a few institutions set fees for bulk water consumption or pollution control. If fees are even established in national regulatory frameworks, these financing mechanisms are not sufficient to cover operational and administrative costs, let alone investments. More importantly, they do not have a ring-fencing system to capture all water-related costs. In Mexico, the National Water Commission (CONAGUA) is a decentralized agency of the Ministry of the Environment and Natural Resources responsible for issuing permits and redistributing the proceeds from tariffs in water resources management projects. Even though these tariffs represent a large percentage of CONAGUA's budget, the lack of incentives and effective verification mechanisms discourage further improvements in cost recovery. Another institution that exemplifies this case is the National Water Authority (ANA) in Peru, which established retribution mechanisms with the aim to reduce wastewater discharges and protect ecosystems. Though these tariffs are directed towards ANA's expenses, they do not cover the entire operation and investment costs.

114. These water management fees cannot be implemented in the region largely due to the lack of water use and water contamination information as well as enforcement capabilities. Most countries lack adequate institutional structures and regulatory capacity to enforce these instruments. For example, Colombia has built a wide range of water management instruments in the past 40 years—quantity and quality regulation, price signals for efficient water use, and mandatory investments that protect important water resources (ECLAC 2011). However, there is still no legislation that charges for water contamination as such.

The 2021 United Nations Environment Programme's (UNEP) SDG 6.5.1 indicator report shows that the region continues to rank as low/very low in terms of national investments in IWRM implementation.

2.1.2 Performance Issues in Water Services

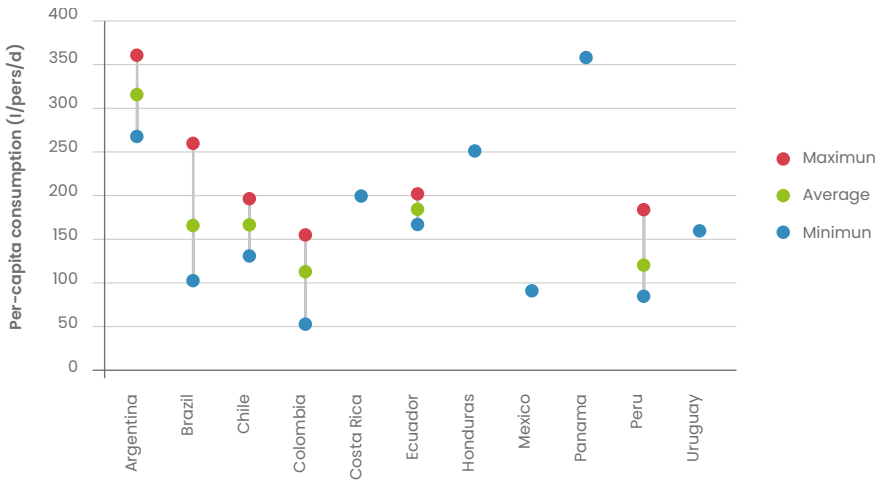
Water Supply and Sanitation

115. Two different factors are evaluated to assess the performance of water and sanitation delivery: quality of service and operational efficiency.

(i) **Quality of service.** Quality of service is not fully satisfactory even in areas with high coverage. The main problems detected are: (i) lack of potability due to the presence of fecal matter and chemical pollutants; (ii) lack of sufficient pressure to ensure the arrival of water to upper floors; and (iii) lack of continuity in the service, with long periods of water outages (Bretas, et al. 2020). Poor quality of the groundwater supply reduces potability due to the presence of nitrates, arsenic, boron, and other pollutants. About a quarter of those with access to groundwater get it by informal means (Borja-Vega, Perochena, and Zuilu 2015). Moreover, in recent years, the continuity of service has declined (Bertoméu-Sánchez and Srebrisky 2018), and many countries continue to struggle with water quality. For example, Nicaragua ranks 0.76 (0-1) in the Unsafe Water Quality Index, passing LAC's ranking of 0.75 (0-1) (See Regional Water Security Diagnostic World Bank 2021).

(ii) Operational Efficiency (production and consumption, losses, micro metering). On average, the per-capita water consumption in Latin American cities is estimated at 159 l/person/day, significantly higher than the average in other regions (Lentini 2015).[46] A study of 66 water companies indicates that 26 out of them are within a range of 125-175 l/person/day. However, some operators report average values of up to 360 l/person/day.[47] These numbers portray the differences between countries. On the one hand, low average values of per-capita consumption are reported in Colombia and Peru with 110 and 122 l/person/day, respectively.[48] [49] On the other hand, the highest per-capita consumption values are reported in Argentina, where users consume 320 l/person/day (see figure 40). This is in line with the fact that Argentina is also the country with the lowest presence of household metering (31 percent). High per-capita water demands indicate low awareness, inefficient water use, or the use of drinking water for other (non-household) purposes. High water demands also create a problem of legitimacy when asking other users (for example, farmers) to increase efficiency.

Figure 40.
Per-capita Water Consumption in Cities



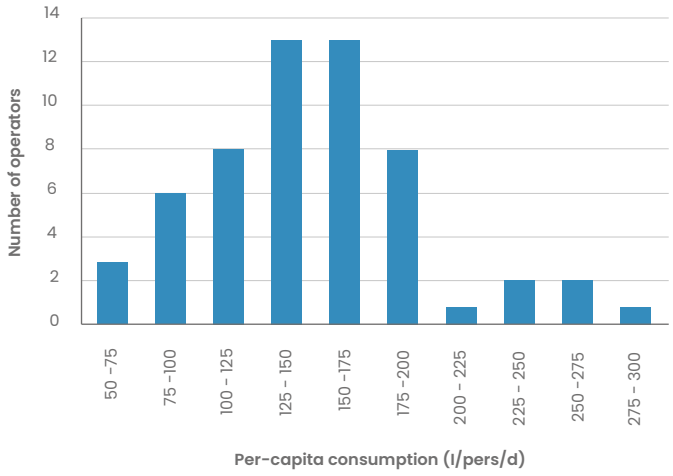
Source: Own calculation based on on Lentini, 2015

116. Lower per-capita consumption on a large scale is feasible, including an enormous potential to save water in Latin American cities that tend to face water shortages. For example, Lima, Sao Paulo, and Buenos Aires have average consumption rates of 163, 197 and 336 l/person/day respectively. Reducing consumption to values closer to the ones observed in European cities would contribute considerably to alleviating the context of water stress in LAC.

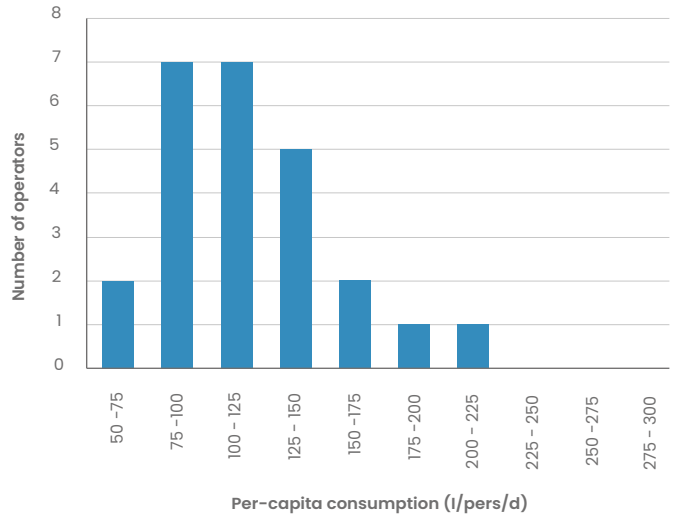
[46] Average water consumption in many European countries is in the range of 75-125 l/person/day with an average value of 118 l/person/day (EUROSTAT).
[47] Lentini (2015). El futuro de los servicios de agua y saneamiento en América Latina – Desafíos de los operadores de más de 300000 habitantes.
[48] Empresa de Acueducto y Alcantarillado de Bogotá (2020)
[49] Superintendencia Nacional de Servicios de Saneamiento (2015)

Figure 41.
Comparison of Per-capita Water Consumption in Latin American Cities and Europe

57 Latin American cities, average consumption: 149 l/person/day



25 European countries, average consumption: 118 l/person/day



Source: Own calculation based on Lentini, 2015 and EUROSTAT
Notes: Outliers are excluded in LAC and Europe analysis. Outliers are observations that differ significantly from the data sets obtained for the analysis.

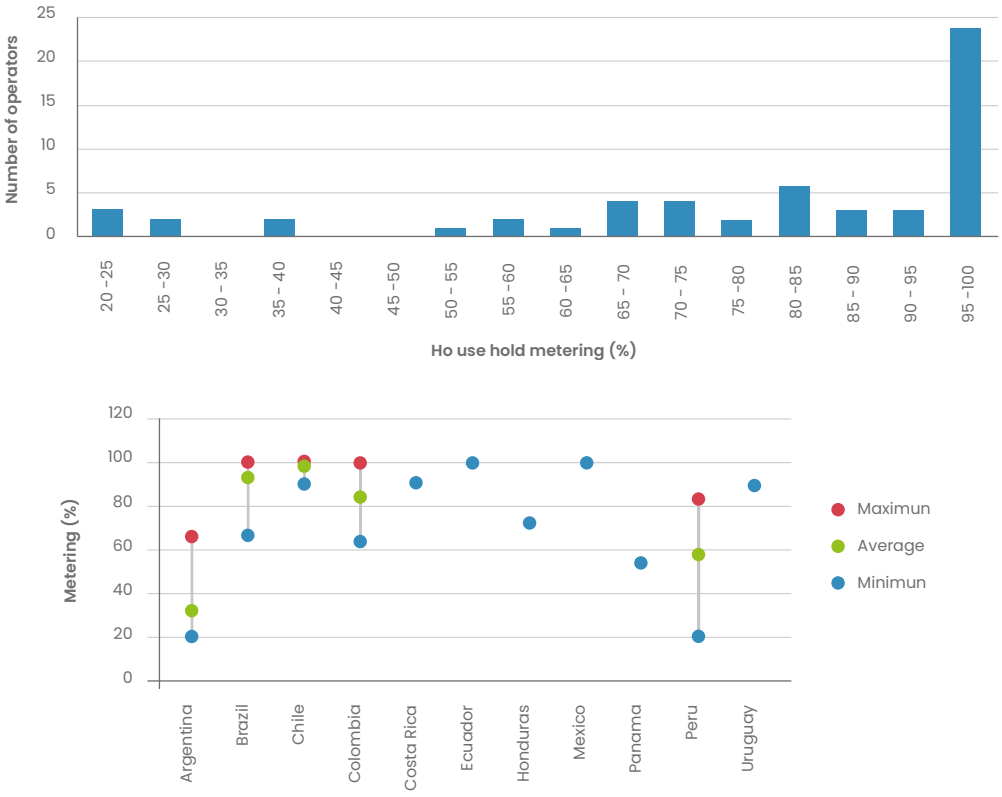
Table 5.
Per-capita Water Consumption in Lima, Sao Paulo, and Buenos Aires

City	Operator	Population served	Per-capita consumption (l/person/day)
Lima	SEDAPAL	8,710,675	163
Sao Paulo	SABESP	25,484,070	197
Buenos Aires	AySA	8,797,301	336

Source: Lentini, 2015, and SEDAPAL, 2018

117. Household metering has been implemented in most LAC countries since it is considered an important element for controlling and incentivizing rational water use. According to previous studies, nearly 80 percent of households are equipped with metering devices. A survey among water companies revealed that 24 out of 55 had implemented 100 percent metering at the household level. However, while connections in many supply systems are metered, there are cases where only 20 percent are equipped with metering devices. Moreover, significant differences between countries exist, with the highest percentage of metering found in Brazil, Chile, Ecuador, and Mexico. While countries such as Argentina and Peru have only 31 percent and 54 percent of households equipped with metering devices, respectively.

Figure 42.
Household Metering

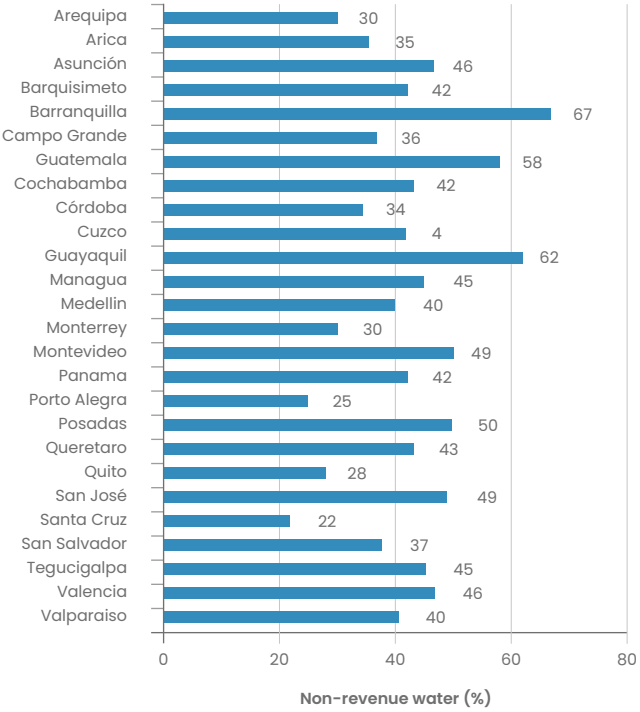


Source: Own calculation based on Lentini, 2015

118. In Latin America, an important share of water is lost before it reaches the customer. A study carried out in 26 medium-sized cities in different LAC countries revealed that non-revenue or unaccounted-for water exceeded 40 percent (Carrera, et al. 2018). The city with the lowest percentage lost (Santa Cruz) still had 22 percent of non-revenue water (NRW), with the caveat that the provider there serves only 50 percent of the population in the higher income part of the city where the service is under operational control (Carrera, et al. 2018).[50]

[50] A report that analyzed operational and financial data of 66 water companies in 11 countries estimated average non-revenue water to be 38 percent. According to this study, the best companies reach ratios of 10-15 percent. In contrast, the company with the highest percentage of non-revenue water reported a loss of 75 percent. Practically, in all countries, the average unaccounted-for water was 35-40 percent.

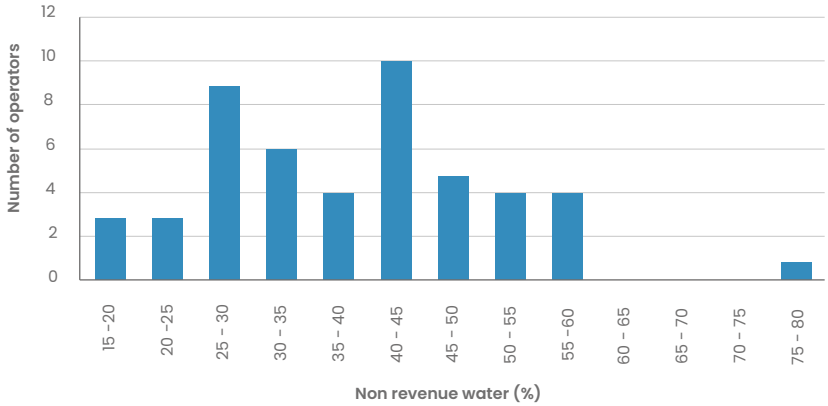
Figure 43.
Non-revenue Water Latin American Cities

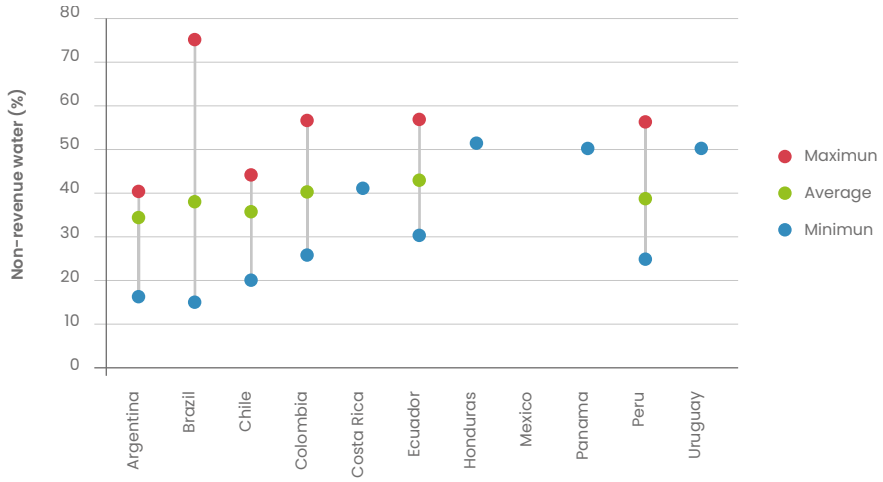


Source: Carrera et al., 2018

119. The high percentage of NRW not only constitutes an important loss in revenue, but also has significant operational and financial implications for service providers. TThis results in additional treatment costs, loss of scarce water resources, negative impact on service quality, and energy for treatment and pumping. Reducing NRW is an important part of a service provider's strategy to increase drinking water coverage, improve water security, and achieve financial sustainability.

Figure 44.
Non-revenue Water in Latin American Water Companies





Source: Own calculation based on Lentini, 2015

Financial Sustainability of Operators

120. The financial sustainability of WSS operators in LAC has room for improvement. Revenues from tariffs usually cover most of utilities' expenses (except for countries like Argentina or Panama). However, they are far from achieving full cost recovery levels, including debt service, amortization of assets, and capital expenditures. The consequences of this challenge are reflected in table 6 (Andres, 2021).

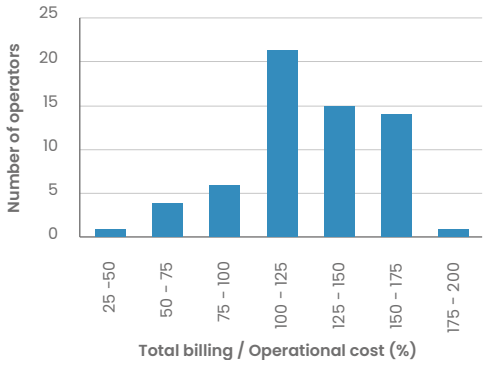
121. The combination of tariff revenue and government transfers continues to be the predominant financing scheme. The proportions in which both elements are combined vary not only from one country to another but also among regions, provinces, municipalities, and cities within a country. In a study carried out among 62 operators in cities with more than 300,000 inhabitants, most companies (51 out of 62) generate more revenue through total billing than their operational cost, which means that, in principle, they are able to finance operations through their regular income.

Table 6.
Impacts of Failing to Achieve Full Cost Recovery for Water Utilities

Total cost	Description	Impact
O&M costs	The cost of operating and maintaining the WSS system.	Failure to recover O&M costs leads to immediate financial stress and deterioration of the quality of supply in the short term.
Financial costs	O&M costs plus depreciation, debt costs, and equity return.	Failure to recover depreciation costs reduces productive capacity in the long term. Failure to recover equity and debt costs could lead the utility to underinvest. Both lead to deterioration in the quality of supply in the long term.
Economic costs	Financial costs plus opportunity costs and externalities.	Failure to recover economic costs can result in resource depletion and environmental degradation.

Source: Andres 2021, adapted from World Bank, 2019, report, "Doing More with Less: Smarter Subsidies for Water Supply and Sanitation"

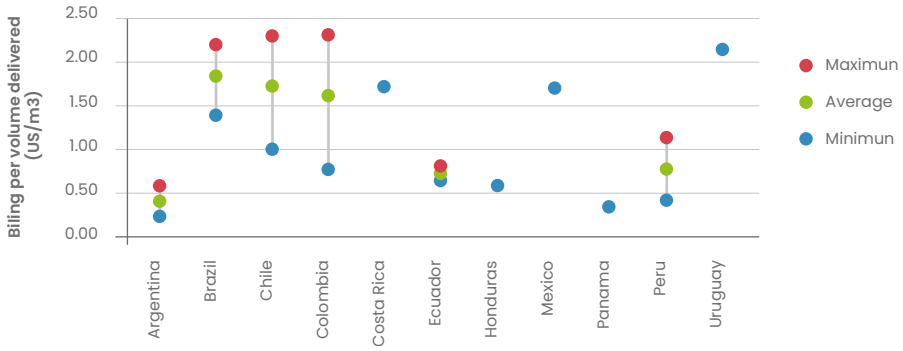
Figure 45.
Operational Income Versus Operational Cost



Source: Own calculation based on Lentini, 2015

122. Water tariffs in LAC are determined by balancing the financial needs of operators, regulatory requirements, affordability concerns, and social/political viability. The average water tariff in Latin American cities is in the order of 1.4 US$/m³, with significant variations between countries. Relatively low tariffs (less than 1 US$/m³) are reported by companies in Argentina, Ecuador, Panama, and Peru and higher billing rates (above 1.5 US$/m³) prevail in Brazil, Chile, Colombia, Costa Rica, Mexico, and Uruguay.

Figure 46.
Billing per Volume Delivered in Latin American Cities

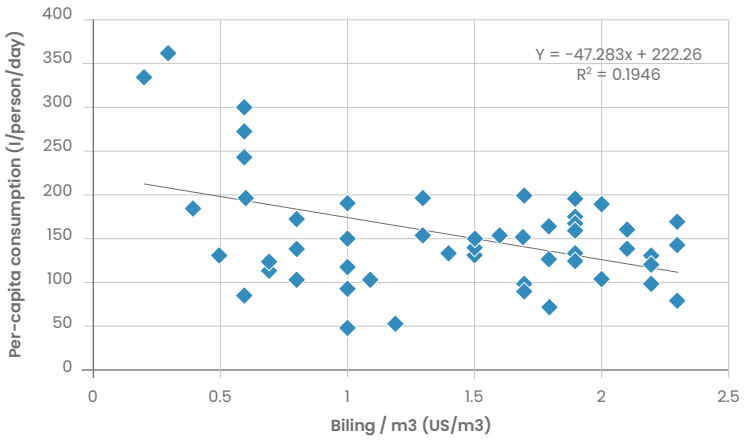


Source: Own calculation for this publication based on Lentini, 2015

123. Design of water tariffs respond to often conflicting objectives (Andres, 2021). Cost recovery, economic efficiency, and affordability also compete with other objectives such as environmental sustainability, simplicity, stability, transparency, acceptability, and promotion of access. In terms of efficiency, an analysis of the records of 57 companies supplying water to cities with more than 300,000 inhabitants reveals that a relation between water tariffs and per-capita water consumption exists; higher tariffs tend to coincide with lower consumption, but the correlation is not very strong. Thus, it seems reasonable

to assume that low water consumption is the result of several factors (including obviously water tariffs, but also household metering, user awareness, public water saving campaigns, etc.). Consequently, demand management programs must combine these different elements to be effective.

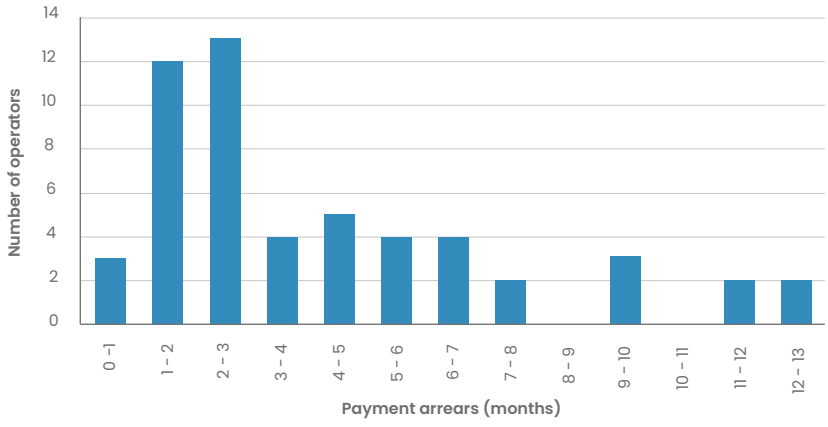
Figure 47.
Correlation Between Water Tariffs and Water Consumption



Source: Own calculation based on Lentini, 2015

124. In LAC, service operators face significant problems in obtaining regular payments from customers. In a comparison of 52 water companies, 37 operators received payments after a delay exceeding two months. Only 15 had arrears of less than two months.

Figure 48.
Payment Arrears of Water Companies



Source: Own calculation for this publication based on Lentini, 2015

125. Water bills and the amount people spend on water from private vendors are a significant cost factor for many families in Latin America. While some receive water from municipal networks, others purchase water from private vendors. The cost of water from trucks is often a multiple of the price for domestic consumers. In addition, due to the distrust of the quality of tap water, a large part of the population in many LAC countries use drinking water from 20-30 liter-containers of purified water, which are sold commercially.

Box 10. SIASAR: the Rural Water Supply and Sanitation Information System

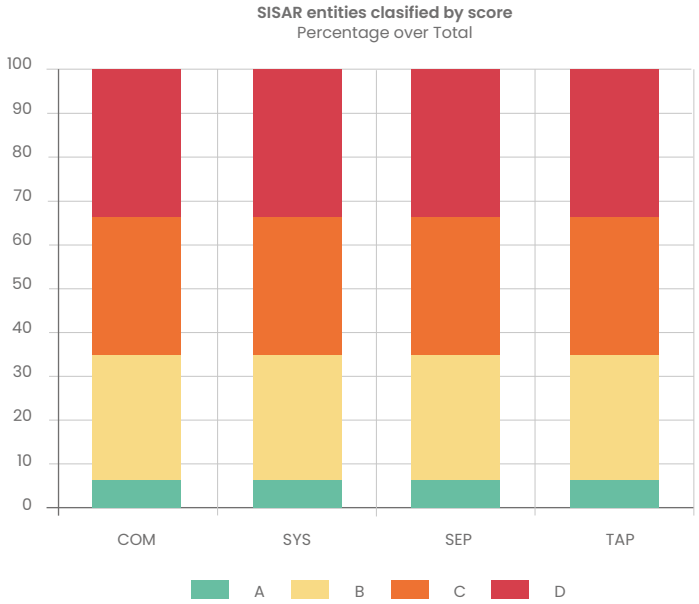
The Rural Water Supply and Sanitation Information System (known by the Spanish acronym SIASAR) was launched by the governments of Honduras, Nicaragua, and Panama in partnership with the Bank in July 2011. This initiative emerged from the need for countries to count on systematic and reliable information and aimed to develop information, communication technology-based monitoring, and decision-making tools for the rural water supply and sanitation sector. At present, more than 32,000 rural communities have been entered into SIASAR, covering approximately 26,000 water supply systems managed by 22,000 service providers. SIASAR coverage data reaches more than 35 percent of targeted rural communities —an equivalent of approximately 18 million people.

Analyzing data from the communities registered in the system offers an insight into the reality of rural services that complements coverage data. Specifically, SIASAR provides a snapshot of the current status of water supply and sanitation systems, providers, and communities, and factors that contribute positively or negatively to the sustainability of water supply and sanitation services over time. Similarly, data gathered using SIASAR offers a disconcerting picture of the sustainability of rural water supply and sanitation services provided in communities.

Communities: When looking at the community level index, which aggregates indicators from the level of service, the system, and the service provider, a similarity of the community level classification distribution with that of service providers is observed. Approximately seven percent of communities have achieved a classification of "A" as shown in the figure below. More than 60 percent of communities fall into categories "C" or "D," suggesting that external support is needed to increase functionality rates and deliver more sustainable services.

Service Providers: Less than one percent of service providers are in the "A" bracket, while 23 percent face issues that they can resolve on their own, landing them in category "B." On the other hand, nearly 75 percent of service providers have been assessed to need outside technical assistance or financial support. In rural communities (category "D" below), 32 percent of lack a service provider and 43 percent have a service provider facing problems that exceed their capacities. Taken together with the data on systems, this suggests that there is not only a need for technical assistance for the maintenance and upkeep of systems, but also to provide support to service providers to ensure that they can sustainably manage those existing systems.

Systems: Twelve percent of systems are classified as category "A," thus fully functional and considered sustainable. A further 45 percent of systems have been classified as category "B," encompassing systems in need of repair, but within the community's capacity. Conversely, less than 50 percent of systems have been classified as category "C" or "D," suggesting the system is on the verge of failure or is completely offline and repairs are beyond the community's capacity.



These data contrast with the "official" figures for access to drinking water services and sanitation, e.g., coverage data presented by the JMP. Moreover, data indicate where services are failing and where they are performing well and point to key challenges that could inform policymaking. It can be observed that without effective maintenance, technical assistance, and financing, the gains made to expand WASH services are at stake.

Source: Adapted from SIASAR (2017). Data available at http://data.globalsiasar.org. Accessed in March 2021

126. As governments struggle to ensure basic WASH services in rural areas, the adoption of SDGs have raised the bar even higher; governments have now committed to ensuring universal access to safely managed water supply and sanitation services by 2030. This implies that a shift in policies and resource allocation is urgent, going from infrastructure delivery to tackling multiple challenges, including reaching unserved population groups and eliminating inequalities, gradually improving service levels and ending open defecation, and sustaining existing and future services. Moreover, the shift towards safely managed sanitation means that countries must take the whole sanitation service chain into account, from demand creation to containment, collection/emptying, transport, treatment, and disposal/reuse. In most rural areas, achieving sustainable sanitation services also requires behavior change and hygiene promotion to ensure continued and safe use of toilets.

127. Improving urban sanitation requires a holistic approach that also looks at urban drainage. The World Bank City-Wide Sanitation Strategy looks at urban sanitation in a holistic way, considering the entire value chain from containment to disposal, not to mention looking at the impact of climate change on urban water systems. A key challenge is that drainage systems are planned without consideration of wastewater flows, or the impacts of climate change on such systems, which would increase variability. Embedding resilience in urban wastewater and drainage systems holistically is thus important to reduce vulnerability of these urban water systems to climate change.

Irrigation

128. Despite advancements in irrigation productivity in LAC, there are still large gaps between the actual and attainable yield per unit of water. While the potential for efficiency gains and water productivity is considerable, the challenge remains in how to improve irrigation performance without compromising on sustainability. The present agriculture model in LAC countries is based on an intensive use of inputs (land, water, soil) with important environmental and social consequences (FAO 2020b).

129. Moreover, investments in irrigation systems require significant financial resources, both from the public and private sector. In Peru, investments are characterized by its low level of budget usage since they tend to rank low in the priorities set by governments. Investment in irrigation has reached approximately 5.9 percent of total public investments. Even though Argentina, Chile, Colombia, Costa Rica, and Mexico have increased the investment in agriculture-related infrastructure, there has been a decreasing trend between 2015 and 2017 (OECD/FAO 2019). Additionally, there is little to no information about private sector investments in irrigation, which are currently estimated to be low. This translates into the lack of cooperation between public and private sector to restore, expand, or modernize systems that can adapt to future climate and other food security related challenges.

130. While water user organizations play an important role in irrigation systems, they are still facing capacity issues across the region. Water user organizations allow greater participation in the management of water resources and are key for the management of water resources in many countries. Their institutional set-ups vary widely across Latin America (see World Bank studies in Chile, Peru, and Argentina – World Bank 2013a, 2013b and 2021). In Chile, for example, the majority of these water user organizations are not legally recognized in national policies and they do not represent all users, further preventing them from exercising the respective powers to control the distribution of water resources (World Bank 2011). This lack of representation is also illustrated in Peru where women experience barriers with limited board positions, either because they are not invited to community meetings, or they are unaware of their duties (World Bank 2014a). Despite these differences, poor organizational and professional performances are common across LAC and often result in a lack of capacity to meet demands (World Bank 2013).

Box 11. The Improvement of On-farm Irrigation Systems in Sierra, Peru

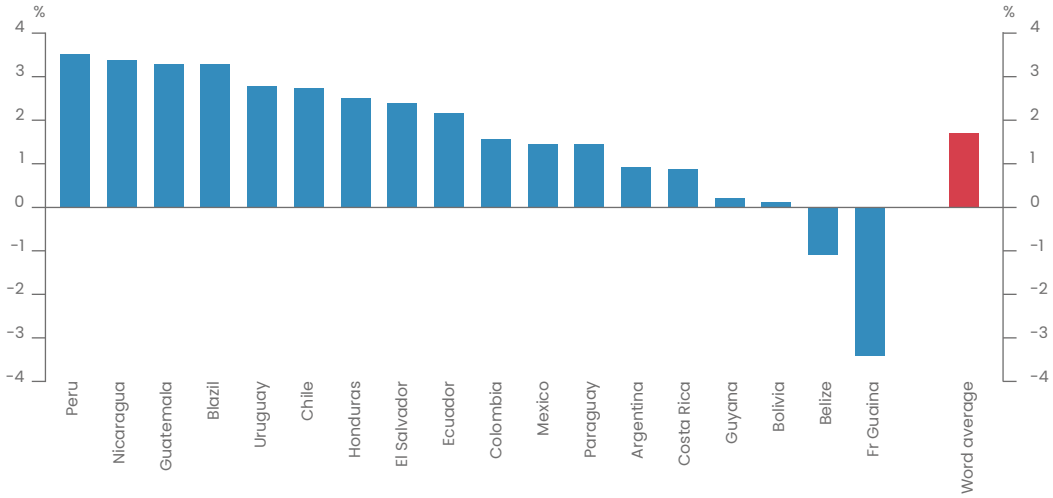
In the last decades, Peru has experienced one of the fastest growing economies in Latin America. However, poverty in rural areas continues to be high, hampering the country's economic sustainability. While approximately 75 percent of the rural population in Sierra is characterized as poor, 40 percent is characterized as extremely poor.

In 2010, household incomes in Sierra came mostly from agriculture. However, irrigation systems (usually small-scale) encountered management and regulation challenges. These systems lacked infrastructure and relied on networks of open canals, leading to rudimentary water intakes with low production. Due to the lack of quantity, uniformity, frequency, and reliability of irrigation service delivery, families struggled to secure water and produce higher-value crops for markets.

From 2011 to 2016, the Peru Sierra Irrigation Subsector Project was implemented to improve agricultural performance by modernizing irrigation technology and providing technical assistance to farmers. As a result, this project increased irrigation water flow and frequency by 28 percent on average and irrigation efficiency by 72 percent, leading to agricultural yields ranging between 118 and 170 percent.

In this regard, approximately 1,680 farmers benefited from the improvement of on-farm irrigation systems, which covered 1,969 hectares of land. This progress has made significant contributions to the growing agricultural sector, further benefiting water user organizations at local and regional levels.

Figure 49.
Average Annual Gains in Agricultural Productivity, 2002-2011



Source: Rabobank, 2017

131. In Central America, a common feature used in almost all districts using irrigation systems is to pay for services per irrigated area, per crop season, and not the volume of water used because there is a lack of water metering. As a result, these rates usually do not cover the real costs attributed to the use of freshwater resources in irrigation, and also because irrigation systems are subsidized (ECLAC 2005). Similar issue occurs in Mendoza, Argentina, where modernization has no incentives because water rights are defined by area. Only when the water rights granted goes beyond the actual area irrigated would the producer have an incentive to invest in efficiency in order to extend the irrigated area.

Hydropower

132. Although LAC has lower generation costs from renewable sources than in any other regions in the developing world, it has the most expensive electricity. This paradox is partly due to the high prevalence of energy subsidies elsewhere. But regardless of what countries in other regions do, firms and households in LAC pay substantially more for the electricity they use than it would cost to produce it based on the existing generation matrix. The main reason is the inefficiency of many of its electricity systems. This inefficiency manifests itself in the frequency and duration of power outages, the magnitude of technical and commercial losses, the over-staffing of state-owned utilities, and the exercise of market power by private generators. However, addressing inefficiency through policy reforms may be challenging at a time when economies are barely recovering from the COVID-19 crisis and in the aftermath of a period of social unrest.

2.1.3 Performance Issues in Managing Water Risks

Floods

133. High exposure and vulnerability levels, together with low capacities to mitigate, prepare, and respond to floods, are the main causes of the high impacts from flood events. LAC has six countries with significant levels of exposure and vulnerability according to the Global Climate Risk Index (box 12). Exposure levels are determined by the lack of risk zoning regulations or the lack of their enforcement, leaving room for the proliferation of settlements, often informal, in urban areas near waterways. The socio-economic vulnerability of the population, as well as safety nets, low diversification of livelihoods, poor level of preparedness and response capacity of the affected government and communities, are also very important factors determining the impact of floods. For instance, Guyana, which experienced "only" five events over the 2000-2019 period, is proportionately more impacted, with almost 40 percent of the population affected during these events due to high vulnerability and lack of preparedness and response capacity (OCHA, 2020).

Box 12. Results of the Global Climate Index for LAC

Bolivia, ranking tenth in the Global Climate Index for 2019, suffered wildfires that destroyed two million hectares of forest and grassland, with almost half of the losses being protected areas with high biodiversity. It is estimated that the regeneration of the local ecosystem will take about 300 years. Furthermore, Bolivia experienced heavy rainfalls and flooding throughout the year. In April 2019, 79 of the 338 municipalities were under a state of disaster and 25 were under a state of emergency. In total, 34 people died and over 23 000 families became homeless. In January 2019, the Isiboro River near Gundonovia stood at 9.35 meters – about one meter above the danger mark.

Haiti also ranks third in the long-term Climate Risk Index (CRI) in the 10 countries most affected from 2000 to 2019 (annual averages). It has remained with Puerto Rico and Myanmar as the three most affected countries in the world over the past two decades. Guatemala also ranks among the countries with high risk; Peru, Bolivia, Colombia, Nicaragua, Salvador, and Honduras show medium-high indexes.

Source: Global Climate Risk Index 2021. (David Eckstein 2021)

134. Rapid and unmanaged changes in soil use decrease soil permeability and increase exposure levels to floods. Urban growth has traditionally neglected the preservation of natural drainage across many cities in LAC.[51] Urban planning is not consistent with water resources planning, and cities often grow in ways that are not "water friendly." In these urban growth processes, watercourses are invaded by urban infrastructure. This progression tends to go unnoticed until it rains heavily and water tries to find its way through consolidated urban soil, damaging dwellings and urban infrastructure. The situation is worsened by the lack of proper solid waste disposal, as urban drains can easily get clogged.

135. These challenges are not exclusive to urban areas. Land use changes in rural areas also affect the incidence of floods. Deforestation or inadequate agricultural practices can change the local water dynamics in a basin. In Argentina, for instance, the rise of the water table in areas of the Pampean plains is not only related to the increase in rainfall but also to changes in land use (from pastures and perennial crops to annual crops) and production systems. The increase in the water table restricts infiltration and increases runoff and floods. In Tartagal, in Northern Argentina, a combination of intense rainfall and soil degradation also led to massive floods and landslides.[52]

136. In addition to incoherent land planning and insufficient and inadequate flood mitigation infrastructure, governance constraints are also causes behind flood impacts. These factors are further analyzed in the following sections.

[51] https://www.iagua.es/blogs/victor-arroyo/drenaje-urbano-tarea-pendiente-america-latina
[52] World Bank. 2021a. Argentina Water Security Assessment - Valuing Water.

Box 13. The Case of the Bañados in Asuncion, Paraguay.

The metropolitan area of Asuncion has experienced low-density urban sprawl and an increase in informal settlements, particularly in high risk areas. The largest informal settlements in Paraguay are located along the natural floodplains (Bañados) of the Paraguay River. This area is home to the poorest income quintile in the city. Public services are often absent or inadequate and housing quality is low. Despite the increasing risk of climate hazards like flooding and heatwaves, the population living in precarious conditions in the Bañados has grown steadily over time, almost tripling from around 40,000 inhabitants in 1993 to 115,000 in 2012, which represents around one-fifth of the municipal population of Asuncion.

Floodplains are considered unhabitable by municipal plans and regulations as these are located at very low elevation. Cyclical river level rises cause a portion or all Bañados inhabitants to be relocated in shelters around safer areas of the city. Relocation, asset losses, and job losses are a huge burden on families and on public budgets as well.

Although Paraguay River level rise is usually slow, in January and February 2021, the city experienced record rainfall, causing the Paraguay River to rise by 48 cm in one day and leading to quick flooding and landslides that resulted in at least 10 deaths and damage to thousands of homes and public infrastructure like roads and flood retention walls. Hundreds of riverfront families were forced to evacuate, and, because of a lack of emergency shelters, many set up informal shelter in public parks and plazas, creating a public backlash and costs to the receiving communities.

The government of Paraguay and the Asuncion City government have been planning to address the socio-environmental degradation of the urban riverfront for the past 30 years, but they have faced interinstitutional coordination and implementation challenges. In the last years, a new effort has been undertaken with the support of the World Bank and several other development partners including the Inter-American Development Bank (IADB), the Development Bank of Latin America (CAF), and the United Nations Development Programme (UNDP) to operationalize the Coastal Strip Master Plan through complementary financing and technical assistance.

Source: Global Climate Risk Index 2021. (David Eckstein 2021)

Droughts

137. Performance challenges behind the impacts from droughts relate to poor knowledge, lack of drought resilience of the basin, wasteful use of water, and the lack of coping mechanisms. Many basins are not properly characterized, and drought monitoring indicators that can serve as "predictors" of the natural regulatory capacity are underdeveloped (for instance, related to groundwater monitoring as a buffer during dry periods). Drought resilience strategies are also scarce, and many basins are vulnerable to droughts due to inadequate practices including high water consumption in different uses due to the lack of demand management strategies, deforestation and/or inadequate soil management practices degrade soil and enhance the effects of droughts. Insufficient insurance coverage is also an issue in certain regions like Central America where crop insurance policies are not well developed (Sanabria Garro 2017).

2.2 Constrains in Latin America and the Caribbean's Water Sector Architecture

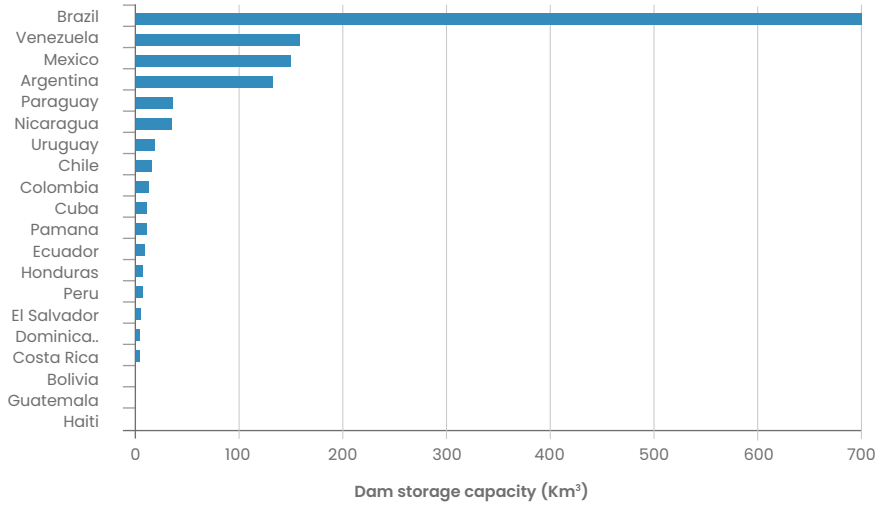
138. Performance issues in LAC can be explained by constrains in the water sector architecture, namely in infrastructure and funding, and in governance constrains.

2.2.1 Infrastructure and Funding

Storage

139. Although some LAC countries have implemented important hydraulic infrastructure projects which contribute to supply security, flood protection, and energy production, there is still a large untapped potential for the development of projects in many countries. On average, surface storage capacity in relation to renewable resources in LAC is in the order of seven percent which is significantly lower than other regions. The countries with the largest dam storage volumes are Brazil, Venezuela, Mexico, and Argentina. At the other extreme are countries like Haiti, Guatemala, Bolivia, and Costa Rica that have practically no surface storage. While an analysis on a national scale inevitably masks regional storage aspects, it nonetheless points to a potential lack of storage which is critical for ensuring water supply and increasing resilience in the face of urban expansion and climate change. This is especially so, given that in general, LAC countries rely predominantly on surface water for satisfying their water demand, making them vulnerable to natural variations of water availability. Nevertheless, some countries are developing important projects to balance territorial and seasonal variations, particularly during dry periods.

Figure 50.
Dam Storage Capacity



Source: FAO Aquastat, 2016

140. Building storage capacity is particularly important for satisfying increasing demands in the context of increasing climate variability. Expanding irrigation and growing cities are requiring larger storage capacities. Latin American cities are expanding rapidly with the population, but urban infrastructure has not been able to keep up (Terraza 2017). As a result, many cities have insufficient water supply systems (old networks, lack of extra capacity/storage), becoming extremely vulnerable to natural variations of water availability. As a result, major cities (or parts of cities) in LAC regularly face water supply problems. However, some cities are investing efforts to balance their water budget by implementing both gray and green infrastructure. Lima, for instance, gets water from the Amazonia through a series of water transfers, also promoting green infrastructure in Rímac River catchment.

141. Traditional dam projects built in the past were predominantly single use schemes. Dams for hydropower production have not been traditionally explored for other potential uses such as irrigation, water supply, or even their potential for flood protection (in the case of the largest ones). This trend is changing now, and most of the current projects are designed as multi-purpose dams. Given the multiple players involved in dam development that are coordinating and balancing their interests (public and private sector, different levels and branches of administration, user groups, local communities), the development and operation of multipurpose schemes is complex, not only from a technical perspective, but also from an institutional point of view.

142. Ageing dams and hydropower plants are expected to require modernization to cope with the projected increase in extreme precipitation events, in addition to general rehabilitation (IEA 2021). A recent study by Ubierna, Alberti and Alarcon Rodriguez (2020), assessed 354 plants in LAC with installed capacity of 113 gigawatts were subject to modernization and estimated the related necessary investments to be around US$33 billion (half of it corresponding to Brazil, followed by the Andean and Southern Cone regions with US$6 billion each). These investments relate mainly to modernization of main assets, and equipment that has been in operation for more than 20 years.

143. Despite substantive progress in setting up regulatory frameworks on dam safety in many LAC countries, this important agenda is still underdeveloped. In the case of Brazil, the National Water Agency (ANA) has implemented Dam Safety Law through the development of norms and regulations with the support of the World Bank, enhancing capacity-building and training through the National Dam Safety Information System (SNISB). Nonetheless, gaps related to the effective implementation and enforcement of dam safety frameworks persist across the rest of LAC (e.g. Bento Rodrigues-Brazil in 2015; Ituango-Colombia in 2018; and Brumadinho-Brazil in 2019). In Argentina, a new law on dam safety has been prepared and is being discussed at the parliament, which, among other things, proposes a first national registry of dams (World Bank 2021a). In Chile, the regulatory framework exists, but there is still no specialized technical entity that controls and verifies dam safety over time. Design and operation of new dams will also need to adapt to new paradigms, such as ecological use and the recalculation of drainage elements due to climate change. This will also require modifications to existing dams, including higher sedimentation rates, altering storage capacities faster, and altering operation rules and dam safety protocols. The WB has recently released a guidance on dam safety that could be a relevant tool for countries that wish to improve dam safety.[53]

Water supply and Sanitation Infrastructure and Funding

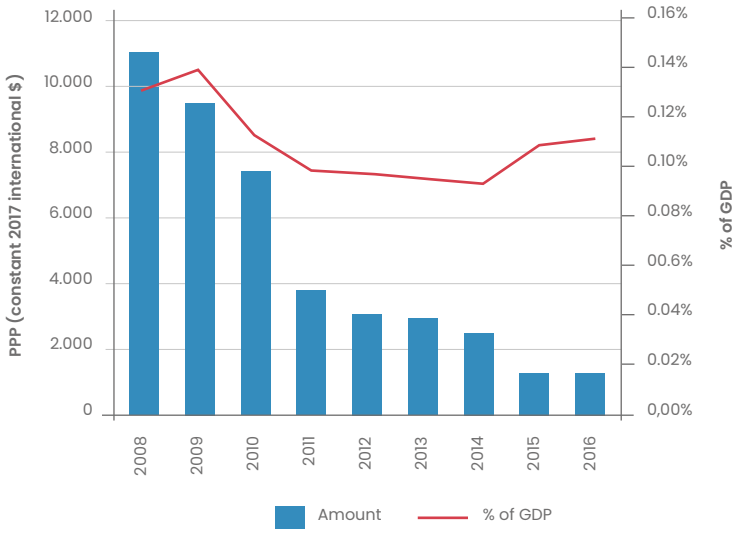
144. To achieve targets under SDG 6.1 and 6.2, the WSS infrastructure gap entails water supply and sanitation systems for 166 million people and 443 million people respectively. The greatest challenge is in sanitation since the majority of the facilities are still considered basic.

145. In LAC, funding water and sanitation has been and continues to be a critical issue in many countries. During the 2008-2016 period, public investment in the water supply and sanitation sector was US$5.2 billion annually (in 2019 prices) and represented 0.11 percent of the regional gross product[54] (US$5.6 trillion in current dollars of 2019) (figure 52).

146. The region is off-track in achieving SDG 6.1 and 6.2. since the annual investment needed to achieve these targets is estimated to be US$ 14 billion per year.[55] Between 2009 and 2017, the coverage of drinking water and safely managed sanitation grew by only 1 percent and 12 percent, respectively. At this rate, coverage in 2030 will be 77 percent for drinking water and 55 percent for sanitation. To achieve the SDGs in LAC, the number of people with access to services must be multiplied by 3.4 for drinking water service and by 3.7 for sanitation. Thus, meeting the SDG 6.1. and 6.2. agenda until 2030 in LAC will require considerably a greater proportion of GDP of each country. In addition, significant funds will be needed for the operation and maintenance of water and sanitation services.

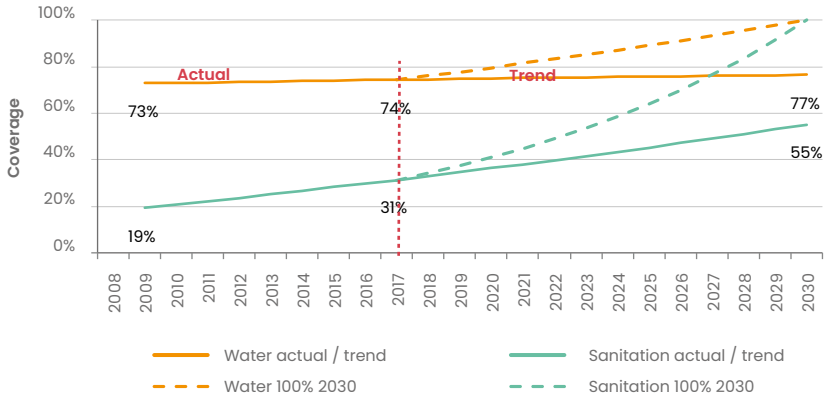
[53] World Bank, 2020g. Good Practice Note on Dam Safety.
[54] Proportion of the regional GDP, weighted by countries' GDP. The simple average across countries is around 0.3% of their respective GDPs.
[55] Hutton & Varughese. 2016. The costs of meeting the 2030 sustainable development goal targets on drinking water, sanitation, and hygiene.

Figure 51.
Annual Public Investment in Water and Sanitation



Source: Own calculation based on data from the World Bank and INFRALATAM

Figure 52.
Current and Desired Trends to Achieve SDG 6.1 and 6.2



Source: Source: JMP data and Long Term Population Estimates And Projections 1950-2100 (CEPAL)
Notes: SDG 6.1: Drinking Water / SDG 6.2: Sanitation and Hygiene

147. Historically, investments in the water sector have been financed with public funds or through loans by international financial institutions. Only a small percentage of funds generated by companies' operations have been directed to infrastructure investments. An exception to this is seen in Chile and, to some degree, in Brazil and Colombia, where private capital markets have been used for infrastructure financing. To evaluate the financial situation of operators, records of 58 companies from 10 countries have been analyzed. The average level of debt (expressed in total liabilities divided by total equity) is about 100 percent, with large variations between companies and countries. The highest levels of debt are found in Argentina, Peru, and Brazil, while the average debt tends to be lower in Chile and Colombia.

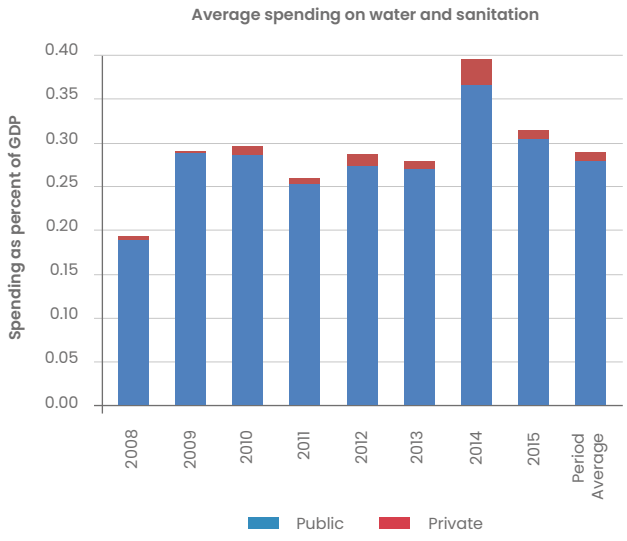
Table 7.
Debt Levels of Water Service Providers

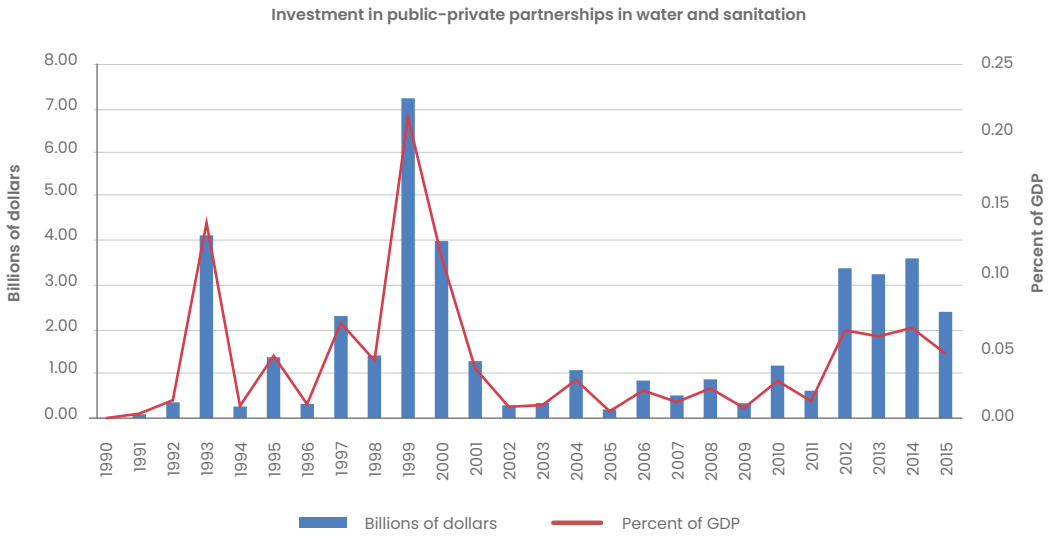
Country	Number of operators	Liabilities/Equity (percent)		
		Minimum	Average	Maximum
Argentina	6	7	153	346
Brazil	11	27	123	488
Chile	11	20	75	156
Colombia	17	11	88	249
Costa Rica	1	11	11	11
Ecuador	2	35	79	123
Mexico	1	5	5	5
Panama	1	16	16	16
Peru	7	26	146	411
Uruguay	1	29	29	29
Total	**58**	**5**	**101**	**488**

Source: Own calculation based on data from the World Bank 2020a
Notes: The average level of debt (expressed in total liabilities divided by total equity) is about 100 percent.

148. Given limited government budgets, the private sector is often seen as an important player in financing infrastructure development in LAC. In the LAC region, private participation in the water sector has gone through various cycles. After a peak in 1999, private activity has declined considerably, increasing again after 2012, which made LAC the leading region with the greatest private participation in the sector (Bertoméu-Sánchez and Srebrisky 2018). Successful cases go from heavy concessions (i.e., Chile) to subtle public-private partnerships (PPPs), such as for the operation of wastewater treatment plants in ENACAL-Biwater. Yet, the limitations to further private sector involvement are interlinked to the gaps in sector governance assessed in the next section.

Figure 53.
Average Spending in Water and Sanitation and Investment in Public-Private Partnerships in LAC





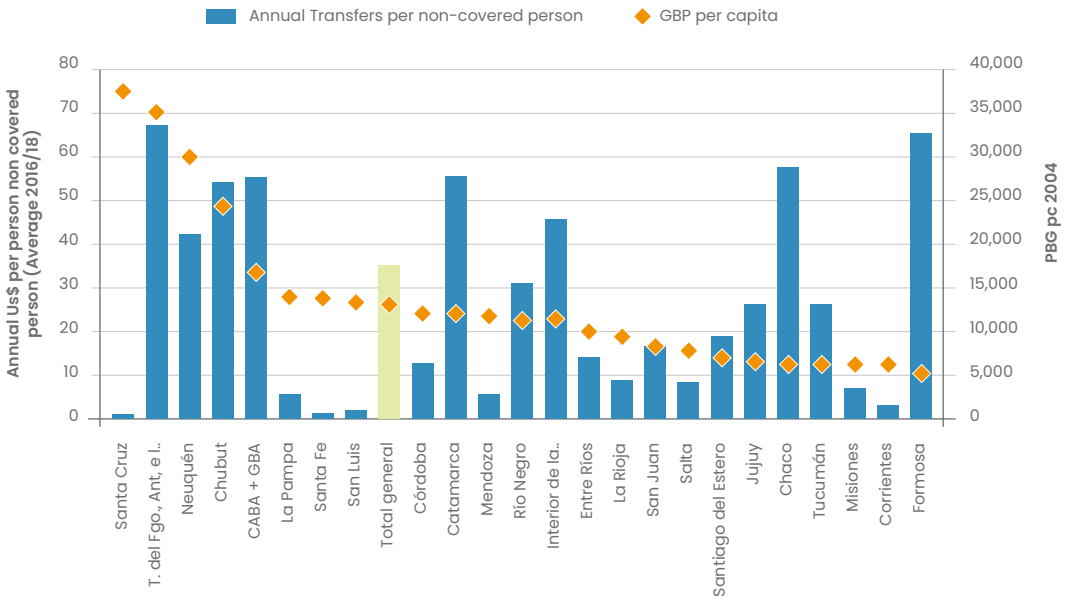
Source: Bertoméu-Sánchez and Serebrisky, 2018

149. Overcoming the funding gap requires a great effort aimed at improving efficiency in the use of funds and in expanding the sources of financing. The COVID-19 pandemic has reinforced the need for universal services, although, at the same time, it has increased poverty and consequently reduced the population's ability to pay for services and the fiscal capacity of states to subsidize. The impact and spending efficiency of public funds in the water sector is limited mostly because of poor targeting strategies and lack of technical criteria to allocate public funds. For example, in Argentina, as shown in figure 55, regional annual transfers per non-covered person are not correlated with the income level of recipients. In Colombia, rural areas, which have the largest access and quality gaps, account for 24 percent of the population, but only receive four percent of total water sector public funds (MVCT 2018). Also, most of the countries do not implement prioritization tools to allocate funds to projects or programs that meet social, economic, or developmental targets.

150.Unclear and inefficient allocation of public sector funds crowd out private investments. In general, utilities in the region have low-credit ratings that affect their capacity to access commercial funds. Governments have also not been inclined to develop adequate risk mitigation instruments to address credit enhancement issues. Yet, exceptions exist. In Peru, and Panama, public funds allocated to finance investments of water utilities in capital cities crowd out private funds that could potentially finance infrastructure, especially since these cities have the potential to be financially viable. Public funds allocated in rural areas are less likely to be financed by the private sector because they have a lower chance of being financially viable due to lower tariffs and affordability concerns.

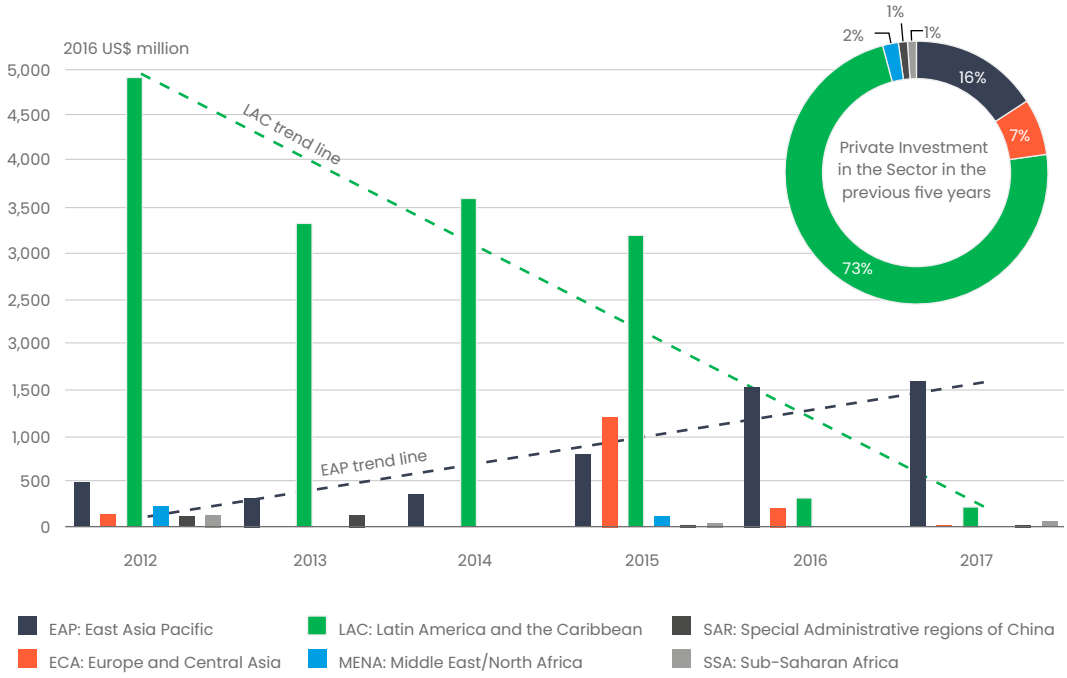
151. Also, unclear allocation of funds increases the risk perceived by potential lenders or investors, hindering the process of ensuring access to commercial financing (or other forms of private sector participation). This risk is inherent in the low predictability of cash flows to ensure debt service payment and the low revenues from tariffs. This risk is also related to the lack of clearly defined roles and responsibilities among the sector institutions. As shown in figure 56, private participation in the sector in Latin America has decreased over time.

Figure 54.
Resource Allocation Asymmetries in Argentina



Source: World Bank 2021
Notes: Average annual transfers per non-covered person (2016-2018) and GDP per capita (2004).

Figure 55.
Private Participation in the Sector



Source: Adapted from World Bank, 2017c

152. Another critical aspect is the quality of the investment portfolio and its execution. Even when resources are available, the low capacities of implementing agencies result in inadequate engineering designs and poor quality of bidding processes, which translate into longer-than-planned execution periods and costs overruns. In Peru, only about 50 percent of what is programmed in water supply and sanitation is executed, and projects take about 10 years on average, with low to moderate results.

Flood mitigation Infrastructure

153. Latin America has given priority to water supply and sanitation infrastructure over drainage in urban areas (Buss 2016). As a result, urban drainage is often unplanned, insufficient, outdated, or inadequately built and maintained. Proof of that is that many Latin American cities report having separate systems for sewage and drainage. Yet, due to the lack of proper drainage, urban runoff ends up in sewers that are not properly designed for that extra flow and this is further exacerbated by land degradation resulting from urban expansion processes. This is a reason for frequent sewer bursts, or high dilution in wastewater influents, leading to inefficient operation of treatment plants and extra costs for water utilities. There is no storage capacity in the system for runoff excesses, so sewers discharge excess flow in streets or urban waterways or surface water bodies before reaching the plant, becoming a source of pollution.

Traditional urban drains, either buried pipes, or surface trenches (lined or unlined) are still the predominant typology of flood mitigation infrastructure in LAC and are predominant over retention infrastructure.

154. Gray infrastructure is still mainstream, with unexplored opportunities to develop green infrastructure. Traditional urban drains, either buried pipes, or surface trenches (lined or unlined) are still the predominant typology of flood mitigation infrastructure in LAC and are predominant over retention infrastructure. Green infrastructure –understood in this context as a series of nature-based solutions with regulatory functions to manage excess runoff—when combined with traditional infrastructure, has proven to increase system resilience due to its natural adaptive and regenerative capacity and provide numerous co-benefits. Although its degree of consideration is still relatively small, several interesting initiatives have been implemented in the region, and there is considerable room for expanding knowledge about these types of interventions.

155. Drainage and other flood mitigation infrastructure tend to be financed with public funds. While there is not much information to estimate the funding gap for flood mitigation infrastructure, CAF indicated that financing needs were US$33.6 billion in 2011 to reach 85 percent of the pluvial drainage needs, including renovation by 2030. These types of works tend to be publicly funded, hence, administrations struggle to find sustainable ways to cover O&M costs. There are good examples in other regions where a portion of the water tariff is defined to finance drainage infrastructure,[56] but these schemes are not commonly found in Latin America (mostly in Mexico).

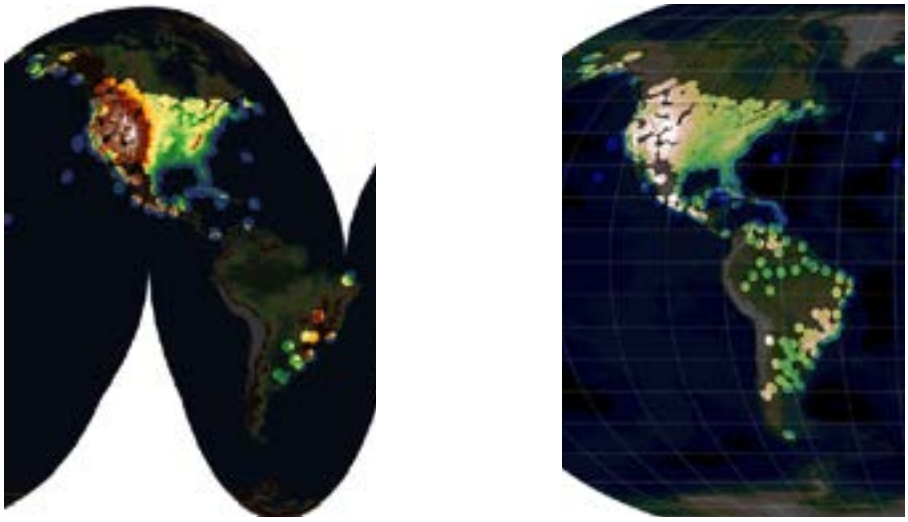
156. Flood early warning systems (FEWS) are still incipient in LAC. These systems need robust hydromet services-related infrastructure (stations, information, and communication technology) in place. Gaps in this type of infrastructure are causes for the slow development of these FEWS systems, among others.[57] An

[56] E.g., UK, Australia, US.

[57] Other causes are the (i) limited accuracy and lead-times of flood predictions, (ii) Early warning systems based on precipitation and soil saturation only (not including-based on flow-water levels variables), (iii) difficulties in converting monitored raw data into actionable information/products/services for end-users, and (iv) poor dissemination and outreach to end-users of flood forecasts/products. Other causes are included in Section 2.3.3.

essential tool for the development of solid monitoring networks and forecast systems, the number of weather radars has grown exponentially in the last years. Sustainability and integration of hydromet networks belonging to different agencies, sectors, jurisdictions, or countries in transboundary basins, are also big challenges. National and regional administrations frequently struggle to find financial mechanisms that can guarantee their adequate operation and maintenance, but also modernization and expansion.

Figure 56.
Weather Radar Coverage in America 2012 vs. 2019



Weather Radar Coverage in America 2012 | Weather Radar Coverage in America 2019

Source: Left: (Jacobi 2013); Right: American Meteorological Society, 2019.

2.2.2 Water Governance

157. Gaps in water institutions' performance –but also infrastructure and funding gaps—are tied to the lack of proper water governance for both the provision of water services (water supply and irrigation) and the management of water resources. For the purpose of this section, institutions will follow the simplified definition of Fox (1976), understanding institutions as both entities (organizations) and rules (law and regulations). Institutions constrain and enable behavior. They can be formal or informal. They are informed by intangibles such as the values and convictions that influence the ways in which societies and their members act and perform.

158. In recent years, the socio-political environment in LAC, marked by social protests in 2019, the COVID-19 external shock, climate change, and the need to boost economic recovery in the region in 2020, is influencing water institutions' performance, reinforcing the need to implement the basic principles of integrated water resources management (GWP, 2000) and strengthen water supply and sanitation service provision, with a stronger focus on three key challenges: fairness, efficiency, and resilience. This section will try to assess the adequacy of the regulatory and institutional framework in LAC.

2.2.3 Key Governance Gaps in Water Resources Management

159. To simplify the analysis, the region was divided into two groups according to the information available for 14 countries: countries that lack the basic institutions, management tools and legal systems for water resources management; and countries with an institutional framework, a legal system, and most of the basic management tools, but require modifications. Due to the limited data on water resources management (WRM) governance status in LAC, it was difficult to include the assessment of all countries.

Countries that Require Building a Basic Enabling Environment and Tools for Water Resources Management

160. The first group of countries includes most countries in Central America and Haiti. As table 8 shows, most of these countries lack either an institution responsible for water resources management, a legal framework, and/or basic management tools.

Most of the existing participatory initiatives in the region are developing but are commonly related to the creation of "watershed committees" unable to fulfill the organizational level that is established by governing water laws.

Table 8.
Countries with Largest Gaps: Water Resources Management Governance

	Law that regulates water resources		Organization responsible for WRM at National Level		River basin management plans that include water allocation principles		Financing instruments for WRM		Integrated information system for WRM	
Countries	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Belize	X			X	X		X		X	
Costa Rica		X		X	X		X		X	
El Salvador	X		X			X		X*	X	
Guatemala		X	X			X		X		X
Honduras	X		X			X	X			X
Nicaragua	X		X			X		X		X
Panama	X		X		X		X			X
Haiti		X		X		X		X		X

* The new 2021 water law establishes financial instruments; however, these instruments are not in place yet.
Source: Own analysis
Note: WRM: water resources management.

161. Despite efforts made by these countries in recent years (see table 9), challenges in institutional frameworks persist. In Honduras, more than 20 institutions are involved in water resources management, resulting in overlapping responsibilities. In Guatemala, the lack of a water resource framework has resulted in an unclear definition of the institutional water framework. In El Salvador, the government approved a new water law that includes the creation of a National Water Resources Authority. This new law facilitates coordination between the different sectors, but an institutional framework is still needed to implement it.

Table 9.
Recent Evolution of Water Legal and Institutional Frameworks

Panama	**2015** Development of National Water Security Plan 2015 (NWSP)	**2016** Establishment of the National Water Council (CONAGUA)	**2019** Technical Secretariat of CONAGUA institutionalized as part of the Ministry of the Presidency
Nicaragua	**2015** Interinstitutional committee for water resources management	**2016 - 2017** Development of national water resources plan	
Honduras		**2018-2019** Inputs for a water security strategy in the dry corridor of Honduras	**2019-2021** Drafted and consulted regulations governing the 2009 National Water Law, including the establishment of the National Water Authority
El Salvador	**2015** National integrated Water Resources Management Plan	**2021** Approval of the new Water Resources Management Law	

Source: Own analysis for this publication.

162. The institutional structure in the region also relates to weak or non-existent water management tools, including information, planning, and water allocation mechanisms.[58] Institutional capacities that produce reliable water resources management information are still lagging. Yet, some countries are taking steps in the right direction. Nicaragua and El Salvador have advanced in national water resources planning instruments to assess the status of water resources at national level and identified key priorities. Panama too, through its National Water Security Plan, has laid out the key priorities for the country. Honduras has started to develop guidelines for river basin plans in priority basins. Despite this progress, planning at the local level is still weak and planning instruments are more focused on watershed management and do not incorporate principles of water allocation or infrastructure planning (e.g., in Panama, both the Hydrographic River Basin for Territorial and Environmental Planning, and its Conservation, Protection, Development, Management Plan, have basic elements of hydrological planning but do not address the allocation of water resources nor the planning of hydraulic infrastructure).

[58] With the support from the World Bank, Panama has advanced in the definition of a National Water Resources Information System, while El Salvador has made progress in developing a national water observatory, and Nicaragua is advancing in its definition of a national water information system.

163. In addition, in some cases water resources management legal frameworks are outdated or non-existent. In recent years, Panama and El Salvador have begun revising and updating their current legal frameworks. In the case of Guatemala, past studies of the World Bank have suggested the need to advance in the definition of a water resources law and in Honduras and Nicaragua both countries have a water law that is pending implementation.

Countries that Require Additional Tools and an Enhanced Environment

164. In addition to the above-mentioned countries, the rest of Latin America has already developed basic institutional, legal, and management tools for water resources management (see table 10). This includes well-developed systems such as in Argentina (most provinces), Brazil, Chile, Mexico, Uruguay, and Peru that have created allocation and management tools including water rights, water markets, water charges and water management organizations. Others such as Bolivia and Colombia are in early processes of institutional development, trying to find a balance between sectoral management based on uses; management based on the resource; and centralization and decentralization.

Despite progress, challenges remain regarding the sector neutrality of water resources management institutions, conflict-solving mechanisms, information tools, financing mechanisms, and planning.

Table 10.
Countries with Smaller Governance Gaps: Water Resources Management Governance

	Law that regulates water resources		Organization responsible for WRM		River basin management plans		Financing instruments for WRM		Integrated information system for WRM	
Countries	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Argentina	X		X		X		X		X	
Brazil	X		X		X		X		X	
Chile	X		X			X		X		
Mexico	X		X		X		X		X	
Uruguay	X		X		X		X			X
Peru	X		X		X		X		X	

Source: Own analysis
Note: WRM: water resources management.

165. Despite progress, challenges remain regarding the sector neutrality of water resources management institutions, conflict-solving mechanisms, information tools, financing mechanisms, and planning.

166. Authority and sector neutrality of water resources management institutions have different forms in LAC. The water manager should be an objective third party arbitrator with enough power to regulate competing users and interests. There are sensible differences concerning the scope of authority and the sectoral independence of the water manager in LAC. In Chile, the water manager deals only with water as a resource, sitting in a non-sectoral ministry responsible for Public Works. In Mexico, the water manager is responsible for management, water works, and service provision in some areas. In Peru, the water manager depends

on the Ministry of Agriculture. In Colombia, the water resources management authority sits in the Ministry of Environment, and the councils of the Autonomous Regional Corporations, consisting of local mayors, make decisions at the local level. In the federal countries of Brazil and Argentina, states and provinces respectively are the water managers, with the National Water Agency (ANA) in Brazil having a strong regulatory role that doesn't exist in Argentina at the national level. There, policy functions are divided between the Ministry of Public Works and the Ministry of Environment.

167. For many of these countries, past studies have shown weaknesses in the institutional structure at the water management level, reducing the ability to regulate competing needs. In addition, excessive institutional fragmentation (Chile and Colombia) and discrepancies between the responsibilities of the local versus the national government (Argentina, Brazil) can create gaps and weaknesses in the implementation of basic water resources management functions. Thus, functions related to sectorial promotion and water works construction can create strong incentives for bias and non-objective appraisal of water projects, distracting water management intuitions from their core tasks (Mexico).

168. Conflict resolution mechanisms are heterogeneous in the region. Theoretical studies and field assessments have highlighted the importance of conflict-solving mechanisms that are reliable, affordable, and available to all (Donoso & Sanin 2020). Countries in LAC present a wide variety of alternatives for the management of conflicts. Mendoza, Argentina, has a well-established administrative system for conflict resolution which is compulsory, and demonstrates immediacy, efficacy, low costs, and accessibility for all. Chile relies on the judiciary, but the system has been criticized for being slow, lacking expertise, being expensive and thus not accessible for the poor. Peru has a special water tribunal. Mexico has a system where the administration may act as arbitrator at the request of parties (this is different from Mendoza where decisions made by the water administration are mandatory). However, the effectiveness of a voluntary system such as the one in Mexico remains up for debate.

169. In addition, for many of these countries some of the existing tools such as water information systems, planning mechanisms, and water rights registries need methodological updates to include recent innovations and best practices. As mentioned before, water planning mechanisms still follow a traditional linear approach that needs to be revisited to include climate change uncertainties and other risks that could jeopardize system resilience, robustness, and efficiency. Water rights registries are mostly analogue, not georeferenced; water rights change and request submissions are not digitized. Finally, in these countries, there is still ample room to optimize water information systems using remote sensing technologies and data collection mechanisms.

170. Despite context specific characteristics, there are some common challenges faced by river basin institutions. These include problems with stakeholder communication (particularly with rural, Indigenous, and Afro-descendant populations), limited powers to enforce river basin plans, limited management decisions, and lack of financial autonomy. While these challenges are broadly acknowledged, little is being done to tackle them in a meaningful and strategic way.

Transboundary Water Management

171. A large share of the region's economic activities depends on transboundary water resources. As shown in figure 58, the region's largest transboundary basins have medium-to-very-high economic dependence linked to them (i.e., a large proportion of countries' economic activity is located inside the basin). As expected, larger basins also have higher economic dependence because they are more likely to include a larger proportion of a country's economic activity. For these basins, such as La Plata and the Amazon, cooperative management becomes crucial to safeguard economic activity and social wellbeing in the riparian countries. Sharing benefits is critical for basins which have high economic dependence on transboundary waters and high absolute levels of economic activity (UNEP-DHI and UNEP 2016).

Figure 57.
Economic Dependence on Water Resources by Transboundary River Basin

Only 29.4 percent of its transboundary basin area has an operational arrangement for water cooperation (SDG 6.5.2)and no country in Latin America has, to date, ratified the UN Watercourses Convention52 or the United Nations Economic Commission for Europe (UNECE) Water Convention.

Source: UNEP-DHI and UNEP (2016). Transboundary River Basins: Status and Trends.
Notes: LAC countries, based on economic activities located inside the basin.

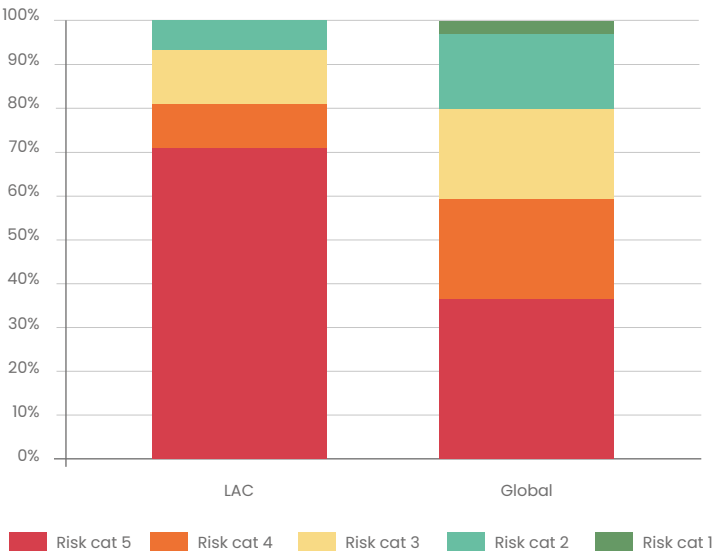
172. However, Latin America is also among the lowest ranking regions in terms of transboundary cooperation. Only 29.4 percent of its transboundary basin area has an operational arrangement for water cooperation (SDG 6.5.2)[59] and no country in Latin America has, to date, ratified the UN Watercourses Convention[60] or the United Nations Economic Commission for Europe (UNECE) Water Convention.[61] Cooperation is relatively well established along some of the major shared water bodies (notably Amazon, La Plata, and Lake Titicaca),

[59] https://sdg6data.org/indicator/6.5.2
[60] https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-12&chapter=27&clang=_en
[61] https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-5&chapter=27&clang=_en

but the third and fourth largest basins (Orinoco and Essequibo) lack treaties for cooperation. However, most of the remaining shared basins do not have frameworks in terms of treaties or institutions managing them to mitigate or confront tensions between their riparian countries.

173. In an indicator-based assessment of the world's 286 transboundary rivers undertaken in 2016, 71 percent of the transboundary basins in the LAC region were represented in the highest risk category in terms of legal framework (figure 59), indicating that the legal framework in most basins, to the extent it exists, is not guided by key principles in international water law (UNEP-DHI and UNEP 2016). Key principles of international water law include principles of equitable and reasonable utilization; not causing significant harm; environmental protection; cooperation and information exchange; notification, consultation, or negotiation; and consultation and peaceful settlement of disputes.

Figure 58.
Status of Legal framework by Transboundary River Basins per Relative Risk Category



Source: Own elaboration adapted from UNEP-DHI and UNEP, 2016.
Notes: Transboundary river basins per relative risk category (1-5, with risk category 5 being the highest). Basins in the highest risk categories have very few of the key principles of international water law present in the legal framework; in several basins in the highest risk category, there is no treaty in place.

174. LAC has 67 international river basins covering approximately 50 percent of its territory,[62] yet examples of long-lasting cooperation are limited. Even in such cases as the La Plata, the Amazon, or Titicaca basins, water governance is primarily consolidated in the political level and there is still a lack of legal biding instruments that ratify global conventions. No LAC country has ratified the UN Watercourses Convention or the UNECE Water Convention yet. (Iza, Sanchez y Hulse s.f.)

[62] Central America has 29 international river basins that represent 37 percent of the land while South America presents 38 water basins covering 60 percent of its territory (Hydropolitics in Latin America).

175. Possible conflicts may arise between neighboring countries over shared water resources, as they seek to ensure adequate access to sustain their economic, social, and environmental needs. These conflicts increase as resources are unequally distributed, leading to competing demands to ensure access to basic services, develop hydropower potential, or expand the agricultural frontier. Additionally, the region presents both an underrealized use of water resources—particularly for hydropower and irrigation—and underdeveloped international water cooperation which shows a lack of integrative legal framework to properly manage present and future challenges.

176. The combination of limited cooperation over shared international water bodies and low capacity for water resource management within many of the basins, countries need increasing capacity to respond to current and future water security challenges, not to mention, untap the potential in transboundary co-operations. CConsequently, implementing a comprehensive and participatory cooperation framework could enhance policy coordination and water governance, not only supporting multinational agreements but also aiding to strengthen national and subnational policy implementation in issues such as water pollution, scarcity, and biodiversity. As the La Plata Basin is the most important transboundary basin in the region in terms of economic activity, box 10 illustrates the main challenges it faces with respect to transboundary management.

Box 14. Transboundary Water Management Challenges in the La Plata Basin

Argentina, Bolivia, Brazil, Paraguay, and Uruguay participate in the Intergovernmental Coordinating Committee of the La Plata Basin Countries (CIC). Those countries identify common objectives, themes of interest, and strategic actions in the basin. The committee's Strategic Actions Program addresses critical challenges identified in a transboundary diagnostic analysis developed in 2016–17. The following stand out:

- **Hydrometeorological information gaps still hinder efficient prevention of the impacts of extreme events.** For example, the reduced depth of the Paraná River, clearly seen at the end of 2019 and in the first months of 2020, cannot be analyzed rigorously since no consolidated data repository exists. The riverside areas of Parana are traditionally the ones suffering the most from large floods, so this information is vital.
- **Loss of water quality is caused by mining and industrial activities without adequate treatment, sewage and solid waste in urban centers, and agriculture with intensive use of agrochemicals.** Yet, the lack of common standards prevents determining quality parameters by mutual agreement.
- **Sedimentation of the major rivers and water courses of the basin limits the capacity of inland waterways and ports.** It leads to major maintenance costs due to increasing erosion and land degradation, changes in land use, and loss of vegetation cover.

The Strategic Actions Program also identifies a series of strategic areas with specific components and strategic actions to be taken. Despite this progress, an integrated basin management mechanism that allows decision making on the basis of consolidated information has not succeeded in any of the critical areas described. In 2019, countries in the CIC met to prepare a new program to set up the basis for the implementation of the Strategic Actions Program.

Other major problems are the pollution in the Pilcomayo international basin and erosion in the Bermejo international basin. In the first case, the Tri-National Commission for the Development of the Pilcomayo River Basin is preparing a new management plan for the basin, with external financing. In the second case, the Regional Commission of the Bermejo River is executing work identified in an existing plan prepared by the Binational Commission for the Development of the Upper Basin of the Bermejo River to control the clearing and minimize the exposure of areas sensitive to erosion, and to promote new irrigation systems for production. Both the Tri-National Commission and the Binational Commission still have significant organizational and capacity challenges. On the other hand, meetings are held related to the water resources shared with Chile, incorporating the federal vision into the binational agenda.

Source: UNEP-DHI and UNEP (2016). Transboundary River Basins: Status and Trends.
Notes: LAC countries, based on economic activities located inside the basin.

Corruption in Water Management

177. Concerns around the fairness of water allocation have been brought forward by social protests and political movements in 2019 in Mexico and Chile, and issues around transparency of water allocation, hoarding of water rights, and corruption have been topics for debate in recent time in Mexico, Peru, and Chile. Corruption is a persistent challenge for the water sector, and for Latin America. The Corruption Perception Index from Transparency International (TI, 2020) shows that nearly half of countries have been stagnant on the index for almost a decade, indicating stalled government efforts to tackle the root causes of corruption. More than two-thirds of the countries score below 50. In LAC, there are wide disparities, with Uruguay perceived as the least corrupt country, with a score of 71 out of 100 while Venezuela with the worst perceived level of corruption, at 15 points. While there are no fully reliable figures of the impact of corruption on the water and sanitation sector, some estimate corruption impacts in water services ranging from 10 to 30 percent, while other scholars put it over 30 percent in some regions.[63]

178. Corruption impacts go beyond cost increase; it affects priority setting, leaving often the most vulnerable behind, and often has damaging consequences for the environment. Corruption can impact the efficiency and effectiveness of vital services, such as for example, water services. There are certain characteristics in the water sector that make it vulnerable to unethical practices, such as the fact that the water service is a natural monopoly, has a high level of public sector participation, and requires large-scale construction for water resources infrastructure. According to the Corruption Barometer report (Transparency International, 2017), 29 percent of the citizens in LAC surveyed have paid a bribe to obtain a public service; 14 percent did so to obtain access to operator services by service providers, such as energy, telecommunications, or water.

Corruption is a persistent challenge for the water sector, and for Latin America. The Corruption Perception Index from Transparency International (TI, 2020) shows that nearly half of countries have been stagnant on the index for almost a decade, indicating stalled government efforts to tackle the root causes of corruption.

Gender Participation in Managing Water Resources

179. Women are excluded from water governance at the local, regional, and national levels, and in dealing with resources such as water, seas, land, and forests, thus excluding them from water and related natural resource decision-making (ECLAC 2021). In Peru, the development of women's skills in water resource management and in agricultural and livestock production has had positive impacts on women's income. Likewise, better technical training has made it possible for women to be nominated and elected for management positions in water user organizations (WUOs). Their improved technical skills, self-esteem, and position in WUOs have raised awareness of their specific needs and expectations for water management in communities (World Bank 2013).

[63] See a discussion about this in Adam, et al., 2020.

2.2.4 Key Governance Gaps in Water Supply and Sanitation

180. Institutional arrangements for water supply and sanitation are more developed in the region than they are for water resources management. Historically, this has been the stronger pillar of water security given that government efforts have paid particular attention to the provision of universal access to water supply and sanitation for their populations (See section 1). As a result, most countries have a basic regulatory and institutional framework for water supply and sanitation service provision (table 11). Some countries, like Colombia, Brazil, and Chile have separated the functions of policy and service provision and have independent regulatory bodies.

A common denominator of WSS sector reforms the region is the separation of policy making and sector planning, economic regulation, and control of service providers.

Table 11.
Institutional Evolution of the Water and Sanitation Sector

Country	Creation of national company	Decentralization to local level	Regulation	Legislation
Small unitary countries				
Costa Rica	1961	Limited	1961	1942
Cuba	1962	2001	--	2001
Dominican Rep.	1962	1973	--	Pending
Ecuador	1965	1992	2001	2014
El Salvador	1961	Limited	--	Pending
Guatemala	--	Limited	--	Pending
Haiti	1977	2010	--	2009
Honduras	1961	1991	2003	2003
Nicaragua	1998	Limited	1998	2007
Panama	1961	Limited	1996	1997
Paraguay	1966	2000	2000	2000
Uruguay	1952	--	2002	1952
Large unitary countries				
Bolvia	--	--	1997	2007
Chile	1977	--	1990	1988-90
Colombia	--	1974	1992	1994
Peru	1981	1994	1992	1993
Federal countries				
Argentina	1912	--	1992	Pending
Brazil	--	1988	2007	2007
Mexico	--	1983	--	Pending
Venezuela	1943	--	--	2001

Source: Ferro, 2017, table obtained from IADB, 2019

181. Closing the funding gaps to reach universal access to water supply and sanitation coverage in a reliable, inclusive, and sustainable manner, requires a robust enabling environment in terms of sector governance. This is key not only to attract investments but also to ensure predictability over time. This section summarizes the specific flaws in institutional frameworks related to the provision of water supply and sanitation services. These challenges can be classified in three groups: regulatory institutional design challenges; corporate governance challenges in service providers; participation and inclusion challenges.

Regulatory Institutional Design

182. The institutional structure presents gaps in the fulfillment of its functions, overlapping and fragmenting responsibilities (Lentini, 2015). A common denominator of WSS sector reforms the region is the separation of policy making and sector planning, economic regulation, and control of service providers (Donoso and Sanin 2020). Some countries with less developed frameworks such as Central American and Caribbean ones, still do not have, or are in the process of developing, sectoral policies, plans, and goals. Others with longer trajectories in constructing WSS institutions present problems of overlaps or excessive bureaucratic arrangements. In Colombia, for instance, functions such as policy making, investment, oversight, or compliance in different fields of water and sanitation service provision (rural, urban, water quality, sanitation), are divided among nine different institutions at just the national level. This number further increases when considering the departmental and local levels (World Bank, 2021).

183. Jurisdictional asymmetries between management versus financing functions are structural factors that affect performance of service providers. In some cases, these asymmetries have roots in imperfect or incomplete decentralization processes where functions were transferred to local entities without sufficient development of capacities and lack of transparent rules in terms of fiscal transfers. Thus, contrary to previous assessments made regarding institutional setup challenges[64] the main distortion in institutional setups, particular in heavily decentralized countries, such as federal ones like Brazil, Mexico, or Argentina, or others like Peru, comes from asymmetries between the financing role (central level) versus the management and regulatory roles (provincial/state/local), as illustrated in figure 58, which shows a lack of correlation in Argentina between the level of federal funding and the water coverage needs of provinces. Countries like Colombia made good attempts to solve this by setting rules by which municipalities have a legal right to receive transfers from the central government calculated through a formula based on costs and poverty levels (IADB 2015). A potentially good initiative that still needs to prove success is the one included in the recently approved regulatory reform in Brazil, where the ANA has been given functions over the state regulators. ANA´s requirements on performance for state regulators are not compulsory to comply with, but necessary if states want to access federal funds to invest.

184. Strengthening the quality of the regulator's functions and roles in the case of public operators continues to be a pressing need to improve the enabling environment. Andres et al., 2013, assessed the performance of regulatory agencies across the region.[65] Agencies performed relatively better on their levels of autonomy, compared with performance on levels of accountability, transparency, and tools to develop their functions, showing that the capacity of many agencies was still low, with best performers overall being agencies in Colombia, Brazil, Peru, and Trinidad and Tobago, and the worst performing ones in

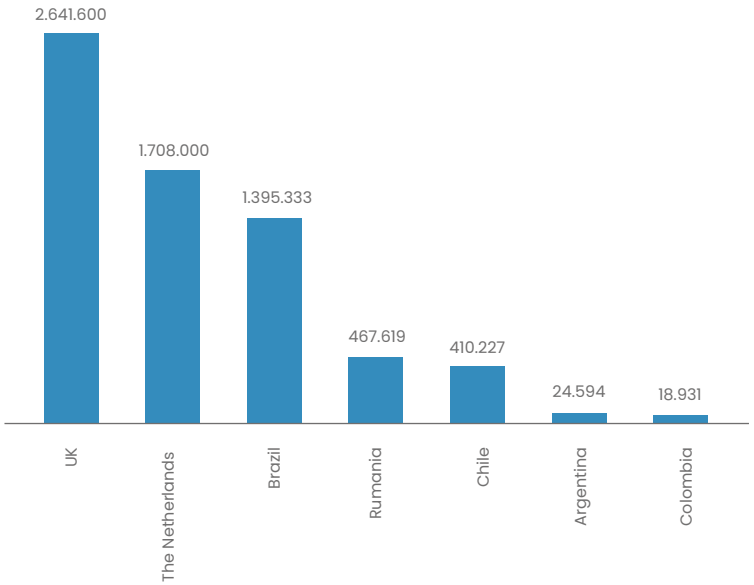
[64] Bertoméu-Sánchez and Srebrisky (2018) argue that having management responsibilities at the local level, when the regulatory functions are exercised at the central level, create conflicts that endanger the well-functioning of the sector and limit the positive effects of reforms, making the sector unattractive to private investors.

[65] Responses from the survey covered 28 water regulatory agencies in Brazil, Argentina, Colombia, Perú, Honduras, Costa Rica, Barbados, Paraguay, Panama, and Trinidad and Tobago.

Brazil and Argentina. This picture of WSS regulatory performance is progressively evolving, with recent reforms in Peru (2016) or Ecuador (2014),[66] or the latest one in Brazil in 2020, heralding change. But their implementation is slow, mainly with respect to the development of capacities, as the case of Ecuador shows, where the regulatory agency has still not deployed its potential functions.

185. Fragmentation of water supply and sanitation providers can be a challenge as performance problems are common in small operators with less capacity and resources. Poor governance structures and decentralization of water services in the region has resulted in an inefficient market structure characterized by many poor performing small municipal utilities. Political interference has not enabled small and poor performing utilities to aggregate. Agglomeration of water utilities could create economies of scale, as there is some evidence that shows that large utilities tend to operate at a lower unit cost and perform better than smaller ones do (Ferro 2017). There are other factors that influence unit costs so it may not always be the case, but the truth is that agglomeration does positively influence performance in terms of quality of service (World Bank 2017c). In the region, Brazil has been able to set up regional utilities serving more than one municipality. However, in countries like Argentina, Colombia, and Bolivia there are multiple municipal utilities operating at an inefficient scale, and the lack of autonomy of service providers and political interference of municipal governments that operate small providers has perpetuated an inefficient market structure in water supply and sanitation. Figure 60 shows that countries that have actively promoted agglomeration of service providers to achieve more efficiency such as the United Kingdom, The Netherlands, and Brazil have utilities with more than a million people served.

Figure 60.
Population Served per Water Provider



Source: Witteeveen Bos, 2019

[66] These reforms are well described in (Donoso and Sanin 2020).

Box 15. Regulating the Rural and Peri-urban WSS Sector

Regulating the rural and peri-urban WSS sector remains a big challenge in many Latin American countries. Throughout the last 20 years, the heavily decentralized structure of the WSS sector in Colombia and distinction between large and small-scale service providers has proved a useful source of knowledge for many other countries.[67]

- **Large providers:** Defined as serving more than 2,500 subscribers, these organizations are subject to regulation and may therefore only charge regulated tariffs for the provision of WSS services.
- **Small providers:** Defined as serving fewer than 2,500 subscribers, small providers are subject to a different tariff methodology. They can be registered or unregistered. In the latter case, they are considered informal providers as they do not follow the legislation or the normative related to the provision of WSS services.

In Peru, the recent reform in the WSS legal framework has extended the regulatory role of the Superintendence of Water Supply and Sanitation Services of Peru (SUNASS) beyond urban areas to include small towns and rural communities. In the attempt to develop a regulatory framework for small and rural water operators, SUNASS has been exploring different regulatory models to gain key insights into what tariffs should be charged in these cases.

Utilities in LAC are still far from reaching gender parity. Moreover, there is variation among countries, with some performing better than others in gender diversity.

Corporate Governance Challenges in Service Providers

186. Corporate governance is also a relevant ingredient of the enabling environment needed to close the funding gap. In addition to stronger financial efforts from public entities, utilities need to have bankable projects, and for that, corporate governance practices that improve efficiency and financial sustainability for the sector are needed and have still not been fully implemented throughout LAC.

187. Corporate governance practices in water supply and sanitation utilities are still not fully widespread across the region, especially in smaller utilities. Application of corporate governance principles in water and electricity state-owned enterprises (SOEs) were again assessed in previous works conducted by the WB (Andres 2013), including concepts such as legal soundness, board competitiveness, professional management, performance orientation, and transparency. Results showed that corporate governance standards vary widely

[67] https://blogs.worldbank.org/water/can-we-regulate-small-and-rural-water-supply-and-sanitation-operators-latin-america

across the region, showing greater challenges in performance orientation where there is no clarity on how utilities set objectives, monitor, and enforce them. This is confirmed by some of the assessments made under this water security initiative in LAC, with pitfalls found in utilities while conducting strategic planning in Argentina or Peru (World Bank 2021).

188. Conflicts of interest due to deficiencies in corporate governance and weak accountability mechanisms are common across the region. For instance, when managers are appointed by politicians, decisions are not always aligned with the fulfillment of the goals defined for the efficient provision of the service or the financial sustainability of the company. Operators often do not have a level of autonomy, or an organizational structure and technical capacity to comply with their responsibilities (Lentini et al. 2015). These issues, together with low levels of professionalism, lack of incentives, and accountability systems for efficiency, were also found in previous studies which linked corporate governance flaws with various features of utility performance (Andres 2013).

189. The role of the private sector in the provision of water supply and sanitation has shifted in the region after challenges observed in the privatization wave of the last decade of the previous century. With the exception of Chile where services are mainly managed by private companies, state-owned companies are dominant in the rest of the region. Yet, there are increasingly successful experiences in service contracts or other types of soft PPPs, such as Build-Operate-Transfer or Design-Build-Operate for treatment plants and desalination. Examples include the wastewater treatment plant of Managua, where the Nicaraguan Company of Aqueducts and Sewers (ENACAL) successfully outsourced the plant's construction and operation for five years to the private sector, with the obligation of training the local operators in ENACAL for plant operations during transfer at the end of the service contract period.

Participation and inclusion challenges

190. Participation in water supply and sanitation provision remains weak. The lack of financial and human resources to support community participation under SDG 6 represents a key area of concern globally. Participation and sense of ownership of the water system is essential to maintaining the systems' functionality, but also to ensure inclusion, accountability, and successful community management approaches in rural areas. In the LAC region, 71 percent of countries reported they have less than 50 percent of the financial resources needed to support participation of users and communities for rural sanitation and drinking water services (UN-Water 2020). In 20 LAC countries, eight stated that they have no community participation procedures defined in law or policy, while 12 countries do (WHO and UN-Water 2019). While having operational policies and procedures is no guarantee for a supported and well-functioning community management system, it would ensure clearer accountability lines and local ownership. In a study of water systems in rural areas of Espírito Santo, Brazil, all the communities studied could maintain an acceptable level of functionality of the water supply systems (Machado, et al. 2020). However, the verified failures represented threats to the systems' sustainability in the long-term. The lack of clear accountability lines and operational policies and procedures, primarily due to a lack of a technical assistance provider, often hinders the development of a more sustainable service.

191. Women comprise a small part of the water utility workforce, particularly in technical and managerial roles. UUtilities in LAC are still far from reaching gender parity. Moreover, there is variation among countries, with some

performing better than others in gender diversity. In Colombia, only 18 percent of utility workers are women, in part because few women pursue careers in science, technology and mathematics (STEM) (K. Navarro 2020). In Peru, only eight percent of utility managers in the last 10 years were women (SUNAAS, 2021).[68] However, in relation to global averages, LAC is a region doing relatively well in terms of representation of female employees. For instance, the global average of the share of female managers in utilities is 21 percent, while in LAC it is 35 percent. Similarly, the share of female engineers globally is 20 percent, while in LAC it is 28 percent (World Bank 2019a). In terms of female-friendly policies and facilities in place at the utility level, LAC is also doing well. All utilities in LAC included in the database reported having policies to prevent sexual harassment as well as separate toilet facilities for women. LAC also surpasses the global averages in terms of offering flexible working arrangements and providing childcare facilities. Where LAC falls behind the global average is in terms of mentorship programs offered to female employees.

Figure 61.
Indicator SDG 6.b: Community Participation Procedures Defined in Law or Policy

Sources: Inputs for a Water Security Strategy for the Dry Corridor of Honduras, 2019; Global Water Partnership. 2016. Situation of Water Resources in Central America. p 117-125.

[68] Contribution to Closing the Knowledge Gap in Sanitation Service Providers with a Gender Perspective. Sunass, 2021

Box 16. The Role of Indigenous Women in Water Management

Indigenous women in Latin America participate in water resource decision-making in three ways: i) community decision-making with men; ii) advising men behind closed doors but not speaking in public; and iii) actively making decisions. Although each of these different participation modalities allow women to express their needs and preferences to a certain extent, the degree of women's power to voice their opinions and influence decisions in the community can vary significantly. Indigenous women hold and transmit traditional ecological knowledge. Women tend to know about traditional practices of water harvesting, preservation, and purification, and have historically passed that knowledge down to younger generations. For example, in the Argentinian Chaco, Wichi women pointed out certain plants that indicated the proximity of a water source. Women also play a vital role in promoting the behavior change necessary to encourage Indigenous people to consume piped water rather than potentially contaminated water from the river, practice handwashing, and employ sanitary facilities.

Source: Toolkit: Water and Sanitation Services: Achieving Sustainable Outcomes with Indigenous People in Latin America and the Caribbean, World Bank, 2016

2.2.5 Key Governance Gaps in Managing Water-related Risks

192. Many countries in LAC, such as the Central American ones, focus on disaster relief responses as opposed to overall preparedness, mitigation, and other risk reduction measures. Progress has been made in the last two decades in strengthening risk reduction policies but progress in implementing them is slow. With a few exceptions, multi-sectoral strategies, policies, and budgetary mechanisms targeting causes of risk, such as water resource management, land use planning, and climate change adaptation and mitigation strategies, are not still being considered. (UNDRR 2021)

193. Technical capacity is scarce in key institutions to assess water-related risks. Skilled hydro-meteorologists are hard to find across the region, demonstrating that the funding gaps previously mentioned to operate, maintain, and modernize hydromet information systems are not the only bottlenecks in managing water-related risks. Consequently, there are also technical gaps to develop operational protocols and manuals, and to carry out proper maintenance of the systems.

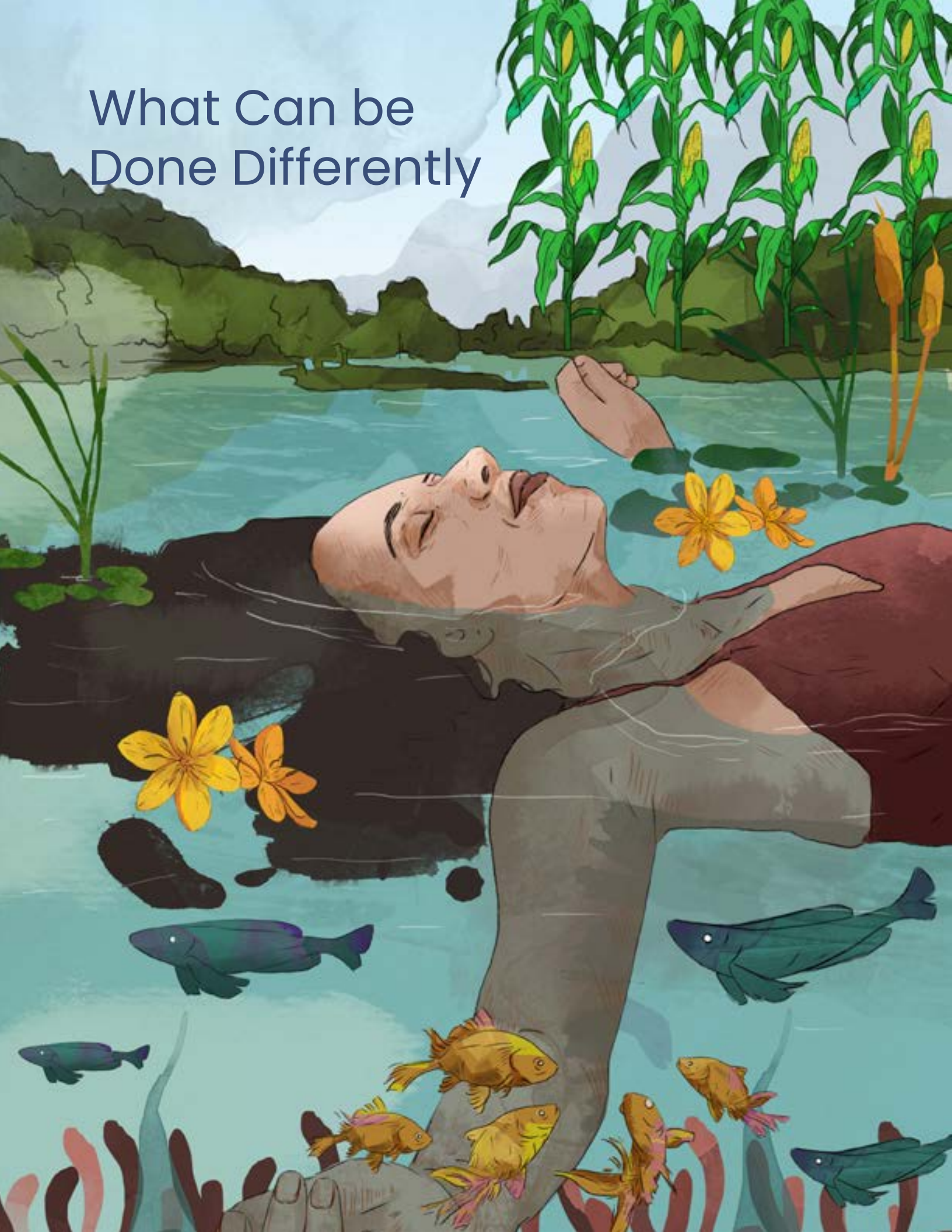
194. Lack of community awareness about water-related risks and participation in risk reduction strategies adds to low levels of accountability (UNDRR 2021). Community engagement in risk prevention and response protocols is a key element for mitigating risk. This informs people about certain actions when flood warning levels are triggered. In general, strategies in the region have failed to incorporate this essential approach effectively, perhaps also influenced

by the poor coordination mechanisms within and across sectors, lack of full engagement, and clear responsibilities of all other stakeholders (Dilanthi Amaratunga 2016).

195. Corruption and clientelism also have a role in explaining the low levels of implementation of risk reduction measures. The lack of enforcement of flood risk zoning mentioned as a key performance challenge in reducing flood risks, may have different causes such as simply neglect or lack of capacity. But forms of clientelist governance are also signaled as causes for the creation of "urban harzardscapes" as signaled by Nygren et all. (Nygren 2020).[69] Repeated cycles of environmental deterioration trigger exchanges of favors as the basis of state power, creating the vicious cycle behind perpetual risk structures and leaving poor residents with limited options in these hazardscapes.

[69] From studying urban floods and lindslides in Mexico and Brazil, authors argue that "clientelist governance and state making, including complex forms of political favoritism, create urban "hazardscapes."

What Can be Done Differently



3. What Can be Done Differently

Key chapter takeaways:

Recommendations to increase water security levels in LAC

1. Water resources management:

- Modify the IWRM implementation strategy, prioritizing the implementation or reform of principles and tools that aim to resolve the most pressing issues in each country.
- Promote the creation of basic WRM tools and institutions in countries where these are still missing, particularly in Central America.
- Modernize key institutions and tools to include the use of new technologies and resilient approaches.
- Consider incorporating technical autonomy, accountability, transparency, resilience, and efficiency in institutional and legal reforms.
- Strategize the creation and enforcement of river basin institutions in basins with the most pressing issues and conflicts.
- Prioritize the strengthening of groundwater institutions.
- Improve transboundary water cooperation to monitor the management of shared basins where conflicts are common (Mexico-US); where water use competition increases (Peru, Chile, Bolivia); and where pollution reduces water availability (Central America).

2. Water services

- Public funds expenditure need to be more predictable, providing adequate incentives at the utility level and optimizing the use of subsidies to maximize connectivity instead of covering operational costs.
- Promote corporate governance and strengthen the capacity of regulatory bodies at all levels.
- Boost investments in rural areas, focusing on marginalized groups to ensure inclusive services and promote greater participation.
- Expand traditional approaches in urban sanitation by incorporating affordability and sustainability criteria, both for the user and the utility.
- Promote the use of digitization tools and circular economy to improve utility resilience.
- Increase water productivity and improve irrigation as well as soil management practices.
- New irrigation developments must be based on a thorough hydrological study, supported by private sector financing.

3. Mitigating risks

- IImprove real-time hydrological information systems, weather forecasts, and early warning systems, promoting greater engagement between all stakeholders.

- Expand green infrastructure in a sustainable way with the support of the private sector.
- Flood risk zoning needs to become integral step of urban planning. Inundation mapping and flood risk zoning can be more consistent in densely populated areas.
- Water authorities could develop drought monitoring and management systems based on set indicators (based on the severity and type of drought).
- Increase water storage to maximize the use of natural buffers. There is a need of better knowledge of groundwater resources to optimize the use of reservoirs.
- Ageing dams requires urgent investments for renovation and climate-proofing. Dam safety needs to be reinforced by institutions with adequate budgets, updated databases, and monitoring protocols.

While most of the challenges in addressing water security require national and sub-national action, there are also a number of regional issues which require collective action from development partners and local governments. They include:

- Elevating water security issues to higher levels in the development dialogue.
- Incorporating water security goals as part of the NDCs and adaptation plans.
- Sharing information at the regional level for targeted intervention, establishing a benchmark to monitor the progress towards the SDGs.

196. This chapter includes a series of recommendations that can lead to a pathway of increasing water security levels in the region and therefore contribute to more inclusive, green, and sustainable growth in the next decade. They are grouped in the three blocks considered by the Water Security Framework: water resources management; water services; and water-related risks. Recommendations included in each block are listed in order of relevance.

3.1 Managing Water Resources

197. The existing threats to water resources and water services require a smarter and long-term strategy to implement water resources management principles and innovate where the basic management tools are in place. Setting up such a strategy requires long-term political support and the political prioritization of water as a key asset to economic, social, and environmental development. As previously mentioned, water resources management functions are broad and require a tremendous effort for their complete implementation. In this sense, all countries do not need to implement all functions at the same time. Tailored prioritization follows the country's most pressing issues through an incremental, long-term approach. A successful example has been the WB support provided to Peru's ANA in the creation of its institutional framework for water resources

management. The drafting of such strategy and the institutional reforms that are usually attached to it also require a profound institutional assessment that identifies a pathway for reform. As an example of the time needed to implement such reforms, in the case of Chile where this analysis was concluded in 2014, has only recently been ratified by the executive power.

198. Moreover, several additional actions are needed to advance in the implementation of sound water resources management principles. For example: i) creating basic water resources management institutions and legal frameworks where missing (mainly in Central America); ii) modernizing existing water resources management institutions to improve technical autonomy, accountability, transparency, resilience, and efficiency principles; iii) prioritizing interventions in river basin institutions to expand their functions, capacities, and resources, to plan, manage, and allocate water resources at the catchment level; iv) enhancing participation mechanisms; and v) strengthening the work in transboundary basins. Work at the basin level needs a pragmatic vision, aiming at intervening in basins with existing water issues and conflicts and then prioritizing basing with growing threats..

199. Priority should be given to the creation of water resources management institutions in countries that are still behind. As mentioned in Chapter 2, Central America is a priority region that requires clarity in legal mandates across institutions and build the basic legal framework for integrated water resources management. To achieve this, sound legal analysis can help identify key water security concerns in each country, and design institutional solutions that address these concerns. A good example of this analysis is the assessment carried out to improve the institutional framework of the water sector in Chile and Brazil. It is important to avoid replicating legal or institutional settings since reforms take a long time to enact and they should be targeted to yield tangible and measurable results.

200. Existing water resources management institutions need to be modernized, bearing in mind the need to improve technical autonomy, accountability, transparency, resilience, and efficiency. LAC needs to invest efforts to simplify complex institutional frameworks and separate key functions between the water resources management regulator and the services providers (WSS and irrigation), ensuring sector neutrality and proper hierarchy among peers.[70] In many cases, accountability and transparency mechanisms need to be improved to promote reliable water access as the first step in conflict resolution. As a second step, in many countries, there is still a need for formal mechanisms for conflict resolution that take into consideration the concerns of all relevant parties and stakeholders. This requires defining tools for consensus building, clear procedures for decision making and approvals, and legal rules or, in the case of disagreement, arbitration. Finally, the efficiency improvement of water resources management institutions requires building up or reforming the financing mechanisms for integrated water resources management. This may require securing or ring-fencing resources and allowing for economic compensations from water users and polluters to be fed back to the water sector such as through Payment for Ecosystem Services (PES) funds.

[70] This has been a continuous discussion in Chile as part of the process of the creation of the Undersecretary of Water Resources, alleging that the creation of this new institution under the Ministry of Public Works would allow "water user neutrality." Past studies have found intuitional difficulties when water resources management is institutionally tied together with water service provision (e.g., Mexico and Peru).

Box 17. MERESE – An Innovative Mechanism to Compensate the Conservation, Recovery, and Sustainable Use of Water Sources

Recognizing the need to prevent the environmental deterioration of ecosystems, particularly in the face of water scarcity, desertification, and deforestation, Peru's Ministry of Environment introduced an innovative legal framework (Law 30215) for Payments for Environmental Services (PES) called "Mechanisms of Compensation for Ecosystem Services" or Mecanismos de Retribución por Servicios Ecosistémicos (MERESE). Within this legal framework, SUNASS, the national sector regulator, developed and approved an innovative regulatory structure that allows water utilities to invest in nature-based solutions to protect water sources by improving water quality and availability. To finance MERESE, SUNASS requires water utilities to earmark one percent of revenue from the water tariff to be used towards source water protection activities. MERESE recognizes that upstream communities should be remunerated for the implementation of nature-based solutions, such as reforestation and watershed restoration. It places particular emphasis on promoting the strategic participation of rural communities and women as key actors in the governance and management of water resources.

Today, 40 out of the 50 water utilities in Peru have incorporated a MERESE fund in their tariff scheme, and seven water utilities are executing projects funded through MERESE funds. For example, Sedapal, the utility in Lima, announced in late 2020 the call for bids for the first project to be executed with the proceeds collected through MERESE. The project centers on the recovery of the water regulation ecosystem service in the Milloc micro basin, located in the province of Huarochirí, with the objective of promoting the conservation, recovery, and sustainable use of water sources for the cities of Callao and Lima.

When it comes to safeguarding water sources, the implementation of MERESE is a good step towards fostering greater accountability. However, important challenges remain to realize its full potential. Among others, there is a clear lack of installed technical capacity in terms of human resources in the water utilities to effectively deliver MERESE. On this front, SUNASS is providing capacity-building to the utilities to guide the incorporation and adequate implementation of MERESE in their operations, with the ambition of expanding MERESE to all 50 utilities by 2023.

Source: Toolkit: Water and Sanitation Services: Achieving Sustainable Outcomes with Indigenous People in Latin America and the Caribbean, World Bank, 2016

201. Strengthening river basin institutions is still a key challenge to achieving water security. As mentioned in Chapter 2, many basin institutions in the LAC region are still weak or even non-existent. Similar to institutional reforms or the implementation or river basin plans, the creation of river basin institutions need a strategic prioritization where water conflicts exist. Where river basin institutions

are deemed necessary, strategic investment projects that that support this institutional aspect are key to securing continuity and capacity building. A successful example is Peru, where positive results were obtained through a long-term engagement with the government of Peru to support river basin institutions.

202. Modernizing Information and planning tools are critical to implementing sound integrated water resources management. Efforts to collect, systematize, monitor, and share data on the availability, quality, uses, and demands of water resources, need to be increased to secure decision making is made on a sound technical basis. To achieve this, new technologies that lower the costs of data acquisition and water monitoring are already at hand but seldom used. Coupled with information improvements, basin planning instruments must be considered as essential tools for territorial development and environmental management, noting that in some cases, should be legally binding in terms of compliance. Moreover, water resources management plans also need to include new methodologies[71] that allow for a more systemic assessment of risks in a basin, the incorporation of climate uncertainties, and a thorough consultation process engaging a wide range of stakeholders. Through this approach, stakeholders can discuss proposals and solutions, raise concerns, and agree about the path to pursue, achieving consensus and minimizing conflict. The successful implementation of these two water resources management tools is only effective if the staff involved has the technical capacities and is motivated. As a result, capacity building plans as well as plans to retain talent are important for the robustness and sustainability of water resources management institutions.

203. Groundwater management needs to be strengthened. Experience from other parts of the world shows that once unregulated groundwater use has been established and economic and social dependencies created, it becomes increasingly difficult to readjust the situation. For instance, groundwater dependency in Guatemala is high, and can reach up to 70 percent of the total population. Even though groundwater is usually safer than surface water, many shallow aquifers near populated areas have become polluted.[72] Therefore, long-term strategies for the efficient use and management of groundwater need to be formulated, including the development of capabilities, knowledge, legislation, institutions, and instruments for creating a comprehensive framework for sustainable groundwater management. In 2013, UNESCO established the Regional Center for Groundwater Management (CeReGAS) to improve and support groundwater management in the region. Located in Montevideo, Uruguay, this center aims to provide scientific and technical capabilities in support of sustainable practices for groundwater management.

204. Finally, climate change and growing demands make the strengthening of the transboundary water agenda an increasing need in LAC. As the main threats to the region are global (climate change, external market demands for food or commodities), they require a basin-wide approach, and collaboration over shared basins. Increased institutional capacity is required to address challenges posed by the growing demands of water by the different sectors, and by climate change. Moreover, information sharing on water resources among the member states in transboundary basins is needed for productive collaboration. This could include building data sharing platforms on water balances, water quality,

[71] Ray, Patrick A.; Brown, Casey M. 2015. Confronting Climate Uncertainty in Water Resources Planning and Project Design: The Decision Tree Framework. Washington, DC: World Bank

[72] IGRAC 2014. Summary report of information shared during the Regional Workshop on Groundwater Monitoring, UNESCO.

sedimentation, forecasts, etc. Countries need to increase efforts to monitor shared aquifers and develop methodologies on how to reliably forecast the impacts of interventions on shared water bodies, given the multiple institutions involved, and limited operational capacities.

3.2 Delivering Water Services

Water supply and Sanitation

205. As depicted in Chapter 1, speeding up connections to reliable water and sanitation services and improving the existing levels of service is the first step towards reducing vulnerability of the poor, increasing resilience to shocks, and reducing inequalities in LAC. This requires the following measures: (i) address performance through efficiency as a basis to help close financing gaps; (ii) focus on inclusion, speeding up access and prioritizing the most vulnerable; and (iii) prepare for shocks and increase resilience levels.

Address Performance Through Efficiency to Help Close Financing Gaps

206. Reducing the financing gap to quickly expand and modernize services in the context of macro-economic crisis is at the center of the debate. As this report has argued, financing gaps in water supply and sanitation are still large and have become even larger as a result of COVID-19 (see Chapter 2) pushing for the optimization of public funds. Countries must advance their analysis in financing systems to find clarity on the right mix of tariffs, taxes, and transfers to invest in the expansion of services (e.g., Mexico financing system strengthening study).[73] A crucial debate in most countries emerges from the need to optimize subsidies. Examples of these can be found in Colombia and Mexico. Therefore, an analysis of public expenditures in the sector, such as the one conducted in Argentina under the water security initiative is a useful tools in this dialogue (World Bank 2021a).

207. The efficiency agenda requires clear allocation criteria of available funds at all administrative levels to have better predictability of funding and facilitate the planning process at the utility level. For this, clear public investment management mechanisms need to be in place to guarantee efficient spending. These mechanisms could be in the form of incentives linked to needs but also performance of different jurisdictions or water utilities. This can be a solid route to climb in the financial sustainability ladder,[74] as utilities increase performance, reduce operation and maintenance costs, and increase cost recovery, reaching higher credit worthiness to access commercial finance and free up the public funds required to finance projects that will help close access gaps.

[73] See: World Bank, 2014
[74] See: World Bank Course on Measuring Creditworthiness of Water Utilities at https://thedocs.worldbank.org/en/doc/197501544810224462-0090022018/related/Session0100Cre1er0Utilities0160413.pdf

208. To succeed in addressing these issues, regulatory frameworks must incentivize efficiency by defining adequate tariff structures and promoting sound design using key performance indicators. These performance indicators can be used as an incentive for fiscal transfers to expand infrastructure, as proposed in the case of Argentina, or also by following the example of Brazil mentioned in Chapter 2. Increasing macro and micro-metering rates, lowering non-revenue water levels, and reducing energy consumption are key performance indicators of utility action plans. Tariff policies and structures must find adequate mechanismos that contribute to efficiency. However, as tariffs often respond to competing objectives (Andres 2021), this task may not be simple. What remains clear is the need to abandon flat tariff regimes to pursue a more widespread use of volumetric tariffs (with or without blocks) based on metered connections.

209. Regulatory frameworks can also do more to promote institutional sustainability through corporate governance in water utilities, establishing accountability mechanisms that help minimize the risk of political capture and corruption in the water sector (see Chapter 2). Examples include Peru, where the national regulator SUNASS has established an index of corporate governance of all public utilities; Brazil, where the new law forbids politicians from administering water utilities; and Colombia, where the national government is advancing a corporate governance policy at national level.

Focus on Inclusion, Speeding up Access and Prioritizing the Most Vulnerable

210. In a continent with such high inequalities where the largest share of water security costs come from water supply and sanitation, connecting the unconnected in marginal and poor urban areas is central, but complex. In this sense, utilities must find ways to speed up and maximize connectivity in these areas. From a financial point of view, the most efficient way to spend public funds is by subsidizing connection costs. Yet this strategy gets more complicated when considering large informal urban spaces lacking not only water and sanitation services, but also other basic services. Thus, providing services in these areas often require integral and complex "slum upgrading" processes involving a wide array of institutions and coordination mechanisms to intervene with efficacy in these areas.

211. Once again, tariff structures play a key role in securing access for the poor. Creative examples adapted to a local context can be found in the region of tariff structures that can lead to both financial sustainability and inclusion criteria. In the department of Atlántico in Colombia, the utility of the city of Barranquilla centered its strategy on improving water supplies in small, neighboring towns by setting a regional tariff methodology that provides cross-subsidies between the municipalities served by a single utility. This has been accepted by the government and the national regulator (Andres 2021).

212. A greater effort is needed to expand services equitably and sustainability in rural areas and small towns, particularly in Indigenous and Afro-descendant communities. As stated in Chapter 1, these communities are more vulnerable, their water systems more fragile, and more information is needed on their systems. The SIASAR initiative, successfully implemented in many countries, can be replicated and reinforced in most countries. Some countries have several small and fragile utilities, so regionalization efforts like those in Brazil, Chile, or Colombia, can be scaled up to achieve better and more reliable services. A broader inclusion criteria can help identify and prioritize Indigenous and Afro-descendant communities, which are often left behind in terms of access to basic services.

213. In addition, citizen engagement in service provision can be further promoted, both in urban and rural areas. This can be achieved either through updates in the existing regulatory frameworks in countries where provisions for participation do not exist or by policy initiatives at the utility level. These measures can create an enabling environment for institutional and political conditions that promote citizen engagement throughout a project, from the design to the operation, including adequate feedback mechanisms (e.g. grievance redress ones). These measures are key to ensuring the sustainably of systems, either community-led or utility-operated.[75]

214. Sanitation access needs prioritization, with special focus on solutions for the poor. There is wide room across the region to shift from traditional expensive sanitation solutions in the form of conventional sewers and wastewater treatment plants (WWTPs) to more affordable, cost-effective options. The World Bank City-Wide Sanitation Strategy[76] looks at urban sanitation in a holistic way, considering the entire value chain from containment to disposal, but also promotes a wide range of different solutions that are cost-efficient and offer affordable solutions for the poor. In this sense, utilities can adopt properly regulated septage management functions in areas of low consolidation, controlling that septic tanks are adequately built and regularly emptied, and sludge is correctly treated in the corresponding plant. Condominial sewers, successfully implemented in Brazil, could be expanded to many other places in the region. Urban sanitation strategies need to be understood jointly with the functioning of the drainage systems, as they often have formal or informal links that impact mostly the poor and those living in informal settlements. Finally, considering that subsidies mostly go to water access, designing more comprehensive subsidy strategies to cover sanitation costs will require striking a better balance across water and sanitation subsidies, particularly when targeting the poor.

Prepare for Shocks and Increase Resilience Levels

215. Adaptive management strategies for greater resilience to climatic and non-climatic shocks form part of utility action plans. Resilience planning for water systems lowers the risk of climatic and non-climatic shocks, improving the robustness and reliability of water services. Adaptive management strategies can start evaluating existing vulnerability levels and the resiliency of the utility during shocks. These strategies should therefore incorporate uncertainty into the utilities' planning and engineering design processes, considering options to securing water supplies and increasing the flexibility of system operation, but also having tools to manage demands, raise awareness, and engage with the public (American Water Works Association 2021). Methodologies to increase resilience have been implemented in Mexico and Peru, which serve as an example for basins and cities that are already facing similar issues due to climate change and scarce water resources.

216. Digitalization tools are great options to promote resilience. Digitalization renders internal processes more agile and streamlined, helping the utility to respond faster to shocks and enabling it to be better prepared for changing

[75] Jiménez et al., 2019. The Enabling Environment for Participation in Water and Sanitation: A Conceptual [75] Framework

[76] For more information, visit: https://www.worldbank.org/en/topic/sanitation/brief/citywide-inclusive-sanitation

environments. The latest World Bank report in Buenos Aires, Argentina,[77] for instance, incorporated: (i) digital solutions to enable the remote work modality on a continuous basis; (ii) predictive maintenance of main assets, incorporating solutions such as advanced predictive analytics and artificial intelligence, digital twins and dynamic 3D visualization; (iii) digitalization of commercial processes in the utility´s network of commercial offices; and (iv) optimization of the customer complaint management system through the adoption of mobile and digital tools.

217. The adoption of circular economy principles provides a great opportunity for water utilities to advance their resource efficiency and resilience. This is particularly relevant for the sanitation agenda. In addition to environmental benefits, sanitation and wastewater treatment facilities can generate byproducts (gas, water and biosolids) that can be reused and become a source of additional financial revenues. This waste-to-resource perspective can transform sanitation from a costly service to one that is self-sustaining and adds value to the economy.[78] Indeed, if financial returns can cover operation and maintenance costs partially or fully, a circular economy approach to wastewater management offers a double value proposition.

218. The COVID-19 crisis should not only be seen as a call for action to expand water supply, hygiene, sanitation and wastewater treatment services, but also as a reminder to increase resilience to climatic and non-climatic shocks. In this sense, resilience is not seen as opposite from efficiency (e.g. having extra capacity, spare resources, etc.), but rather as having the necessary tools to adapt, plan with flexibility, and develop response plans such as Emergency Prevention Plans and financial resiliency strategies.[79] Resilience could also be applied to incorporate special adaptative construction features to water supply and sanitation infrastructure.

Irrigation

219. As described in Chapters 1 and 2, the irrigation sector in LAC needs to overcome two main challenges: staying resilient to climate change while maintaining or even enhancing productivity; and exploiting the irrigation potential to achieve food security in a sustainable manner that respects other uses and the environment. Increasing efficiency with a sustainable use of water resources in the basin and improving irrigation and soil management practices are at the center of the first challenge. For this purpose, farmers need to invest in more efficient irrigation methods, taking into account downstream user impacts and available resources at the basin level. And for that, they need greater access to different forms of financing. This is where the public sector could play a role, facilitating access to financing through different mechanisms (such as granting guarantees, or establishing specific funds), while subjecting this support to compliance meeting efficiency indicators. These initiatives could support land titling and regulation programs, making the granting of concessions more flexible (World Bank 2021a). The corresponding water administration can promote best practices involving farmers to support water conservation and better use of the resource.

[77] Argentina: 500,000 people will have access to better water, sanitation services, and social housing. World Bank, 2021.
[78] Wastewater? Waste to Resource. World Bank, 2020.
[79] Global Risk Financing Facility (GRiF). The governments of Germany and UK, with the support of the World Bank, are establishing a new facility to pilot and scale up support to strengthen the resilience of vulnerable countries to climate and disaster shocks.

220. Governments can also promote regulatory measures to incentivize water use efficiency. For example, water rights systems could be reinforced by establishing taxes that cover negative externalities (pollution and overexploitation) or creating payments for water use (such as for the volume delivered) that would allow recovering the costs of administering the resource (World Bank 2021a). Several factors need to be taken into account when considering expansion of the irrigation frontier in LAC.

221. New developments need to be based on a profound knowledge of the water dynamics (hydrology and demands) in the area. These need to be discussed in the context of the river basin, and with the river basin authority, creating consensus among farmers and all the other water users on the viability of the new development, including environmental considerations and the availability of water. A series of factors must be considered to ensure the viability of new irrigation schemes, such as guaranteeing the existence of adequate communication and logistical infrastructure for the swift delivery of products to markets. Political action is central to promote the project as well as establishing agreements that allow access to new markets under competitive conditions.

222. Innovative forms of financing to mobilize private resources are necessary for new developments. The "Argentina: Valuing Water" report includes the case of Meseta Intermedia Project, with financing through the establishment of a trust that draws on future capital gains generated by the irrigation infrastructure and associated services.[80]

223. For the efficient management of the water resources, agrometeorological infrastructure is essential, as well as the incorporation of new technologies like information systems forecasts models and early warning systems tailored to farmer's needs. These tools would help them make timely decisions and undertake more accurate management actions on plots and productive areas. Improved resource use monitoring would also help establish tighter controls on externalities including diffuse pollution.

Hydropower

224. Ageing hydropower projects require the strengthening of dam safety across the region, building regulations, institutional capacity, and directing investments for the implementation of dam safety procedures during all phases of a dam project. A couple of examples include the work carried out in Brazil[81] and Peru[82] to support the strengthening of dam safety measures. To advance in this task, it is critical to update national databases of dam infrastructure statuses, including tailing dams, to better prioritize investment needs as it is estimated that US$33 billion would be required only to refurbish electro-mechanical equipment in facilities of more than 20 years old (IADB 2020). Previous WB experience in supporting national water programs and sector reforms such as ANA's new mandate of regulating authority for the safety of multipurpose dams in federal rivers across Brazil, can be replicated and tailored to each country's conditions and needs.

[80] Argentina: Valuing Water. World Bank, 2021.
[81] Dam Safety in Brazil: When Engineering Serves Society. World Bank and ANA, April 2015.
[82] Peru: Integrated Water Resources Management in Ten Basins Project. World Bank, 2017.

225. To secure sustainability of infrastructure projects and avoid energy imbalances during droughts (see Chapter 1), hydropower projects need to be screened against climate change risks and conceived using a basin planning approach to avoid water resource conflicts with competing users, reaching consensus among all stakeholders. Multipurpose schemes may be needed more than ever since water storage is limited and these projects are critical for basins of higher demand to mitigate risks against increasing water variability resulting from climate change. These developments require more sophisticated institutional arrangements as they involve different sectors. Consequently, they may take longer to prepare, but they yield higher benefits than single purpose projects.

3.3 Mitigating Water-related Risks

226. To deal with the impacts of water-related extremes, it is important to focus on increasing resilience. This requires to improve reliable information, balancing green and gray infrastructure, and strengthening risk mitigation governance.

227. The timely and reliable response to water-related risks requires expanding and reinforcing hydrological real-time monitoring, weather and climate forecasts, and early warning systems as cost effective measures, implementing them more widely across the region. Hydroclimatic information in general is useful for water resources management as "ex-ante" measures for risk preparedness. In areas more exposed to extreme weather events, such as the Caribbean, strengthening and expanding early warning systems is the way to go to reduce the risk of disasters in islands. The implementation of such systems must go hand-in-hand with a series of measures: addressing gaps in early warning communications and dissemination; engagement across all stakeholders; and the consolidation of the entire range of threats into these systems (UNDP 2016). There needs to be a push for more real-time monitoring and open data sharing. For instance, including the global community will help improve the global/regional weather and climate ensemble forecasts, which are then usually downscaled by met agencies in countries to be used in flood predictions. In doing so, several governance-related factors need to be incorporated:

a. Normative frameworks can enable multi-stakeholder engagement around the alert system.
b. High qualified staff needs to manage and operate these systems, and in most cases, this capacity has still to be created. They will need to implement skills in hydrometeorology and risk prevention with cross-collaboration programs among experienced institutions in other countries.
c. Administrations in charge of building and operating early warning systems must ensure that there are financial mechanisms in place to operate and maintain the system in the long term.
d. Private sector participation will be also beneficial in this field as they are usually effective in leveraging ICT technology, considering that they can also be users that could "pay" for specific services in a way to help reduce the financial gaps to some degree.

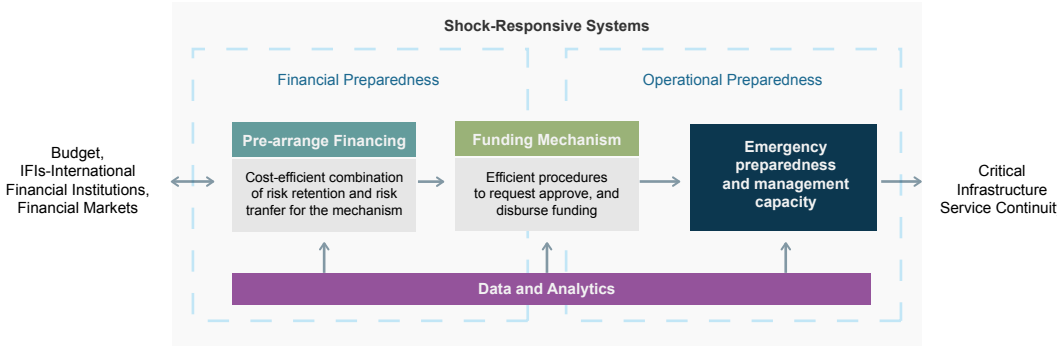
228. LAC must consider expanding the use of green infrastructure to increase resilience in a sustainable way. Green infrastructure can play a significant role in improving water security in the region not only for greater resilience, but also for sustaining water resources and providing water services. Natural systems such as forests, floodplains, and soils may act as buffers to reduce the impacts from floods and drought. In many circumstances, combining "green infrastructure" with traditional "gray infrastructure," such as dams, levees, reservoirs, treatment systems, and pipes can provide solutions that enhance system performance and better protect communities in the long run. In many cities, green infrastructure, like green roofs, permeable surfaces, and parks are already being integrated in urban projects, improving living conditions. These interventions increase retention capacity and infiltration and as such, reduce peak flows and flooding; they may also ameliorate high temperature in cities, regulate air flows and provide habitat space. An example of green and gray infrastructure is the Bogota River Restauration Project in Colombia.[83]

229. LAC needs to develop policies and regulatory frameworks that facilitate collaboration with the private sector for cross-sectoral implementation to increase financing for green infrastructure. As capital expenditures and operating expenditures associated with green infrastructure differ from traditional infrastructure, structuring and designing the terms of such financing conditions is important. This type of infrastructure also requires special technical capacities that still have to be developed in the region to assess impacts and benefits. This will provide the basis for assessing economic efficiency, as well as the required substantiation for cross-sectoral collaboration, integrating the multifunctionality of green interventions and the broad range of co-benefits.

230. It is necessary to enhance the financial preparedness of water utilities. Building resilience in water service providers is essential to ensure service continuity during both smaller and more frequent emergencies such as droughts and floods as well as during shocks such as the COVID-19 pandemic. Building resilience in Latin American water utilities requires a two-pronged approach — improving operational and financial preparedness. Operational preparedness refers to having in place the right plans, standard operating protocols, and capabilities (for example, people, equipment, spare parts) to enable quick restoration of critical services. Financial preparedness involves having access to the right mechanisms to access and provide effective, adequate, and timely financing to implement overall contingency plans.

[83] "Restoring a Long-Lost Relationship with Rio Bogotá": https://www.worldbank.org/en/results/2021/04/09/restoring-a-long-lost-relationship-with-rio-bogota accessed in April 2021.

Figure 62.
Components for Shock Responsive Systems to Protect Critical Infrastructure Services



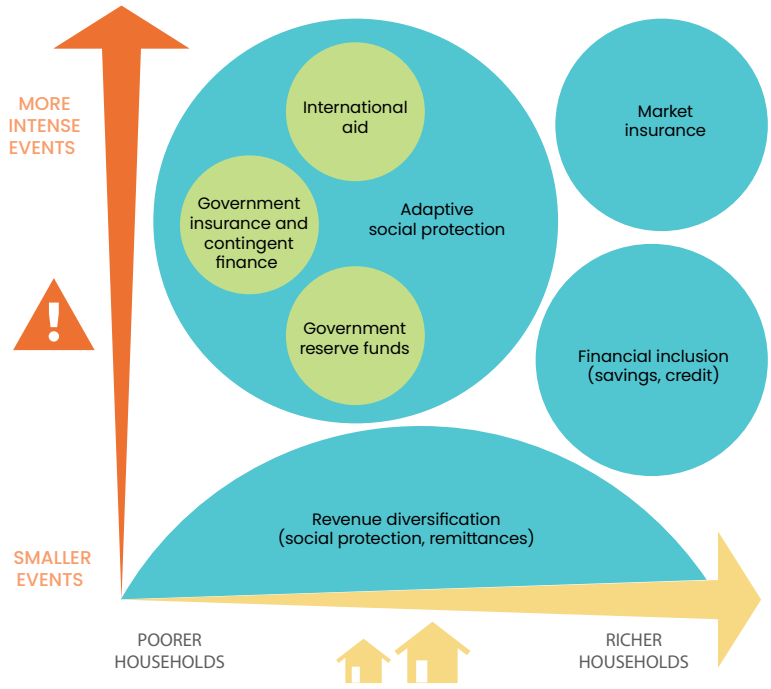
Sources: Financial Protection of Critical Infrastructure Services. (World Bank 2021b)

Floods

231. Despite efforts to reduce exposure to hazards and make assets less vulnerable, in the case of floods, risk cannot be reduced to zero. It is thus critical to strengthen the people's and service provider's ability to cope with disasters, reducing vulnerability and increasing resilience. At a strategic level, a holistic risk management strategy that includes a range of tools has been proposed by Hallegatte et al. 2017:

a. **Revenue diversification for households:** Diversifying revenue and receiving remittances or cash transfers from social programs could help households at all income levels cope with small shocks.
b. **Financial inclusion:** Enabling poor people to access financial instruments (credit) would accelerate and improve recovery and reconstruction. Enabling people to save in forms less vulnerable to natural hazards than in-kind savings like housing would diversify risk.
c. **Market insurance:** Market insurance, presently used mainly for meteorological hazards, could provide protection against large losses. However, its general implementation faces various obstacles, including weak institutional and legal capacity, affordability issues, and high transaction costs. The problem with this mechanism is that will be self-selected depending on willingness and payment capacity. Alternatively, climate-indexed insurance can be applied to anyone affected by a climatic anomaly as defined in the regulation and activation of emergencies.
d. **Adaptive social protection:** Easily scalable social safety nets could provide protection for poor households after large shocks. Evidence indicates very favorable benefit-cost ratios for post-disaster transfers.
e. **Disaster risk financing:** Adaptive social protection programs create liabilities for governments which may require them to draw on various tools such as reserve funds, contingency credit lines, regional risk pools, or transfers of part of the risk to global reinsurance or global capital markets. The COVID-19 crisis has shown dramatically how national finances can be affected widely by external shocks and uncertainty.

Figure 63.
Risk Management Tools for Different Types of Disasters and Households



Sources: Hallegatte et al., 2016

232. Flood risk zoning needs to become integral part of urban planning. Inundation mapping and flood risk zoning in populated areas can help to identify the appropriate measures to reduce risks. Areas at high-risk must be first identified in order to design development plans according to their risk profile. In the preparation of inundation mapping and flood risk zoning, municipalities must work in close cooperation with water resources departments.

Droughts

233. Water authorities must develop drought monitoring and management systems. Based on indicators that determine the different levels of drought (based on severity and type of drought), contingency plans are necessary to define management structures, procedures, and measures to be adopted. Depending on the level of drought, measures typically include public alert campaigns, restriction of certain water uses (e.g., irrigation of parks), intermittent water supply, reprogramming of reservoir releases, activation of emergency wells, and reallocation of water depending on the priority of respective uses (urban supply, irrigation of permanent crops, irrigation of other crops).

234. There is an urgency to implement the efficiency measures previously described in sectors that have wide room for reducing consumption (irrigation, water supply, and sanitation), particularly in drought-prone and arid areas. These measures are only part of wider strategies that diversify and protect sources of water (surface and groundwater). Increasing efficiency may not always protect the poor from erratic rates of rainfall or guarantee the sustainable use of water. For this reason, it is essential to hedge against disasters through social

protection or disaster insurance mechanisms. In rural areas where agricultural establishments consume the most water, these protection mechanisms could be crop insurance systems; whereas in cities, supply companies must be regulated to guarantee access to clean water (World Bank 2017b).

235. Fighting drought also means building more water storage and optimizing the use of natural buffers (groundwater, snowmelt). A better knowledge of groundwater resources can also optimize their use as reservoirs and promote conjunctive use. Also, water authorities need to plan in advance for the changes in dynamics of glacier and snowmelt that are currently happening. The important regulatory role of these natural buffers needs to be replaced with other types of storage.

3.3.1 COVID- 19: An Opportunity to Build Back Better

236. In 2020, strategies for water security in LAC have taken on new significance in light of the global pandemic. The COVID-19 pandemic has been a significant global shock, but also an opportunity to leverage unprecedented government response and stimulus for critical actions on long-term development (see Chapter 1).

237. Following the World Bank Group (WBG) approach to confronting the COVID-19 crisis, the WB Water Global Practice has outlined a sector-based COVID-19 response strategy with key action areas identified. These include immediate emergency response in the short term, as well as targeted support in the medium term in WASH, water in agriculture (WiA), and water resources management. In LAC, the COVID-19 response is aligned with the WGB response and the Water GP priorities through: interventions in filling the gaps in WASH service access to help contain the spread of infections; advancing waste water-based epidemiology as a cost-effective tool for pathogen monitoring and early warning; supporting water supply and sanitation sector utilities for financial sustainability and resilience; and investing in protections and management of water resource systems for long-term agriculture, food, and watershed security. The impacts of COVID-19 have created an opportunity for implementing regulation that promotes resilience and allows utilities to better prepare for economic and climate change shocks. For example, in Colombia the regulator allowed utilities to include the cost of capital investments of green infrastructure and adaptation actions in the tariffs. Not only that, but the COVID-19 pandemic offers an opportunity for governments around the world to focus on better integrating biodiversity and sustainability in their stimulus measures and recovery efforts. It is important to note that biodiversity loss is seen as a key driver of emerging infectious diseases and poses a variety of risks to society and global economy. Investing in biodiversity can help to address these risks while providing jobs, business opportunities, and other benefits to society.[84]

238. By looking at the pandemic as an opportunity to build back better, interventions from governments can support the balanced goals for pandemic response and economic stimulus in parallel with meeting the goals for

[84]https://read.oecd-ilibrary.org/view/?ref=136_136726-x5msnju6xg&title=Biodiversity-and-the-economic-response-to-COVID-19-Ensuring-a-green-and-resilient-recovery

poverty reduction, while looking at urbanization, regional migration, climate change, natural disaster risk, water security, biodiversity, and environmental sustainability. Key criteria for selecting and supporting individual projects and investments in the water sector include identifying projects that are: fast-disbursing projects, pro-poor interventions, labor-intensive investments, and sustainable and safe solutions.

3.3.2 A Call for Regional Action

239. While most of the challenges in addressing water security require national and sub-national action, there are also a number of issues that are regional and require collective action from development partners and government at a regional level. This includes: i) focusing on elevating water security issues to higher levels in the national development dialogue; ii) incorporating water security goals as part of NDCs and adaptation plans; iii) sharing information to fill existing monitoring gaps; iv) addressing transnational challenges such as transboundary waters; v) aligning policy priorities among development partners to avoid overlaps and joining efforts to support the prioritization of water in national and regional agendas.

240. Elevating water security issues to higher levels in the national development dialogue. As seen from this report, the situation surrounding water in LAC is critical. Water practitioners, development partners, and sector government officials need to come together to raise these issues and help in their prioritization in national policy agendas.

241. Incorporate water security goals as part of the NDCs and adaptation plans. Impacts of climate change are primarily felt in the water sector. As such, NDCs and adaptation plans have space to strengthen their focus on water resources management, service provision, and the management of water risks. The recent rise of climate change discourse gives a unique opportunity to put these issues back in the agenda.

242. Sharing information at the regional level is key to better targeted interventions and to benchmarking and monitoring the progress in the achievement of SDGs. At the time of writing, numerous information gaps existed on groundwater status, water quality, and the performance of water resources management institutions. Information gaps need to be addressed, especially around the performance of water resources management institutions, as they are needed to monitor and assess past and future reforms in the water resources management side.

243. Addressing transnational challenges such as transboundary water quantity and quality demands will require reviewing the roles and responsibilities of existing transnational institutions and current legal frameworks. Regional institutions like the Central America Integration Systems (SICA) can play a more active role in the management of shared resources, but should be accompanied by a suitable legal framework to allow regional decisions to become binding by national governments. Moreover, aligning policy priorities among development partners will play an important role to avoid overlaps and join efforts to prioritize water in national government counterparts' agendas.

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Abbreviations

- **ANA:** National Water and Basic Sanitation Agency
- **CAF:** Latin American Development Bank
- **CG :** Corporate Governance
- **CIC:** Intergovernmental Coordinating Committee of the La Plata Basin Countries
- **COBINABE:** Binational Commission for the Development of the Upper Bermejo River and the Río Grande de Tarija Basins
- **CONAGUA:** National Water Commission
- CeReGAS: Regional Center for Groundwater Management
- **CRED:** Centre for Research on the Epidemiology of Disasters
- **CRI:** Climate Risk Index
- **DALY:** disability-adjusted life year
- **DGA:** General Directorate of Water
- **ECA:** water quality standards
- **ECLAC:** Economic Commission for Latin America and the Caribbean (of the UN)
- **ENACAL:** Nicaraguan Company of Aqueducts and Sewers
- **ENSO:** El Nino Southern Oscillation
- **ETP:** Potential Evapotranspiration
- **ETR:** Real Evapotranspiration
- **FAO:** Food and Agriculture Organization (of the UN)
- **FEWS:** flood early warning systems
- **GDP:** gross domestic product
- **GEM:** global education monitoring
- **GLAAS:** global analysis and assessment of sanitation and drinking water
- **HALE:** healthy life expectancy
- **HWISE:** Household Water Insecurity Experiences
- **IADB:** Inter-American Development Bank
- **ICT:** information and communication technology
- **IEA:** International Energy Agency
- **IGRAC:** International Groundwater Resources Assessment Centre
- **IHME:** Institute for Health Metrics and Evaluation
- **IHP:** Intergovernmental Hydrological Programme
- **ICU:** Intensive Care Units
- **ILO:** International Labour Organization
- **IPC:** Infection Prevention and Control
- **IPCC:** Intergovernmental Panel on Climate Change
- **IUCN:** International Union for Conservation of Nature
- **IWRM:** Integrated Water Resources Management
- **JMP:** Joint Monitoring Program (WHO/UNICEF)
- **LAC:** Latin America and the Caribbean
- **MERESE:** Ecosystem Services Compensation Mechanism
- **MVCT:** Ministry of Housing, City and Territory
- **NBS:** nature-based solutions
- **NDC:** National Determined Contributions
- **NRW:** non-revenue water
- **NTD:** neglected tropical diseases
- **NWSP:** National Water Security Plan
- **OCHA:** United Nations Office for the Coordination of Humanitarian Affairs
- **OECD:** Organisation for Economic Co-operation and Development
- **O&M:** operation and maintenance
- **PES:** payments for environmental services
- **RCP:** Representative Concentration Pathway
- **SDG:** Sustainable Development Goal
- **SEDAPAL:** The Potable Water and Sewerage Service of Lima
- **SIASAR:** Rural Water Supply and Sanitation Information System
- **STEM:** science, technology, engineering, and mathematics
- **SUNASS:** Superintendence of Water Supply and Sanitation Services of Peru
- **UNDP:** United Nations Development Programme
- **UNDRR:** United Nations Office for Disaster Risk Reduction
- **UNECE:** United Nations Economic Commission for Europe
- **UNEP:** United Nations Environment Programme
- **UNFCCC:** United Nations Framework Convention on Climate Change
- **UNICEF:** United Nations International Children's Emergency Fund
- **WASH:** water supply, sanitation, and hygiene
- **WHO:** World Health Organization
- **WiA:** water in Agriculture
- **WRI:** Water Resources Institute
- **WRM:** Water Resources Management
- **WSS:** water Supply and Sanitation
- **WUOs:** Water User Organizations
- **WWTP:** wastewater treatment plant

Annexes

Annex 1.
LAC Countries with Recent or Updated NDCs (Post 2019)

Country	Updated NDC Submission Date	Excerpts from Updated or Recent NDC (Original language followed by informal translation as applicable.)
Argentina	30/12/2020	Manage water heritage with a comprehensive approach to ensure the availability, sustainable use, and quality of the resource for various human and natural uses in the face of the impacts of climate change.
Brazil	21/09/2016*	It should be further noted that Brazil seeks to enhance its national capacity in water security (National Water Security Plan) and conservation and sustainable use of biodiversity (National Strategic Plan for Protected Areas, as well as the implementation of the Forest Code, particularly concerning protected areas).
Chile	09/04/2020	Water security: The instruments and measures arising from the implementation of this NDC shall favor water access in terms of proper quantity and quality, determined according to each basin's characteristics, for its maintenance and timely use for health, subsistence, socioeconomic development, and ecosystem conservation.
Colombia	30/12/2020	Establish and define the guidelines and methodological approach of complementary studies required to incorporate climate change in watershed management processes (POMCAS).
Costa Rica	29/12/2020	By 2030, water security and sustainability will be promoted in the face of climate change, as well as the adequate and integrated management of hydrographic basins through the protection and monitoring of sources, considering both surface and groundwater.
Dominican Republic	29/12/2020	Water Security: Improve the quality of water-producing ecosystems that serve as sources of supply-to-supply systems, including improving the conditions of sanitation services.
Ecuador	29/03/2019	Formulation and implementation of a national water culture strategy which includes practices and knowledge of ancestral people as a mechanism that contributes to local awareness of the effects of climate change.
Jamaica	01/07/2020	For example, the Integrated Management of the Yallahs and Hope River Watershed Management Areas (Ya-llahs-Hope) Project aims to improve the conservation and management of biodiversity and the provision of ecosystem services within the region; the watersheds accounts for around seven percent of the island's far-mlands.
Mexico	31/12/2020	Promote hydrological environmental services through conservation, protection, and restoration in basins with special attention to nature-based solutions.

Nicaragua	24/12/2020	Develop a national program to capture water and promote irrigation systems in the dry corridor of Nicaragua for an investment amount of approximately US$800 million.
Panama	28/12/2020	Plans will emphasize the application of nature-based solutions, the application of which will result in increased resilience in prioritized watersheds, reduced emissions, and increased carbon storage through reforestation, afforestation, restoration of soils, sustainable management of forests, and the conservation of forest carbon stocks.
Peru**	18/12/2020	Prioritized thematic areas: v) Water, which includes the incorporation of transversal approaches.
Suriname	09/12/2019	Suriname has since worked to reduce vulnerability through the promotion of climate-smart agricultural technologies and identified both the scale of water-related challenges and appropriate responses. Suriname is strengthening coastal protection through nature-based solutions, such as mangrove planting, which beyond improved resilience brings significant co-benefits in the form of carbon sequestration and enhanced food security.

Note: *Brazil submitted a communication on the 9/12/2020 that confirmed the commitments found in the first NDC.
** Peru submitted a communication that outlined what will be included within their enhanced NDC in 2021; a full update is anticipated in 2021.

Annex 2.
Logical Framework and Recommendations

Water Resources Management		
CHALLENGES	**CAUSES**	**RECOMMENDATIONS**
• WRM institutional set-ups continue to underperform, reducing the ability to regulate competing needs and avoid/solve water conflicts.	• Low prioritization of water in the national political agenda that holds back institutional and legal reforms. • Absence of an appropriate legal framework that dictates clear responsibilities among stakeholders. • Lack of accountability and compliance with key performance indicators in water resources management institutions. • Missing authority and sector neutrality to resolve conflicts in water resources management practices. • No specific indicators that track institutional performance. • Lack of financing of water resources management including national budget for investment, budget to cover recurrent costs, and revenues raised from users.	• Bring forward and substantiate each country's most pressing issue to seek long term political support, prioritizing water as a key asset for economic, social, and environmental development • Draft strategies t based on technical analysis that prioritize reforms upholding the impacts of water in the society, the environment, and the economy. • Define participatory tools for consensus building, clear procedures for decision making and approvals, and legal rules or arbitration in case of disagreement • Secure ring-fencing resources and allow for economic compensations from water users and polluters to be fed back to the water sector (See box 17)
• Over-abstraction of groundwater at a rate greater than natural recharge.	• Lack of knowledge regarding natural recharge, rate of abstraction, quality, and flow dynamics in most aquifers in the region. • Unregulated use of groundwater, and no systematic monitoring nor control of abstractions.	• Gather more data and information about groundwater resources to optimize their use as reservoirs, promoting conjunctive use. • Expand groundwater storage, protecting it from domestic, agricultural, and industrial pollution to increase availability.
• Information gap hindering the allocation and control of water resources in terms of quantity and quality	• Inaccessible information by other institutions and/ or the public • Lack of clarity in legal mandates across institutions that produce WRM information • Limited financing to secure the financial sustainability of WRM information systems	• Increase information availability on water resources among member states in transboundary basins through data sharing platforms on water balances, water quality, sedimentation, weather forecasts, etc.
• Water resources management interventions fail to address basin issues and integrate longer term development concerns	• Water resources planning is only partially done on a catchment scale. • Many basin institutions in LAC are still weak or non-existent; methodologies in river basin planning are usually out-dated, failing to incorporate climate change uncertainty and other risks to the water services provision. • Limited powers to enforce river basin plans due to inefficient operational capacity and lack of financial autonomy.	• Prioritize interventions in river basin institutions to expand their functions, capacities, and resources, enhancing stakeholder participation • Strengthen management efforts in transboun-dary basins to define the sources of funding and forecast the impact of interventions

Water Services		
CHALLENGES	CAUSES	RECOMMENDATIONS
• Unequal access to safely managed water and basic sanitation services in rural and peri-urban areas.	• Lack of basic public services and infrastructure alongside poor performing utilities . • Inability to optimize subsidies and lack of financing mechanisms.	• Focus national policies to speed up connections to reliable water and sanitation services and improve existing levels of service. • Advance the analysis of each country's financing systems to find clarity on the appropriate mix of tariffs, taxes, and transfers to invest in the expansion of services.
• Slow progress in improving public service provision; greater consumption levels and water loss.	• Low investments in modernization and refurbishing of existing water sector infrastructure • Utilities' inability to keep up with fast-growing cities and cover O&M costs • Problems in household metering to improve collection rates	• Consider innovative forms of financing such as incentives to attract and mobilize private capital • Increase financial efficiency as well as operational efficiency to lower O&M costs. • Adopt regulatory frameworks that incentivize efficiency by defining adequate tariff structures and key performance indicators (Ch. 2).
• Increasing vulnerability to natural hazards and growing exposure to shocks	• Utilities' inability to cope with shocks due to difficulties in planning • under uncertainty • Insufficient anticipation and adaptive management strategies • Lack of risk awareness	• Increase resilience planning for water systems to lower the risk of climatic and non-climatic risks, improving the robustness and reliability of water services • Incorporate uncertainty into the utilities´ engineering design processes for a broader system operation flexibility • Digitalization of tools for more agile responses in changing environments
• Less inclusive and sustainable water and sanitation provision for vulnerable groups such as women, children, and elderly people. • Exclusion of Indigenous and Afro-descendant populations in water resource decision-making.	• Women comprise only a small part of the water utility workforce, particularly in technical and management roles. • Most countries lack comprehensive data about Indigenous and Afro-descendant populations' access to water and sanitation services. • Poor understanding of Indigenous institutions, governance, and value systems.	• Enhance public participation mechanisms to maintain systems functionality, ensuring inclusion, accountability, and successful community management approaches in rural areas. • Promote greater consultation process and intercultural strategies engaging a wider range of stakeholders.
• Economic losses due to interrupted services in times of crisis.	• Lack of preparedness during emergencies.	• Develop emergency prevention plans, financial tools for resilience, and adaptative construction features in water supply and sanitation infrastructures. • Set targets for greater resilience to climatic and non-climatic shocks.
• Losses in agricultural productivity due to water scarcity.	• Inadequate drainage networks aggravating waterlogging, salinization, and land degradation. • Need to rehabilitate irrigation and drainage systems on a recurrent basis through significant public subsidies.	• Agrometeorological infrastructure and new technology tailored to farmers' needs. • Innovative forms of financing to mobilize private capital for irrigation.
• Climate change and water scarcity posing issues to hydropower production.	• Ageing infrastructure with growing dam safety risks. • Climate change posing an additional uncertainty in new hydropower development. • Single use schemes foregoing benefits to other users.	• Update national databases of dam infrastructure status and renovation investments. • Implement dam safety procedure during all phases of dam projects, incorporating climate proofing methodologies. • Build multipurpose schemes that adapt to the increasing variability from climate change.

Water-related Risks		
CHALLENGES	**CAUSES**	**RECOMMENDATIONS**
• Growing exposure to floods and major landslides in slums and highly populated areas.	• Change in runoff patterns and climate change variability. • Informal settlements with poor quality housing infrastructure.	• Inundation mapping and flood risk zoning in populated areas. • Holistic risk management strategy including revenue diversification for households, financial inclusion, market insurance, adaptive social protection, disaster risk financing.
• Increasing risk from droughts and water scarcity.	• Irregular rainfall distribution across the region with no monitoring system in place. • Increase in competing water demands. • Low water storage.	• Develop drought monitoring and management systems with contingency plans with drought severity indicators. • Diversify and protect sources to reduce consumption (irrigation, water supply, and sanitation), particularly in drought-prone and arid areas . • Build more water storage and optimize the use of natural buffers (groundwater).
• Increasing burden from the COVID-19 crisis.	• Changes in consumer behavior and cost recovery delay during the pandemic. • Lack of regulations that promote resiliency allowing utilities to better prepare for economic shocks.	• Advance interventions from governments in response to the pandemic through economic stimulus that support sustainable and safe solutions both socially and environmentally. • 'Build Back Better' through the WB's COVID-19 response strategy which includes immediate emergency response as well as medium term support in WASH, WiA, and WRM.

Recommendations at a regional level		
CHALLENGES	**CAUSES**	**RECOMMENDATIONS**
• Concerns around the fairness of water allocation.	• Growing demands of water use across different sectors. • Poor information regarding water use and water contamination.	• Collect, systematize, monitor, and share data on the availability, quality, uses, and demands of water resources. • Publicly advertise water rights allocation and allow time for public complaint.
• Hoarding of water rights impacting the efficiency and effectiveness of water services, leaving the most vulnerable behind.	• Corruption and low-quality control on service performance even in areas of high coverage.	• Establish accountability mechanisms to corporate governance, minimizing the risk of political capture and corruption.
• Inability to cope with extreme events leading to cumulative climate-related damage of over US$11 billion per year.	• Poor operational resilience against hydrometeorological extremes. • Water service providers and water resources management institutions have not fully adopted the principles of resilience in their planning and operational models.	• Improve reliable information, incorporating a more balanced mix of green and gray infrastructure, and strengthening risk mitigation governance. • Reinforce hydrological real-time monitoring, weather, and climate forecasts, and implement early warning systems.

• Performance gaps for proactive cooperation and dissemination strategies towards a regional water security.	• Limited knowledge regarding each country's hydrological balance. • Low benchmarking across countries.	• A call for regional action aligning policy priorities among development partners. • Define a better dissemination strategy with open-data sharing. • Incorporate water security goals in NDCs to address transnational challenges and work towards the SDGs conjointly.

Annex 3.
Regional Stakeholders in the Water Sector.

Regional Institutions in LAC	Water Sector Engagement
A4WS – Alliance for Water Stewardship.	Standards in agricultural supply chains.
ALOAS – Asociación Latinoamericana de Operadores de Agua y Saneamiento.	Potable water and sanitation, sewage collection, and wastewater treatment.
CABEI – Central American Bank for Economic Integration	Water and sanitation service modernization, water resources management.
CAF – Development Bank of Latin America	Potable water and sanitation, watershed management and protection, agricultural development and irrigation, drainage, and flood control.
CDB – Caribbean Development Bank	Household water and sanitation, reduction in greenhouse gas emission from solid waste, water and wastewater treatment systems, water education.
ECLAC – Economic Commission for Latin America and the Caribbean	Potable water and sanitation, water resources management, water-energy-food nexus, agriculture and rural development, SDGs.
FAO – Food and Agriculture Organization of the United Nations	Soil and water conservation, sustainable agriculture, AQUASTAT, forest and water program, climate change, food security.
IICA – Inter-American Institute for Cooperation on Agriculture	Leaders of rurality, sustainable agriculture, regional trade, climate change, natural resources management.
GRICCIP – Red Latinoamericana de Gestión del Riesgo y Cambio Climático en la Inversión Pública	Methodological instruments in risk management and adaptation to climate change.

Regional Institutions in LAC	Water Sector Engagement
IADB – Inter-American Development Bank	Potable water and sanitation (urban, peri-urban, rural), IWRM, water funds, solid waste management.
LA-WETNET – Red Latinoamericana de desarrollo de capacidades para la gestion integrada del agua	Capacity building for sustainable water management practices.
Latin American Water Funds Partnerships	Water security, water funds network.
National Red Cross Societies	Transboundary water, IWRM, biodiversity conservation, water and wastewater management, coastal area protection.
OECD – Organization for Economic Cooperation and Development	Water governance, water quality and quantity, risks/disasters/climate change, water inance/investment/pricing, agriculture, cities, sustainable growth and the SDGs, country-specific policy dialogues.
PAHO/WHO – Pan-American Health Organization	Potable water, sanitation, hygiene, disease prevention, emergency and disaster preparedness
SICA – Central American Integration System	Potable water supply and sanitation, water-energy nexus
TNC – The Nature Conservancy	Land and water conservation, agriculture, water funds, food and water sustainability, healthy cities, climate change
World Bank	Water supply and sanitation, water resources management, water in agriculture, resilient cities, circular economy, disaster recovery

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

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Country Data Sheet

Select a country: **Argentina**

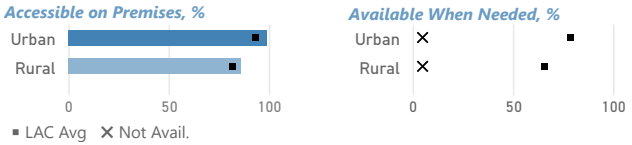
"LAC" = All countries

"CA" = Central America

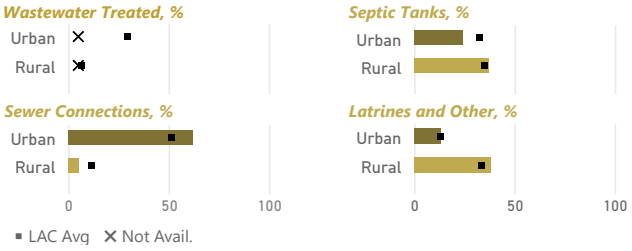
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	**Not Avail.** % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
14.7 %	**5.9** %
LAC: 30.9%	LAC: 23.7%

Key Challenges

Piped drinking water coverage is relatively high and sewer coverage is similar to the regional average, but both are growing slowly. In rural areas, unsafe sources among the disperse population result in the perpetuation of vulnerability and poverty conditions.

50 percent of the population without piped water and more than 9 million inhabitants without sewers lives in the Metropolitan Area of Buenos Aires. Together with the high population density, exacerbates the economic, social, and environmental impacts of the lack of access to basic services.

While the quality of service is acceptable in terms of continuity and water quality, the level of efficiency of service provision is low. The most significant challenges are the low level of micro metering and the high level of water production.

The price of water for irrigation does not always allow for service provision cost recovery. The disparities in the collection rate of water fees depend on the socio-economic conditions and institutional capacity in each province. The applied fees do not incentivize water resource conservation nor service efficiency. The overall average water use efficiency is 34 percent.

Water Capital & Water Resources

Water Capital & Availability

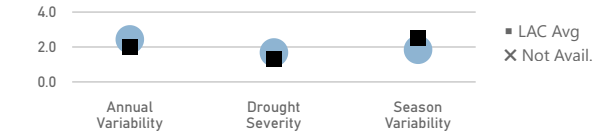
19,792. *m3/inhab/year* *Water Resources per capita*	LAC: 44.1K
66.7 *%* *Transboundary Sources*	LAC: 15.8%
10.5 *%* *Water Stress*	LAC: 13.6%
0.24 *(0-1)* *Unsafe Water Quality Index*	LAC: 0.66
1.0 *%* *Water Ecosystems Area*	LAC: 1.2%

Water Resources Management

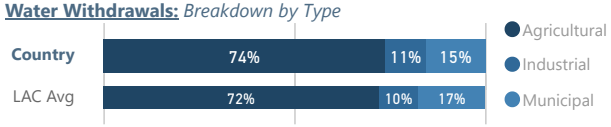
2,994.36 *m3/inhab* *Dam Capacity per capita*	LAC: 2.9K
29.0 *%* *Electricity from Hydropower*	LAC: 36.6%
7.0 *%* *Agri. Sector Value to GDP*	LAC: 7.5%
38.0 *%* *Implementation of IWRM*	LAC: 33.0%
9.5 *%* *WR Climate Change Impact*	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Argentina has one of the highest dependency rates of external water resources, and water availability across the country is unequal. The arid and semi-arid areas cover 70 percent of the country's territory. Macrobasins in the central and northwestern regions are the most compromised in terms of surface water availability.

Provinces are responsible for Water Resources Management. Planning at the basin scale is limited to specific cases and not strongly linked to decision-making processes or investments. Data and information on water resources and water quality is not easily shared among institutions or with the public, although there are initiatives in place to centralize it.

Institutional capacities for water resources management need strengthening in many provinces. Horizontal and vertical coordination between federal and provincial institutions has room for improvement.

Efforts to promote a legal framework at the national level to establish minimum standards related to environmental and water management have not materialized. There are also no criteria or guidelines for the allocation of environmental flows.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

 # 84 Out of 181

CGI World Ranking

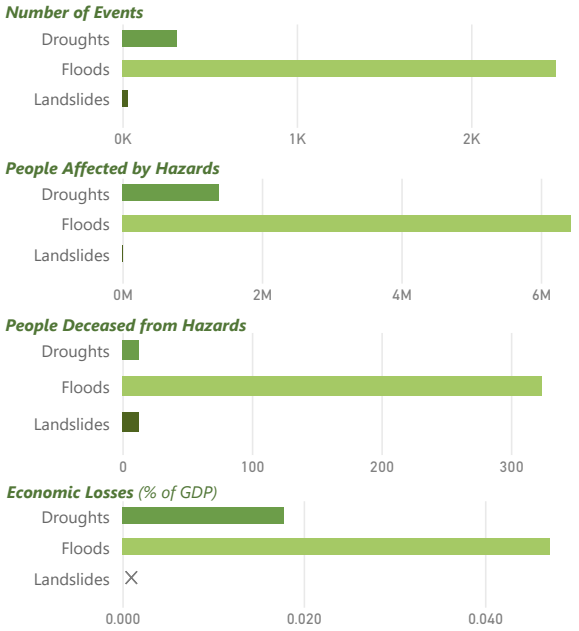
LAC: 74

79.5

GCI Index Score

LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Urban floods have significant impacts on the country. Argentina is one of the most urbanized countries in the region, together with the fact that 70 percent of the population lives in a natural flood plain of the lower La Plata basin.

High levels of vulnerability and exposure and low levels of resilience have a more important role in explaining these impacts, mostly in poor peri-urban areas. In many rural areas of Argentina, flood risk management relates closely to land use management.

Climate change and climate variability can affect major economic activities that depend on water. The central region shows high sensitivity, where dry anomalies are relatively frequent and cause significant economic damages to crops.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Datasheet Page 2

Select a country: **Argentina**

Water Service Delivery

Information, Analysis, and Planning Tools

Expand and promote the implementation of Management and Results Plans by monitoring key performance indicators focusing on improving efficiencies.

Expand the National Information System on WSS

Move on from flat tariff regimes. Keep promoting volumetric tariffs and installing micro-meters.

Update the National WSS Plan, setting realistic milestones towards achieving SDG 6.1 and 6.2 and defining clear intervention priorities.

Update and ensure an adequate cadaster of irrigation users, contrasting granted rights with calibrated water balances.

Institutional Structure

Strengthen the National Directorate of Drinking Water and Sanitation to enhance WSS policy making, planning, and monitoring of the sector's performance.

Strengthen provincial regulators to perform their functions efficiently. Streamline infrastructure delivery to reduce execution times.

Investments

Expand WSS infrastructure to cover the gap in the most vulnerable areas: peri-urban and disperse rural areas and communities

Investments in wastewater treatment plants and rehabilitation of water supply networks.

Efficiency improvements and expansion in irrigated agriculture in the most vulnerable areas to drought, and complementary irrigation in areas with higher TIR.

Legal and Regulatory Framework

Continue the process to improve and approve a WSS law through a participatory process, including a new system of matching grants to provinces.

Update provincial regulatory WSS frameworks to define volumetric tariff regimes, to monitor providers' performance, and to create incentives for service expansion in difficult areas.

Water Capital & Water Resources

Information, Analysis, and Planning Tools

Improve hydrometeorological knowledge, especially on groundwater.

Prepare a hydrologically informed National Water Plan that identifies priority areas for investment.

Prepare a national water quality map for surface resources and groundwater, analyzing causes, and proposing remediation measures. Use tailored indicators for each basin and collect information through monitoring programs, starting with the SDG 6.3 proposed parameters.

Institutional Structure

Harmonize water resources management competencies across provincial and federal institutions to reduce fragmentation. Identify and take advantage of synergies among national and federal water and environmental agencies.

Adopt an institutional strengthening plan for provincial and federal water resources management institutions - especially on planning, monitoring, enforcing, and implementing policy instruments.

Investments

Improve hydrometeorological infrastructure.

Analyze sustainable multipurpose reservoirs projects to improve climate change adaptation and resilience.

Legal and Regulatory Framework

Work on a water resources management law of minimum standards through a participatory process.

Consider improvements in the provincial water resources management regulations, aiming to increase efficiency in water use and resilience, establishing allocations and contemplating environmental flows, and to strengthen and enforce pollution control sanction regimes.

Water Risk Management

Institutional Structure

Keep improving the National System for Comprehensive Risk Management to ensure interinstitutional coordination, bottom-up institutions engagement, and citizen participation for disaster risk management. Promote further collaboration in data sharing.

Investments

Promote the development of green infrastructure for flood risk management with drainage systems in urban areas, especially in specific hotspots of recurrent flooding in the Metropolitan Area of Buenos Aires, urban areas along the Parana river, and in the northern provinces.

Legal and Regulatory Framework

Enforce hydrological risk zoning in urban planning - with dissuasive sanctions - and enforce public domain along rivers.

Mandatory compliance with soil management plans should be considered in sensitive areas. More emphasis needs to be placed on consensual provincial planning for collective improvements in agricultural land use, promoting good practices for soil conservation and efficient use of water resources according to availability.

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

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Country Data Sheet

Select a country: **Barbados**

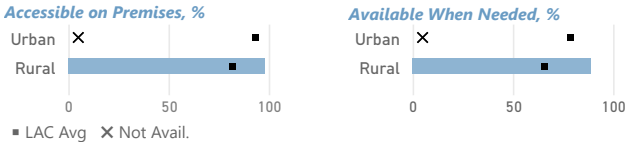
"LAC" = All countries

"CA" = Central America

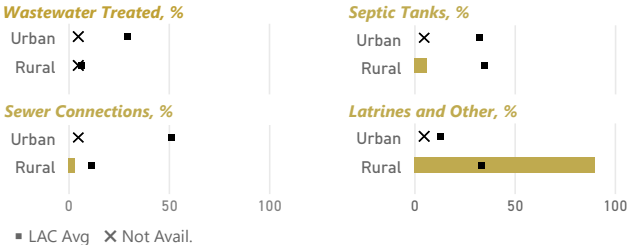
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	1.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
Not Avail. %	67.9 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

- Groundwater is the only source of potable drinking water on the island.
- There is no cost recovery policy framework.
- There are not efficient water service providers.
- There is weak sanitation service provision.

Water Capital & Water Resources

Water Capital & Availability

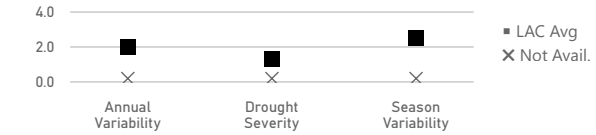
280. *m3/inhab/year* *Water Resources per capita*	LAC: 44.1K
0.0 *%* *Transboundary Sources*	LAC: 15.8%
87.5 *%* *Water Stress*	LAC: 13.6%
0.57 *(0-1)* *Unsafe Water Quality Index*	LAC: 0.66
0.0 *%* *Water Ecosystems Area*	LAC: 1.2%

Water Resources Management

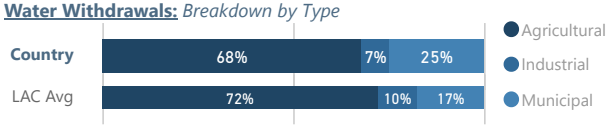
Not Avail. *m3/inhab* *Dam Capacity per capita*	LAC: 2.9K
0.0 *%* *Electricity from Hydropower*	LAC: 36.6%
Not Avail. *%* *Agri. Sector Value to GDP*	LAC: 7.5%
42.0 *%* *Implementation of IWRM*	LAC: 33.0%
16.2 *%* *WR Climate Change Impact*	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

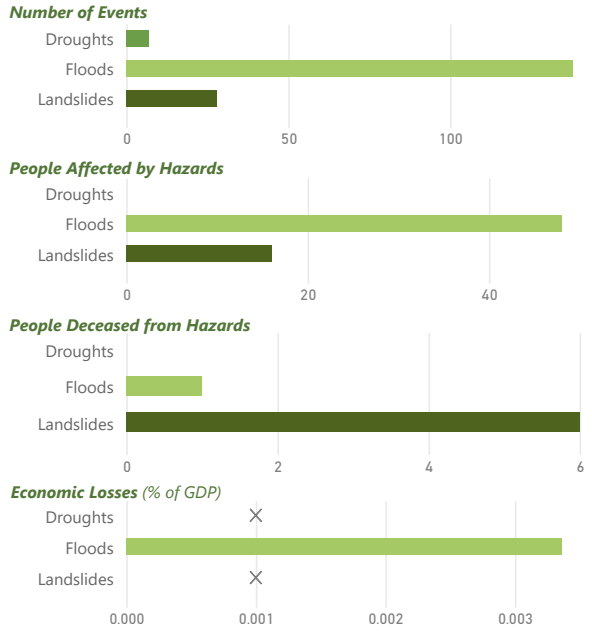
- Barbados is in the top 20 of the world's most water scarce countries, and in the top 10 most arid. Actual surface flows within the island are periodic and only at times of high intensity rainfall. Most of the rivers are dry due to the permeable nature of its geology, resulting in no perennial rivers that could be used for water supply.
- High demand of water resources and low per capita renewable water resources. Desalination is needed.
- Pollution of groundwater and surface water are key issues. Pollution comes mainly from agricultural and industrial activities, urban development and solid and liquid waste disposal.
- There is no adopted National Water Policy, nor a cross-sectoral coordination framework and the regulatory framework is incomplete and fragmented.
- There is no properly functioning agency dedicated to water resources management
- There is poor data collection, monitoring and analysis capacity on water resources or water pollution.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 151 Out of 181 *CGI World Ranking*	**141.7** *GCI Index Score*	
LAC: 74	LAC: 76.0	

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

- Barbados is relatively exposed to frequent natural disasters (hurricanes and floods).
- Flooding is increasing.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

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Country Data Sheet

Select a country: **Belize**

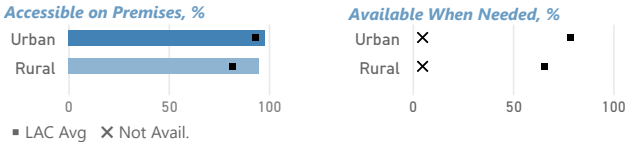
"LAC" = All countries

"CA" = Central America

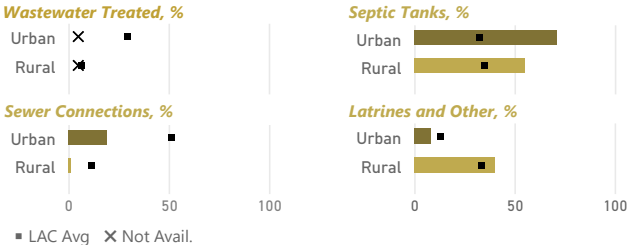
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	1.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
Not Avail. %	2.9 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

Almost 70% of water sources for urban centers are surface water, while 95% of water sources in rural areas are groundwater, that is extracted using rudimentary systems in several municipalities.

Reported cases of children with diarrhea or diseases associated with contaminated water, have continued to increase according to reports from the Health Ministry.

There is about 30% of losses of water in the systems, due to leaks, illegal connections or stealings

Obsolete infrastructure needs important investments.

Water Capital & Water Resources

Water Capital & Availability

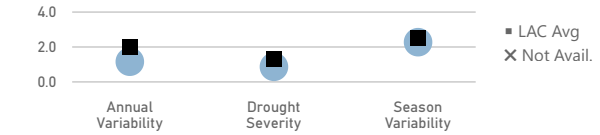
	LAC
58,000. m3/inhab/year Water Resources per capita	LAC: 44.1K
29.8 % Transboundary Sources	LAC: 15.8%
1.3 % Water Stress	LAC: 13.6%
0.87 (0-1) Unsafe Water Quality Index	LAC: 0.66
1.2 % Water Ecosystems Area	LAC: 1.2%

Water Resources Management

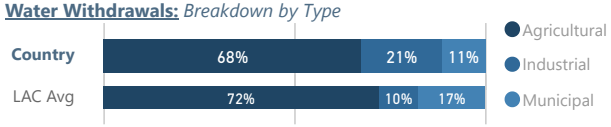
	LAC
323.86 m3/inhab Dam Capacity per capita	LAC: 2.9K
37.0 % Electricity from Hydropower	LAC: 36.6%
10.0 % Agri. Sector Value to GDP	LAC: 7.5%
20.0 % Implemention of IWRM	LAC: 33.0%
25.7 % WR Climate Change Impact	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

The agricultural frontier, illegal logging, oil exploitation, urbanization and pollution, are fast growing activities that are putting incrasing pressure over natural resources including water. Agriculture is mostly rainfed.

There is not an integral program for water quality monitoring. Several organizations carry out this work based on a self-interest initiative.

Belize does not have yet a national authority in charge of water resources administration. Water legislation is being considered, as the current one is incomplete, dispersed, outdated and, in most cases, it has weaknesses in its application.

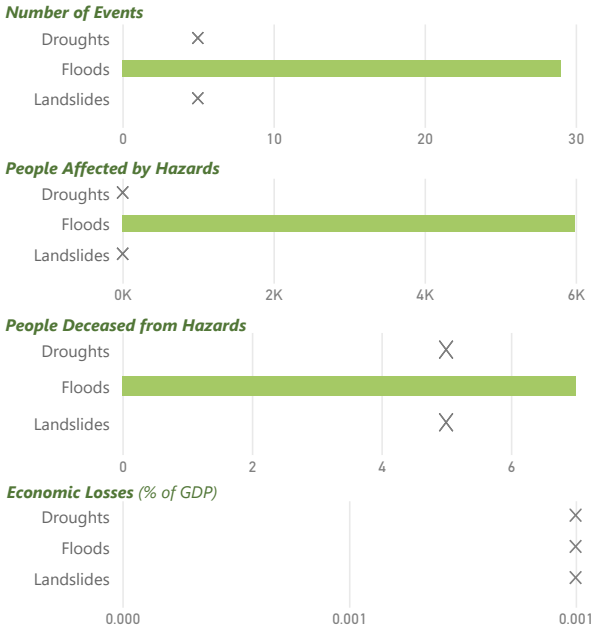
The pending challenges to overcome after the approval of Water Law are the nomination of the National Water Authority, the full development of its normative framework and the preparation of the master plan for IWRM or adequate environmental policies. However, capacities are low to confront these challenges

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 32 Out of 181 CGI World Ranking	48.5 GCI Index Score
LAC: 74	LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Tropical cyclones and hurricanes have always been, and will continue to be, an unwanted factor in Belize´s history and development. Damage costs caused by six tropical cyclones (2000 - 2008) were US $ 526,206,905.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

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Country Data Sheet

Select a country: **Bolivia**

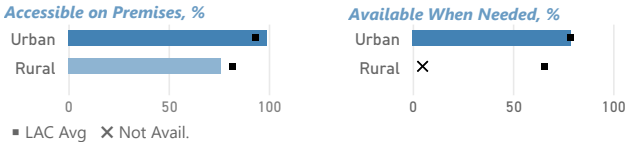
"LAC" = All countries

"CA" = Central America

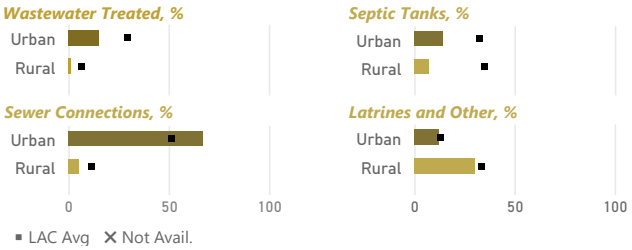
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water

5.0 % (national)

LAC: 2.5%

Population Practicing Open Defecation

13.0 % (national)

LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential

6.6 %

LAC: 30.9%

Coverage of Cultivated Area

6.6 %

LAC: 23.7%

Key Challenges

Delivery of basic WSS services and rainwater drainage are increasingly under pressure due to rapid urbanization and climate change. Regulatory frameworks are weak. Most of regulated service providers do not cover operating costs and lack funding to rehabilitate and expand their services. Water utilities are heavily dependent on transfers or support from the national or municipal governments, which face their own financial constraints. Non-revenue water is high and quality of services decline with time.

Water access in rural dispersed areas is very low, in comparison to rural concentrated communities and periurban areas. Open defecation in rural areas is very high with 38% of rural population and the absence of a national strategy to increase access to basic sanitation in rural communities.

Water quality challenges intensified due to mining activities and urban development lacking adequate facilities for treatment and final disposal of wastewater. Wastewater reuse in agriculture is not regulated but widely practiced, particularly in Cochabamba, El Alto, and La Paz, which are located in water scarce areas. The country also lacks a national strategy on bio-solids managemente, threatening existent surface water and groundwater sources.

Water Capital & Water Resources

Water Capital & Availability

51,936. *m3/inhab/year*
Water Resources per capita
LAC: 44.1K

47.1 *%*
Transboundary Sources
LAC: 15.8%

1.2 *%*
Water Stress
LAC: 13.6%

0.57 *(0-1)*
Unsafe Water Quality Index
LAC: 0.66

1.1 *%*
Water Ecosystems Area
LAC: 1.2%

Water Resources Management

53.16 *m3/inhab*
Dam Capacity per capita
LAC: 2.9K

25.7 *%*
Electricity from Hydropower
LAC: 36.6%

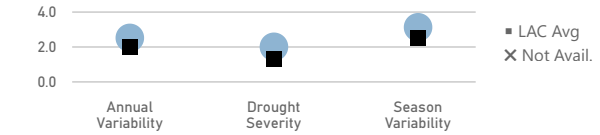
12.0 *%*
Agri. Sector Value to GDP
LAC: 7.5%

49.0 *%*
Implemention of IWRM
LAC: 33.0%

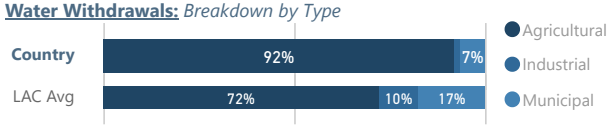
14.1 *%*
WR Climate Change Impact
LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

The main challenges for management include a low level of information and knowledge on the status of the hydrographic basins, incipient development of the institutional and administrative framework, insufficient policies, and a weak legal-regulatory framework. While technical capabilities for water resources planning improved, the capacities for inter-institutional coordination across different sectors and government levels remained the same, carrying out activities in an isolated and sectoral manner.

The departmental governments are also holders of competencies in water-environmental issues but have limitations in terms of financial and operational capacity to fulfill their functions, so the results achieved are heterogeneous and dispersed.

Water scarcity is the main cause of socio-environmental conflicts, which has been increasing due to the expansion of activities that increase pressure on natural systems, the degradation of water sources, and climate change.

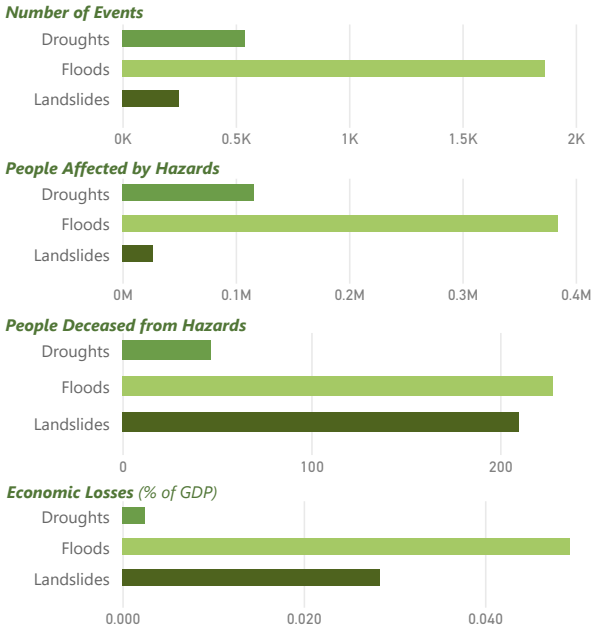
Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

 # 28 Out of 181
CGI World Ranking
LAC: 74

45.3
GCI Index Score
LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

The country is highly exposed to natural disasters associated with extreme rainfall, flash floods, droughts and landslides.

Vulnerability to extreme hydroclimatic phenomena is enhanced by ENSO anomalies and as a result of poor territorial planning.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Brazil**

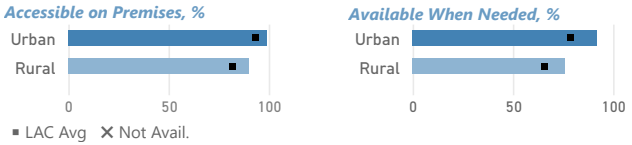
"LAC" = All countries

"CA" = Central America

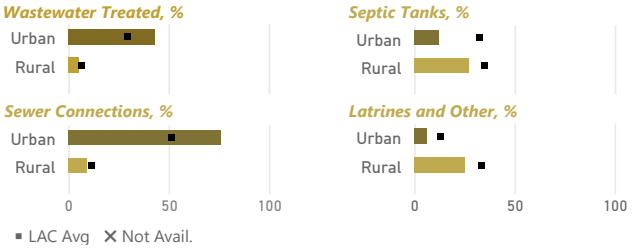
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	1.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
17.3 %	8.0 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

Brazil still faces important deficits in WSS access affecting mostly the poor, especially in lower income segments and urban peripheries with environmental, social and economic negative impacts.

To meet the Sustainable Development Goals (SDG) and the goals set in the current National Basic Sanitation Plan (PLANSAB) on WSS services, Brazil needs to double current investment levels.

While lacking access and resilience, the WSS sector still has operational and economic inefficiencies that affects cost recovery and investment capacity.

Urban water supply systems mostly operate with limited long-term planning and without sufficient consideration of adaptation measures. Rural areas lack of prioritization criteria and they need technical assistance programs to promote sustainability.

In the Northeast region, the population has low levels of sanitary sewerage, which compromises water quality, aggravaing the scarcity problems.

Irrigated area has increased over 4% annually, on average, up to 6.95 million hectares in 2015, but still represents only 11.8% of the agricultural land.

Water Capital & Water Resources

Water Capital & Availability

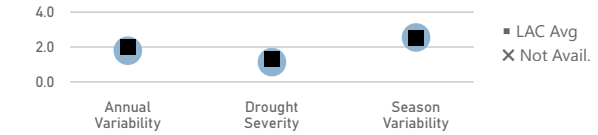
41,316. *m3/inhab/year* *Water Resources per capita*	LAC: 44.1K
34.5 *%* *Transboundary Sources*	LAC: 15.8%
3.1 *%* *Water Stress*	LAC: 13.6%
0.7 *(0-1)* *Unsafe Water Quality Index*	LAC: 0.66
1.2 *%* *Water Ecosystems Area*	LAC: 1.2%

Water Resources Management

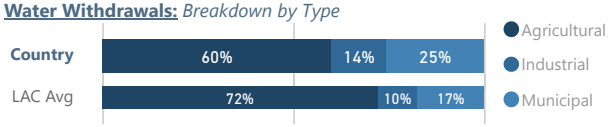
3,370.17 *m3/inhab* *Dam Capacity per capita*	LAC: 2.9K
63.2 *%* *Electricity from Hydropower*	LAC: 36.6%
4.0 *%* *Agri. Sector Value to GDP*	LAC: 7.5%
51.0 *%* *Implemention of IWRM*	LAC: 33.0%
8.9 *%* *WR Climate Change Impact*	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Water management in the dual domain presents administrative and technical challenges, as well as the need to adapt the management model to great regional diversity, with different hydroclimatic and socioeconomic characteristics

Water Resources Management in Brazil has not yet become a strategic priority on the national political agenda.

Water resources planning faces insufficient financial resources for the implementation of policies, instruments, and coordination of the responsible institutions. The National Water Safety Plan totals US$ 4 billion in investments until 2035 and an average of US$215 million per year in operation and maintenance. Most of them are to increase the availability of water go to the Northeast region (58%).

Economic instruments such as water charges are insignificant in relation to the total investment needs. Charges are also not sufficient for inducing a rational use and internalizing environmental impacts.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

 # 88 Out of 181

CGI World Ranking

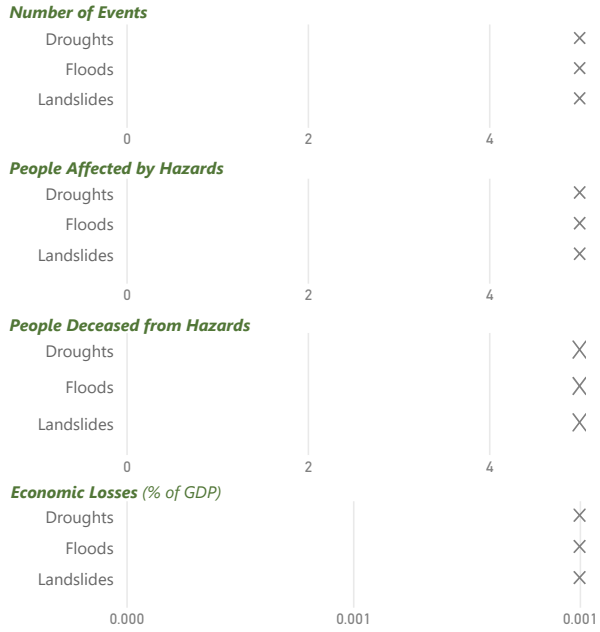
LAC: 74

83.2

GCI Index Score

LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Several multi-user water supply systems have undergone water crisis events recently in Brazil between 2012-2017. The crises did not result on consistent resilience programs and/or water basin recovery programs and redundant systems investments.

Brazilian regions with a strong dependence on water infrastructure still face financial difficulties and limitations for its operation and maintenance, especially during critical periods of drought. Tariffs are not realistic at most of the Northeast states WSS.

In the Northeast region, drought is a natural and cyclical phenomenon, being the main stressor for the management of water resources in the semiarid region. Some of the recent works for water access (S.Francisco river transboundary canal) feed into hight water consumption crops.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Datasheet Page 2

Select a country: **Brazil**

Water Service Delivery

Information, Analysis, and Planning Tools

Maintain and improve the water user and water permits database, through the "Progestao" program created by the National Water Agency (ANA)

Strengthen the rural sanitation policy in the National Basic Sanitation Plan, establishing the objectives to be achieved and the strategy for the rural area.

Conclude the National Rural Sanitation Program with the definition of an advanced strategy, sources of financing, prioritization criteria, with a focus not only on infrastructure but also on supporting the development of sustainable projects and technical assistance for service management.

Improve access to information to improve transparency, control and participation. Implement tools that allow knowledge, support, decision-making, and planning in the water and sanitation sector, such as the National Sanitation Information System (SNIS) with urban focus and the Rural

Strengthen the rural component of the Municipal Basic Sanitation Plans, including the identification of financing sources and ways to ensure the sustainability of the systems, together with technical training programs.

Institutional Structure

Improve coordination with other sectors - such as education, health, and energy - to achieve synergy, consistency, and efficiency in the results to achieve the universalization of water and sanitation services in a country of great diversity.

Legal and Regulatory Framework

Develop a public policy for the rural water and sanitation sector that establishes roles and responsibilities, defines planning and regulation, considers efficiency aspects, agrees on criteria for prioritizing investments and their sources of financing with a view to universalization.

Define a framework that encourages operation and maintenance for sustainable water systems.

Water Capital & Water Resources

Information, Analysis, and Planning Tools

Promote the implementation of the National Water Resources Policy (PNRH) and the performance of the National Water Resources Management System (SINGREH).

Improve the preparation of the Basin Plans, ensuring a greater link between financial resources for implementation. Seek greater ownership of the Plans by the Basin Committee.

Implement more effective mechanisms for monitoring and disseminating the implementation of the Basin Plans.

Improve flexibility through conjunctive use of groundwater and surface resources, where available, through a coordinated and integrated operation.

Improve groundwater monitoring through the Integrated Groundwater Monitoring Network (RIMAS)

Improve meteorological and hydrological data, modeling, and forecasting skills.

Institutional Structure

Articulation by the water resources sector and other sectors is vital to raising the management of water resources on the national political agenda.

Articulation between political and institutional sectors to raise the strategic importance of water resources management on the national political agenda.

Under the context of the dual-domain of water, it is necessary to set clear federative attributions related to the management of water resources with the definition of legally coherent and binding mechanisms.

Legal and Regulatory Framework

Improve the implementation of the instrument for charging for the use of water in an integrated manner with financial planning.

Define or update interstate flow delivery targets and agreements.

Define integrated rules for multi-use reservoir operation and watershed withdrawals control.

Update economic water management instruments: revise and update water charges, incorporating opportunity costs, considering seasonal variations and ecosystem services.

Water Risk Management

Information, Analysis, and Planning Tools

In the Northeast region, continue with the improvement of proactive drought management, improving tools such as drought monitoring and early warning, vulnerability and impact assessment, and the development of drought preparedness plans.

Municipal Plans should include resilience measures and preparedness to extreme hydrological events (droughts and floods), following water resources management plans.

Municipal Plans should have clear priorities on social inclusion and equality, including tariff and subsidy instruments to ensure that access to the poor is sustained.

Establish a drought monitor and forecasting center nationwide.

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Chile**

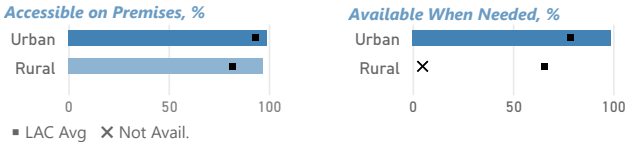
"LAC" = All countries

"CA" = Central America

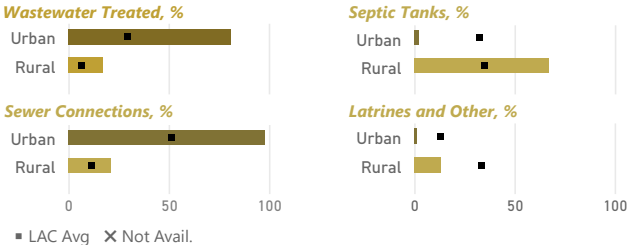
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	1.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
44.3 %	64.0 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

In Chile, losses in conduction systems are higher than those recorded in developed countries (34%).

In the last decade, hydro-meteorological phenomena, such as floods and alluviums, have made evident the fragility of various Water supply systems to respond to this type of emergencies, with regular services suspended in several occasions.

Droughts in recent years have revealed a weakness of the systems to operate in conditions of water scarcity, with 400,000 people supplied by water trucks.

The country lags behind in the provision of safely managed rural sanitation. In 20 years, these coverages in the rural population barely grew 9 and 11 percentage points. Of the few existing treatment plants in rural areas, a high proportion are in poor or non-functioning condition.

The tariff in rural areas is not enough to cover operating, administration and maintenance costs, increasing dependence on the State to maintain and repair services.

Water Capital & Water Resources

Water Capital & Availability

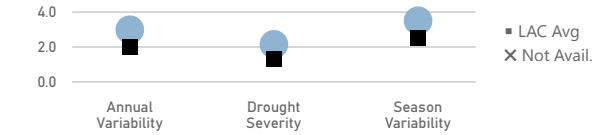
	LAC
51,127. m3/inhab/year Water Resources per capita	LAC: 44.1K
4.1 % Transboundary Sources	LAC: 15.8%
9.0 % Water Stress	LAC: 13.6%
0.19 (0-1) Unsafe Water Quality Index	LAC: 0.66
1.6 % Water Ecosystems Area	LAC: 1.2%

Water Resources Management

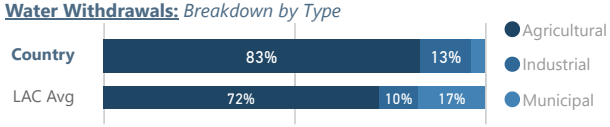
	LAC
715.51 m3/inhab Dam Capacity per capita	LAC: 2.9K
31.2 % Electricity from Hydropower	LAC: 36.6%
4.0 % Agri. Sector Value to GDP	LAC: 7.5%
23.0 % Implementation of IWRM	LAC: 33.0%
7.0 % WR Climate Change Impact	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Goods whose production and competitiveness depends on adequate water management is extremely relevant for the country's economy, reaching a value of US58 billion.

A rapid increase in groundwater exploitation has led to a gradual closure of aquifers to new exploitation (157 aquifer sectors declared as restricted or prohibited areas).

Desalination is used to supplement mining demands and domestic uses.

The Metropolitan Region in the north is using almost all the resources that are generated naturally in the basins, overexploiting groundwater, and limiting water availability for its economic growth.

The current management system does not consider planning instruments with an integrated vision that coordinates both public and private initiatives in the medium and long term.

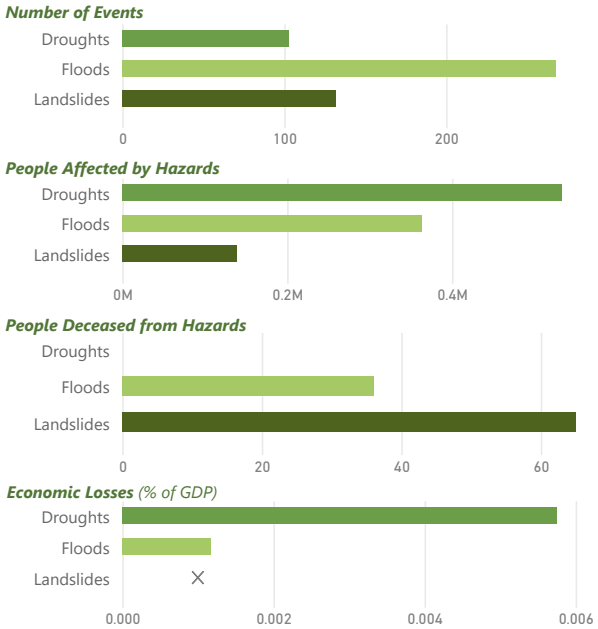
There are two important environmental issues: the increase in polluting sources and the lack of environmental flows in most of the country's rivers.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 93 Out of 181 CGI World Ranking	87.8 GCI Index Score
LAC: 74	LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

The country's social and economic development has not only been affected by shortages but also by floods. In the period 1965-2019 the country has lost over US$5 billion in 37 events, the most important one representing a loss equivalent to 0.62 percent of the year's GDP.

There is a significant deficit of protection infrastructures, especially in cities.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Colombia**

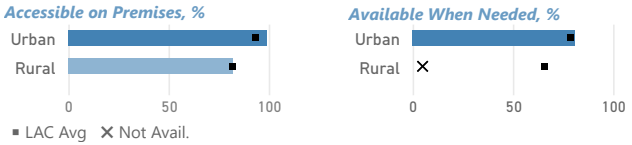
"LAC" = All countries

"CA" = Central America

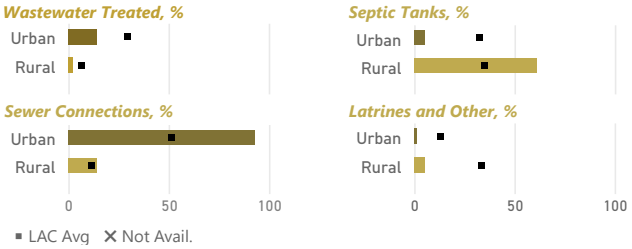
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
9.0 % (national)	13.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
14.3 %	28.5 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

- Lack of treatment decreases the overall quality of water and poses problems for downstream users. Striking examples of the mismanagement of wastewater are readily found in many urban areas.
- In many regions of the country, contamination's hardships fall disproportionately on the most underserved people. Often, they have no safe drinking water because treatment is insufficient or non-existent.
- In addition to the investment gap, water utilities operate with substantial efficiency shortcomings related to water resources management, energy use, and environmental sustainability.
- Only about 6% of potentially irrigable land is connected to some sort of irrigation system.
- The infrastructure built in recent decades in an effort to upgrade irrigation and other water services has substantial operational problems. About 75% of installed capacity does not function.

Water Capital & Water Resources

Water Capital & Availability

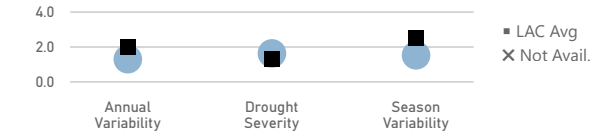
	LAC
48,098. m3/inhab/year Water Resources per capita	LAC: 44.1K
9.1 % Transboundary Sources	LAC: 15.8%
1.8 % Water Stress	LAC: 13.6%
0.78 (0-1) Unsafe Water Quality Index	LAC: 0.66
0.8 % Water Ecosystems Area	LAC: 1.2%

Water Resources Management

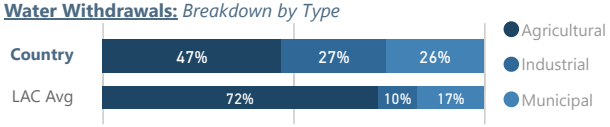
	LAC
230.67 m3/inhab Dam Capacity per capita	LAC: 2.9K
71.1 % Electricity from Hydropower	LAC: 36.6%
7.0 % Agri. Sector Value to GDP	LAC: 7.5%
50.0 % Implemention of IWRM	LAC: 33.0%
-1.6 % WR Climate Change Impact	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

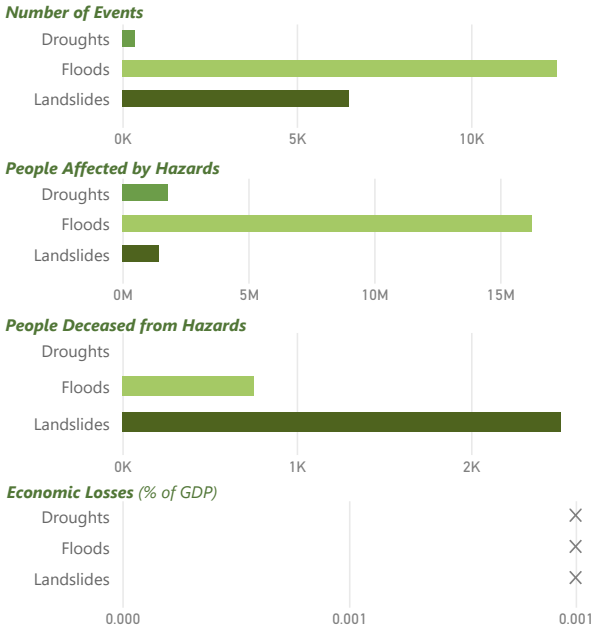
- Existing hydraulic and storage infrastructure is insufficient in productive areas.
- Water endowment has been declining in some macro basins due to climate change and population growth, risking availability.
- Groundwater resources are inadequately measured and managed, even though it could become a strategic reserve.
- Water sector governance is fragmented, lacking an authority to oversee the sector and existing National Water Council rulings.
- There is a bottleneck in the transition from planning to implementation because authorities lack technical capacity.
- Limited monitoring and transparencyhinder the quality in the implementation of strategic plans, particularly in Regional Autonomous Corporations (CARs) and municipalities.
- Water plays a role in the Peace Agreement with the FARC, including Development Programs with a Territorial Approach (PDETs) for rural areas in WSS and agriculture.
- Land-use changes affect water balances causing larger peak flows in natural systems such as the Páramos,the Amazon and Orinoco basin.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

#44 Out of 181 CGI World Ranking	LAC: 74	55.7 GCI Index Score LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

- Colombia has high exposure to natural hazards. It has the highest recurrence of extreme events in South America.
- Rainfall varies significantly inter and intra-annually due to the events known as El Niño and la Niña. Climate change is amplifying these anomalies, making floods and droughts more frequent and severe.
- Resilience to floods is overall low, in terms both of mounting exposure to disaster and the high asset vulnerability of poor communities. The floods of 2010 and 2011 caused more than US$6 billion in damages.
- Colombia makes limited use of integrated river basin management, an effective approach for flood prevention. CARs have developed only a small number of River Basin Management and Development Plans (POMCAS).

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Datasheet Page 2

Select a country: **Colombia**

Water Service Delivery

Information, Analysis, and Planning Tools

Integrate Water Security into the PDETs. Further integrate water services (water supply and sanitation and irrigation) into the program that focusses on the development of regions impacted by the armed conflict.

Apply the concept of the Circular Economy to reduce the capital and operating expenditures of wastewater treatment projects and improve utilities' performance. Wastewater can be treated to various qualities to satisfy demand from different sectors, including industry and agriculture.

Infrastructure

Promote integrated urban water management practices adopting sustainable urban drainage solutions. Promote the design and implementation of separate systems for drainage and sewage, which will reduce required capacity of wastewater treatment plants and contamination as a result of overflows.

Investments

Move forward to regionalize water service. Strengthen capacity to provide basic services related to water supply and sanitation through regional upscaling of the services.

Create an investment planning facility for water and sanitation. Initiate a programmatic approach to increase the number of rural water supply projects using priorities of the PDETs.

Prioritize action plans for hotspots of water pollution. Devote increased investments to protect large populations against health risks of polluted water based on population density, magnitude of pollution, and hot spots.

Water Capital & Water Resources

Information, Analysis, and Planning Tools

Upgrade water information systems and unify water sector data bases to integrate hydrometeorological information with current use.

Develop decision-making tools and metrics, to help capture water risks and reflect water utilization patterns and overexploitation.

Promote inclusion of water security in territorial development. The development of Territorial Arrangement Planning (POTs), Water Resource Management Plans (PORHs), and POMCAs needs to be aligned.

Strengthen Payment for Environmental Services instruments, with private sector participation.

Institutional Structure

Depoliticize the water security responsibilities of the CARs by setting clear minimum requirements to accomplish and secure the resources needed. Strengthen its capacity to collect data, program and implement projects, and enforce regulation.

Simplify water's governance structure. Assess the reduction of the number of authorities, agencies, and institutions that oversee the sector and assure that responsibilities are clear.

The Institute of Hydrology, Meteorology and Environmental Studies should be further strengthened to improve informed decision making

Investments

Promote, plan, and implement the development of multipurpose and multifunctional projects, and review the existing institutional and regulatory framework for their development. Greater storage capacity can be achieved through grey and green interventions. PDETs provide opportunities for multifunctional water projects.

Prioritize protection of Páramos, as they provide ecosystem services to water-dependent sectors.

Legal and Regulatory Framework

Develop a water law that brings together all laws, by-laws, and decrees related to the sector. To increase transparency, evaluate the feasibility of bringing together into one water law all laws and regulations as well as their amendments over the past decades.

Review the current regulatory framework to allow Circular Economy projects, to incentivize the reuse of treated wastewater, biosolids and energy.

Water Risk Management

Information, Analysis, and Planning Tools

Develop and implement POMCAs. Water resource management, water services, and mitigation of water-related risks should be incorporated into river basin management plans.

Integrate risk reduction plans into territorial planning, including definitions and enforcement mechanism of the Rondas Hídricas defining the flood-prone areas of water bodies.

Institutional Structure

Build capacity for enforcement and control. Improve capacity of responsible authorities to enforce zoning of water bodies and control land use changes that threaten water systems.

Disaster Risk Management has improved considerably under the National Unit for Disaster Risk Management, but more collaboration is needed to prevent disasters using an holistic river basin management approach.

Investments

Align incentives for investments in CARs. Prioritize investments in watershed management through CARs, focusing on areas where floods do major damage and water is in declining supply.

Legal and Regulatory Framework

Reinforce social protection systems. Sustain and improve traditional and scalable social protection systems to increase resilience and improve well-being in the country.

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Costa Rica**

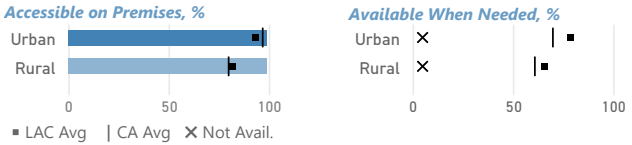
"LAC" = All countries

"CA" = Central America

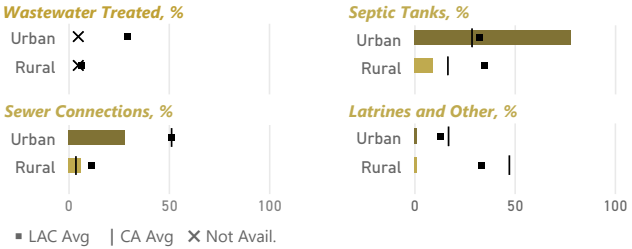
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	1.0 % (national)
LAC: 2.5% ; CA: 3.7%	LAC: 4.9% ; CA: 7.3%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
37.1 %	28.0 %
LAC: 30.9% ; CA: 26.5%	LAC: 23.7% ; CA: 11.5%

Key Challenges

- Only 10% of wastewater is treated in the country.
- Despite the country's deficit in sewage and wastewater treatment, most investments continue to be directed towards drinking water services, while average investment in sanitation services was 67% less than investment in drinking water.
- National sewage coverage is low, even in urban areas while septic tank coverage is high, however, these systems are not guaranteed to operate adequately.
- The coverage wastewater treatment plants is deficient with only 14.43% coverage at the national level and 19.4% at the urban level.

Water Capital & Water Resources

Water Capital & Availability

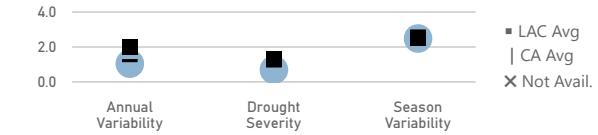
	LAC	CA
23,033. m3/inhab/year Water Resources per capita	44.1K	17.5K
0.0 % Transboundary Sources	15.8%	10.6%
5.4 % Water Stress	13.6%	5.4%
0.75 (0-1) Unsafe Water Quality Index	0.66	0.75
0.3 % Water Ecosystems Area	1.2%	2.0%

Water Resources Management

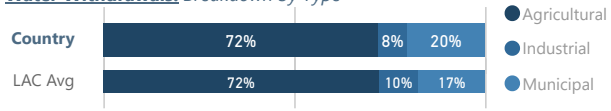
	LAC	CA
403.37 m3/inhab Dam Capacity per capita	2.9K	1.5K
74.6 % Electricity from Hydropower	36.6%	37.6%
4.0 % Agri. Sector Value to GDP	7.5%	7.7%
43.0 % Implemention of IWRM	33.0%	29.4%
6.5 % WR Climate Change Impact	17.8%	14.0%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

- There is a deficiency in environmental protection backgrounds that value water as a vital element in the country's development. There is insufficient citizen participation in the sector.
- Less than 5% of water extracted is reused in the country. There are strict limitations in the management of wastewater, due to the poor instrumenttory and information resources.
- The roles and competences of the institutions are not clear in the sector, as well as there are limited capacities for the implementation of the national water plan.
- 60% of the country's marshes are not suitable for any type of use and some water bodies in urban areas have a moderate to severe degree of pollution.
- The quality monitoring plan is in its beginning stage so water bodies are not officially evaluated and classified by THE Ministry of the Environment and Energy.
- There is a poor groundwater management.
- The rural systems (ASADAS) present problems with their sustainability.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

#95 Out of 181

CGI World Ranking

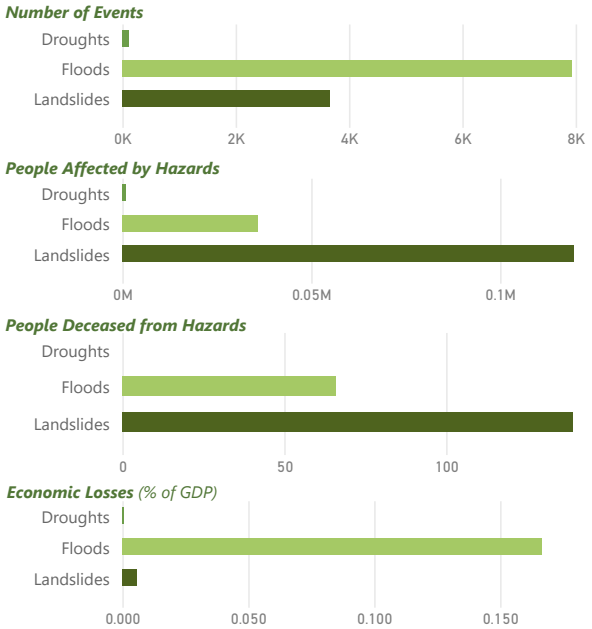
LAC: 74 ; CA: 55

88.2

GCI Index Score

LAC: 76.0 ; CA: 60.2

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

- Costa Rica is vulnerable to climate change with areas prone to drought and flooding (more frequent during May and July). The most affected areas are those of Sixaola in the border with Panama, and Guanacaste in the border with Nicaragua.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Dominican Republic**

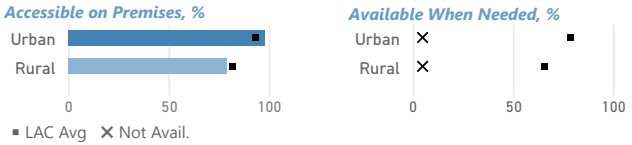
"LAC" = All countries

"CA" = Central America

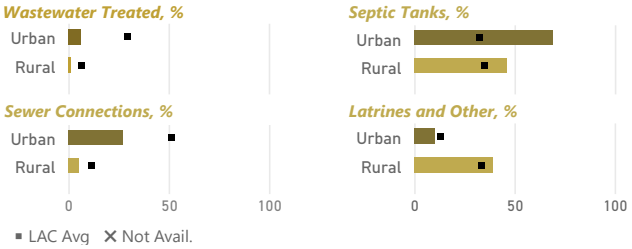
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	3.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
43.7 %	26.8 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

- The quality of water supply and sanitation services remains poor, despite the increases in acces rates over the last decade. Only 10% of population in average, has a good quality of drinking water service in terms of continuity.
- The gap in access to drinking water in urban and rural households has remained at around 30% since 2000
- There is not enough social investment (public spending) in drinking water and sanitation.
- The poor quality of services derives to an extent from lack of clarity in the institutional and legal framework with respect to policy making, financing, tariffs, and service provision.

Water Capital & Water Resources

Water Capital & Availability

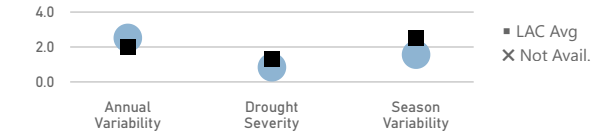
	LAC
2,183. m3/inhab/year Water Resources per capita	LAC: 44.1K
0.0 % Transboundary Sources	LAC: 15.8%
39.6 % Water Stress	LAC: 13.6%
0.8 (0-1) Unsafe Water Quality Index	LAC: 0.66
1.0 % Water Ecosystems Area	LAC: 1.2%

Water Resources Management

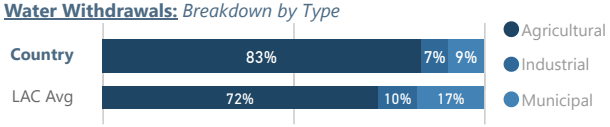
	LAC
215.51 m3/inhab Dam Capacity per capita	LAC: 2.9K
8.5 % Electricity from Hydropower	LAC: 36.6%
5.0 % Agri. Sector Value to GDP	LAC: 7.5%
36.0 % Implemention of IWRM	LAC: 33.0%
16.8 % WR Climate Change Impact	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

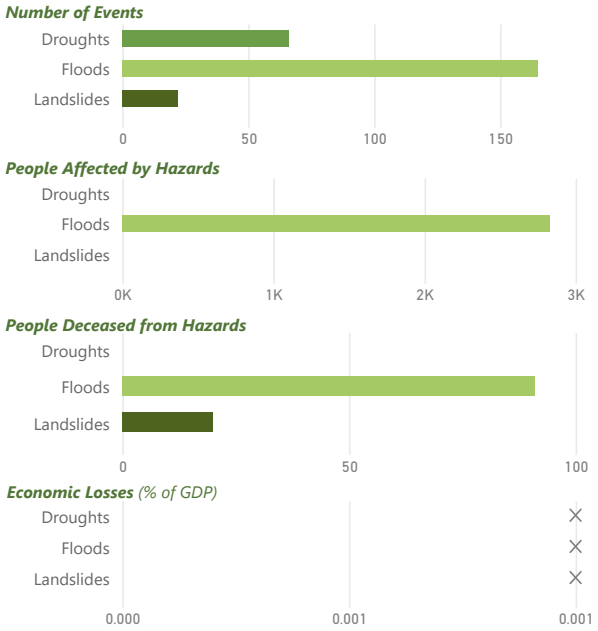
- Irregular spatial and seasonal distribution, coupled with high consumption by irrigation and urban water supply, as well as unsustainable groundwater abstraction, translates into water scarcity.
- Human activities in the southeast of the country are heavily dependent on groundwater sources. 30% of Santo Domingo's water supply comes from underground sources.
- Many coastal aquifers are at risk of contamination from agrochemicals and poorly located solid waste disposal.
- Resource quality issues are a result of the lack of wastewater management and agricultural runoff, causing health problems which largely affect the poor, human and agricultural consumption and for recreation in tourist areas.
- It does not exist an efficient hydro-meteorological data collection system, nor an adequate monitoring system for water quality.
- There is a lack of updated water legislation, a definition of sustainable water policies, leading into a disorganization of the water sector.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 50 Out of 181 CGI World Ranking	58.5 GCI Index Score
LAC: 74	LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

- Dominican Republic is exposed to a high number of natural hazards, such as hurricanes, storms, floods, drought, earthquakes and fires.
- It is expected that global climate change cause permanent climate shocks in the country with sea level rises, higher surface air and sea temperatures, extreme weather events, increased rainfall intensity and more frequent and more severe El Niño-like conditions; causing more droughts.
- There is weak watershed management, causing soil erosion and amplifing the frequency of flooding.
- In the Dominican Republic, phenomena such as the "El Niño" have caused the country to experience the worst water deficit situation in the last 20 years.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Ecuador**

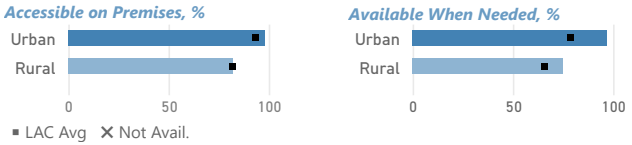
"LAC" = All countries

"CA" = Central America

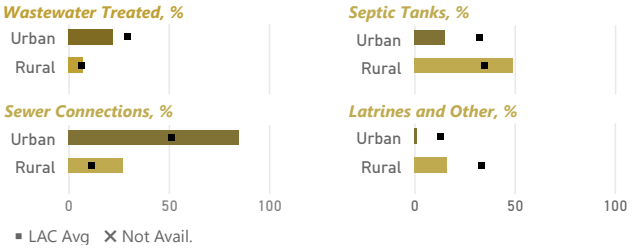
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
3.0 % (national)	2.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
54.5 %	69.4 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

Despite important advances in water supply service, sanitation remains a challenge with water quality degradation problems. 83.4% of sources for domestic use fail to meet quality criteria. Wastewater treatment capacity is generally poor as most cities and towns don´t have wastewater treatment facilities. Rural treatment of surface water is almost non-existent due to the Water Managing Boards' low financial and technical capacity.

There is a wide gap of water and sanitation coverage between rural and urban areas.

Water-borne diseases identified by Ministry of Public Health have a growing trend and affect or impact thousands of Ecuadorians each year.

Water Capital & Water Resources

Water Capital & Availability

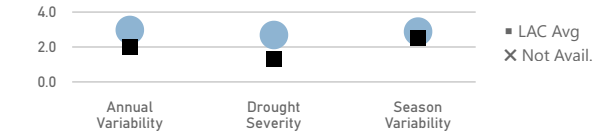
26,611. *m3/inhab/year*	
Water Resources per capita	
LAC: 44.1K	
0.0 *%*	
Transboundary Sources	
LAC: 15.8%	
6.8 *%*	
Water Stress	
LAC: 13.6%	
0.53 *(0-1)*	
Unsafe Water Quality Index	
LAC: 0.66	
0.8 *%*	
Water Ecosystems Area	
LAC: 1.2%	

Water Resources Management

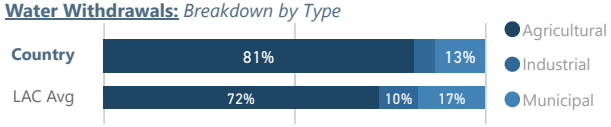
458.24 *m3/inhab*	
Dam Capacity per capita	
LAC: 2.9K	
47.1 *%*	
Electricity from Hydropower	
LAC: 36.6%	
9.0 *%*	
Agri. Sector Value to GDP	
LAC: 7.5%	
42.0 *%*	
Implemention of IWRM	
LAC: 33.0%	
-6.6 *%*	
WR Climate Change Impact	
LAC: 17.8%	

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Ecuador has abundant water resources, but unevenly distributed in space and time.

Although water quality is not well monitored, it is estimated that 55% of surface water sources do not meet water quality criteria for human consumption. 65% of waters are not suitable for human consumption. Pollution is inecrasing due to untreated wastewater, industrial, agricultural and mining.

The lack of regulations clarifying the competencies and forms of inter-institutional intervention is evident.

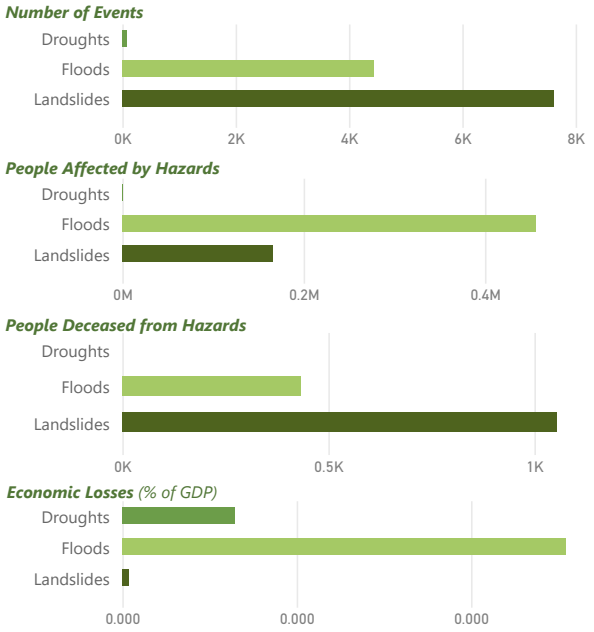
Water resources governance framework is incomplete. There are overlaps between different regulatory instruments. The Water Resources Management Agency is developing slowly, delaying monitoring responsibilities in accordance to the water law. Technical support capacity is insufficient to support effectively the country's IWRM.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 100 Out of 181	92.8
CGI World Ranking	*GCI Index Score*
LAC: 74	LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Floods and droughts are recurrent in the central and western regions.

El Niño phenomenon (ENSO) performs its greatest influence in Ecuador.

Irregular distribution of water resources,socioeconomic development, and storage capacity lack, drives directly to frequent droughts.

Agricultural area affected by droughts in Ecuador represents 66.7% of total crops area.

In all country, Guayas Region has the highest number of floods and affected people. Almost half of floods and more than 60% of affected people are located there.

There is a lack of structural measures and insufficient flood control capacity in some areas.

Ecuador doesn´t have a practical contingency plan against floods.

There is a poor information system for natural hazard events, and only a small number of records are available.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Guatemala**

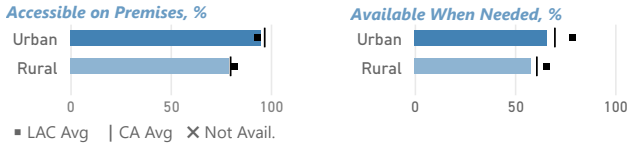
"LAC" = All countries

"CA" = Central America

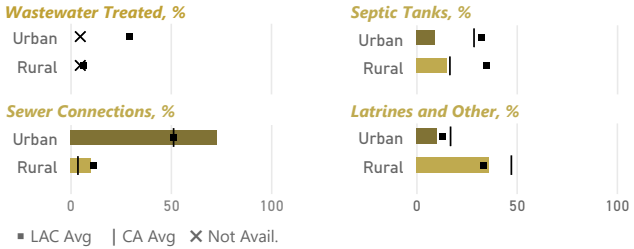
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
3.0 % (national)	**8.0** % (national)
LAC: 2.5% ; CA: 3.7%	LAC: 4.9% ; CA: 7.3%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
12.9 %	**16.5** %
LAC: 30.9% ; CA: 26.5%	LAC: 23.7% ; CA: 11.5%

Key Challenges

- Public investments for drinking water are more than sanitation projects, especially in rural areas.
- The gaps in inequality between the poor and non-poor remain large. Sanitation coverage is extremely low in rural areas where indigenous populations are more affected.
- The capacity of municipalities to meet the sustainable service aspects (quality, quantity and continuity) is weak and there is limited technical and financial programs to support them. The continuity of the services is in average 17 hours/day, 26 days per month. 90 % of the rivers are contaminated and only 5% of wastewater is treated.
- Inadequate tariffs and the culture of non-payment for services affects the sustainability of the sector. For most service providers, the fees paid by users do not cover the full cost of supply.
- Diarrheal diseases are responsible for 18% of the deaths of children under five and is the second leading cause.

Water Capital & Water Resources

Water Capital & Availability

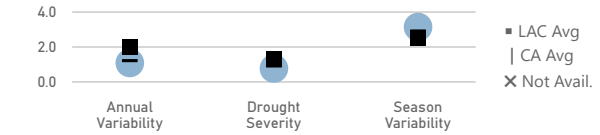
	LAC	CA
7,562. *m3/inhab/year* *Water Resources per capita*	44.1K	17.5K
14.6 *%* *Transboundary Sources*	15.8%	10.6%
5.7 *%* *Water Stress*	13.6%	5.4%
0.8 *(0-1)* *Unsafe Water Quality Index*	0.66	0.75
1.1 *%* *Water Ecosystems Area*	1.2%	2.0%

Water Resources Management

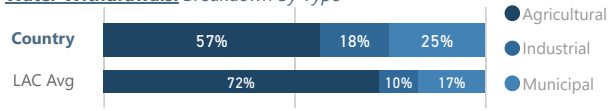
	LAC	CA
27.42 *m3/inhab* *Dam Capacity per capita*	2.9K	1.5K
35.0 *%* *Electricity from Hydropower*	36.6%	37.6%
9.0 *%* *Agri. Sector Value to GDP*	7.5%	7.7%
25.0 *%* *Implemention of IWRM*	33.0%	29.4%
18.1 *%* *WR Climate Change Impact*	17.8%	14.0%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

- Strategic Sector Policies, Planning and Programs are yet to be updated/developed.
- Rural areas and indigenous groups have historically been excluded of the financial resources distribution, due to a lack of capacity and technical resources.
- There are low levels of central government spending. The average total spending on the water sector is insufficient and significantly lower than in the health and education sectors.
- Effective resource allocation and water use and pollution monitoring is undermined by a lack of strategic planning and historical underinvestment.
- There is lack of regulation of service providers and access to performance information.
- Water data is scarce and unreliable. There are no geo-referenced or updated information systems that provide accurate data about coverage and quality of water services and availability. Although systems are in operation, they are not updated.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

 # 16 Out of 181

CGI World Ranking

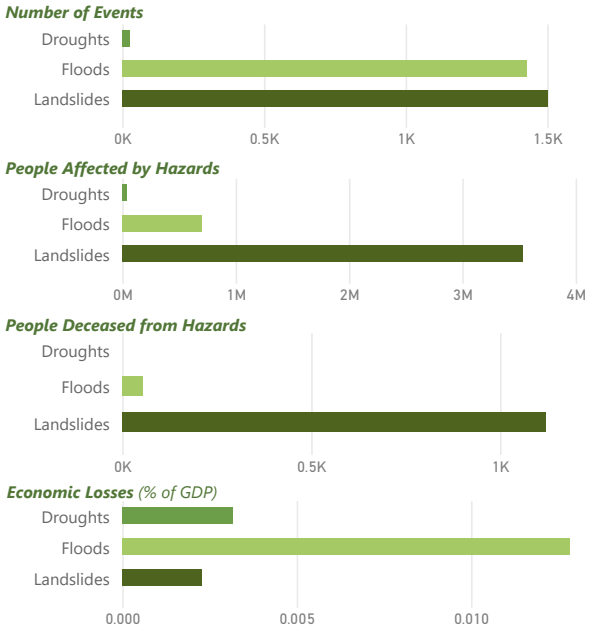
LAC: 74 ; CA: 55

38.3

GCI Index Score

LAC: 76.0 ; CA: 60.2

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

- Guatemala is now considered one of the most vulnerable to hydroclimatic risks countries on the planet due to its geographical position and institutional and poverty characteristics.
- 30% of the territory and about 700,000 people are at risk to flooding events.
- About 5% of the territory is highly exposed to droughts, located mainly in the dry corridor. About 604,000 people live in Guatemala's dry corridor, located in the middle of the country's two major rainfall belts.
- Impacts from natural disasters (droughts) and lack of water storage infrastructure affect mainly food production systems and WASH, perpetuating poverty cycles, driving migration, and further aggravating malnutrition, particularly in rural areas and in the Dry Corridor.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Guyana**

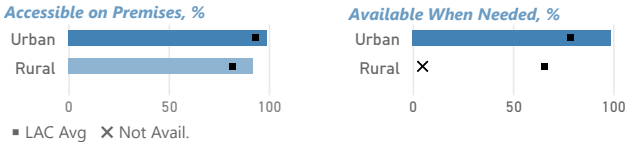
"LAC" = All countries

"CA" = Central America

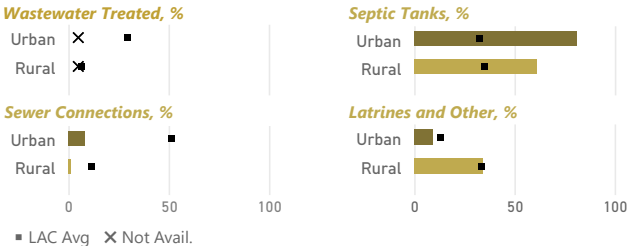
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
2.0 % (national)	**1.0** % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
Not Avail. %	**30.4** %
LAC: 30.9%	LAC: 23.7%

Key Challenges

Groundwater is the main source of domestic water supply in the coastal zone, but in Georgetown, water is supplied by the East Demerara River Water Conservancy.

Domestic water supply has third priority use of surface water supplied by the conservancy, after irrigation and transportation demands are met,which is a challenge during short supply periods, and groundwater is being considered to supplement domestic water requirements.

The water supply system in Georgetown faces poor maintenance, providing low-quality and unreliable services.

Sewage systems in urban areas are almost nonexistent, and wastewater treatment occurs only intermitently in Georgetown. The rest of the country uses septic tanks.

Main crops sugarcane and rice require intensive irrigation. Poor maintenance of drainage and irrigation systems have led to deterioration and inefficient service.

The lack of storage capacity restricts opportunities for agricultural production growth, flood control capacity, and restricted the use for domestic supply.

Guyana has approximately 6,000km of navigable waterways.

Water Capital & Water Resources

Water Capital & Availability

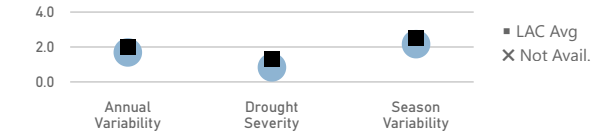
	LAC
348,374. *m3/inhab/year* Water Resources per capita	LAC: 44.1K
11.1 *%* Transboundary Sources	LAC: 15.8%
3.3 *%* Water Stress	LAC: 13.6%
0.77 *(0-1)* Unsafe Water Quality Index	LAC: 0.66
0.7 *%* Water Ecosystems Area	LAC: 1.2%

Water Resources Management

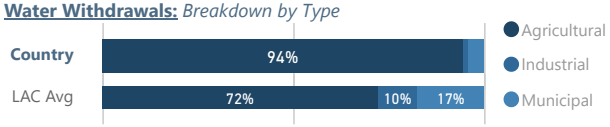
	LAC
1,043.76 *m3/inhab* Dam Capacity per capita	LAC: 2.9K
0.0 *%* Electricity from Hydropower	LAC: 36.6%
12.0 *%* Agri. Sector Value to GDP	LAC: 7.5%
16.0 *%* Implemention of IWRM	LAC: 33.0%
29.3 *%* WR Climate Change Impact	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Limited water resources monitoring data constrains evidence-based informed decisions on sustainable management and use.

Water Resources Management is fragmented in different sectors. The main challenge is coordinating institutional responsibilities ensuring that water resources are protected, evaluated, and sustainably utilized through appropriate national water management strategies and water use planning. Among water institutions and agencies, there are also insufficient budgetary allocations, limited capacity and knowledge.

Pollution is a key problem due to inadequate wastewater treatment infrastructure, insufficient financial support, limited water resources monitoring, and a lack of enforcement of water and environmental regulations.

Sea level rise and groundwater overexploitation can lead to saltwater intrusion in coastal areas.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

 # 120 Out of 181

CGI World Ranking

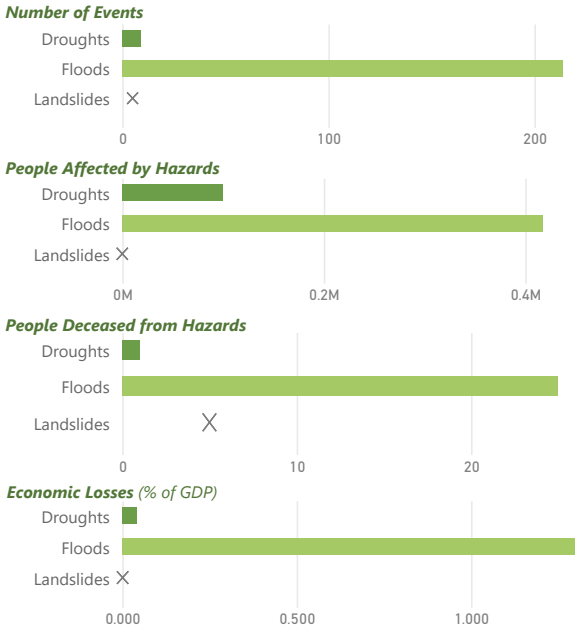
LAC: 74

107.2

GCI Index Score

LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Because of the uneven distribution and seasonal variation of rainfall, Guyana often suffers from droughts during the dry season. Dry years occur approximately every five to seven years, usually in coincidence with the El Niño effect.

Most of the population and agricultural lands are found in coastal lowland areas, subjected to flooding by sea invasion during wet seasons and high tides. The lack of repair and long-term maintenance of the coastal sea defense systems have caused devastating damage.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Haiti**

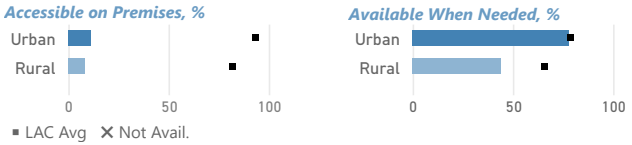
"LAC" = All countries

"CA" = Central America

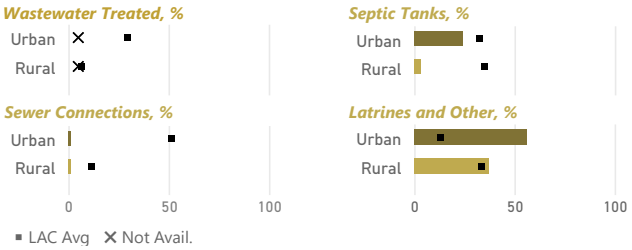
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	20.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
64.0 %	6.8 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

Haiti's water system ranks the lowest in the LAC region in terms of service standards and extremely limited coverage. The labour force is affected due to a small and undertrained staff, limiting operational performance. Water supply relies on water trucks.

Water water supply service often malfunctions as a result of the lack of funding, unqualified staff, poor infrastructure, theft or vandalism, electricity supply outages at pumps and wells and high contamination.

Several ONGs and organisations are managing drinking water services in the country.

Population are particulary vulnerable to waterborne diseasses due to the lack of water and sanitation systems.

Water Capital & Water Resources

Water Capital & Availability

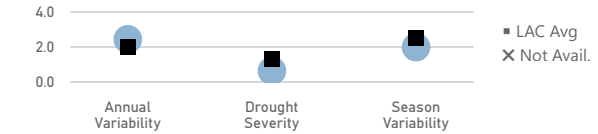
	LAC
1,278. m3/inhab/year *Water Resources per capita*	LAC: 44.1K
7.2 % *Transboundary Sources*	LAC: 15.8%
13.4 % *Water Stress*	LAC: 13.6%
0.93 (0-1) *Unsafe Water Quality Index*	LAC: 0.66
0.8 % *Water Ecosystems Area*	LAC: 1.2%

Water Resources Management

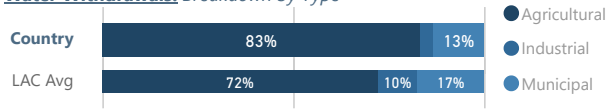
	LAC
27.05 m3/inhab *Dam Capacity per capita*	LAC: 2.9K
8.7 % *Electricity from Hydropower*	LAC: 36.6%
19.0 % *Agri. Sector Value to GDP*	LAC: 7.5%
29.0 % *Implemention of IWRM*	LAC: 33.0%
22.2 % *WR Climate Change Impact*	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Although rainfall rates are not low, there are water availability problems to reach demands. The main causes are the lack of infrastructure, and pollution.

Water pollution is a key issue. Soil erotion, polluted runoff due to lack of sanitation, jointly with the lack of protection of sources, threatens drinking water supply systems. Salinity is also a problem in groundwater.

Increased deforestation decreases inflitration and aquifer recharge, so it negatively affects water availability for irrigation.

The hydrolo-climatological data is poor, and gauging stations are limited in the country.

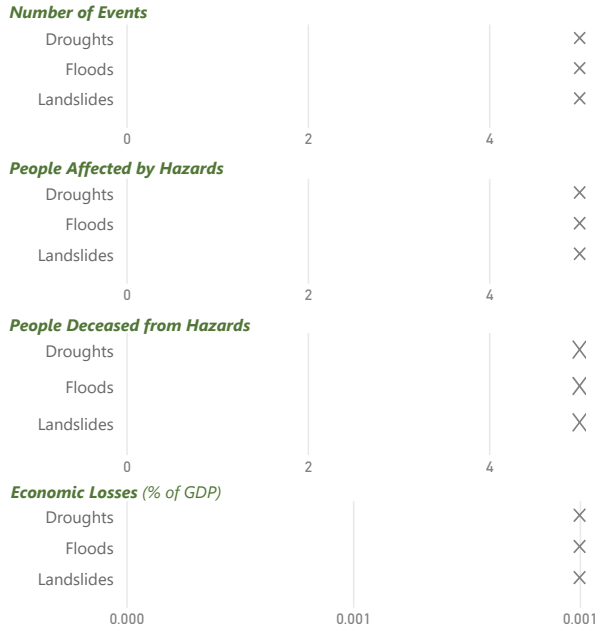
Water policy is fragmented. The laws are ambiguous and the responsabilities and authorities spread among three agencies in the country. There is no no water ministry. However any of those agencies account for sanitation regulation.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 3 Out of 181	13.8
CGI World Ranking	*GCI Index Score*
LAC: 74	LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Haiti has high exposure to Cyclons and Huricans. The vulnerability to hurricanes and severe storms is high, specially from June to October, which leads on subsequent intense flooding.

Haiti has high rates of periodic droughts.

Deforestation and the absence of storm water drainage systems produces serious flooding, which has detrimental effects as most major Haitian cities are coastal.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Honduras**

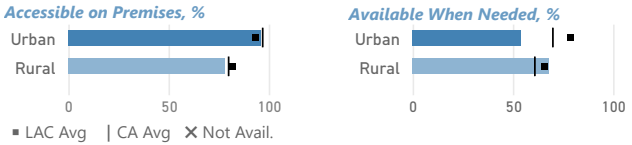
"LAC" = All countries

"CA" = Central America

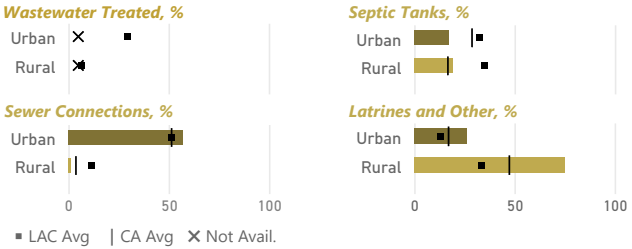
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	4.0 % (national)
LAC: 2.5% ; CA: 3.7%	LAC: 4.9% ; CA: 7.3%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
14.6 %	4.3 %
LAC: 30.9% ; CA: 26.5%	LAC: 23.7% ; CA: 11.5%

Key Challenges

- 1.4 million people in Tegucigalpa suffers from inefficient and unreliable WSS. These problems are exacerbated due to a lack of WRM planning, upstream water pollution due to poor sanitation, deteriorated water supply systems, and climate change.
- In around half of the urban centers, (Tegucigalpa, Choluteca and San Lorenzo) drinking water services are rationed, guaranteed for no more than 5 hours/day.
- Only 14% of wastewater is treated.
- Drinking water and sanitation services in the Dry Corridor are deficient, 15% of households do not have access to drinking water.
- Cost recovery per service is very inefficient, it is only enough to cover 3/5 of the supply costs, due to inadequate tariff and fee schemes, non-legalized uses, and poor bill collection.

Water Capital & Water Resources

Water Capital & Availability

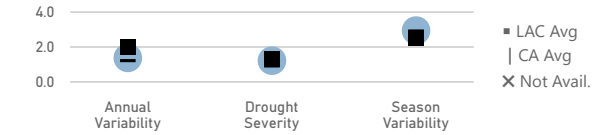
	LAC	CA
9,947. m3/inhab/year Water Resources per capita	44.1K	17.5K
1.6 % Transboundary Sources	15.8%	10.6%
4.6 % Water Stress	13.6%	5.4%
0.78 (0-1) Unsafe Water Quality Index	0.66	0.75
0.7 % Water Ecosystems Area	1.2%	2.0%

Water Resources Management

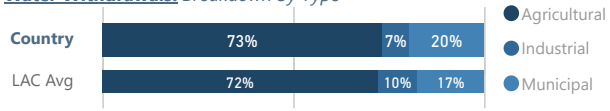
	LAC	CA
615.61 m3/inhab Dam Capacity per capita	2.9K	1.5K
26.1 % Electricity from Hydropower	36.6%	37.6%
11.0 % Agri. Sector Value to GDP	7.5%	7.7%
21.0 % Implemention of IWRM	33.0%	29.4%
16.6 % WR Climate Change Impact	17.8%	14.0%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

- Limited information on surface and ground water availability and quality. The most recent national water balance is from 2003 and lacks details.
- The most pressing issue regarding groundwater resources is pollution, due to the inadequate wastewater management, and salinization.
- Water extractions are not regulated and users do not comply with legal authorizations.
- No systematic hydrometrological monitoring. Hydromet networks are managed by different institutions and no networks for groundwater.
- Instutional authorities and competencies for WRM overlap. Current regulation is based on the General 2009 Water Law but it is not in place.
- Allocation of financial resources for investments is often unplanned an unprioritized, specifically in the areas with high levels of poverty such as the Dry Corridor.
- Honduras has several transboundary basins but has limited instruments for sharing and managing common water resources.
- Most of the existing wastewater treatment infrastructure is insufficient or collapsed.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

 # 42 Out of 181

CGI World Ranking

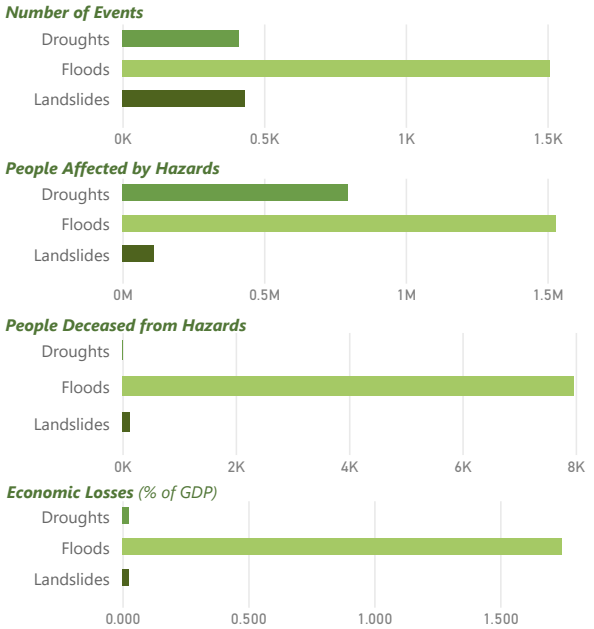
LAC: 74 ; CA: 55

55.0

GCI Index Score

LAC: 76.0 ; CA: 60.2

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

- Honduras is highly vulnerable to climatic changes and weatherrelated impacts.
- The existing early warning systems only cover 80% of flood events and 0% for droughts.
- Drought events cause losses of up to 80% in agricultural production.
- There is no flood protection infrastructure in the Dry Corridor.
- Estimated losses of 2-3% of annual GDP are due to flooding; much of this is in the Dry Corridor.
- During the dry season, earth dams or embankments that are built to store water can be destroyed by heavy rainfall and lead to damages of infrastructure from flooding.
- The most vulnerable and poor populations are located in the Dry Corridor, in the western and southern areas of the country.
- Investment in multipurpose infrastructure projects to mitigate the effects of drought and flood events has been very limited.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Jamaica**

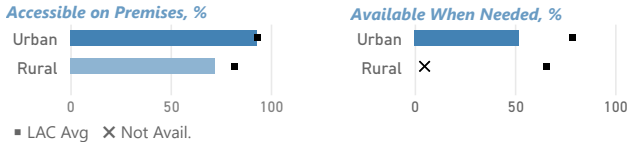
"LAC" = All countries

"CA" = Central America

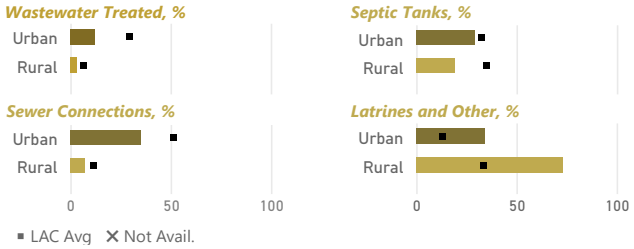
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
2.0 % (national)	1.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
24.4 %	21.3 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

There is a significant gap between rural and urban wss services coverage. Collecting water remains difficult in Jamaica, especially in rural communities.

The higher cost of serving the rural sector and the lower revenues and cost recovery prospects, demand higher subsidies than in the urban sector.

The sector does not generate enough funds to finance the expansion of irrigation service.

The infrastructure to transport water to the areas where it is demanded is inadequate in many parts of the country.

Wastewater treatment is deficient.

Water Capital & Water Resources

Water Capital & Availability

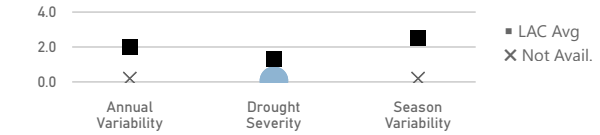
	LAC
3,744. m3/inhab/year *Water Resources per capita*	LAC: 44.1K
0.0 % *Transboundary Sources*	LAC: 15.8%
12.5 % *Water Stress*	LAC: 13.6%
0.67 (0-1) *Unsafe Water Quality Index*	LAC: 0.66
0.2 % *Water Ecosystems Area*	LAC: 1.2%

Water Resources Management

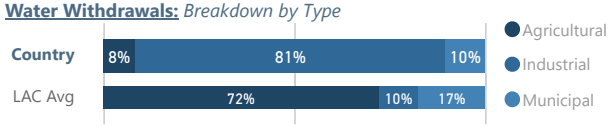
	LAC
1.87 m3/inhab *Dam Capacity per capita*	LAC: 2.9K
3.3 % *Electricity from Hydropower*	LAC: 36.6%
7.0 % *Agri. Sector Value to GDP*	LAC: 7.5%
43.0 % *Implemention of IWRM*	LAC: 33.0%
20.8 % *WR Climate Change Impact*	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

10% of the water resources, in average, have been lost due to saline intrusion and pollution.

87% of water supply is obtained from groundwater sources.

Aquifers and surface waters are extremely affected due to over-exploitation, sewage effluents, and industrial wastes. The main aquifer supplying to Kingston and St Andrew metropolitan area is contaminated by saline intrusion and other harmful chemicals.

Domestic and commercial activities pollute rivers and coastal waters. Water quality is severely affected in streams due to clothes washing.

The National Water Commission has financial difficulties constraining its ability to perform its mandate. It can only cover its operating costs.

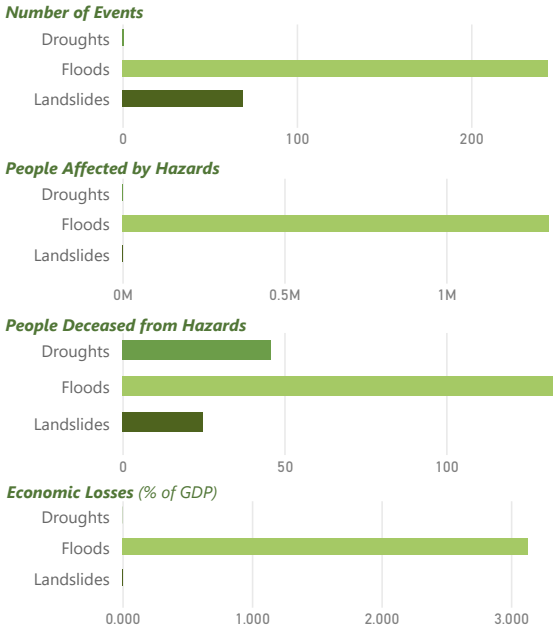
Institutional responsabilities are poorly defined with a lack of an effective coordination in water management and responsibility overlap.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 57 Out of 181	64.8
CGI World Ranking	*GCI Index Score*
LAC: 74	LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Jamaica is increasingly hard hit by drought. In 2018, the average rainfall was below the 30 year mean.

As cause of climate change, sea level rise will cause increased coastal flooding and erosion.

Jamaica is exposed to extreme weather events such as hurricaines.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Mexico**

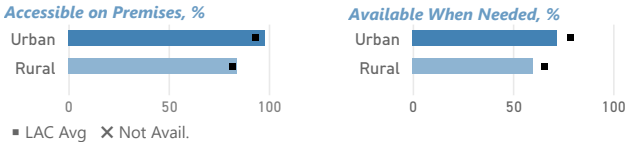
"LAC" = All countries

"CA" = Central America

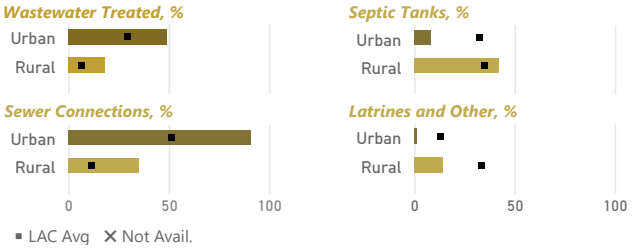
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	1.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
64.6 %	23.7 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

Population with inadequate access to basic water and sanitation services is greater than the share with low levels of educational attainment, very poor housing quality, or inadequate access to basic health services.

Only 58% of the country's population has daily water at home and has improved basic sanitation.

Municipalities are responsible for providing drinking water and sanitation services to population; however, many of them lack technical and managerial capacities.

Financial resources of service suppliers are insufficient to operate optimally; having problems with the collection of service fees, lack of trained employees and a high turnover of management personnel.

Water Capital & Water Resources

Water Capital & Availability

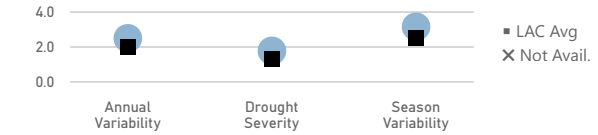
	LAC
3,576. m3/inhab/year Water Resources per capita	LAC: 44.1K
11.5 % Transboundary Sources	LAC: 15.8%
33.0 % Water Stress	LAC: 13.6%
0.75 (0-1) Unsafe Water Quality Index	LAC: 0.66
0.5 % Water Ecosystems Area	LAC: 1.2%

Water Resources Management

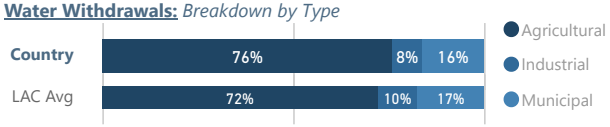
	LAC
1,220.43 m3/inhab Dam Capacity per capita	LAC: 2.9K
10.0 % Electricity from Hydropower	LAC: 36.6%
3.0 % Agri. Sector Value to GDP	LAC: 7.5%
49.0 % Implemention of IWRM	LAC: 33.0%
21.2 % WR Climate Change Impact	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Climate change affects the country's hydrological cycles. Water scarcity leads to groundwater overexploitation and production losses.

The increasing extraction from watersheds and aquifers has put significant pressure in the central and northern areas, where the pressure is 55%, and will continue increasing.

Wastewater treatment plants are inefficient. Surface and ground water are contaminated by untreated wastewater and agrochemicals.

Water use in the agricultural sector is highly inefficient, and agricultural runoff increasingly pollutes freshwater lakes and rivers.

Increasing urbanization, demographic growth, and climate change are intensifying the gap between rural and urban water users.

Complex public investment management system and operating rules. The annual budget cycle discourages multi-year investment projects.

Despite significant reforms, policy challenges remain. CONAGUA's broad mandate reduces regulatory efficiency and regulatory autonomy.

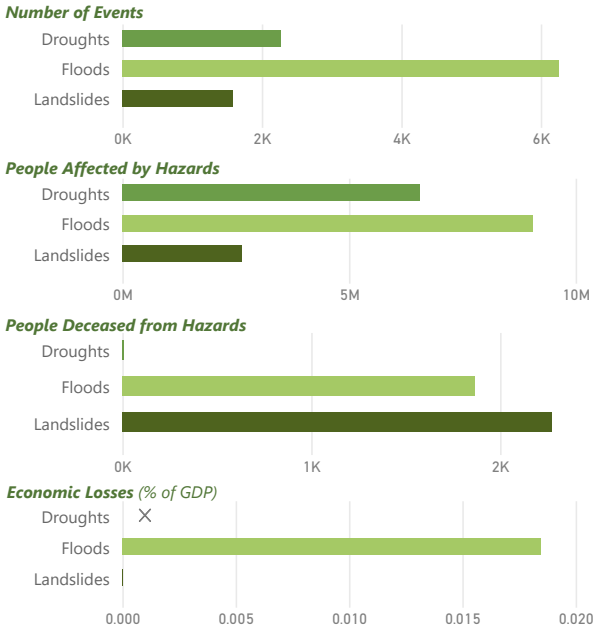
Mexico shares eight transboundary watersheds with USA, Guatemala, and Belize.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 54 Out of 181 CGI World Ranking	61.8 GCI Index Score
LAC: 74	LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Policymakers continue to lack accurate and timely weather and climate information, and interinstitutional coordination is weak. The institutional framework does not support multisector investment in climate change adaptation and mitigation projects.

Limited investment in key water management infrastructure is exposing Mexico to higher climate and non-climatic related risks. Even though Mexico ranks 19th worldwide in water- storage capacity, some of these dams were built more than 50 years ago, and need more investment in maintenance and rehabilitation.

Extreme hydrometeorological events, as well as droughts and floods, tend to affect the most vulnerable population, due to their poorly planned location. The most affected states are Veracruz, Tabasco and Chiapas.

Even if the country has EWS for Tropical Cyclones, or Drought Monitor, there are not effective strategies to avoid or prevent impacts, protect population and support community organization against climate threats.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Nicaragua**

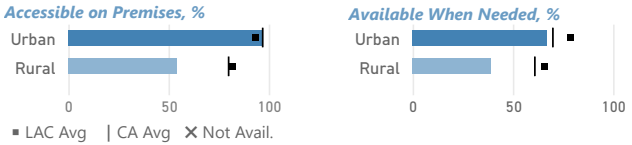
"LAC" = All countries

"CA" = Central America

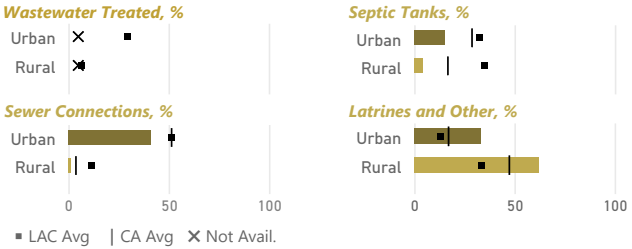
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
8.0 % (national)	**14.0** % (national)
LAC: 2.5% ; CA: 3.7%	LAC: 4.9% ; CA: 7.3%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
54.5 %	**11.1** %
LAC: 30.9% ; CA: 26.5%	LAC: 23.7% ; CA: 11.5%

Key Challenges

In the absence of piped water services, households rely on public or private wells (16.6%) and springs or alternative waterbodies (8.3%) for household water supply.

The management of water and sanitation systems in the rural sector has a general decentralization approach, mainly in the operational phase, which translates a relevant vulnerability of these systems.

There is a limited financial sustainability and operational efficiency in WSS.

The irrigation and multiple-use water sector show a regression in legal and institutional development manifested in the practical absence of a set of functions needed to implement programs.

Water Capital & Water Resources

Water Capital & Availability

26,455. *m3/inhab/year*
Water Resources per capita
LAC: 44.1K ; CA: 17.5K

5.1 *%*
Transboundary Sources
LAC: 15.8% ; CA: 10.6%

2.7 *%*
Water Stress
LAC: 13.6% ; CA: 5.4%

0.76 *(0-1)*
Unsafe Water Quality Index
LAC: 0.66 ; CA: 0.75

7.5 *%*
Water Ecosystems Area
LAC: 1.2% ; CA: 2.0%

Water Resources Management

5,012.72 *m3/inhab*
Dam Capacity per capita
LAC: 2.9K ; CA: 1.5K

6.4 *%*
Electricity from Hydropower
LAC: 36.6% ; CA: 37.6%

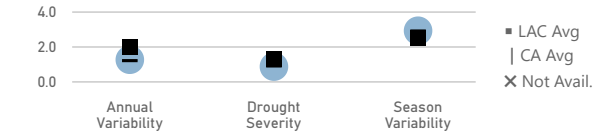
15.0 *%*
Agri. Sector Value to GDP
LAC: 7.5% ; CA: 7.7%

Not Avail. *%*
Implemention of IWRM
LAC: 33.0% ; CA: 29.4%

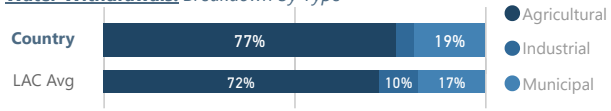
21.7 *%*
WR Climate Change Impact
LAC: 17.8% ; CA: 14.0%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

There is a deficit from December to April in the dry corridor and no regulation infrastructure that allows water storage during these dry periods with only the natural regulation of the aquifers to meet water demands.

Groundwater is the main source of water, 80% of the population is supplied from wells with the majority of the aquifers are located in the Pacific Region. There is a general downward trend in piezometric levels and no control over the volume extracted.

There is currently no continuous monitoring program to determine the status of water quality. The predominant pollutant stems from the agricultural sector.

There is limited financial sustainability of institutions. In the case of both ENACAL and ANA, the revenues do not cover the cost of operation and there is limited funding for the investment required to implement the National Water Resources Plan.

Nicaragua shares transboundary river basins. Particularly, the San Juan an Coco Rivers which are the largest and longest, respectively, in Central America.

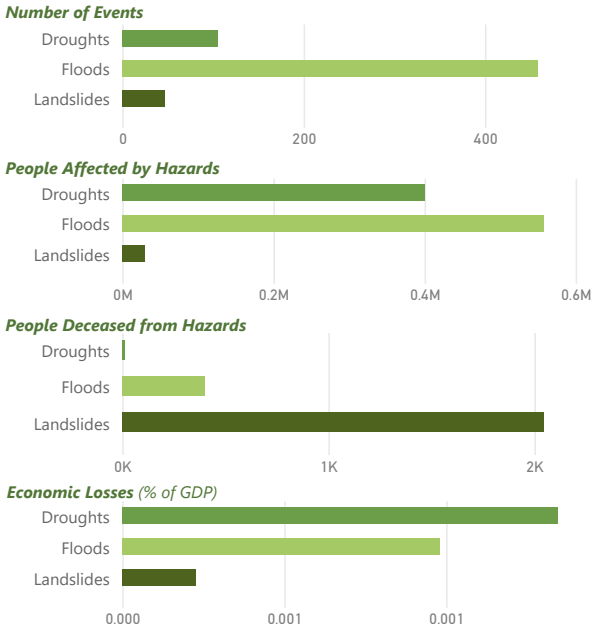
Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

 # 38 Out of 181
CGI World Ranking
LAC: 74 ; CA: 55

53.8
GCI Index Score
LAC: 76.0 ; CA: 60.2

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Current climate change projections indicate an increase in water resources by 2030 (on the water-rich Caribbean Coast), but no significant changes are expected in the Rio Coco and Pacific planning regions where resources are scarcer. However, changes in land use and the loss of forest land, observed in recent decades, are expected to reduce soil retention capacity and the natural regulation of watersheds.

Nicaragua has significant problems relating to flooding, which affects a large part of its territory.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Panama**

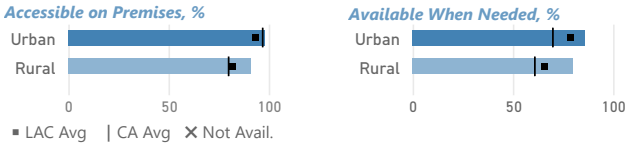
"LAC" = All countries

"CA" = Central America

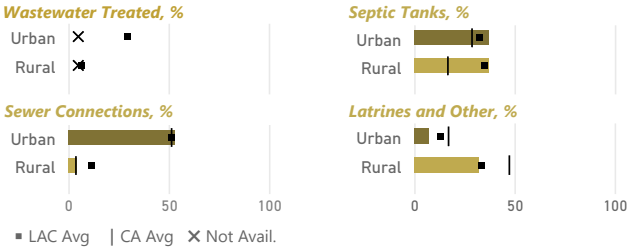
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
2.0 % (national)	**13.0** % (national)
LAC: 2.5% ; CA: 3.7%	LAC: 4.9% ; CA: 7.3%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
17.2 %	**4.3** %
LAC: 30.9% ; CA: 26.5%	LAC: 23.7% ; CA: 11.5%

Key Challenges

Piped drinking water coverage levels are high, but the quality of services has significant deficits in relation to the continuity of service, especially in the dry seasons. Panama has among the highest ethnicity-based inequalities in the region, with indigenous women often being worst off.

Only 31% of the population who has access to water are connected to a sewerage network; and only 6% of that network is followed by a waste water treatment.

The fees applied are very low to incentivize water resource conservation and there are financing gaps for CAPEX and OPEX.

Water Capital & Water Resources

Water Capital & Availability

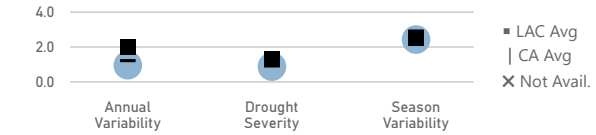
33,984. *m3/inhab/year* *Water Resources per capita*	LAC: 44.1K ; CA: 17.5K
1.9 % *Transboundary Sources*	LAC: 15.8% ; CA: 10.6%
0.9 % *Water Stress*	LAC: 13.6% ; CA: 5.4%
0.67 *(0-1)* *Unsafe Water Quality Index*	LAC: 0.66 ; CA: 0.75
1.0 % *Water Ecosystems Area*	LAC: 1.2% ; CA: 2.0%

Water Resources Management

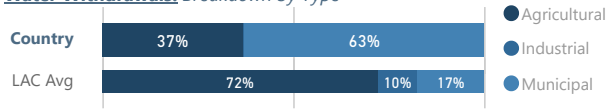
2,224.88 *m3/inhab* *Dam Capacity per capita*	LAC: 2.9K ; CA: 1.5K
60.8 % *Electricity from Hydropower*	LAC: 36.6% ; CA: 37.6%
2.0 % *Agri. Sector Value to GDP*	LAC: 7.5% ; CA: 7.7%
37.0 % *Implemention of IWRM*	LAC: 33.0% ; CA: 29.4%
2.2 % *WR Climate Change Impact*	LAC: 17.8% ; CA: 14.0%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Despite the availability of water resources, Panama struggles to define and implement management tools for its institutional framework to ensure that access to safe water will not be a limiting factor for economic growth the country has experienced in the last 15 years.

There are problems with water resource distribution due to competing water users which are not adequately regulated.

There is a lack of data and centralized information concerning the use of underground water and water quality management. It needs clearer policies and management authorities.

The water institutional framework is not adapted to the current situation as it reamins weak and the government does not have tools to ensure a robust and resilient management.

There is no enacted regulation and methodologies to calculate and oversee the ecological flow or to verify the waterbodies flow.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

 # 118 Out of 181

CGI World Ranking

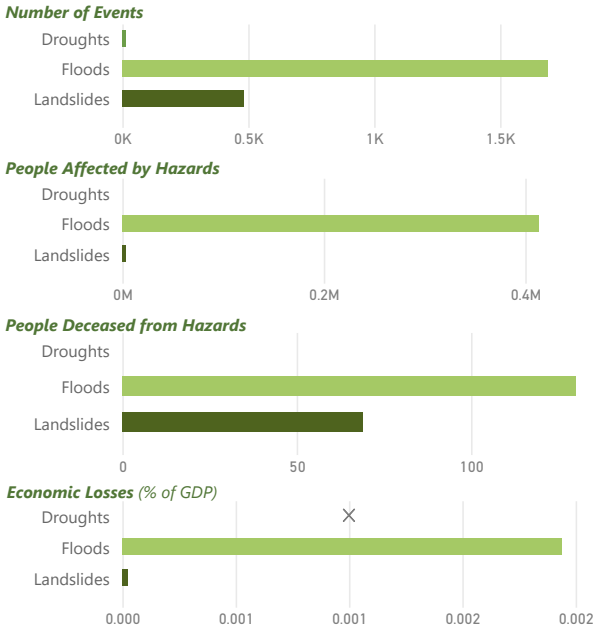
LAC: 74 ; CA: 55

106.5

GCI Index Score

LAC: 76.0 ; CA: 60.2

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

There is little reliable information for risk management of droughts and floods. The aspects related to hydrological security are not centered under the responsibility of any authority and their information is dispersed.

Climate change and extreme temperatures affect major economic activities which are water dependent. Water levels in canal reservoirs are affected by extreme drought periods. The state of emergency in 2015 caused by El Niño triggered losses of US$ 40 million for the Panama Canal Authority (ACP) in just 3 months' time.

The Panamanian Dry Arch (Arco Seco) does not have a complete rural development strategy that guarantees the development of resilient productive activities in drought periods.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Paraguay**

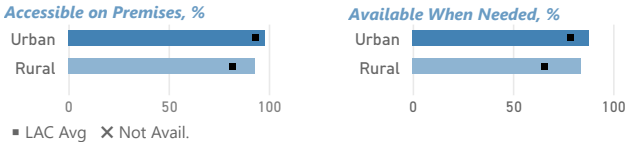
"LAC" = All countries

"CA" = Central America

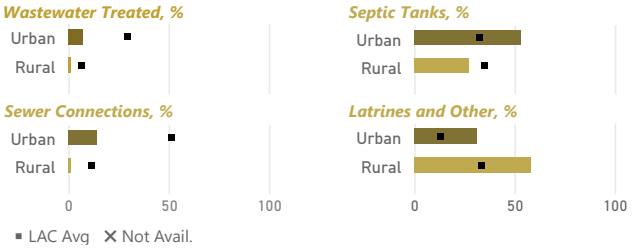
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	1.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
Not Avail. %	2.8 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

Improved water and sanitation coverage experienced significant growth, particularly in rural areas. However, piped water and sewerage network coverage present large inequalities between subnational regions, socio-economic and ethnic sub-groups.

Only 11 percent of the population is covered with sewage networks, and the wastewater treatment coverage is only 2 percent nationwide. This has not registered significant variations in recent years, exacerbating the environmental deterioration.

Urban and rural areas have similar levels of accessibility and availability, but there is still a gap in water quality. Almost half of the households have a poor quality of drinking water.

70 percent of users receive water service from providers who are not sustainable, generating inefficiencies such as poor operation and maintenance, overlapping of service providers, low service quality and deterioration of infrastructure, lack of adequate control and regulation.

Water Capital & Water Resources

Water Capital & Availability

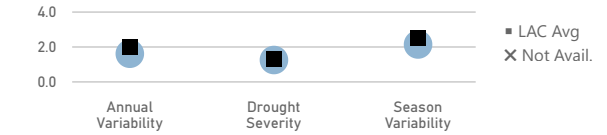
	LAC
56,937. m3/inhab/year *Water Resources per capita*	LAC: 44.1K
69.8 % *Transboundary Sources*	LAC: 15.8%
1.8 % *Water Stress*	LAC: 13.6%
0.69 (0-1) *Unsafe Water Quality Index*	LAC: 0.66
0.8 % *Water Ecosystems Area*	LAC: 1.2%

Water Resources Management

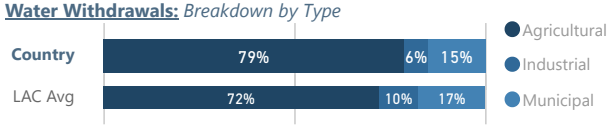
	LAC
4,882.58 m3/inhab *Dam Capacity per capita*	LAC: 2.9K
99.9 % *Electricity from Hydropower*	LAC: 36.6%
10.0 % *Agri. Sector Value to GDP*	LAC: 7.5%
32.0 % *Implemention of IWRM*	LAC: 33.0%
51.3 % *WR Climate Change Impact*	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Paraguay has one of the highest water availabilities in Latin America with almost 57,000m3 per inhabitant per year. However, water availability across the country is unequal. The Oriental region has water surplus, while the Occidental 'Chaco Paraguayo' region has less dense surface water network, strong seasonal variability, and limited groundwater exploitation due to poor water quality.

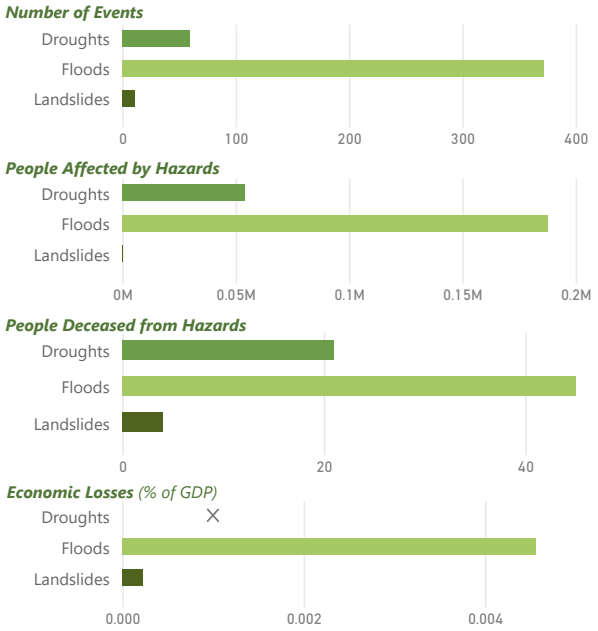
Great challenges remain for the country, such as land use planning, effective control of deforestation and contamination of water resources.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 70 Out of 181	73.5
CGI World Ranking	GCI Index Score
LAC: 74	LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Floods and drought impacts are increasing due to climate change, higher intensity, and levels of exposure. In Asuncion population is under threat of fluvial floods as they occupy natural floodplains of the Paraguay River.

Pluvial floods have significant impacts in urban areas due to the concentration of the population and the lack of storm drainage infrastructure and uncontrolled occupation of the natural drainage systems.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Peru**

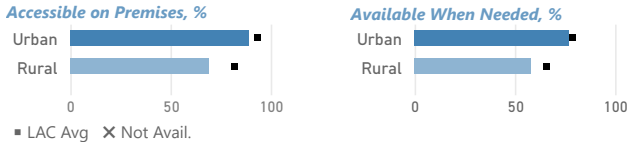
"LAC" = All countries

"CA" = Central America

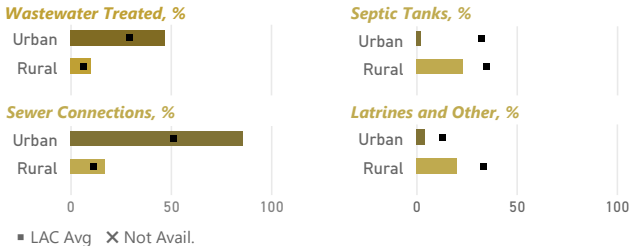
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
3.0 % (national)	**7.0** % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
40.2 %	**53.0** %
LAC: 30.9%	LAC: 23.7%

Key Challenges

- Surface water supply will not sustain drinking water demands, irrigation and coastal economic activities, and the metro area of Lima.
- Water scarcity threatens universal access for WS services and other productive uses.
- Some aquifers are overexploited, falling 1m per year on average, impacting production costs. Recharge via surface water infiltration is declining in some areas and seawater intrusion threatens to cause irreversible damage.
- Low water quality significantly increases production costs. SEDAPAL spends an average 40% more on pre-treatment due to contamination of water sources. The same in the south of Perú, including Tacna, Moquegua, Arequipa and Puno.
- Irrigated agriculture is low in productivity and competitiveness. Farming is incentivized to overexploit water sources to produce products for international markets while generating profits for professional agricultural companies.
- Large gap between urban and rural WSS accessibility. WSS services, sewarage and WWTP are not financially viable in remote, rural areas.
- Low quality and efficiency of WSS services. Drinking water service is not continuous.
- Service providers don't cover operating costs, nor generate funds fo investments.

Water Capital & Water Resources

Water Capital & Availability

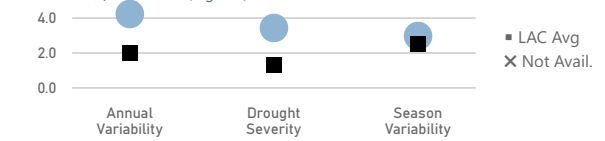
	LAC
58,449. *m3/inhab/year* Water Resources per capita	LAC: 44.1K
12.7 % Transboundary Sources	LAC: 15.8%
3.0 % Water Stress	LAC: 13.6%
0.53 *(0-1)* Unsafe Water Quality Index	LAC: 0.66
1.0 % Water Ecosystems Area	LAC: 1.2%

Water Resources Management

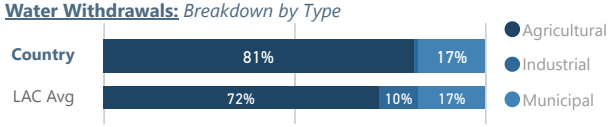
	LAC
183.58 *m3/inhab* Dam Capacity per capita	LAC: 2.9K
49.1 % Electricity from Hydropower	LAC: 36.6%
7.0 % Agri. Sector Value to GDP	LAC: 7.5%
30.0 % Implemention of IWRM	LAC: 33.0%
10.9 % WR Climate Change Impact	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

- Lack of a financing policy focused on sustainability. The budget process is not an efficient tool for planning and monitoring spendings.
- There is a lack of institutional coordination.
- The Pacific watershed has water scarcity and drains water originating west of the Andes. It only contains 1.5% of total available water resources, but is home to over 60% of the population; being the area where most economic activity.
- Of total available water resources, 75% originate in surface sources, and 25% from groundwater sources.
- Groundwater in the Pacific watershed allows storage of water resources needed for irrigation and drinking water.
- Quality of water declines due to untreated wastewater, inadequate solid waste management, illegal mining, droughts, and floods.
- Only 25% of the population has access to safe water.
- There are large urban/rural disparities in water quality, and declining levels pose public health risks.
- Peru is the third country in Latin America in terms of dryland area, with 40% area.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

#47 Out of 181

CGI World Ranking

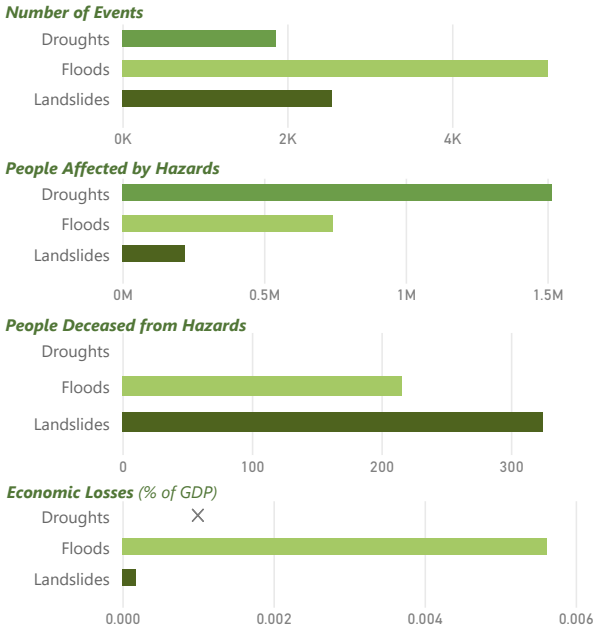
LAC: 74

58.0

GCI Index Score

LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

- Floods and waterlogging affect real estate and the built environment, leading to destruction of irrigation channels, traffic interruption, road destruction, water supply cuts, water pollution, inudation/erosion of agricultural land, and drainage failures.
- The El Niño Southern Oscillation (ENSO) phenomenon reverses the oceanic currents along the equator in the Pacific ocean causing a change in temperature of the seawater off the coast of Peru for several months, influencing the regional weather, resulting in excessive rainfall in the North and droughts in the South. If not managed well, this can cause damages and losses of millions of dollars.
- Annual increases in temperature lead to glacier retreat and to higher incidence rates of landslides, overflowing of lakes, increases in river flows and sea levels as well as pollution, resulting in greater flooding and salinisation.
- Natural geographic imbalances between water supply and demand (i.e. coast, highlands, and jungle) are worsening as a result of climate change.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Datasheet Page 2

Select a country: **Peru**

1 2 ?

Water Service Delivery

Institutional Structure

Defining roles and responsibilities in WSS sector, improving governance, revitalizing regulatory and supervisory functions

Investments

Establish a Investment policy, includinf cofinancig, tariffs and subsidies. Allocate resources to committed entities, prioritize investments, establish strategy for peri-urban and rural areas.

Establish a Investment policy, including cofinancig, tariffs and subsidies for urban and rural areas, oriented to results.

Legal and Regulatory Framework

Engaging the private sector with the public interest in mind. Further engagement with the private sector through strengthened public regulation towards guaranteeing the public interest and improving the connection of research, technological development and, above all, innovation in the water sector has become a priority.

Water Capital & Water Resources

Information, Analysis, and Planning Tools

Implement a set of "micro reforms" within the current water management model.

Ensure sufficient capacity in terms of numbers of staff and qualification profiles of staff in organisations providing technical support (such as WSOs and AASs) to decision making at regional and local level.

Strengthen the knowledge base. Strengthen the information and knowledge base about current and future risks of pollution, water scarcity, droughts and floods.

Institutional Structure

Strengthen Watershed Councils

Multi-sectoral water resources management. Regardless of its institutional attachment, both ANA and its multi-sectoral character should be strengthened.

Ensuring strong coordination of wider investments at a basin level and Service Providers Optimized Masterplans.

Investments

Link financing and results, establish co-financing criteria, improve investment efficiency, and increase investment in water infrastructure.

Improve the targeting, transparency and efficiency of public investment.

Legal and Regulatory Framework

Adopting a more sophisticated and diverse approach to water security, especially in the most water scarce basins.

Raise the status of water security as a national security objective.

Water Risk Management

Infrastructure

Enhanced policy coherence to support natural infrastructure development. Planning instruments could be strengthened by improving coherence at various levels of government and actual implementation, through securing ecosystem services for future planning.

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **El Salvador**

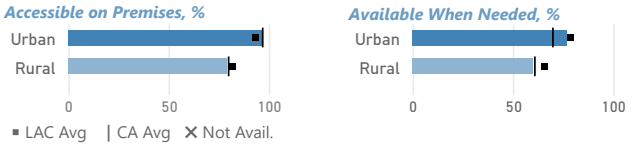
"LAC" = All countries

"CA" = Central America

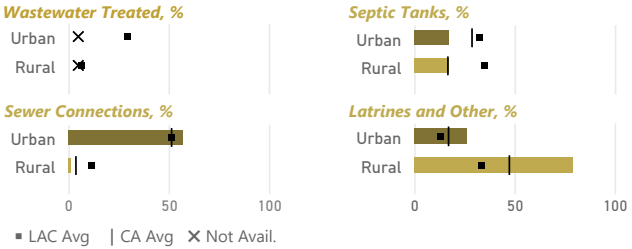
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
7.0 % (national)	4.0 % (national)
LAC: 2.5% ; CA: 3.7%	LAC: 4.9% ; CA: 7.3%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
22.6 %	4.9 %
LAC: 30.9% ; CA: 26.5%	LAC: 23.7% ; CA: 11.5%

Key Challenges

Poor service quality. Only 52% of the drinking water supply is continuous and 50% of the population reports deficiencies in the quality of the water supplied, and only 4.5% report they receive wastewater treatment.

The sector lacks a formal regulator, separate from the providers, and a comprehensive regulatory framework. Responsibilities of ANDA in relation to rural water supply not clear.

Drinking water and sanitation services are underinvested. While population growth demands faster provision, the large investment deficit estimates a total lack of around US$ 255 million per year to cover the necessary investments and achieve the national targets for the sector.

Tariffs do not allow for cost recovery.

The irrigation infrastructure is not sufficient to cover the natural potential of the country's land for irrigation and lands with infrastructure are not all irrigated.

Water Capital & Water Resources

Water Capital & Availability

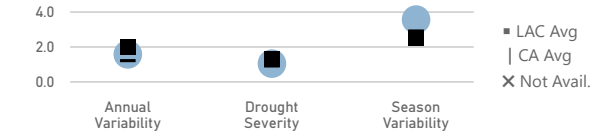
4,119. *m3/inhab/year* *Water Resources per capita*	LAC: 44.1K ; CA: 17.5K
40.5 *%* *Transboundary Sources*	LAC: 15.8% ; CA: 10.6%
13.2 *%* *Water Stress*	LAC: 13.6% ; CA: 5.4%
0.75 *(0-1)* *Unsafe Water Quality Index*	LAC: 0.66 ; CA: 0.75
1.6 *%* *Water Ecosystems Area*	LAC: 1.2% ; CA: 2.0%

Water Resources Management

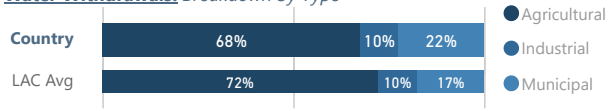
607.22 *m3/inhab* *Dam Capacity per capita*	LAC: 2.9K ; CA: 1.5K
22.6 *%* *Electricity from Hydropower*	LAC: 36.6% ; CA: 37.6%
5.0 *%* *Agri. Sector Value to GDP*	LAC: 7.5% ; CA: 7.7%
21.0 *%* *Implemention of IWRM*	LAC: 33.0% ; CA: 29.4%
19.1 *%* *WR Climate Change Impact*	LAC: 17.8% ; CA: 14.0%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Intra-annual climate variability, increased pressures from various sectors, and source pollution impact water availability. Agricultural impacts in the Dry Corridor decrease the hydroelectric generation capacity on the Lempa River and the quality of drinking water service.

Around 50% of water used for agriculture is non-licensed.

El Salvador has LAC's highest dependence on transboundary waters, sharing basins with Guatemala and Honduras with weak coordination.

Transboundary water bodies are heavily polluted and countries blame each other. Different users discharge water without treatment.

There are significant gaps on data regarding groundwater resources.

Fragmented institutional performance and a lack of regulation framework lead to weak coordination at local, regional and national levels. Sectors act individually with different capacities and faculties. Information on water rights and water use is extremely limited.

There are low public funding mechanisms.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

 # 25 Out of 181

CGI World Ranking

LAC: 74 ; CA: 55

42.5

GCI Index Score

LAC: 76.0 ; CA: 60.2

Natural Disaster Hazard Risks & Impacts (cumulative)

Key Challenges

A reduction of rainfall has contributed to droughts affecting the sector with the highest water dependence and consumption such as the hydroelectric sector, where conditions reduced flows by up to 95%. There is sufficient yearly average precipitation, but insufficient storage capacity (reservoirs / aquifer recharge).

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Suriname**

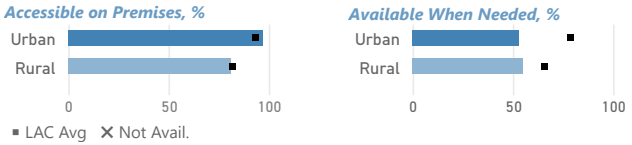
"LAC" = All countries

"CA" = Central America

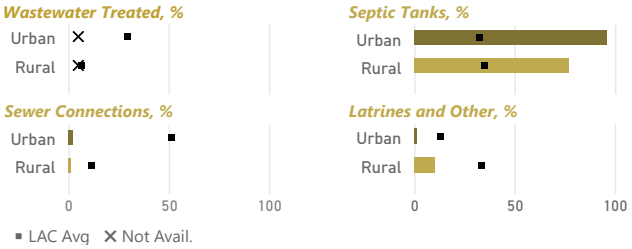
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water

4.0 % (national)

LAC: 2.5%

Population Practicing Open Defecation

3.0 % (national)

LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential

Not Avail. %

LAC: 30.9%

Coverage of Cultivated Area

72.4 %

LAC: 23.7%

Key Challenges

The coastal area uses groundwater for domestic water supply because of its higher quality. Saltwater intrusion becomes a problem by decreasing water availability for domestic and agricultural use. Most of the water supply in rural areas rely on rainwater collection systems or surface water.

Drinking water infrastructure and irrigation systems do not function properly and face severe deterioration due to lack of finance for good maintenance, resulting in efficiency problems and poor service quality, water leakages, low pressure, intermittent supply, and breakdown of pumping stations.

No wastewater treatment systems exist in the country, and septic tanks are used as sanitary solutions. The disposal of effluent and sludge of these sanitary systems are not correctly managed.

In the coastal area, the high flood risk and high groundwater tables, combined with the high population density, inadequate management of septic tanks, and the lack of maintenance of the water supply system, increase water-related disease outbreaks.

Water Capital & Water Resources

Water Capital & Availability

175,719. *m3/inhab/year*
Water Resources per capita
LAC: 44.1K

0.0 %
Transboundary Sources
LAC: 15.8%

4.0 %
Water Stress
LAC: 13.6%

1. *(0-1)*
Unsafe Water Quality Index
LAC: 0.66

1.1 %
Water Ecosystems Area
LAC: 1.2%

Water Resources Management

35,057.21 *m3/inhab*
Dam Capacity per capita
LAC: 2.9K

62.3 %
Electricity from Hydropower
LAC: 36.6%

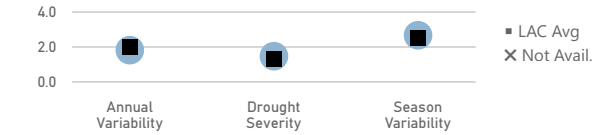
10.0 %
Agri. Sector Value to GDP
LAC: 7.5%

15.0 %
Implement of IWRM
LAC: 33.0%

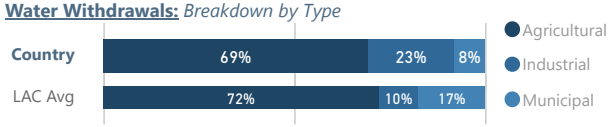
26.2 %
WR Climate Change Impact
LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Water resources monitoring network density is low, and data collection and information sharing arrangements are limited. There is low public awareness of and political attention for water-related problems or sustainable water use.

Surface water quality is under great stress due to poor sanitary services and agricultural, industrial, and mining activities.

The water legal and regulatory framework does not comply with the current sector challenges. Lack of rights and obligations of water users, lack of control mechanisms, and undefined responsibilities and powers division are some of the identified deficiencies.

The institutional framework faces challenges related to limited institutional capacity, lack of financing, and inexistent legislative direction leading to fragmentation of responsibilities, duplication of efforts, coordination problems, and inefficiencies in the water sector.

The country has two boundary rivers that face bilateral conflicts with the neighboring countries.

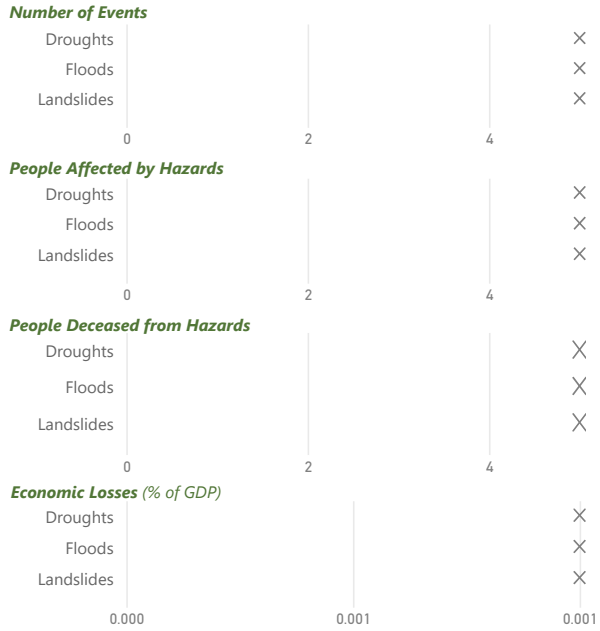
Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

 # 173 Out of 181
CGI World Ranking
LAC: 74

166.0
GCI Index Score
LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

Sea-level rise is a major threat to the coastal zone, where most of the population and agricultural land is located, causing coastal erosion, flooding and saltwater intrusion.

In the coastal area, the stormwater drainage system is critical during the wet seasons because of the frequent flooding affecting these flat and low-lying lands.

The country faces shortages of irrigation water in dry seasons.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Trinidad And Tobago**

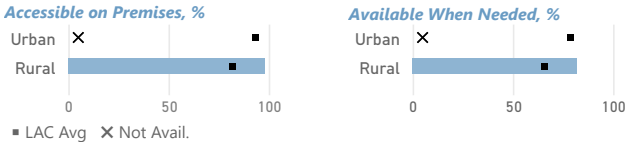
"LAC" = All countries

"CA" = Central America

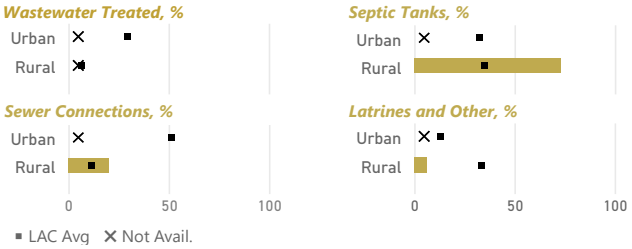
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	1.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
23.3 %	14.9 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

- There is inadequate infrastructure, notably leaking pipeline.
- Unaccounted water represents 48%, affecting the supply, and creating higher expenditure on treatment and pumping costs.
- Service providers are not financially self-sufficient. They don't have enough funding nor technical capacity.
- There are higher sediment yields leading to an increase in the cost of drinking water production and more regular maintenance of water treatment plants, together with increased incidences of flooding in areas.
- Due to the spatial and temporal availability of the water, localized imbalances occur, resulting in water shortages being experienced by the population.

Water Capital & Water Resources

Water Capital & Availability

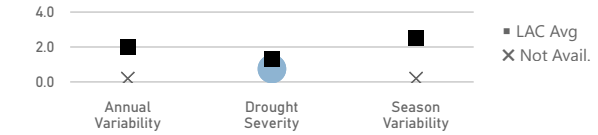
2,805. m3/inhab/year	Water Resources per capita
LAC: 44.1K	
0.0 %	Transboundary Sources
LAC: 15.8%	
20.3 %	Water Stress
LAC: 13.6%	
0.5 (0-1)	Unsafe Water Quality Index
LAC: 0.66	
0.3 %	Water Ecosystems Area
LAC: 1.2%	

Water Resources Management

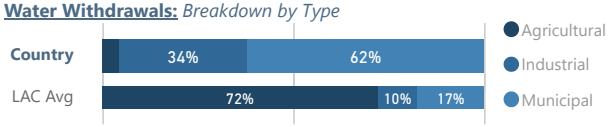
51.64 m3/inhab	Dam Capacity per capita
LAC: 2.9K	
0.0 %	Electricity from Hydropower
LAC: 36.6%	
1.0 %	Agri. Sector Value to GDP
LAC: 7.5%	
25.0 %	Implementation of IWRM
LAC: 33.0%	
49.4 %	WR Climate Change Impact
LAC: 17.8%	

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

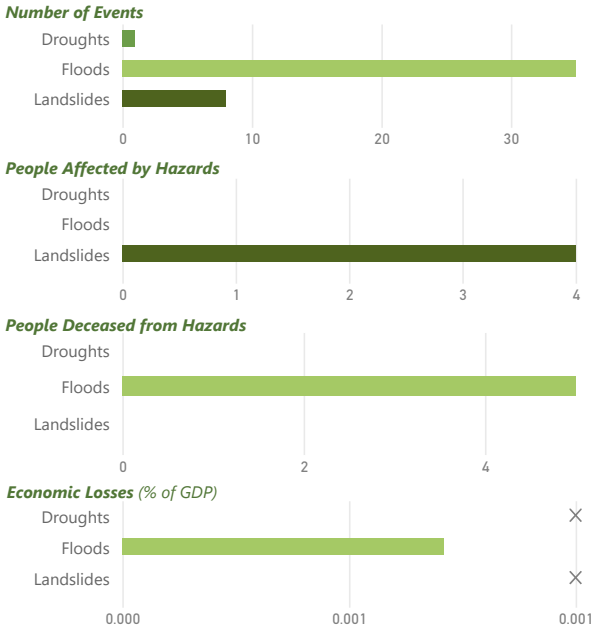
- The quantity and quality of water resources are under significant threat due to climate change, pollution, watershed degradation and increasing sectoral demand.
- With seasonal variation,the deficit in water availability is exacerbated during severe dry weather due to low surface water flows. Desalination is needed to accomplish water demands.
- Some aquifers are overexploited, and are affected by saltwater intrusion, situation which will get worse with climate change impact.
- Pollution due to malfunctioning WWTP and hydrocarbon industry affect inland freshwater and coastal water resources. Abstraction in aquifers leads to saltwater intrusion, which threatens agriculture.
- Theree hydrometeorological and water quality monitoring network is not well developed or maintained.
- Their institutional framework lacks appropriate policies, legislation, and master plans to govern and direct the respective sectors.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 161 Out of 181	150.2
CGI World Ranking	GCI Index Score
LAC: 74	LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

- Flooding is the natural hazard of major concern to the population by virtue of its frequency of occurrence and the extent of damages resulting.
- In the dry season, there are prolonged droughts, so there is not enough water to recharge the water table. In the rainy season, heavy flooding occurs.
- Indiscrete quarrying operations and deforestation are increasing landslips and flooding.
- The country is exposed to excessive Ocean Storms, which may range up to Hurricane Level,

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Uruguay**

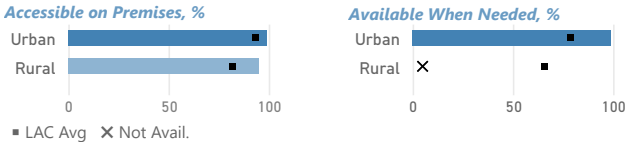
"LAC" = All countries

"CA" = Central America

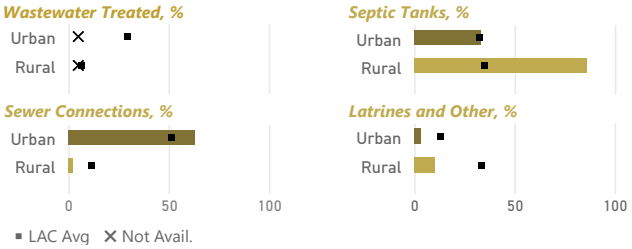
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	1.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
13.5 %	9.6 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

Around 38% of the country's population is not connected to sewerage systems. On-site sanitation systems face several operational challenges resulting in overflows, uncontrolled infiltration and wastewater discharges.

In 2018, 30% of the sewerage connectivity of Obras Sanitarias del Estado (OSE) and the Municipality of Montevideo was not treated.

There is a strong need for the construction and expansion of WWTPs, both for collective systems and for the reception and treatment of effluents from individual systems.

The total area under irrigation increased four times from 1970 to 2015. Rainfed agriculture also expanded from 400,000 to 1,500,000 hectares of crops between 2000 and 2015.

The hydroelectric sector's participation in the electricity matrix strongly depends on the annual hydraulic regime. It varied between 50% and 80% in the last 10 years.

Waterways are strategic for Uruguay, positioning the country as a regional logistics center.

Water Capital & Water Resources

Water Capital & Availability

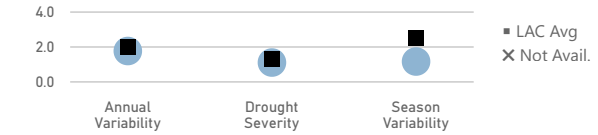
49,812. *m3/inhab/year*	LAC: 44.1K
Water Resources per capita	
5.1 *%*	LAC: 15.8%
Transboundary Sources	
9.8 *%*	LAC: 13.6%
Water Stress	
0.17 *(0-1)*	LAC: 0.66
Unsafe Water Quality Index	
2.3 *%*	LAC: 1.2%
Water Ecosystems Area	

Water Resources Management

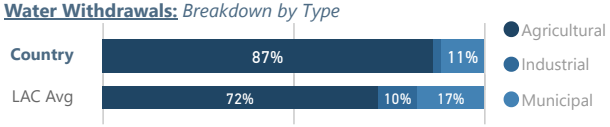
4,991.4 *m3/inhab*	LAC: 2.9K
Dam Capacity per capita	
74.2 *%*	LAC: 36.6%
Electricity from Hydropower	
6.0 *%*	LAC: 7.5%
Agri. Sector Value to GDP	
Not Avail. *%*	LAC: 33.0%
Implementation of IWRM	
33.4 *%*	LAC: 17.8%
WR Climate Change Impact	

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

Surface water resources of Uruguay are distributed in three transboundary macro-basins.

Difficulties for the development, operation, and maintenance of information systems. Outdated monitoring programs with little coordination between hydrometric, meteorological, and water quality networks.

One of the main water quality problems is eutrophication. The occurrence of cyanobacterial blooms, mainly in summer, has become an increasingly frequent phenomenon.

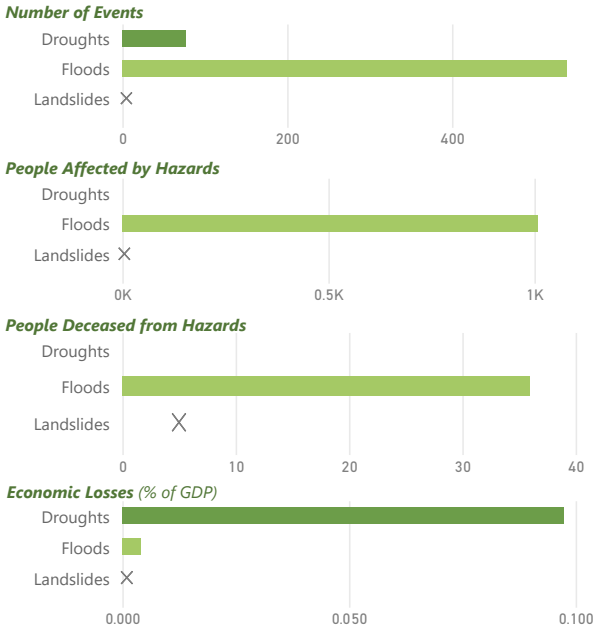
Higher agricultural production put greater pressure on water quality due to the intensive use of the soil and increased diffuse export to water resources. It is expected that the universalization of Land Use and Management Plans will contribute to the reduction of erosion and control of the diffuse contribution to water resources, especially nutrients associated with the eutrophication processes of waters.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 97 Out of 181	88.3
CGI World Ranking	*GCI Index Score*
LAC: 74	LAC: 76.0

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

The ENSO phenomenon significantly skews the distribution of rainfall in Uruguay. This phenomenon represents an opportunity to anticipate actions to prevent the effects of hydroclimatic extremes in the country.

According to the National Emergency System (SINAE), between 2000 and 2010, 73% of the recorded events correspond to hydrometeorological phenomena, of which 63% correspond to floods, where 18 of the 19 departments were affected.

Few instruments for comprehensive risk management. Little capacity to prevent and mitigate situations of water deficit and insufficient investment for drainage and prevention works.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

Regional Water Security Diagnostic | for Latin America & the Caribbean (LAC)

Published: November 2021

WORLD BANK GROUP

Country Data Sheet

Select a country: **Venezuela**

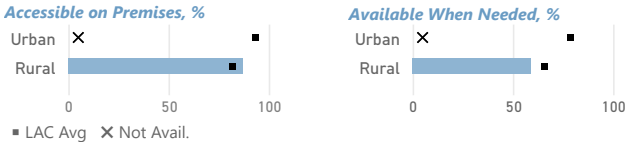
"LAC" = All countries

"CA" = Central America

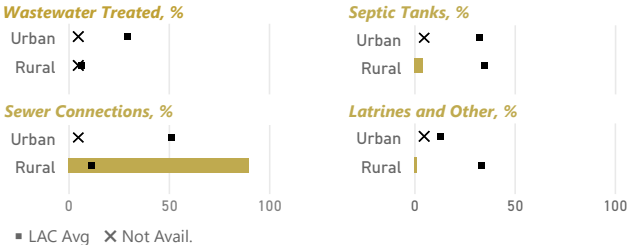
GWSP

Water Service Delivery

Drinking Water Coverage, SDG 6 Criteria (Sustainable Development Goals)



Sanitation Coverage, SDG 6 Criteria (Sustainable Development Goals)



Access to Basic Services, Water and Sanitation

Population Fetching Surface Water	Population Practicing Open Defecation
1.0 % (national)	3.0 % (national)
LAC: 2.5%	LAC: 4.9%

Irrigation Coverage, Areas Equipped for Irrigation

Coverage of Irrigation Potential	Coverage of Cultivated Area
52.8 %	32.0 %
LAC: 30.9%	LAC: 23.7%

Key Challenges

- Drinking water service is not efficient, due to the water availability and the lack of maintenance in the infrastructure.
- The water deficit in the country's coastal zone forced water transfer from other basins, requiring big investments, high operating and maintenance costs mainly due to pumping energy consumption.
- Water quality is the biggest environmental problems, with not enough treatment plants for 63% of discharged water.
- There is a large gap between drinking water and sanitation coverage, even in urban areas.
- The latest investments favored the urban areas, leaving a notable gap in coverage with the rural ones.
- A fundamental aspect that has a great impact on the sector's financial deficit is non-billed water.

Water Capital & Water Resources

Water Capital & Availability

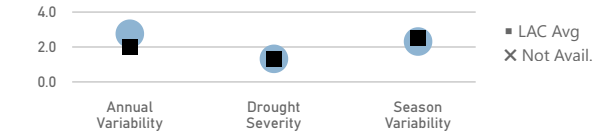
41,436. m3/inhab/year Water Resources per capita	LAC: 44.1K
39.3 % Transboundary Sources	LAC: 15.8%
7.5 % Water Stress	LAC: 13.6%
0.77 (0-1) Unsafe Water Quality Index	LAC: 0.66
1.1 % Water Ecosystems Area	LAC: 1.2%

Water Resources Management

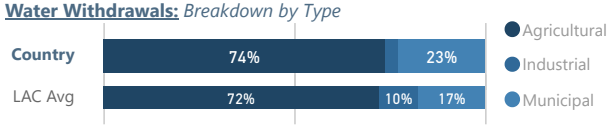
5,360.96 m3/inhab Dam Capacity per capita	LAC: 2.9K
68.3 % Electricity from Hydropower	LAC: 36.6%
Not Avail. Agri. Sector Value to GDP	LAC: 7.5%
Not Avail. % Implement of IWRM	LAC: 33.0%
11.8 % WR Climate Change Impact	LAC: 17.8%

Variability of Water from Precipitation

Index Values, from 0 to 5 (highest)



Water Withdrawals: *Breakdown by Type*



Key Challenges

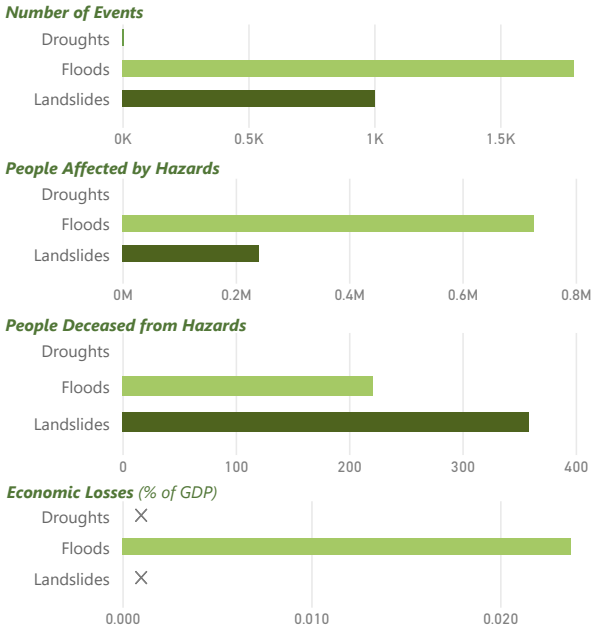
- Over 90% of wastewater dischrges directly into rivers or lakes without treatment.
- Venezuela deforestation is one of the highest in Latin America, impacting water purification plants due to the high concentration of suspended particles.
- Oil spills affect water bodies, and occur more frequently due to the maintenance lack of pipelines and wells.
- There has been significant increase in illegal mines that use polluting practices. The important Orinoco River watershed is one of the most affected.
- 60% of the country's population is located in the Andean Coastal region, with the least availability of water resources. This deficit is increasing.
- In the last decade, no significant investments have been made in the water sector, and those realized, have not been carried out efficiently.
- Information about surface water is outdated and unreliable. Groundwater information is even more limited, with no robust national database.
- Since 2007, Venezuelan legislation contemplates the creation of decentralized instances for the management of water resources. However, no efforts have been made to implement them.

Water Risk Management

Global Climate Risk Index (GCI), 1999-2018

# 59 Out of 181 CGI World Ranking	66.0 GCI Index Score LAC: 76.0	LAC: 74

Natural Disaster Hazard Risks & Impacts (cumulative)



Key Challenges

- Climate change and the country's extensive coastline make it particularly vulnerable to natural disasters such as hurricanes, floods and mudslides.
- The rain seasonality means that part of the year there is a water shortage, while in the other period there are floods.
- Land degradation by socioeconomic activities also increases the dangers faced by the poorest segments of the population from natural disasters (landslides, floods, among others).
- More than 40% of the country's reservoirs cannot be operated. Currently, the country's reservoirs are unattended by the State despite their strategic importance for risk prevention, leading to infrastructure degradation and failure.

Abbreviations: CA = Central America; GDP = Gross Domestic Product; IWRM = Integrated Water Resources Management; LAC = Latin America & the Caribbean; WR = Water Resources; WQ = Water Quality

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