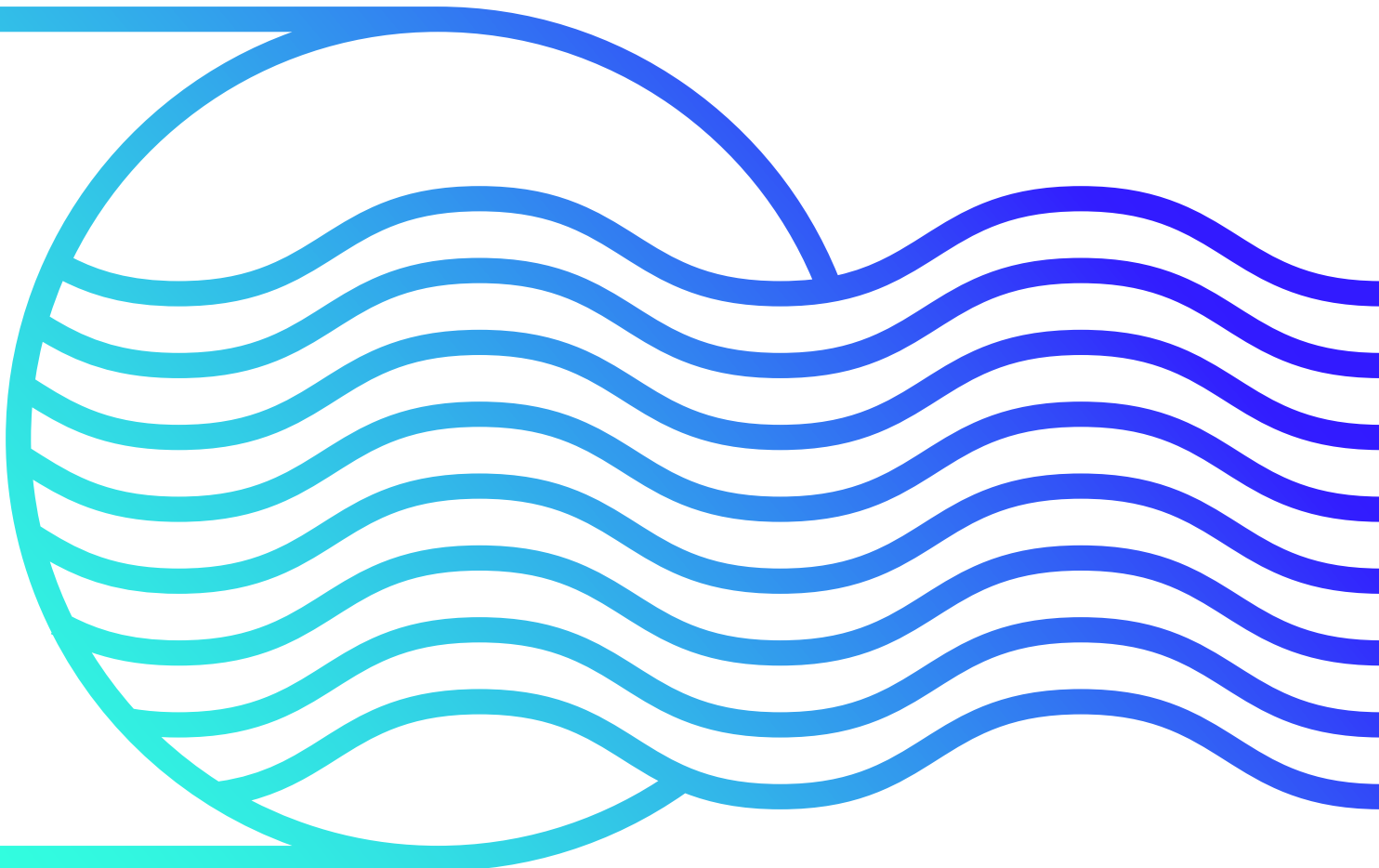


Water Security Strategy 2023-2026

CAF DEVELOPMENT BANK
OF LATIN AMERICA
AND THE CARIBBEAN



Written by
Franz Rojas Ortuste, Carlos Orellana and Agustín Alonso, GDUAEC, VCPE.

Contributing authors (alphabetical order)
Fabiana Bianchi, Luis Burbano, Raúl Caldevilla, Jorge Escurra, Fernando Loría, Antonio R. Morales, Florencia Pietrafesa, Carlota Real, Andrea Rispo, Paulo Rodrigues, Santiago Symonds, and Osvaldo Valverde.

Supervision
Ángel Cárdenas, Urban Development, Water, and Creative Economies Area, VCPE

Acknowledgments
The authors are grateful to their colleagues Fernando Peñaherrera, Helena Castañeda, Carolina Hoyos, and Santiago Caballero from GDUAEC, as well as Jorge Concha, Martha Castillo, René Gómez-García, and Edgar Salinas from GACBP; Dilberth Cordero and Andrea Rousset from GDSH; and Edgar Lara from GGID for their comments and suggestions.

Editorial Management
CAF's Strategic Communications Department

Graphic design
Estudio Bilder / Buenos Aires



Digital work available in CAF's virtual library scioteca.caf.com with open access under the Attribution-NonCommercial-NoDerivs 4.0 International (CC-BY-NC-ND 4.0) license.

To view a copy of this license, visit <http://creativecommons.org/by-nc-nd/4.0>.

The ideas and opinions expressed in this work are those of the authors and do not necessarily reflect the views of CAF or bind the organization/entail any endorsement by the organization. The terms used and the presentation of the data contained therein do not imply CAF's stance with respect to the legal status of countries, territories, cities, or regions, or regarding their authorities, borders, or boundaries.

Content

Foreword — 6
Introduction — 7
Acronyms — 8

Executive Summary — 9

1

Water Security in the current context and CAF's corporate strategy — 12

Water: Embedded in CAF's corporate strategy as a connector between global agendas — 13

Water and global challenges: Critical issues in LAC — 20

Developments from CAF's 2019–2022 Water Strategy — 24

2

Major challenges for water security in LAC — 26

Strengthening mechanisms for Integrated Water Resources Management (IWRM) involves addressing fragmented institutional structures to efficiently utilize water and manage droughts and floods to build resilient and sustainable communities and ecosystems — 27

Improving planning and governance, and increasing investment in drinking water and sanitation to promote healthy and inclusive communities — 33

Minimizing untreated wastewater discharge and inadequate solid waste disposal, promoting their reuse and recycling, supports environmental sustainability and green growth — 37

Harnessing the region's agricultural irrigation potential, which contributes to food security and improves resilience within the agricultural sector — 39

3

2023–2026 Water Security Strategy — 42

Strategic objectives and programmatic lines — 44

Instruments and tools — 58

Follow up and expected results — 63

Annex 1

List of potential activities and actions to be developed by CAF classified by objective and strategic guideline — 64

Annex 2

Typology of water security programs and projects — 69

References — 73

List of figures

- Figure 1. Water: connector of global agendas — 14
- Figure 2. Water Security and CAF's mission and cross-cutting initiatives — 16
- Figure 3. Water and the SDGs — 23
- Figure 4. Internal renewable water resources (m³/pop/yr) — 28
- Figure 5. Usos del agua en el mundo — 29
- Figure 6. Frequency of droughts and floods in LAC — 30
- Figure 7. Basic and safe access to water and sanitation in LAC — 34
- Figure 8. Investment expressed in average GDP 2008–2019 and to 2030 — 35
- Figure 9. Investment requirements per capita and percentage of GDP in LAC — 36
- Figure 10. Urban wastewater treatment coverage (2022) — 37
- Figure 11. The holistic approach to water security — 44
- Figure 12. Strategic challenges and objectives — 45
- Figure 13. Strategic objectives and programmatic lines — 45
- Figure 14. Portfolio composition of the investment goal — 63

List of boxes

- Box 1. CAF's 2023–2026 Corporate Strategy — 15
- Box 2. Water security and the Strategic Ecosystem Mission Initiative — 17
- Box 3. Water security and the Blue Economy and Oceans Mission Initiative — 18
- Box 4. Sustainable Agriculture and Livestock Sector Mission Initiative — 32
- Box 5. Towards resilient and sustainable cities — 32
- Box 6. Nature-based solutions for rainwater drainage: Case of Sobral, Brazil — 47
- Box 7. Sludge management at the Juan Díaz WWTP, Panama — 51
- Box 8. Healthy, inclusive, resilient, and sustainable cities — 53
- Box 9. Technology-based family irrigation — 57
- Box 10. Water Project Preparation Facility (PPSA) — 60
- Box 11. Water Finance Coalition — 62

Foreword

Water is present in many activities that human beings engage in: from direct consumption to food preparation or personal hygiene; in various productive activities such as agricultural irrigation—which utilizes more than two-thirds of exploited water—as well as in industrial, mining and fishing practices among others also adhering to the shared responsibility of ensuring sufficient water in the waterbodies to maintain the equilibrium within ecosystems.

It is rightly asserted that water is abundant in Latin America and the Caribbean. However, it is unevenly distributed in that some areas floods occur frequently while in other areas within the continent, scarcity of water prevails. For this reason, the notion of Water Security becomes pertinent, advocating the need to address four risks: the lack of water (scarcity and droughts) to fulfill various uses while prioritizing human consumption; the contamination of water bodies, and unrestricted use leading to overexploitation situations, as is often the case with aquifers.

Hence, countries are called upon to put into place policies, plans, and actions for water management as a strategic asset, fundamental for their harmonious socioeconomic and environmental development.

CAF has clearly expressed its commitment to become the bank supporting the economic reactivation of the region as well as LAC's green bank. To achieve this, it has set the goal that by the end of 2026, at least 40 percent of its operation approvals will be green, which represents a significant effort for the institution, as well as the voluntary commitment, stated at the United Nations Water Conference in March 2023, to approve operations supporting Water Security in the region for up to USD 4 billion in 2023–2026, which implies an increase of more than 60 percent in the historical approvals in the water sector in the last ten years.

This strategy draws from the experience gained in the last decade supporting countries in their pursuit of water security and aligns with the 2030 Agenda, the Paris commitments, and the Sendai Agenda on disaster risk reduction, considering the region's high vulnerability to droughts and floods, both exacerbated by climate change. Likewise, CAF will support economic reactivation through various actions, including agricultural irrigation, fundamental for rural development in the region, and contribute decisively to ensuring that all Latin American and Caribbean populations have access to essential water and sanitation services as soon as possible, recognized as human rights, and also, out of a sense of social justice for the most disadvantaged.

Christian Asinelli

Corporate Vice President of Strategic Programming

Introduction

Water lies at the heart of sustainable development, and its access for human consumption has been defined by the United Nations as a fundamental right. This aligns with SDG 3, which focuses on health, reducing infant mortality, and morbidity from water-related diseases. It also correlates with SDGs 4, 5, 8, and 10 by enabling children to attend schools instead of carrying water from distant and unsafe sources, thus providing better education and opportunities for future employment, thereby reducing existing asymmetries and inequalities. Furthermore, water contributes to SDG 2 in eradicating hunger, as irrigation systems enable sustainable agriculture and contribute to food security.

Efficient water use enables responsible production and consumption as advocated by SDG 12. It is also crucial for the adaptation and resilience of ecosystems and communities, and can contribute to greenhouse gas mitigation by optimizing water and sanitation systems, both established in SDG 13. Additionally, water contributes to SDG 14, which aims to prevent and reduce marine pollution from activities on the mainland, and to SDG 15, which aims for the sustainable use of terrestrial ecosystems, including wetlands.

Water is also essential for SDG 11 due to its contribution to the new urban agenda and the creation of healthy, inclusive, resilient, and sustainable cities. These cities form the foundation of sustainable economic growth in countries, hosting over 81 percent of the Latin American and Caribbean population in the region.

Therefore, the 2023–2026 Water Security Strategy highlights water as a connector of global agendas, addressing the most pressing sectoral challenges of the region and establishing four strategic objectives. The first objective focuses on water resource management, addressing governance challenges and extreme water events such as droughts and floods. The second objective centers on safe access to water and sanitation, both in urban and rural areas. The third objective aims to reduce water pollution, including untreated wastewater discharge and inadequate management of urban solid waste, which pose health and environmental risks. Finally, the fourth objective focuses on agricultural irrigation, considering the significant potential for expansion in agricultural lands currently reliant solely on precipitation. Given the severe drought experienced in multiple regions of the region, there is an urgent need to bolster food security and sovereignty.

To achieve these strategic objectives and targets, the strategy outlines programmatic lines and actions, which will be implemented through the instruments and tools available to CAF to support countries on the path to water security.

Ángel Cárdenas

Manager, Urban Development, Water, and Creative Economies

Acronyms

LAC	Latin America and the Caribbean
RbC	Result-based contract
ECLAC	Economic Commission for Latin America and the Caribbean
WWC	World Water Council
FAO	Food and Agriculture Organization
GHG	Greenhouse gases
IWRM	Integrated Water Resources Management
GWP	Global Water Partnership
IPCC	Intergovernmental Panel on Climate Change
MPI	Multidimensional Poverty Index
JMP	Joint Monitoring Program for Water Supply and Sanitation (WHO/UNICEF)
UBN	Unmet basic needs
OECD	Organisation for Economic Cooperation and Development
SDG	Sustainable development goal
WHO	World Health Organization
UN Habitat	United Nations Human Settlements Programme
GDP	Gross domestic product
WWTP	Wastewater treatment plant
NbS	Nature-based solutions
SIWI	Stockholm International Water Institute
UNEP	United Nations Environment Programme
UNDRR	United Nations Office for Disaster Risk Reduction
WWAP	World Water Assessment Program

Executive Summary

CAF is firmly committed to becoming LAC's Green Bank and the region's main partner for recovery, sustainable development, and integration. Under this premise, it has set its corporate strategy en route to 2026, which requires the implementation of a set of initiatives developed within the framework of Mission Agendas, Cross-Cutting Agendas, and Enabling Agendas.

The "A3a. Water Security" initiative is one of the fifteen that make up the Mission Agendas, which responds to CAF's vision as a multilateral development bank, addressing the region's needs through specific actions and interventions for water security, a fundamental basis for sustainable development.

The strategy underpins the institution's voluntary commitment to provide financing of up to USD 4 billion over the 2023–2026 period. This commitment was presented at the United Nations Water Conference held in March 2023 and represents a 67 percent increase compared to the average annual approvals in the water sector over the past ten years.

This strategy aims to contribute and respond to two major challenges. The first is related to economic recovery/reactivation, which requires immediate attention and short-term action, where water security plays a fundamental role. The second –no less important– is to contribute to increasing the climate resilience of populations and ecosystems, as well as to mitigating greenhouse gas (GHG) emissions; this second challenge is more far-reaching and demands structural and sustained actions.

Addressing these challenges requires understanding water as a connecting element linking global development agendas, slowed down by the impacts of the COVID-19 pandemic, and establishing water as the driving force for their achievement.

The 2023–2026 Water Security Strategy seeks to build on CAF's ongoing work in the sectoral agenda, identifying persistent sectoral challenges in the region and focusing on those actions that, within the framework of its corporate strategy, are compatible with the priorities established by countries to achieve the goals of the 2030 Agenda.

To achieve this, CAF proposes interventions based on identifying sectoral challenges, structured around four strategic objectives and their respective programmatic lines, operationalized through prioritized activities. In a cross-cutting approach, they emphasize territorial management with the hydrographic basin as the management unit, and its relationship with cities to foster health, inclusivity, resilience, and sustainability, complemented by the inclusion of gender perspective and ethnic-racial diversity.

Sectoral challenges

Contrast between availability and asymmetric distribution. IWRM progress is slow and its institutional framework is fragmented.

Growing water demand and diminished supply in quantity and quality.

Inefficient allocation, use, and control of water resources.

Increased frequency of floods and prolonged droughts, resulting in significant economic losses.

1

Consolidate mechanisms for IWRM, addressing fragmented institutional frameworks, to ensure efficient water use and management of droughts and floods to create resilient and sustainable communities and ecosystems.

The gap in secure access is concentrated in peri-urban and rural areas.

Three times more investment is needed to meet countries' sectoral plans.

Operational costs for managing and maintaining both new and existing infrastructure are significant.

Maintaining services in optimal conditions requires improving governance, management models, and efficiency in service delivery to ensure sustainability.

2

Improve planning and governance, and increase investment in drinking water and sanitation, to promote healthy and inclusive communities.

Management of wastewater and solid waste requires higher prioritization on the public policy agenda.

Regulations discourage the construction of WWTPs, and in several countries, there is no legislation for water reuse.

Weak institutions and mechanisms for monitoring regulatory compliance.

Unsustainable financial schemes (no recovery of CAPEX and OPEX)

Inadequate end disposal of solid waste.

The recycling industry needs formalization.

The circular economy faces barriers to utilizing byproducts from processes.

3

Reduce discharges of untreated wastewater and inadequate solid waste disposal, enhancing their reuse and recycling, for environmental sustainability and green growth.

Agricultural irrigation is essential to improve crop productivity and bolster food security.

There are significant opportunities for expanding irrigated land in the region without encroaching on forests.

Small-scale family farming and intensive agriculture rely on irrigation, with both being equally vital in the region.

Agricultural irrigation is an adaptation measure and stimulates resilience to the effects of climate change.

4

Harness the potential of agricultural irrigation in the region, contributing to Food Security and enhancing farmers' resilience.

Cross-cutting approaches

Territorial management

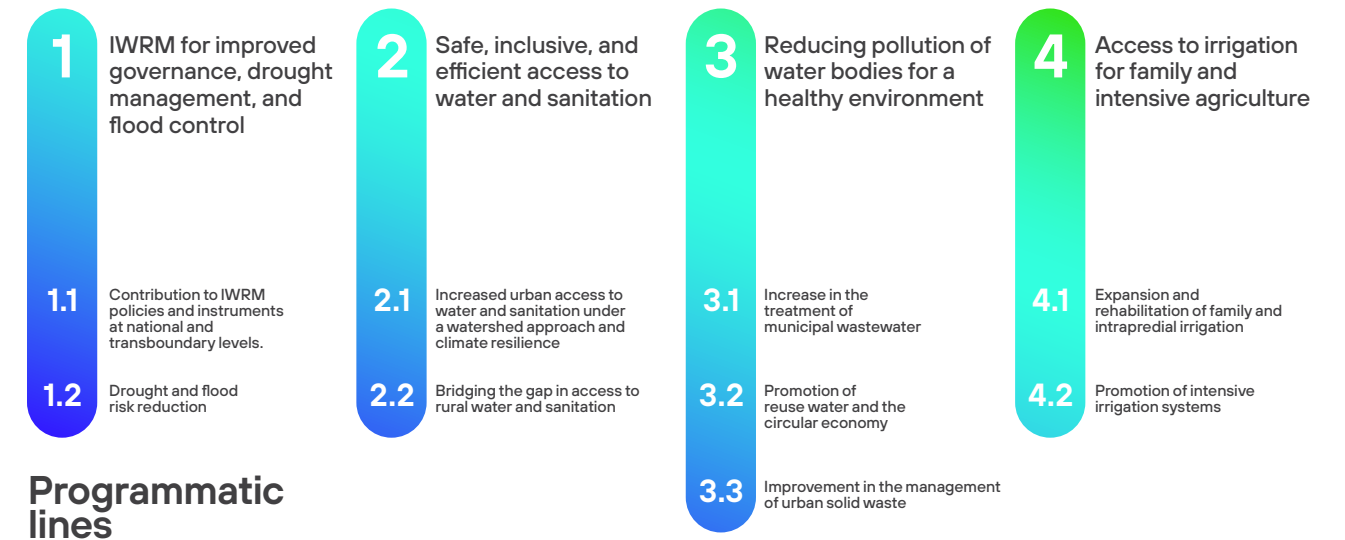
Healthy, inclusive, resilient, and sustainable communities

Gender, health, and nutrition

Water Security Strategy

Promote strategic actions for water security in Latin America and the Caribbean, ensuring access to water and sanitation for the population and productive uses; reducing risks, focusing on basins, scarcity, contamination, and excess water, while strengthening climate resilience of communities and ecosystems.

Strategic objectives

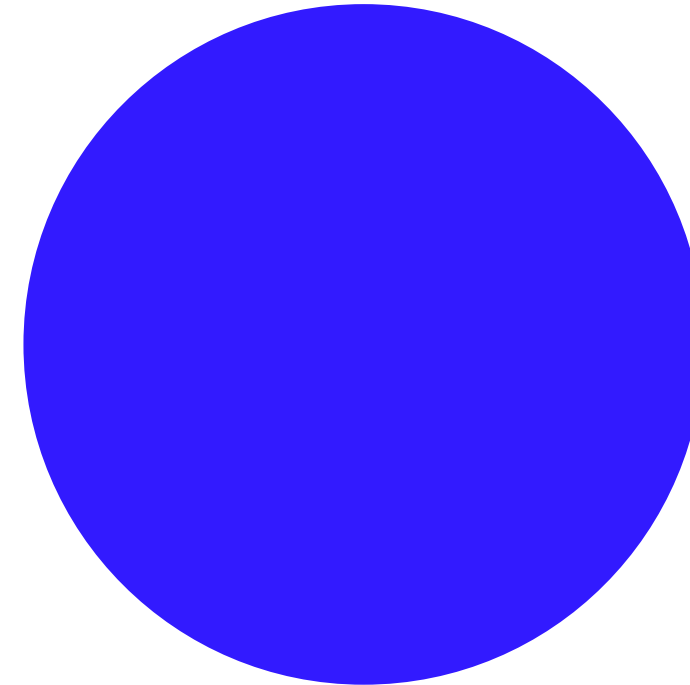


Programmatic lines



Water security in the current context and CAF's corporate strategy

1



CAF's 2023–2026 Water Security Strategy aims to address regional challenges in alignment with the institution's corporate objectives. Water security is a current subject matter addressing two main challenges, outlined in greater detail throughout this chapter. To achieve water security, it is necessary to establish action plans

that address the profound gaps in access to safe water and sanitation, while also promoting productivity through efficient water use. Furthermore, it is crucial to manage promptly the challenges arising from water scarcity, excess, and pollution.

Water: Embedded in CAF's corporate strategy as a connector between global agendas.

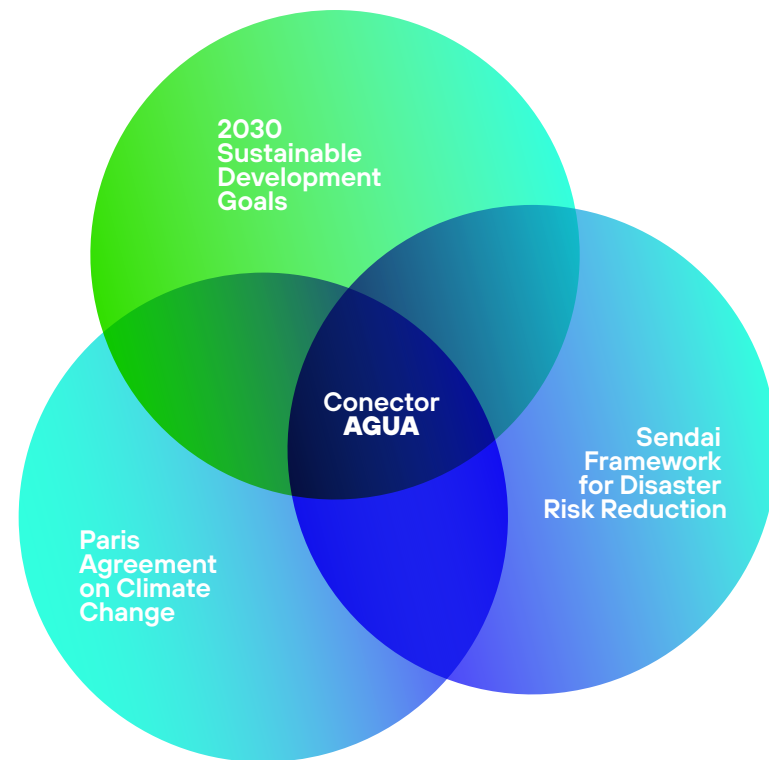
Water connects global development agendas. One of the most far-reaching global commitments relates to the Sustainable Development Goals (SDGs), which establishes

an approach of interrelated objectives, including water management, which directly or indirectly permeates the other objectives¹.

¹ The Kunming-Montreal Global Biodiversity Framework, adopted in December 2022, supports the achievement of SDG 6 and other sustainable development goals, aimed at halting and reversing biodiversity loss and maintaining ecosystem services, including those related to water.

Figure 1. Water: The connector of global agendas

Source: WWAP, 2020



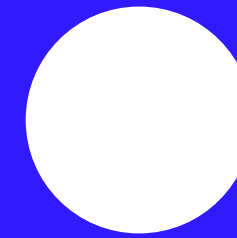
For their part, the Paris Agreements for climate action have resulted in the Nationally Determined Contributions (NDC) that each country commits to achieve, which include climate change mitigation actions, and also progressively incorporate actions in which water is a fundamental element for resilience and adaptation, in addition to being an effective means to connect the effects of climate change with all the SDGs, their interdependencies and potential synergies.

Likewise, the management agreement for disaster risk reduction, better known as the Sendai Framework, establishes guiding principles and priorities in which water management, through the combination of knowledge, perspectives and financial mechanisms, offers a transforming opportunity to turn risk into resilience, poverty into well-being and degraded ecosystems into vibrant ecosystems (WWAP, 2020; SIWI, 2018)² (Figure 1).

CAF is firmly committed to becoming the Green Bank and main partner for the economic reactivation, sustainable development and integration of LAC.

CAF has set, with a view to the year 2026, its objectives to achieve a more integrated, inclusive, green and productive region; to this end, it requires the implementation of a set of initiatives to achieve, among others, the goal that by 2026, 40 percent of the operations financed will be "green", consistent with the global agendas and the plans and programs of CAF member countries. Based on the above, at the end of 2022 CAF's Corporate Strategy was approved, which establishes 27 initiatives aggregated into three interrelated agendas, compatible with the priorities of the countries, which make it possible to contribute to the goals of the SDGs, the Paris climate commitments, and the framework agreement on disaster risk reduction.

² https://siwi.org/wp-content/uploads/2018/06/pb_building-a-resilient-future-1.pdf



Box 1. CAF's 2023–2026 Corporate Strategy

CAF's corporate strategy consists of three types of agendas: Mission, Cross-Cutting, and Enabling, which are articulated for effective implementation.

Mission Agendas: These are fifteen initiatives that respond to CAF's strategic vision toward external clients, focusing on sectors or issues to fulfill the corporate strategy.

Cross-Cutting Agendas: These are six initiatives that encompass components permeating the organization's activities and reflect CAF's actions with its member countries. They work cross-functionally, integrating what is developed with the client (mission agendas) and internal actions (enabling agendas).

Enabling Agendas: These are six initiatives corresponding to the internal elements necessary for the effective execution of the other initiatives.

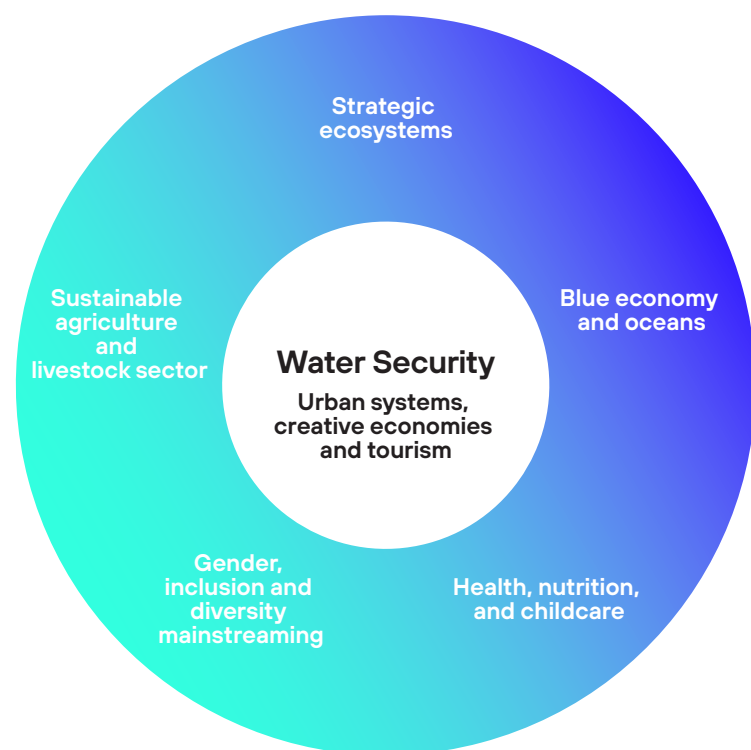
The “A3a. Water Security” initiative of CAF’s Mission Agenda strengthens the scope and impact to contribute to global agendas. The water sector has been one of CAF’s priority areas, progressively strengthening its actions by approving operations totaling USD 6.2 billion over the past ten years, in addition to mobilizing a similar amount from counterpart resources of countries and third-party contributions.

commitment, presented at the United Nations Water Conference held in March 2023, to provide funding of up to **USD 4 billion** over the period 2023–2026. This commitment represents a 67 percent increase compared to the average annual approvals in the water sector over the past ten years, aiming to create healthier, more inclusive, and climate-resilient communities toward a larger goal: the eradication of extreme poverty.

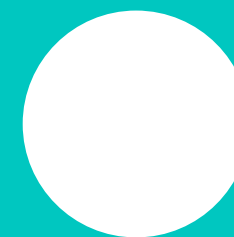
As part of its corporate strategy, CAF has the Water Security mission initiative, which is part of the Resilient Territories Agenda and underpins the institution’s voluntary

Water security is directly linked to other mission initiatives of CAF’s corporate strategy and some cross-cutting initiatives, as shown in the following figure (Figure 2).

Figure 2. Water Security and CAF’s mission and cross-cutting initiatives



The interrelationship that exists in each of them is expressed in the following boxes and descriptions.

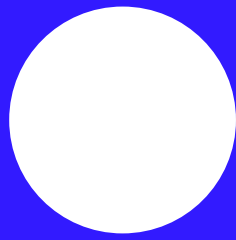


Box 2. Water security and the Strategic Ecosystem Mission Initiative

Water and biodiversity share a symbiotic relationship of mutual needs and convergent interests. The Biodiversity Strategy – BIOCAF 2022–26 provides content to the strategic ecosystems initiative, which is part of the **Biodiversity and Ecosystem Services Mission Initiative**, highlighting the natural heritage of Latin America and the Caribbean present in the territory, bodies of water, and oceans. The complex interactions between species, no matter how small, sustain functional ecosystems and productive economies. Nature sustains livelihoods, acts as a buffer against extreme weather events, and regulates the climate.

Areas with highly biodiverse ecosystems are environmentally healthier, more productive, and more resilient to climate change and natural disasters than areas where ecosystems have been affected by unsustainable practices. Biodiversity is also a crucial element of the natural capital on which societies depend, providing essential “ecosystem functions” such as soil regeneration, air filtration, and water cycles. Therefore, biodiversity loss, along with deforestation and ecosystem contamination, affects the availability and quality of water.

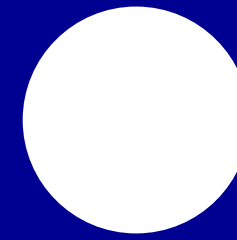
CAF, through its biodiversity strategy, committed at the COP15 on Biological Diversity in Montreal (2022) to prevent biodiversity loss by confronting its underlying causes and addressing biodiversity and climate change issues jointly and synergistically. To this end, actions are planned to conserve and sustainably use ten strategic ecosystems in the region, including the Amazon Rainforest, the Tropical Andes, the ecosystems of the Río de la Plata Basin, the Caribbean Sea, the Humboldt Current upwelling region, all sharing a common denominator: their deep interrelationship with water.



Box 3. Water security and the Blue Economy and Oceans Mission Initiative

Oceans are directly affected by continental activities and river inputs, resulting from urban, agricultural, and mining activities, among others. For example, inadequate wastewater treatment can cause ammonia concentration in the sea, or agricultural fertilizers can cause excessive nutrients in the sea, and continental waters can carry inorganic solid waste (SIWI, 2021). Latin America and the Caribbean is a privileged region in ocean resources, yet the majority of its population and natural resources are extremely vulnerable. The **blue economy** poses a challenge for the sustainable management of ocean resources that requires the building of unprecedented alliances, demanding collaboration and coordination among multiple economic sectors, different levels of government, and various thematic areas of science.

CAF's 2023–2026 Ocean Vision, framed within the Blue Economy and Oceans initiative, which is part of the **Biodiversity and Ecosystem Services Mission Initiative**, aims to manage the multiple aspects of ocean sustainability and a sustainable blue economy, from sustainable fishing practices to ecosystem health. To this end, it plans to support countries by promoting the preservation, protection, and recovery of biodiversity-rich marine-coastal and island ecosystems, the conservation of mangroves and reefs, marine beds, phytoplankton, and blue carbon projects, as well as the sustainability of blue tourism, fishing, aquaculture, and renewable marine energy. Along these lines, at the Ocean Conference in Lisbon (June 2022), CAF announced its commitment to allocate at least USD 1.25 billion to finance investments in coastal and oceanic marine areas for the period 2022–2026, which was ratified at the "Nuestro Océano" [Our Ocean] Conference in Panama (March 2023) in the High Level Panel for a Sustainable Ocean Economy (The Ocean Panel) and the Ocean Action 2030 Coalition. This proposal contributes to achieving the goals of SDG 6 and SDG 14 "Conserve and sustainably use the oceans, seas, and marine resources" in a shorter timeframe.



Box 4. Water security and the Sustainable Agriculture and Livestock Sector Mission Initiative

The **agricultural sector** has strong links with water security. Water availability represents an opportunity, but it can also pose a risk to a country's agricultural performance. Prolonged periods in which crops are exposed to hydro-meteorological and climatic fluctuations affect productivity and the quality of harvested products, making the agricultural sector highly vulnerable to the effects of climate change.

However, few countries in the region have developed strategies to reduce the impact of an eventual reduction in the availability of water resources. Therefore, CAF's 2022–2026 Corporate Strategy seeks to consolidate its role as the green bank and the bank for economic reactivation and social recovery in the region, which implies differential work on various fronts. As part of the six Mission Agendas, the **Biodiversity and Ecosystem Services** agenda incorporates the Sustainable and Productive Agricultural Sector initiative, which aims to support the agricultural sector in its transition to a model of higher productivity and resilience to the impacts of climate change, which is low in emissions and harmonious with biodiversity, prioritizing environmental and social equity.

Similarly, Water Security is linked and articulated with the **Health, Nutrition, and Childcare Mission Initiative**, as the challenges for reducing malnutrition require and demand improving the nutritional and sanitary conditions of people, especially those in vulnerable situations. It is essential to have access to safe water and sanitation, accompanied by the implementation of good hygiene practices, essential aspects for establishing favorable environments for this mission initiative, and also for contributing to family farming for food security.

Water and global challenges: Critical issues in LAC

The world faces two major challenges, the first being economic reactivation. The COVID-19 pandemic hit the world hard, with severe economic and social consequences. The LAC region was no exception, experiencing a marked contraction of around 7 percent in GDP in 2020. In 2021, the region partially recovered and grew by 6.7 percent (ECLAC, 2023), but this growth was insufficient to return to the pre-pandemic situation. Preliminary estimates for 2022 indicate a growth of 3.7 percent (ECLAC, 2023), while for 2023, growth is projected to be only 1.4 percent (ECLAC, 2022b).

Poverty in LAC increased from 186 million people in 2019 to 203 million in 2020, and held at 201 million in 2021 and 2022, with 45% of that population being under the age of 18.

Economic reactivation must also address the strong social effects generated. Poverty increased in LAC by 15 million more people in vulnerable situations than before the pandemic. The region—home to 8.4 percent of the world’s population—witnessed with impotence that pandemic-related deaths in LAC at the end of 2021 accounted for 28.8 percent of the global total (ECLAC, 2022a). During 2022, the region continued to show high vulnerability to the pandemic and, as of September 2022, accounted for 27 percent of the total COVID-19 deaths reported (ECLAC, 2022b).

Finally, there is a clear connection to the **Inclusion, Diversity, and Gender initiative**, which makes it possible to internalize that interventions related to water security must include a gender, inclusion, and ethnic-racial diversity perspective to ensure universal access to potable water and sanitation, particularly for the vulnerable population, including indigenous and Afro-descendant peoples, as well as women and children.

In 2022, 82 million people were living in extreme poverty (unable to afford a basic food basket), 18% of them were under 18 years old.

Social, gender, ethnic, and territorial interrelationships are complex, and recent studies show that, overall, people living in situations of socio-economic vulnerability are at greater risk of infection and death from COVID-19 (ECLAC, 2021).

Lack of safe access to water and sanitation exacerbates poverty and gender and ethnic inequalities. Poverty is multidimensional and affects everyone differently; it affects children, adolescents, and young people more, compromising their future development opportunities, especially impacting the attendance and academic performance of girls, adolescent girls, and women, mainly due to the lack of basic conditions for menstrual management and the time spent fetching water. Moreover, among the working-age population, poverty affects women more than men (ECLAC, 2022), as well as indigenous peoples and Afro-descendants, who are overrepresented at the extreme end of income distribution (CAF, 2022) and face limitations in accessing basic services due to a higher presence of these populations in unhealthy and unsafe urban areas (UNDP, 2021). A home without water and sanitation reflects structural deficiencies in the level of well-being of families, which, as such, constitutes an indicator of poverty.

The pandemic disproportionately affected the poorest, who lacked access to water and sanitation services, at a time when personal and family hygiene was recognized as the first line of defense. Governments and health entities worldwide urged the population to reduce the spread of diseases by proper handwashing with soap and water during the pandemic. However, not everyone had access to water, and water companies were unprepared to meet the emergency, especially in underserved areas. As a result, one of the first measures prioritized by governments was to facilitate access to water. Water operators were instructed to extend their provision even to areas without water networks, typically inhabited by economically disadvantaged populations, using tanker trucks and portable water tanks strategically located in neighborhoods. Additionally, water service operators were tasked with improving service continuity (reducing intermittency) and redistributing water supply, in light of the shift in consumption, which was concentrated in residential areas, as opposed to commercial zones or industrial hubs. This redistribution proved complex in water systems, the majority of which lacked automated management of their distribution networks.

Economic recovery hinges on job/employment recovery, with many sectors relying on water. The Covid-19 pandemic caused an unprecedented crisis in the labor market. Across LAC, there were significant drops in employment and labor force participation, resulting in historically high unemployment rates, disproportionately affecting women, youth, and workers in the informal and low-income sectors (ECLAC, 2022a). Meanwhile, half of the global workforce is employed in eight sectors dependent on water and natural resources: agriculture, forestry, fishing, energy, manufacturing, recycling, construction, and transportation (WWAP, 2016; WWAP, 2019). Therefore, the reactivation and recovery of employment depend on sufficient water resource availability.

The second major challenge entails addressing climate change and its effects. This challenge is more far-reaching, demanding immediate and sustained structural actions that transcend governmental periods. These actions should include policies that focus on reducing the accelerated rate of greenhouse gas (GHG) emissions and concurrently promoting community and ecosystem resilience, including

policies directly aligned with water security. In this context, one concerning effect of climate change is the alarming loss of biodiversity in recent years, leading to what is known as the “twin crisis of biodiversity and climate change” (Solactive, 2023; Citi, 2021; Farber, 2015).

GHG emissions worldwide have been on the rise, and their trajectory is concerning. If GHG emissions lead to warming exceeding 1.5°C by the end of the 21st century, even if only temporarily, many human and natural systems would face serious risks. Depending on the magnitude and duration of the excess warming, this could trigger the release of additional GHGs and irreversible effects (IPCC, 2022b). In this context, the world must achieve net-zero CO2 emissions by the early 2050s, requiring GHGs to peak by 2025 and decrease by nearly half by 2030 (IPCC, 2022). Additionally, methane emissions must be reduced by a third during the same period. These targets necessitate urgent and decisive action.

With just one more degree of temperature rise, the impacts become catastrophic. In 2017, the global average surface temperature exceeded the preindustrial era (1850–1900) by 1.1°C, while in 2022, it rose to around 1.15°C above, confirming that global warming shows no signs of stopping (WHO, 2023)³. This progressive temperature increase brings about changes in hydrological patterns, affecting the intensity and frequency of precipitation, impacting both urban and rural areas, regional connectivity, as well as ecosystems, their services, and biodiversity. Meanwhile, the oceans are undergoing changes in acidity, temperatures, and ocean currents, thus affecting the marine ecosystem. All of these factors contribute to significant impacts on the tourism sector, coastal cities and their infrastructure, the fishing industry, and also on the availability and quality of water. The evidence affirms that the climate crisis is also a water crisis.

LAC is highly vulnerable to climate change. The increased frequency of floods and prolonged droughts, impacting water availability and risking hydro/water and sanitation infrastructure, are consequences of the effects of rising temperatures. Subtropical Andean glaciers receded by almost a third between 2000 and 2018, melting faster than in any other region globally, resulting in the progressive loss of a major water source for consumption,

³ <https://news.un.org/es/story/2023/01/1517852>

irrigation, and hydroelectric power in this continent area. These changes also affect biodiversity; for instance, in the Caribbean, 80 percent of coral reefs have been lost in recent years (World Bank, 2021).

Water is crucial to address both challenges: economic reactivation and climate change adaptation and resilience. As expressed in CAF's 2019–2022 Strategy, water is at the center of sustainable development, with a specific goal (SDG 6) outlining targets to be achieved in water-related matters, which are also interconnected with other SDGs, particularly:

- a. With SDG 3, related to health and well-being, which recognizes water's decisive contribution as a food source, in addition to reducing infant mortality and morbidity from water-related diseases;
- b. With SDG 2, pertaining to hunger eradication, especially through irrigation systems for agriculture, essential to ensure food security;
- c. With SDG 12, on responsible production and consumption, which sets a target to achieve sustainable management and efficient use of natural resources by 2030;
- d. With SDG 13, on climate action, as water is essential for the adaptation and resilience of ecosystems and communities, as well as its contribution, through potable water supply and sanitation systems, to the mitigation of GHG emissions;

- e. With SDG 14, to contribute to preventing and significantly reducing all forms of marine pollution, particularly that caused by activities on land, including marine debris and nutrient pollution;
- f. With SDG 15, focusing on the sustainable use of terrestrial ecosystems, including wetlands and arid areas.

Likewise, it correlates with SDG 4 on quality education, SDG 5 for gender equality, SDG 8 concerning decent work and economic growth, SDG 10 on reducing inequalities, and SDG 11 on sustainable cities and decent housing, among others. Due to the multiplier effects outlined, water also contributes to the eradication of extreme poverty (SDG 1) (see Figure 3).

The challenges mentioned require a realignment of public policies. Governments of countries are called upon to promote: (i) economic recovery, enabling a dynamic reduction of extreme poverty and inequalities, promoting inclusion and sustained economic growth; (ii) clear measures to address climate change, both in terms of climate adaptation and resilience, and in mitigating GHG emissions.

Figure 3. Water and SDG

Source: Authors



CAF is strengthening its role in the water sector to promote economic recovery and green growth in the region. As a development bank,⁴ CAF has not been indifferent to the two major challenges mentioned and has maintained its steadfast support to the countries in LAC during the pandemic, with a commitment to accompany them and promote more inclusive and green growth, aligned with its strategic mission to become the green bank of Latin America and the Caribbean, in addition to being the bank for economic reactivation.

At the end of 2021, member countries unanimously approved a capital increase of USD 7 billion, the largest in CAF's history, which will allow the bank to double its portfolio by 2030. Building on this, CAF has set a goal for its green financing to reach 40 percent by 2026, committing to carry out investments that seek the conservation and sustainable use of the region's natural capital, as well as mechanisms for climate change mitigation and adaptation, a commitment reaffirmed at COP26 and the recent World Water Forum. This entails allocating USD 25 billion over the coming years for operations where water plays a leading role.

⁴ CAF is composed of 20 countries and its total assets exceeded USD 49 billion by the end of 2022.

Developments from CAF's 2019–2022 Water Strategy

CAF's 2019–2022 Water Strategy was centered around water security, a relevant and necessary focus. In early 2019, CAF presented its four-year water strategy, which established water security and its alignment with the 2030 Agenda as a conceptual framework. This provided a structured approach to the institution's efforts in the water sector over the past decade, considering the increasing relevance of the sector in countries' agendas.

CAF's 2019–2022 Water Strategy set five strategic objectives, each with programmatic lines and respective instruments and tools to support their implementation, mobilizing significant financial resources in the region. **Despite the pandemic and the necessary reorientation of priorities by countries, significant results were achieved.** The pandemic demanded that countries reallocate their resources and priorities to address the emergency resulting from the COVID-19 pandemic. Furthermore, a slowdown in project planning and execution was inevitable due to reduced public spending on water and sanitation sector projects, as well as restrictions on human mobility and access to materials, products, and equipment. However, CAF's operations yielded significant results during these four years, including:

- Nearly nine million people in urban areas gained access to new or improved drinking water services.
- 1.5 million people gained access to new or improved sanitation services.
- 1.3 million people benefited from wastewater treatment.
- 80,000 families gained access to irrigation systems for small-scale agriculture.
- 3.6 million people became less vulnerable to disaster risks from floods.

Lessons learned from the implementation of the 2019–2022 Water Strategy reinforce the need to continue fostering adequate planning and pre-investment, as well as sound legal, regulatory, and institutional environments. As a result of the implementation of programs, projects, and technical assistance during the 2019–2022 period, the following reflections emerge:

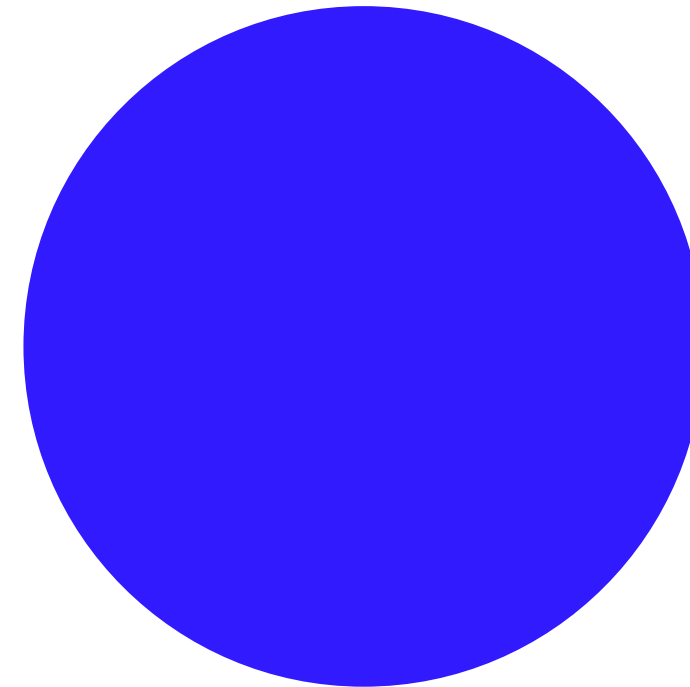
- a. Once again, it is confirmed that the quality of studies and executive projects influences the efficiency in operation execution, the achievement of objectives, and the sustainability of investment, reducing the levels of risks associated with the selection of alternatives, budgets, and deadlines. Recognizing this need, CAF decided to support countries by creating the CAF-PPSA Water Project Preparation Facility, with an allocated fund currently amounting to USD 24 million in non-reimbursable resources, which has financed the implementation of 25 technical design studies, some of which have already been concluded, leading to the approval of investment projects totaling over USD 200 million.
- b. Sectoral management quality and capacity show no significant progress and remain a pending issue, as identified in 2018. Therefore, it is necessary to continue supporting efforts that provide the necessary tools for better governance, transparency, and adequate decision-making. CAF developed an institutional evaluation tool that allows joint identification with the client of areas for improvement and guides the use of institutional strengthening resources that are part of credit operations to support ongoing projects and the management of executing agencies.
- c. The ex-ante definition of indicators, baselines, and targets remains an area to strengthen. In general, countries do not have enough information to establish adequate baselines, making it challenging to define goals resulting from investment projects.

- d. The pandemic underscored the need for water operators to advance in digital transformation. CAF developed a self-diagnostic tool for assessing the technological development level of water operators. The tool—attained by contacting CAF's Sectoral Directorate—is available for anyone interested. The application of some pilots shows that, despite high needs, most operators lack the financial and organizational capacity for a comprehensive digital transformation, given that advancing toward universal service coverage and ensuring continuity and quality remain top priorities. Transitional support, either from the international community or central governments themselves, is necessary to progressively advance in modernizing service provision processes and systems. This will enable operators to prioritize decision-making based on the “value of data” and systematized information, establishing roadmaps to optimize current infrastructure and make more efficient investments.
- e. CAF's ongoing support of the region's countries and their related organizations, actors, and entities contributes to sectoral dialogue, the timely identification of projects and programs, and initiatives built on previous experiences. This fosters greater efficiency and sustainability of investments and services, leading to a better scenario for water security in Latin America and the Caribbean.



Major challenges for water security in LAC

2



Strengthening mechanisms for Integrated Water Resources Management (IWRM) involves addressing fragmented institutional structures to efficiently utilize water and manage droughts and floods to build resilient and sustainable communities and ecosystems.

The region's significant water availability contrasts with its asymmetric distribution amid increasing water use. While LAC comprises 15% of the world's land surface and nearly 30% of its freshwater resources (WWAP, 2016), the distribution of water is uneven.⁵ When considering each country's population, some have per capita availability

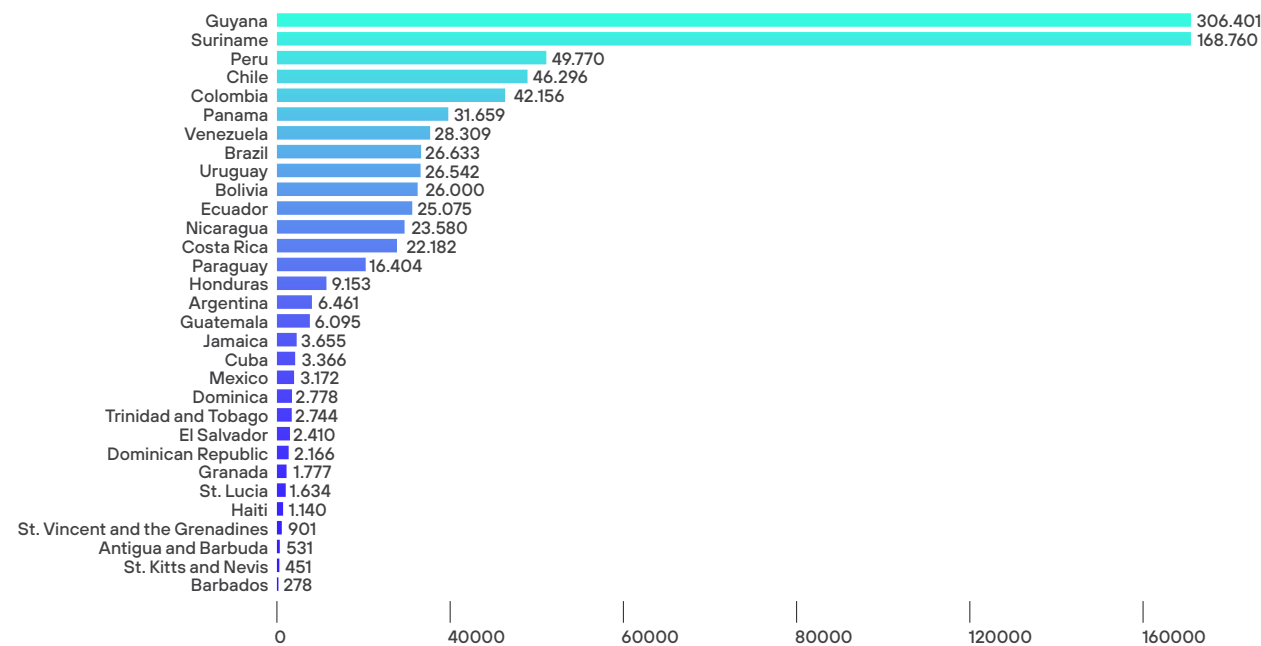
exceeding 200,000m³ per year, while over ten have less than 3,000m³ per year.⁴ Furthermore, disparities in availability occur within countries, notably in megacities like Mexico City or Lima, heavily reliant on sources located in other basins.

⁵ Over 4.5 million km² of xeric, hyper-arid, arid, and semi-arid zones (UNESCO-CODIA, 2022) cover 22% of the region's territory—more than twice the area of Mexico or over three times that of Peru.

⁶ The threshold of 1,700m³ per capita defines a country's water stress (e.g., Haiti and Saint Lucia), with chronic scarcity occurring below 1,000m³ per capita per year.

Figure 4. Renewable Internal Water Resources (m³/capita/year)

Source: Authors based on AQUASTAT data (FAO, 2022)



Water demands are increasing from various user types.

Over the past century, global water demand has increased sixfold and is projected to continue growing at a rate of 1 percent annually from 1980 to the end of the century (WWAP, 2018; WWAP, 2020; WWAP, 2021). As illustrated (Figure 5), the highest demand comes from the agricultural sector, accounting for 69 percent, followed by industrial use—including hydroelectricity—at 19 percent, and municipal use, primarily for domestic purposes, at 12 percent.

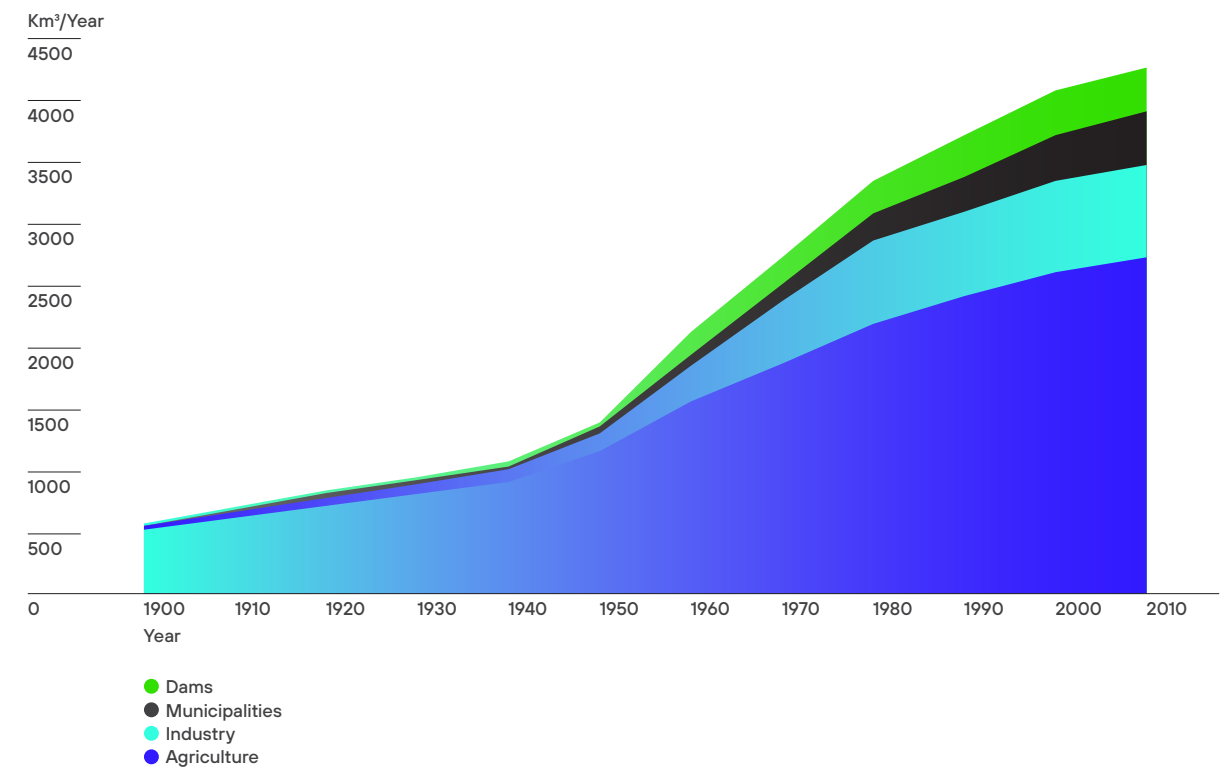
In LAC, the majority of water is allocated to agricultural irrigation, mirroring global proportions (69 percent), followed by demands for human consumption (21 percent), and industrial uses accounting for approximately 10 percent (FAO-AQUASTAT, 2020). This water demand contrasts with the availability of water from nearby sources, leading to water stress and scarcity in the region. In 2019, nearly 150 million people lived in areas of extreme water scarcity (World Bank, 2022), representing 23 percent of the population, highlighting a region with abundance in some areas and scarcity in others.

As water demand increases, water supply decreases.

In addition to growing demand, other factors affecting water supply include (i) a decrease of nearly 7,000 km² in freshwater surfaces in South America (four times the size of São Paulo); (ii) loss of 183,000 km² of permanent snow and glaciers equivalent to the territory of Guatemala; (iii) increased pollution of water bodies (Saravia, 2022), as a result, the number of socio-environmental conflicts initiated between 2000–2019 was four times greater than those initiated between 1980–1999 (Saravia, 2022).

Figure 5. Water use in the world

Source: WWAP, World Water Development Report 2021.



The concentration and growth of the population, higher demand for food, services, and manufacturing, along with impacts on water availability, necessitate the revitalization of IWRM. Due to the uneven distribution of water in LAC, it is essential to regulate, organize, prioritize, and allocate water volumes in line with environmental sustainability criteria. This requires the creation or strengthening of institutional frameworks for water use control, such as basin organizations or similar bodies. These institutions should perform key functions, including (i) allocating water volumes based on availability and priority (e.g., for drinking water, irrigation, mining, industrial use, tourism, and environmental flow, among others); (ii) regulating and penalizing unauthorized water use; (iii) imposing bans during shortages, particularly in overexploited aquifers; (iv) controlling and penalizing wastewater discharges and solid waste disposal in coordination with environmental authorities; (v) managing drought mitigation measures, including infrastructure construction for water storage; (vi) implementing flood

control measures, including hydraulic infrastructure construction; (vii) managing the operation of hydraulic works located in the basin.

In a context of unequal water distribution and increasing demand, IWRM is indispensable, yet its progress in the region is slow and its institutional framework is fragmented. Although many LAC countries incorporate IWRM into their laws and sectoral regulations, there is a need to improve coordination between ministries, specialized agencies, and organizations responsible for water management, both at the central and subnational levels. This fragmentation hinders the application of an integrated approach, and the development of basin organizations is limited, requiring greater political will and financing, as the implementation of IWRM involves budget allocations and a firm commitment from decision-makers, guided by principles of governance, participation, accountability, and transparency.

In addition to efficient management of water allocation, use, and control, droughts must be addressed.⁷

Droughts are lasting longer and causing significant damage, with the LAC region being one of the most heavily affected. Droughts increased by 28 percent between the periods 1980–1999 and 2000–2019, affecting 1.43 billion people. Three cases illustrate droughts: São Paulo, Brazil, in 2014, where 71 percent of citizens experienced water interruptions; La Paz, Bolivia, in 2016, affecting 340,000 people and virtually halting activities for over 15 days; and the recent drought in the metropolitan region of Montevideo, the worst in five decades, deteriorating water quality by mixing freshwater with saline water (prompting the Ministry of Health to temporarily raise the maximum permissible levels of chlorides and sodium to ensure the continuity of service). On the other hand, rural areas are

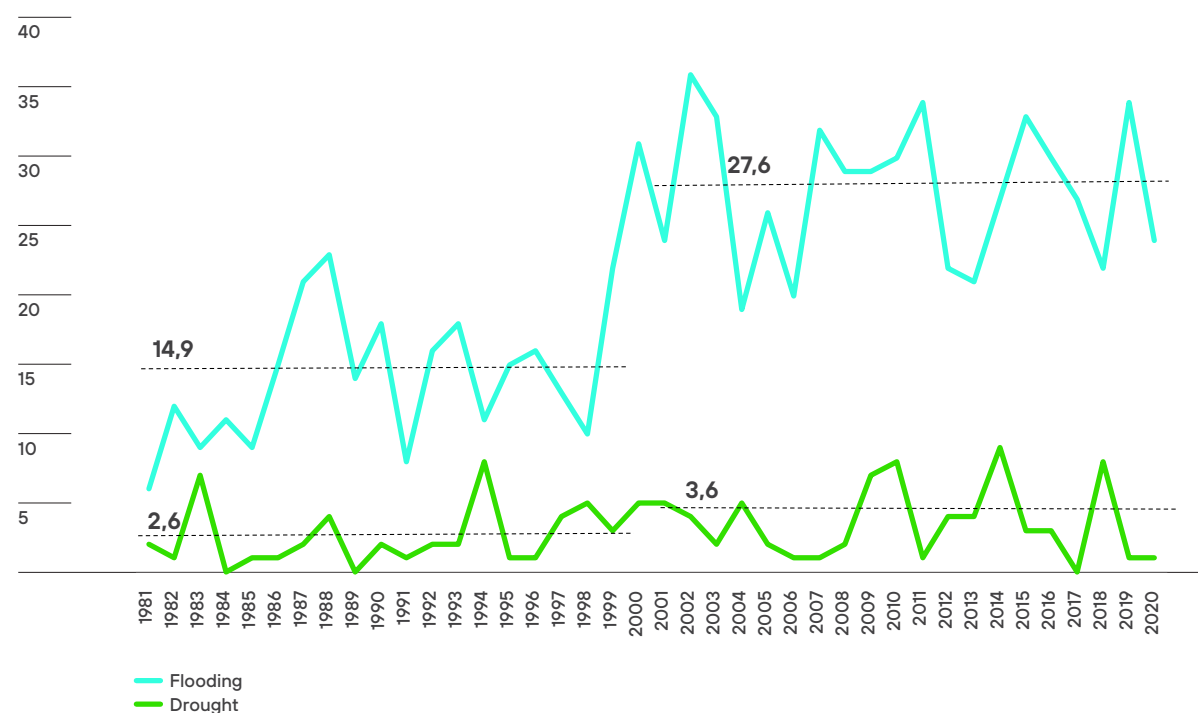
also impacted by droughts, with several countries in the region declaring agricultural emergencies due to water shortages, affecting production and food sovereignty.

Conversely, the frequency of floods in the region has almost doubled over similar periods.

Floods rank first among global disasters, increasing by 134 percent between 1980–1999 and 2000–2019, with the annual average rising from 69 to 163 events, affecting 1.65 billion people. In 2021, the number of floods escalated to 223 events (UNDRR, 2022). In LAC, floods increased from an average of 14.9 events in 1980–1999 to an average of 27.6 events in 2000–2020 (Figure 6), an 85 percent increase.

Figure 6. Frequency of droughts and floods in LAC

Source: Authors using the EM-DAT database (2022)



⁷ Drought can be defined as an exceptional shortage of water compared to normal conditions (GAR, 2021).

Economic losses over the last 20 years due to drought and flooding are significant for the region.

Direct economic losses in the region due to drought effects are estimated at USD 28 billion over the last 20 years (2003–2022), accounting for 15 percent of global drought losses, even though the population of LAC represents only 8 percent of the world's population. Thus, the economic damage in the region is practically double per capita compared to the global benchmark. Additionally, economic losses from floods total nearly USD 35 billion in the period 2003–2022, representing a cost of USD 54 per inhabitant. Both disasters entail an economic cost in the region of just over USD 3 billion per year, nearly half of what the region invests in drinking water and sanitation annually. If negative externalities, such as rural-to-urban migration and international migration, are added to this equation, the economic cost is even higher. For example, in 2014, the significant increase in the number of Guatemalans attempting to enter the United States coincided with the beginning of the El Niño drought in the Dry Corridor of Central America (WWAP, 2020).

Risks from droughts or floods result in significant damage to cities, which are home to the largest populations and concentrate the GDP of countries.

Floods worsen in cities as urbanization waterproofs large areas, intensifies heat waves, and contributes to increased precipitation, leading to more intense runoff (IPCC, 2022a). At the other extreme, water scarcity and droughts (CDP, 2017) lead to reported cases of cities implementing water supply rationing, sometimes in extreme situations, such as the recent case in the metropolitan area of Montevideo, Uruguay. Furthermore, water supply interruptions can have significant socio-economic, environmental, and health impacts (IWA-RIOC, 2022). Managing both extremes leads to achieving climate-resilient cities capable of functioning in the face of extreme events, allowing residents to maintain and develop their lives (Rockefeller, SIWI & ARUP, 2022). This must consider the hydrological context of cities and related watersheds, as well as the interrelations between water and other essential urban systems.

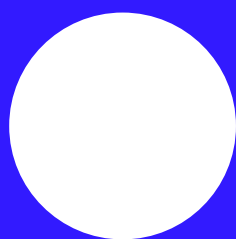
Environmental water management in the watershed is equally essential for enabling sustainable communities and ecosystems.

Understanding that the water use cycle needs to reconnect with its natural cycle is crucial. In particular, new urban areas must adopt principles to increase buffering capacity and reconnect with watersheds to restore healthy river hydraulic regimes (SIWI, 2016). This transition toward the new urban agenda, advocating for the reconnection with the natural water cycle, can adopt the **5R** principles of the circular economy: "reduce" water consumption, "reuse" water, "recycle" materials and nutrients, "recover" energy, and "restore" the surrounding environment (SIWI, 2016). Additionally, in the presence of indigenous peoples, it is essential to consider their environmental worldview, so that, based on their knowledge of indigenous territoriality, customs, and traditions regarding water use, more inclusive and sustainable watershed management strategies can be designed.

Many basins transcend national borders, and few have cooperation agreements or treaties.

In Latin America and the Caribbean, there are 69 transboundary basins, some of them very significant, such as the Amazon, which covers 5.86 million km², the La Plata Basin, which reaches 2.96 million km², or the Orinoco Basin with 960,000 km², representing 92 percent of the total surface area of transboundary basins in the LAC region, and accounting for 68 percent of the total available freshwater on the continent (UNESCO-CODIA, 2022). In South America, only four transboundary basins have international treaties signed between countries, namely the La Plata, Lake Titicaca, Amazon, and Merín Lagoon basins.⁸ Therefore, sectoral international community efforts have promoted hydro-diplomacy aimed at reaching agreements between countries before water conflicts arise.

⁸ In addition to treaties, there are other cooperation mechanisms, such as conventions and operational agreements.



Box 5. Toward resilient and sustainable cities

Santo André has a population of 716,000 and is part of the Greater ABC of São Paulo, consisting of seven municipalities in the São Paulo Metropolitan Region, home to about 2.8 million people. This region is one of Brazil's most significant industrial hubs.

Located in the Alto Tietê basin, encompassing five important subbasins, Santo André faces recurrent floods due to the impermeabilization of surface areas as a result of rapid urban expansion, resulting in economic losses. In response, CAF funds the SANEAR Santo André Program, ongoing since 2019, aiming to reduce flood risk through macro drainage interventions and improve solid waste management in the Municipality of Santo André.

The program includes urban drainage, hydrometeorological monitoring, and solid waste management, with key interventions being: (i) a flood detention basin in "Parque da Juventude" (approximately 215,000 m³); (ii) channelization of the Cassaquera stream (approximately 1,700 m); and (iii) expansion of the monitoring and early warning system.

The Cassaquera stream project, completed in January 2022, goes beyond flood mitigation in its area of influence. The intervention, within a broader concept of water and city, included the channeling of a 1.7-kilometer stretch of the stream. It also involved creating a new road system along its banks, as well as pedestrian paths, bike lanes, and urban spaces with trees.

The new system sees a daily flow of 10,000 vehicles, easing congestion in other parts of the municipality. For some residents, the intervention led to a reduction in travel times by up to 50 percent. It also impacted the lives of those who use public spaces for work, resulting in increased local commerce. Thanks to the improvements in urban spaces and increased vehicle movement, sales at regional establishments have risen. Residents also report more frequent use of the canal area for physical and recreational activities, along with improved citizen safety thanks to the new public lighting system. The intervention serves as an example of how to create quality urban spaces with water security as a driving force.

Improving planning and governance, and increasing investment in drinking water and sanitation to promote healthy and inclusive communities.

The LAC region is the most urbanized in the developing world, with deficient safe water services in peri-urban areas. Cities in the region constitute an ecosystem hosting 81 percent of the total population, estimated to reach 88 percent by 2050 (UN-Habitat, 2022), including several megacities: Mexico City; São Paulo; Buenos Aires; Rio de Janeiro; and Lima. These megacities, along with large cities, have given rise to precarious peri-urban settlements, with the proportion of inhabitants living in informal neighborhoods decreasing from 32 percent in 2000 to 22 percent in 2010, and to 17.7 percent in 2020, though the absolute figure remains significant: 96 million (UN-Habitat, 2022), justifying the label of dual cities,⁹ divided and segregated, both spatially and socially (UN-Habitat, 2012). Moreover, 106 million people living in urban areas do not have access to safe water (JMP, 2023), with a high likelihood that this same population overlaps with those residing in informal settlements. It's noteworthy that the lack of access or continuity of drinking water services unfavorably impacts the time and productivity of these households, disproportionately affecting women, given existing gender roles and norms (Saravia, 2022b).

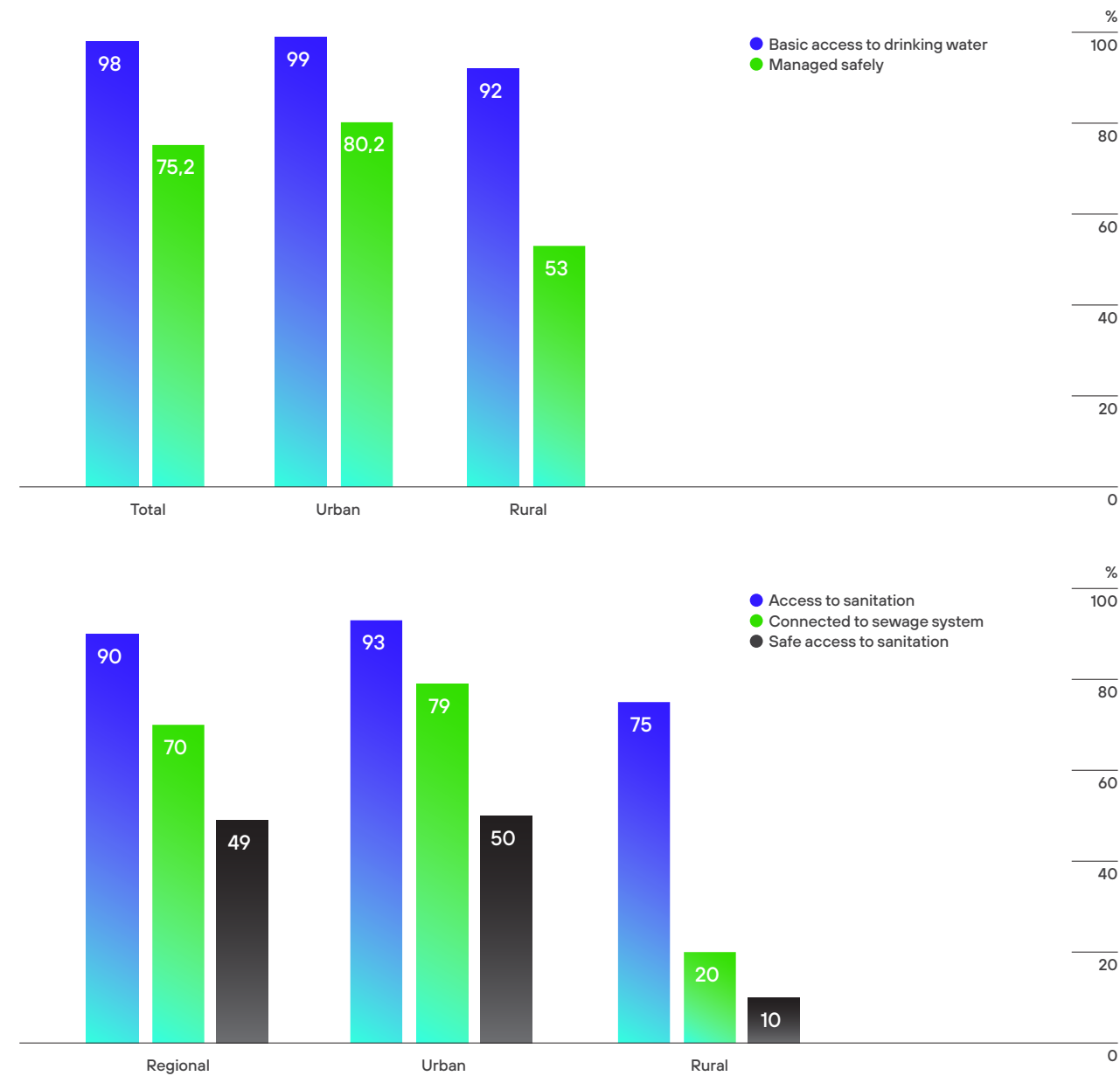
The urban gap for sanitation with treated wastewater is even more pronounced. Around 314 million urban residents lack sanitation services with treated wastewater (58 percent of the urban population), partly because 110 million lack sanitary sewerage and discharge into precarious on-site facilities or outdoors, while the rest discharge their effluents into receiving bodies without proper treatment.

Connecting cities with their basins requires multi-level governance. Water used by downstream users may be affected by upstream activities, and the responsibilities of governments in resolving conflicts caused by water distribution or contamination will depend on each country's institutional framework. In this perspective, governance refers to formal and informal, vertical and horizontal processes, and those of interaction and decision-making among stakeholders involved in a collective interest problem that leads to the creation, reinforcement, or reproduction of social norms and institutions (Hufty, 2011). The OECD has developed a multi-level water governance framework (OECD, 2012), which identifies seven gaps: (i) administrative; (ii) informational; (iii) policy; (iv) capacity; (v) funding; (vi) objectives; and (vii) accountability, to ensure that different sectors and administrative levels share authority for policy formulation, accountability, and implementation, ensuring sustainable economic, social, and environmental relations along the urban-rural continuum (GWP, 2013; IWA-RIOC, 2022).

On the other hand, **the rural gap in access to water and sanitation services is proportionally high.** Indeed, 4.7 out of 10 rural residents lack safe water access (JMP, 2023), which is related to the number of people lacking basic conditions for their development and well-being (1 out of every 2 rural residents is poor) (ECLAC, 2019b). Moreover, only one out of every ten households has safely managed sanitation. Overall, the challenge of advancing sanitation is greater than that of drinking water, as public demand and prioritization are low, largely due to insufficient health education and less population awareness of the risks and diseases associated with the lack of sanitation (Figure 7).

⁹ "Dual cities" is a sociological term that expresses the coexistence, within an urban space, of a socially and economically polarized urban structure.

Figure 7. Basic safe access to water and sanitation in LAC
 Source: Authors based on data from the Programa de Monitoreo Conjunto, 2023



Regional regulations emphasize the human right to water and sanitation, followed by sectoral plans aimed at universal access, but deficiencies persist in their planning and execution. In July 2010, the United Nations

General Assembly recognized access to safe drinking water and sanitation as an essential human right for the full enjoyment of life and all human rights. More than 12 years have passed since this event, and the results are not

satisfactory. Targets under SDG 6 regarding universal access to both services become less achievable, with implications for health and food security, particularly for the most vulnerable populations.

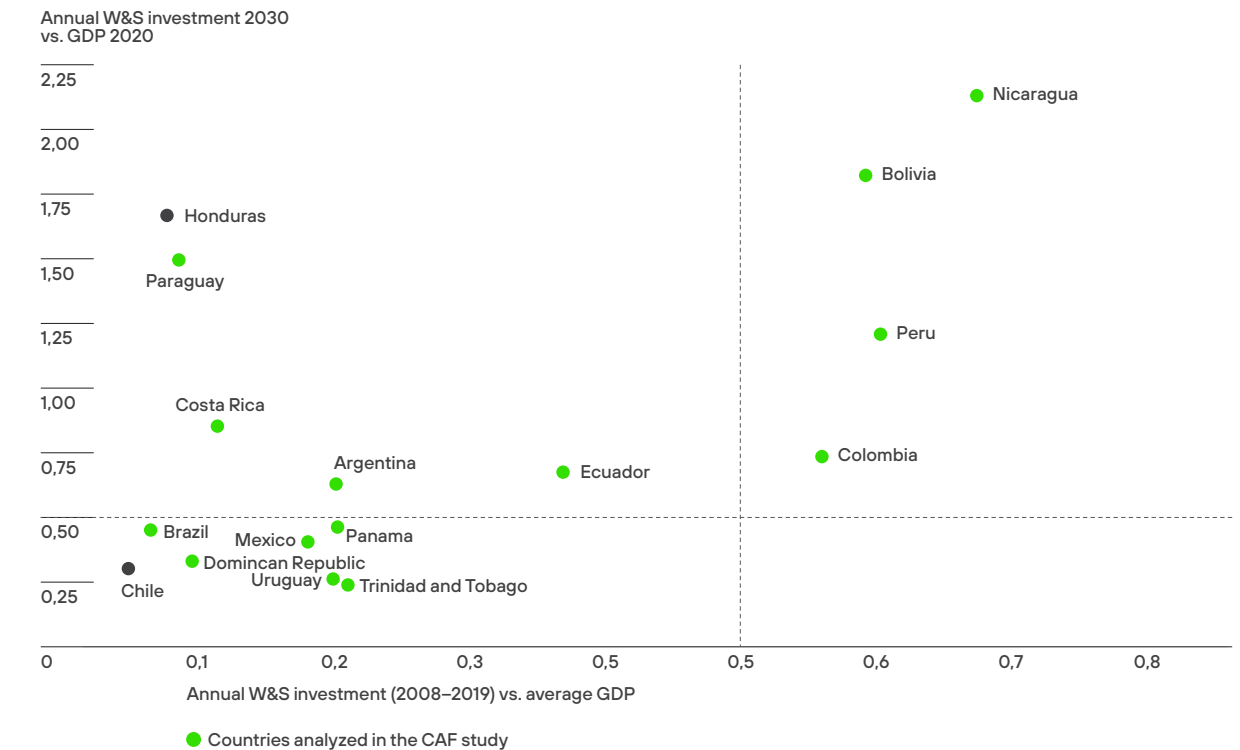
It is necessary to at least triple the investment to meet the countries' sectoral plans. Public investment in water and sanitation in recent years has been around USD 7 billion annually on average (INFRALATAM, 2022). At this pace, the region is not on track to meet SDG 6. CAF compiled the sectoral plans of 13 countries and, based on them, a projection was made, concluding that

an annual investment equivalent to 0.55 percent of GDP is required on average (CAF, 2023).¹⁰ This does not imply that all countries should invest in the same proportion; it is crucial that those lagging review their strategy and budgets allocated to the sector (Figures 8 and 9).

Figure 9 presents the average annual per capita investment required in different countries relative to their respective GDP in 2020.

Figure 8. Investment expressed as a percentage of average GDP 2008–2019 and projected to 2030

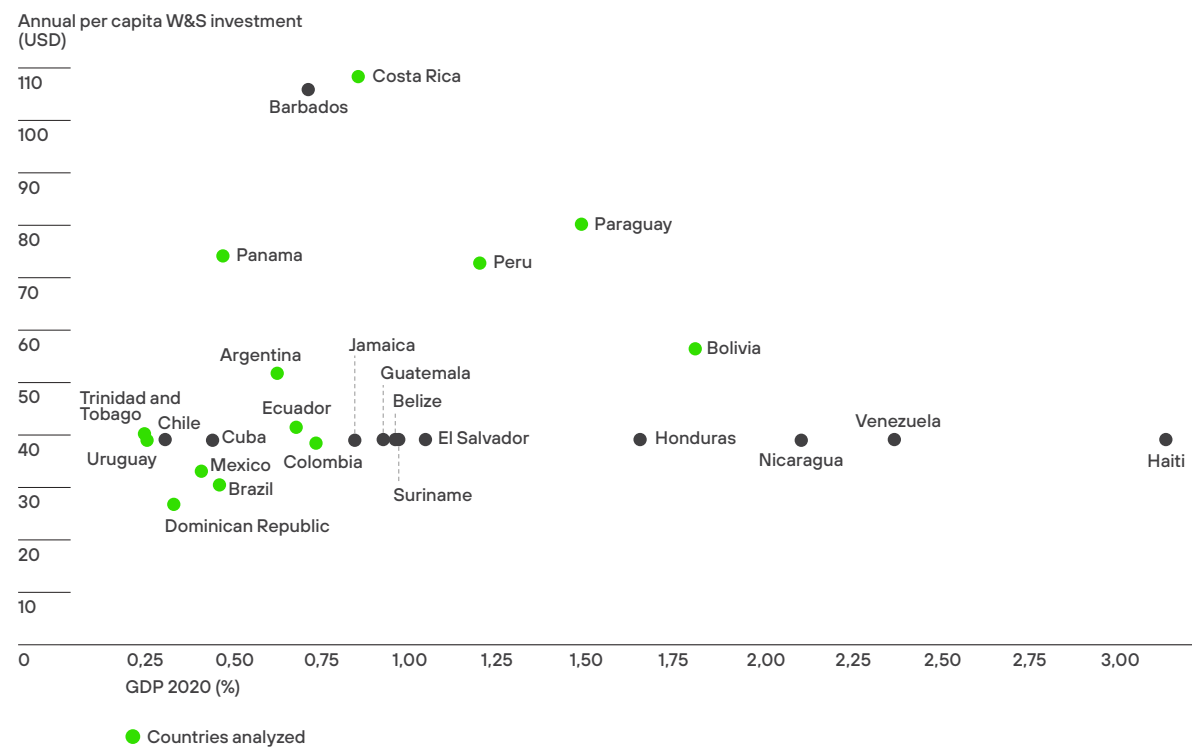
Source: Authors based on the Investment Gap Report for 2040 (2022)



¹⁰ The GDP of Latin America and the Caribbean at constant prices in 2020 was 4.74 trillion dollars, while in 2021 it was 5.45 trillion dollars (World Bank, <https://datos.bancomundial.org/region/america-latina-y-el-caribe>).

Figure 9. Per capita investment requirements and percentage of GDP in LAC

Source: Authors based on the Investment Gap Report for 2040 (2022)



Operational costs associated with new infrastructure and the management of existing infrastructure also require a significant increase. A study conducted by CAF (CAF, 2023) concludes that to operate and maintain the current and projected new infrastructure under a “business-as-usual” scenario, an annual expenditure similar to the investment is required (USD 26 billion on average annually). Assuming that water losses (physical and apparent) are reduced through technical measures (leak control) and commercial measures (micrometering and elimination of unauthorized uses, among others), and asset management is improved through digital transformation actions, operational costs can be reduced by between 15 to 20 percent from the original scenario.

Maintaining services in optimal conditions implies improving the governance of services, reviewing management models, and their sustainability. Except for the largest operators in the region, most have expanded their water and sanitation coverage with strong fiscal support for investments,¹¹ coming from central governments through national programs. Along these lines, operators—hand in hand with sector regulators—need to review and update tariffs, preserving affordability criteria for vulnerable populations. In the region, there are cases where tariffs have not been updated for decades. But this is not enough; it also involves establishing minimum scales given the high fragmentation of operators, making it essential to review management models and promote aggregation strategies that guarantee adequate economies of scale or scope, as well as strengthening their capacities and corporate governance, with accountability, transparency, and participation.

¹¹ Except in Chile, which promoted private sector participation of its main urban operators in the late 1990s, and to a lesser extent, Mexico, Brazil, and Colombia.

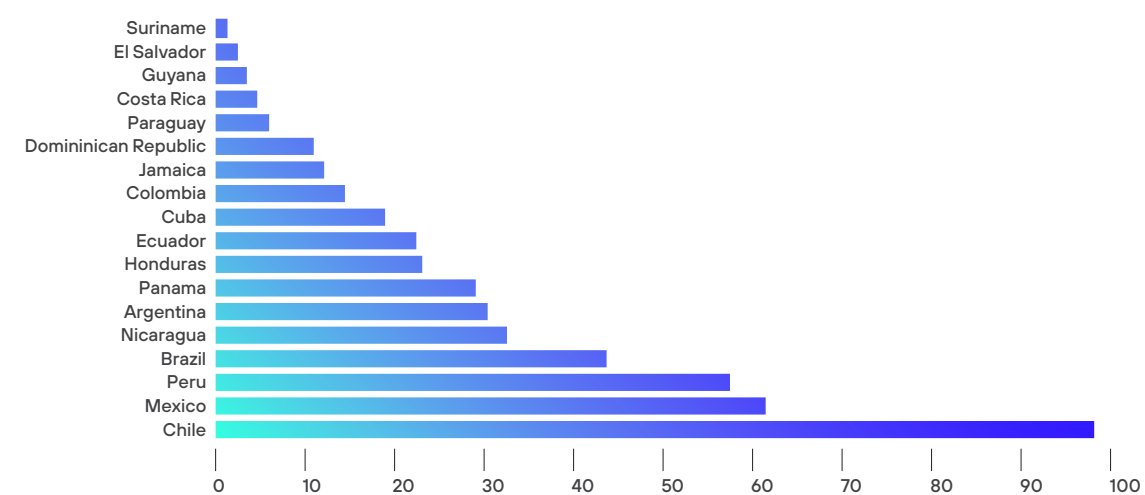
Minimizing untreated wastewater discharge and inadequate solid waste disposal, promoting their reuse and recycling, supports environmental sustainability and green growth.

Wastewater management must be made a higher priority on the public policy agenda. In the region, global coverage is 36 percent, with 42 percent in urban areas and only 10 percent in rural areas (JMP, 2023). These low coverage levels denote the minimal consideration paid to it. As Figure 10 shows, progress is uneven across LAC, and in several countries, there is no data recorded, confirming the lack of attention given to this area within their records and analyses. In general, services have advanced in stages, first drinking water supply, then sewerage services, and finally wastewater treatment, even ignoring issues such as stormwater drainage and solid waste management in cities, which are part of basic sanitation. Positioning the reduction of pollution on the public agenda requires work at different levels, not only by government actors but also through citizen awareness.

Regulatory frameworks often discourage the construction of treatment plants. A study conducted by CAF (CAF, 2022) found that one of the limitations to progress in the development of treatment plants is the existence of very stringent regulations, which do not discriminate based on the receiving water body, and as such, may unnecessarily increase the cost of treatment plants. In fact, the research concludes that in most cases, there is no graduality in the requirement for compliance with maximum permissible limits (MPLs) of the parameters to be controlled, regardless of the flow rate or uses of the receiving body. Only some countries include the concept of the dilution capacity of the receiving water body in their regulatory instruments, which makes it possible to regulate its parameters and flexibilize the requirements according to needs, impacting investment levels.

Figure 10. Urban wastewater treatment coverage (2022)

Source: Authors with data from the JMP up to 2022, WHO-UNICEF, 2023



The institutions and mechanisms for enforcing wastewater discharge regulations need improvement.

. Another finding in the aforementioned study is that the institutions responsible for enforcing environmental regulations lack sufficient staffing and tools to properly monitor discharges, and few countries have punitive mechanisms that encourage compliance with the rules. As a result, many wastewater treatment construction or expansion programs did not yield the expected results due to limited monitoring capacity. An even greater challenge is monitoring wastewater that does not discharge into urban systems (from industrial or mining sources), as it can severely affect ecosystems and biodiversity. In some cases, the damage can be irreversible¹² and reduce water availability, exacerbating socio-environmental conflicts. Agricultural returns are also contaminating, especially those that result in pesticide and fertilizer residues, whose control is even more complex due to their diffuse and dispersed nature.

Overall, the investment costs of wastewater treatment are not recovered. Few countries and operators have differentiated rates that reflect actual costs. Generally, charges for wastewater treatment are part of sanitation fees, which include sewerage systems, and this charge is often determined as a percentage of the drinking water tariff, although actual costs may be higher. Therefore, sewerage and treatment costs are often subsidized by the drinking water tariff, or the service provided is of poor quality.

The increasing generation of urban solid waste warrants prioritization on the public agenda. Solid waste generation increases as the population grows, and it is estimated that in LAC (UNEP, 2018), the scenario for 2050 will be around 245 million tons per year. However, while service coverage in cities is high (90 to 95 percent), it is not effective (Hettiarachchi et al., 2018; UNEP, 2018; IDB, 2021a), as it is estimated that more than 35,000 tons per day are not collected, affecting more than 40 million people (UNEP, 2018). Additionally, most collection services are not differentiated, which does not favor the recovery of recyclable materials. Likewise, collection system designs lack efficiency criteria, as seen in the lack of transfer stations to improve logistics.

12 Wastewater from industrial and mining activities may contain toxic organic compounds such as hydrocarbons, polychlorinated biphenyls (PCBs), persistent organic pollutants (POPs), volatile organic compounds (VOCs), and chlorinated solvents (WWAP, 2017).

The final disposal of solid waste is inadequate in much of the region. Approximately 145,000 tons per day in the region end up in dumps or open-air landfills, without any environmental or health protection measures, where burning or other inappropriate processes are practiced, equivalent to waste generation from 170 million people (UNEP, 2018). There are countries where open-air landfills are the primary option for final disposal, and it is estimated that 40–45 percent of the total solid waste generated is disposed of in unsuitable sites (IDB, 2021a; UNEP, 2021a).

Governance around solid waste needs better management through the implementation of sector-oriented policies. The contrast between policy objectives and waste management plans, as well as the results and performance of implementing these instruments, demonstrates institutional framework failures (World Bank, 2021). Regulatory dispersion, as well as the normative framework for management and oversight, can be complex in promoting a dynamic and sustainable economic sector. The lack of technical capabilities for waste management at different stages represents a barrier to maintaining an adequate level of service. Finally, citizen participation is low, as well as that of different actors in the public and private sectors, reflected in low rates of recycling and waste utilization, around 4 percent (UNEP, 2021a; Correal et al., 2021; World Bank, 2021).

The financial frameworks of solid waste management services are not sustainable. The pricing structures do not reflect the real costs, as in the region, the fees only recover 50 percent of these costs (Correal, 2021; Hettiarachchi et al., 2018). It is estimated that only 65 percent of cities in the region effectively charge for waste management services (Hettiarachchi et al., 2018), often linking the fees to property taxes or services such as water or electricity (UNEP, 2018). Additionally, capital investments are insufficient to provide quality services.

Regionalization of waste management services is not yet an option to generate economies of scale. Regionalization experiences for waste management services provision demonstrate, with varying levels of efficiency, the possibility of generating economies of scale to distribute investments among different actors. This favors the reduction of operating and maintenance costs, which would allow for investment in better technologies and reduce environmental and social impacts. In some countries, regulations require or promote the formation

of consortia of waste management service operators, but there are difficulties in implementing such arrangements, such as defining disposal sites and their governance and institutional framework.

The recycling industry depends on the informal sector, making formalization necessary. Due to a lack of market information, organized systems for collecting recyclable materials, and low citizen participation in source separation, the informal sector plays a leading role in managing recyclable waste. The incorporation of recuperators into production chains requires concerted efforts with the private sector to valorize recyclable materials and generate markets, as well as with citizens to develop habits of separation and classification of recyclable materials. There are experiences related to the formalization of recyclers that can inspire approaches to formal and paid work.

Harnessing the region's agricultural irrigation potential, which contributes to food security and improves resilience within the agricultural sector.

Agricultural irrigation is essential for improving crop productivity. It provides the opportunity to ensure water availability year-round, extend cropping cycles, and diversify production. In essence, it involves increasing the productivity of crops that currently have low yields due to scarce precipitation (Rosa, 2022). Irrigated agriculture is at least twice as productive as rainfed agriculture and is essential for food security. Crop rotation can also be added, further increasing productivity and tending to stabilize farmers' incomes. LAC represents 14 percent of global production and around 23 percent of global agricultural and fisheries exports (OECD-FAO, 2019).¹³

Agricultural irrigation is also essential for reducing hunger and malnutrition, contributing to food security. Increased local food production helps counteract hunger still experienced by millions of undernourished people in Latin America and the Caribbean, which rose from 43.3 million before the Covid-19 pandemic to 56.5 million by late 2021, accounting for 8.6 percent of the population

The circular economy still faces limitations to the sustained utilization of by-products from wastewater treatment plants and solid waste. As water distribution in the region is uneven, the reuse of wastewater presents an opportunity, especially in arid areas or those with low resource availability. Additionally, there is potential to harness by-products associated with water and solid waste treatment processes for energy generation, which can be used in facilities themselves or even sold to city electricity distributors. Despite the benefits mentioned, it is necessary to strengthen regulatory frameworks that encourage the circular economy (UNEP, 2014; World Bank, 2021). For example, few countries have technical standards for wastewater reuse (CAF, 2022), and there are restrictions limiting the possibilities of self-generation and commercialization of energy by third parties.

(FAO, IFAD, WHO, WFP, and UNICEF, 2022), as well as reducing malnutrition, reflected in the fact that 7.5 percent of children under five years of age are overweight in the region, and 11.3 percent of the same age group suffer from stunted growth, the result of which is irreversible (UNICEF, WHO, World Bank, 2022).

Significant expansion opportunities exist in the potential area for irrigated land in the region. In 2021, agriculture accounted for 4.6 percent of GDP; however, in seven countries, it represents more than 10 percent of GDP: Bolivia, Paraguay, Nicaragua, Dominica, Guyana, Honduras, and Haiti; in 11 others, it represents more than 5 percent of GDP, including Argentina, Uruguay, Ecuador, Colombia, and Peru.¹⁴ It is also important because 14 percent of the workforce is employed in agriculture, and in some countries, it is significant: Honduras (31%), Nicaragua (30%), Guatemala (29%), Bolivia (28%), Ecuador (27%), Peru (27%), and Paraguay (19%).¹⁵

13 Según el sitio <https://www.fao.org/americas/acerca-de/es/> las exportaciones podrían llegar a representar el 25%

14 <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS>

15 <https://www.statista.com/statistics/1082252/latin-america-caribbean-share-employment-agriculture-country/>

Overall, it is estimated that the irrigation potential in the region reaches 96 million hectares, while the area equipped for irrigation does not exceed 28 million hectares. For example, Colombia currently has an irrigated area of just over 1.1 million hectares, while its potential is 18 million hectares. Meanwhile, in Peru, the potential irrigated area is estimated at 6.4 million hectares, with an area equipped for irrigation of around 2.6 million hectares and an effectively irrigated area of 1.8 million hectares.

Irrigation for family farming coexists with that of intensive agriculture, both equally important in the region, and there is potential for gender equality. It is estimated that there are 16 million family farming operations, involving more than 60 million people and utilizing 23 percent of the agricultural land in LAC (FAO, 2014). These farms provide between 27 percent and 67 percent of total food production at the country level and generate between 57 percent and 77 percent of agricultural employment, but further training is necessary to improve yields, technological advancements, diversification, and local market commercialization. In this regard, it is important to consider women's participation in these productive units, as many do so as unpaid family labor while balancing domestic household activities, and because there is a trend toward women's access to land ownership, still with gaps in the management of productive resources (Saravia, 2022b). Furthermore, there are large-scale intensive irrigation and agro-export projects in most countries, which require clear public policies to motivate private sector participation, providing legal certainty for their implementation.

Agricultural irrigation is an adaptation measure and, as such, stimulates resilience to the effects of climate change. Irrigation is a climate-smart agricultural (CSA) technology in arid and semi-arid areas and is often essential for the deployment of any other technology (IFPRI, 2020). Rainfed agriculture supports 60 percent of global food production but relies heavily on climatic conditions. Therefore, rural communities that mainly depend on rainfed agriculture will be most affected by climate change (Rosa, 2022). Therefore, establishing irrigation as a climate adaptation solution would alleviate stress from increased heat and water stress on crops, reducing the effects of variability and climate change. However, this must go hand in hand with promoting so-called "sustainable irrigation," which advocates for reducing water demand, improving productivity, and increasing soil moisture, all of which are adaptation measures in an increasingly water-scarce environment (Rosa, 2022).

In summary, the main issues and challenges that CAF is working to achieve water security in LAC are outlined below.

Sectoral challenges



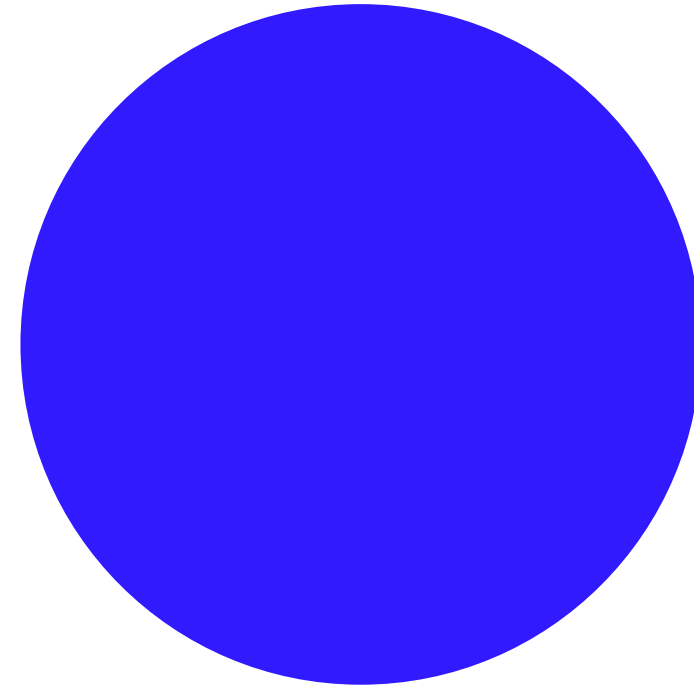
Cross-cutting approaches

- Territorial management
- Healthy, inclusive, resilient, and sustainable communities
- Gender, health, and nutrition



Water Security Strategy 2023–2026

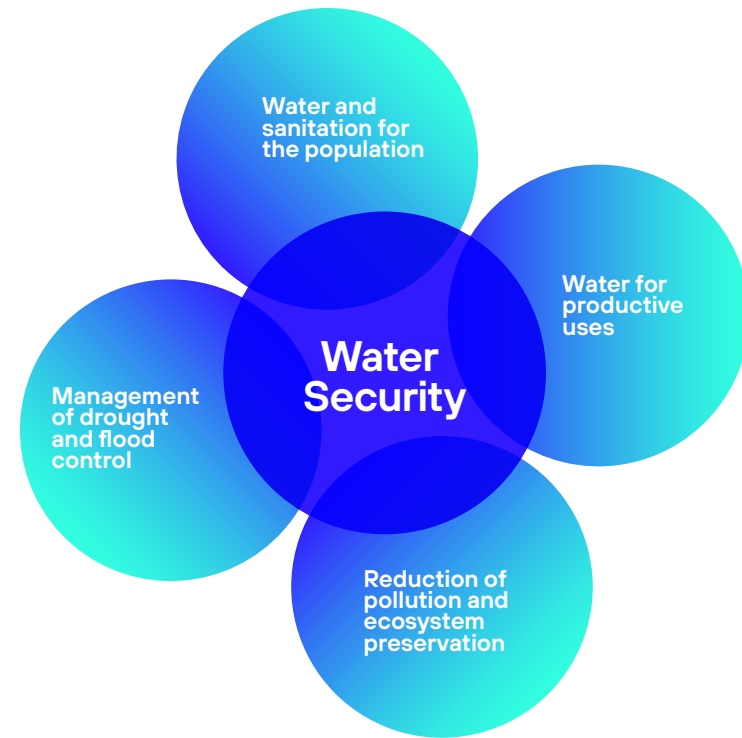
3



Water security should be analyzed from an integrated watershed approach, consistent with IWRM, ensuring that all inhabitants have safe access to water and sanitation while fostering productive development in sectors like agriculture, industry, energy, and mining. It also involves preserving the availability and reducing the pollution of water bodies, as well as managing water scarcity or excess in a timely manner. This is possible only if water is understood as having geographical continuity under a basin approach, and that decisions made upstream affect

downstream, whether they are municipalities, provinces, departments, or countries, and as such consider their interconnections and interrelationships (Figure 11), taking into account the *natural system* (climate and geophysical conditions), the *socioeconomic system* (demographic, social, cultural and economic conditions), and the *institutional system* (defined by the constitutional, legal and political system). This approach also requires flexibility, since climate change demands adaptive planning.

Figure 11. The holistic approach to water security
Source: Authors



Strategic objectives and programmatic lines

The overall objective of CAF's Water Security Strategy can be expressed as follows.

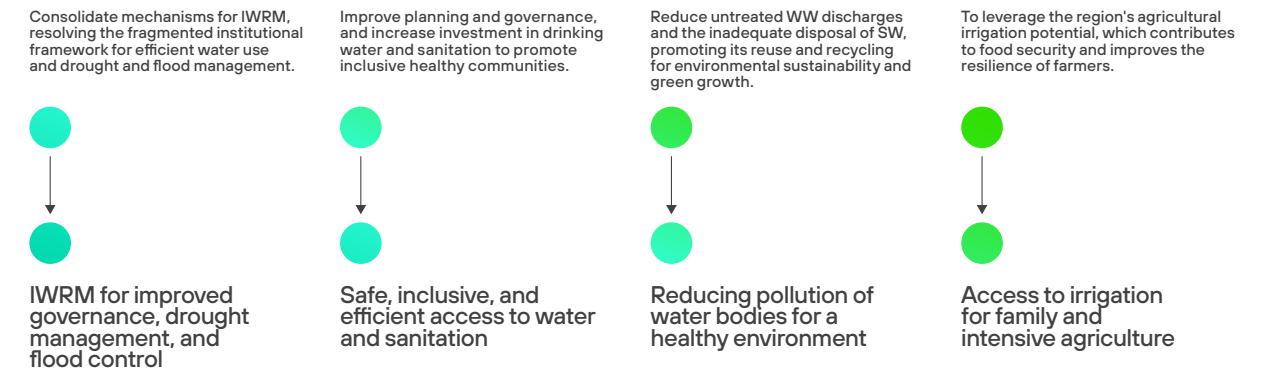
- **Promote strategic actions for water security in Latin America and the Caribbean to guarantee access to water and sanitation for the population and productive uses; reduce risks linked to water scarcity and excess and pollution applying a watershed approach; and to strengthen the climate resilience of communities and ecosystems.**

CAF is committed to water security in the region, rooted in its role as a promoter and coordinator through sectoral dialogue with the countries. Within this framework, the regional challenges outlined in the previous chapter help define the strategic objectives (Figure 12).

Each objective is broken down into its programmatic lines (Figure 13), which guide the execution of generic and specific activities. The investment programs or projects that CAF supports and finances can address one or more programmatic lines, under a holistic approach.

Figure 12. Challenges and strategic objectives
Source: Authors

Challenges

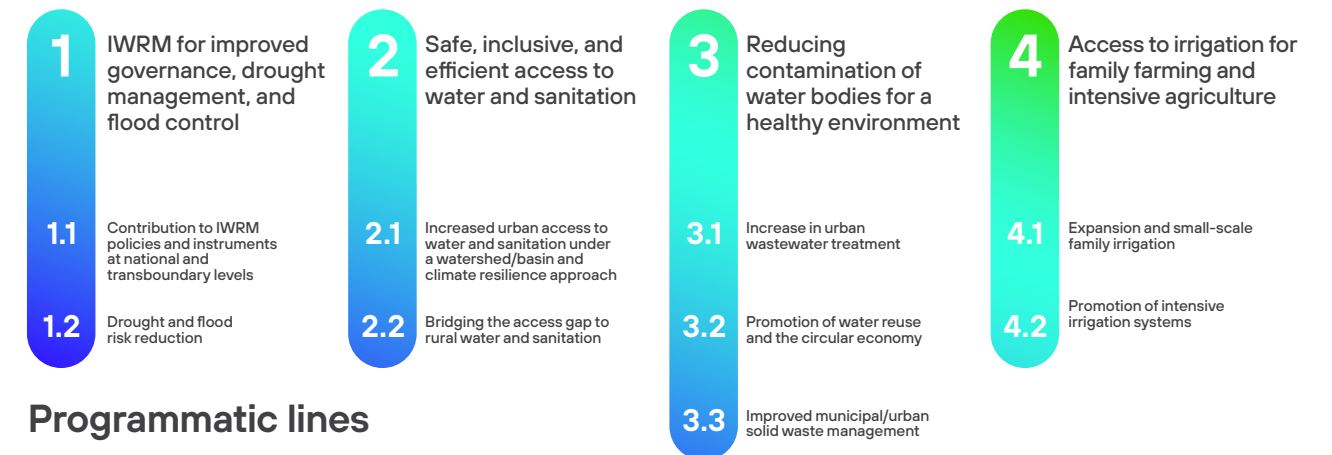


Strategic objectives

Figure 13. Strategic objectives and programmatic lines
Source: Authors

- **Promote strategic actions for water security in Latin America and the Caribbean to guarantee access to water and sanitation for the population and productive uses; reduce risks linked to water scarcity and excess and pollution applying a watershed approach; and to strengthen the climate resilience of communities and ecosystems.**

Strategic objectives



Programmatic lines

Objective 1. IWRM for improved governance, drought management, and flood control

The IWRM-related challenges facing the region require support from CAF in the regulation, planning, and allocation of water resources based on environmental sustainability criteria. Efforts will also be directed toward creating and/or strengthening the institutional framework for water governance and management through river basin organizations, river basin councils, or similar bodies. Additionally, actions will be supported for efficient water use and the management of droughts and floods, and collaboration with the international community on the new hydro-diplomacy agenda, supporting initiatives among countries sharing transboundary basins and in reducing water-related conflicts. Based on the above, CAF has defined the following programmatic lines.

Programmatic line 1.1 Contribution to IWRM policies and instruments at the national and transboundary levels

This programmatic line will be implemented to support the consolidation of IWRM policies in countries, according to their needs and development capacity. Additionally, institutional strengthening around water at transnational, national, and sub-national levels, as well as management instruments, will be enhanced. To this end, the following actions have been identified (a supplemental list is included in the Annex for further reference).

Policy-based

1. Promote the development of basin and aquifer organizations with clear mandates and advise them on establishing links with subnational-level organizations.
2. Strengthen CAF's presence in specialized international bodies guiding policies in watershed management, as well as actively participate in global and regional events, sharing experiences, approaches, and innovation-related topics on the subject.

Institution-based

1. Promote cross-sectoral coordination and management activities, particularly at the basin and aquifer organization levels, for sustainable and efficient water management.

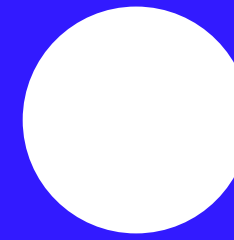
2. Strengthen individual and institutional capacities at the governance, regulatory, and basin organization levels through training courses, peer-to-peer learning, and partnerships with educational institutions, among others.

Management Tools

1. Contribute to improving countries' management instruments through IWRM action plans or similar frameworks, to prioritize and coordinate efforts, as well as methodologies to determine the value of water, ecosystem services, modeling and water balances, risk analysis, and demand management, among others.
2. Boost the financing allocated to climate change resilient infrastructure, where nature-based solutions (NbS) offer an increasingly valuable alternative.

Transboundary waters

1. Foster shared agreements and agendas among peers, with multinational basin organizations, on management tools and adoption of best practices.
2. Finance measures of common interest to riparian countries, including both structural and non-structural measures, such as decision-making systems, early warning systems, and information systems that monitor and forecast hydro-meteorological, climatic, and water quality variables, among others.
3. Advocate, with support from other areas of CAF, for engagement with multilateral banks and climate funds, for the development of Strategic Action Plans (SAPs), short and medium-term operational plans, and innovative portfolio financing mechanisms, so as to prioritize and implement necessary measures for the management of transboundary waters.



Box 6. Nature-based solutions for rainwater drainage: The case of Sobral, Brazil

Possible nature-based solutions (NbS) include: (i) forest catchments that provide clean water and store carbon; (ii) wetlands that increase water infiltration and reduce flood risks; (iii) urban and peri-urban farms that connect people with the food they eat; (iv) parks, tree-lined streets, green roofs, and building facades to mitigate the heat effect and accelerate water drainage; (v) urban parks that connect people with nature and provide recreational spaces; (vi) mangroves, dunes, and reefs that protect coastal cities from storm surges (UNEP-UNDP, 2022).

In this context, CAF received a request for support from the municipality of Sobral (Brazil) and approved a credit operation to finance the PRODESOL Program. This municipality is located in the state of Ceará, about 230 km from the state capital, Fortaleza. It has a population of 210,000 inhabitants and an urbanization rate of 88.35 percent. Although it is the second most developed municipality in the state of Ceará, it faces significant challenges in the basic sanitation sector. This operation seeks to improve the quality of public services and covers interventions in the areas of basic sanitation (water, sewage, and drainage), environmental management (parks, gardens, environmental education), social infrastructure (health and education), urban mobility (paving, bike lanes, and pedestrian paths), and institutional strengthening.

The installation of filtering gardens in the tributaries of the Acaraú River is one of the proposed interventions under the basic sanitation component. The Acaraú River's filtering gardens, which contribute to the decontamination of the main watercourse in the urban area of Sobral, were financed with CAF loan funds.

These purification systems use sustainable nature-based technology to improve water quality, using aquatic plants, stone, and sand for wastewater treatment without the use of chemicals. Sobral has the largest filtering garden in a public area in Brazil. Filtering

gardens have a positive impact on the aquatic ecosystem and also contribute to improving the standard of living for citizens by enhancing public space and offering an environment suitable for recreation and physical activities. In addition, many birds can be observed using the project space as an integral part of their habitat; the presence of wildlife is a good indicator that the gardens have been integrated with the natural ecosystem. All of the above shows that it is possible to integrate the urban and natural environment by investing in nature-based solutions.

The installation of filtering gardens is a significant step forward, but it needs to be complemented with other actions related to increasing basic sanitation coverage and control of effluent discharges into drainage networks. Only in this way can the goal of decontaminating Sobral's rivers, streams, and lagoons be achieved in the coming years.

Programmatic line 1.2 Drought and flood risk reduction

Given the region's high vulnerability to droughts and floods—and the significant economic costs that national and household economies incur from these events—CAF will support countries in implementing comprehensive and inclusive measures of an economic, structural, legal, social, health, cultural, educational, environmental, technological, political, and institutional nature. These measures aim to prevent and reduce the degree of exposure to hazards and vulnerability to disasters, increase response capacity, and strengthen resilience. To this end, the following actions are prioritized (a supplemental list is included in the Annex for further reference).

1. Stimulate financing for projects aimed at increasing water supply for use during dry periods, including both traditional projects and unconventional water sources such as desalination, water harvesting, or wastewater reuse. This includes, whenever possible, NbS such as natural or artificial aquifer recharge.

2. Promote, in a similar manner, financing for exhaustive management projects aimed at reducing or maximizing the volumes of water used by multiple sectors. In both cases, structural measures should be complemented by non-structural measures, such as early warning systems for drought management or flood control.
3. Promote data management (equipment and monitoring), ensuring reliability and timeliness, as well as fostering information exchange among sector ministries, decentralized agencies, other levels of government, and relevant water management stakeholders.
4. Drive pre-investment studies (Water Sector Pre-Investment Facility) to speed up the project cycle and enhance the quality of studies eligible for financing.

Objective 2. Safe, Inclusive, and Efficient Access to Water and Sanitation

Despite the progress made in the last 20 years, the gaps in access to water and sanitation are still significant, as outlined in the challenges section. Therefore, CAF will support efforts to intensify investment and accompany them with improvements in planning and governance processes, as well as in the capacity, efficiency, and transparency in investment execution, strengthening the level of governance, regulation, and capacities of operators. Access to water and sanitation is crucial for healthy and inclusive cities, and the post-COVID-19 recovery offers an opportunity to recalibrate the relationship between cities and nature (UNEP-UNDP, 2022). Therefore, CAF proposes the concept of a healthy city, which aims to create and continuously improve its physical and social environment and expand community resources to enable people to support each other to develop to their fullest potential (WHO, 2020).¹⁶ Thus, CAF proposes to decisively support actions that lead to safe access to water and sanitation to improve public health and eradicate extreme poverty; reduce inequity and contribute to gender equality; contributing to inclusion and increasing social capital. Based on the above, the following programmatic lines are proposed.

Programmatic line 2.1 Increased urban access to water and sanitation under a watershed and climate resilience approach

CAF will support plans, programs, and projects aimed at achieving universal coverage in urban areas, as well as improving the quality of affordable and sustainable services, through various instruments; for this purpose, the following actions are proposed (an additional/expanded list is included in the Annex for further reference).

1. Finance and promote investment programs and projects that include, as appropriate, some of the following components:
 - a. Access to water and sanitation aimed at universal access, especially in vulnerable areas, minimizing reliance on unsafe water sources and reducing water hauling times and unauthorized water purchases.
 - b. Actions related to Water Security Plans (WSPs), involving a basin approach and evaluation of nearby water sources that supply water, establishing the entire service value chain.
 - c. Improvement in the quality of current service provision, both in supply continuity and in quality suitable and reliable for human consumption, through water treatment systems and accredited laboratories for analysis under international standards.

¹⁶ <https://www.who.int/europe/groups/who-european-healthy-cities-network/what-is-a-health-city#:~:text=A%20healthy%20city%20is%20one,developing%20to%20their%20maximum%20potential>

- d. Institutional strengthening of operators, with improvement plans and measurable milestones, based on institutional assessments identifying priority areas for improvement, including gender aspects, jointly agreed upon with the borrower.
 - e. Actions aimed at increasing efficiency, such as reducing water losses or energy efficiency, which can be implemented through various modalities, such as Results-Based Contracts (RbCs).
 - f. Actions to advance digital transformation, based on the self-diagnostic tool developed by CAF, or alternative assessments recognized by the bank.
 - g. Actions to increase sanitation coverage in areas within the scope of projects for access to or improvement of a safe water supply.
 - h. The inclusion, especially in vulnerable areas, of domestic water and sanitation connections, promoting, if necessary, incentives for domestic sanitation connections. These actions will be strengthened with baseline assessments and pilot case applications.
2. Support countries in accelerating the project cycle and improving the quality of studies and designs through the CAF-PPSA Water Project Preparation Facility and third-party funds, for the expansion of drinking water and sanitation services, as well as for optimizing water distribution and efficient water use with demand management projects.
 3. Train service operators on various topics, including technological developments, management models, aggregation frameworks, governance, climate change, and gender equality, among others.
 4. Finance drinking water and sanitation projects aimed at adapting to climate change, incorporating structural and non-structural measures in cities and their associated watersheds/basins (within, around, and outside cities).

Programmatic line 2.2 Bridging the access gap to rural water and sanitation

Rural development requires joint action from various sectors, including health, education, agriculture, connectivity and transportation, and of course, basic services such as energy, drinking water, and sanitation. The issues in rural areas differ from urban ones, and efforts should focus on creating synergies among sectors under a territorial approach, aimed at reducing the backlog/lag in service coverage, combating chronic child malnutrition, and promoting gender equity. Considering these particularities, the planned actions to be carried out are as follows (a supplemental list is included in the Annex for further reference).

1. Promote and finance intersectoral studies and interventions with a territorial approach and a focus on gender and ethnic-racial diversity, which includes addressing rural areas with the sectors of health, nutrition, education, and agriculture.
2. Develop differentiated schemes for safe access to water and sanitation in both concentrated and dispersed rural areas, based on policies and criteria for design, construction, and operation tailored to the particularities of member countries and communities.
3. Promote and develop NbS for both safe water and sanitation services, which can be scalable and applicable to larger groups.
4. Create incentives for programs and projects to include water source protection, watershed management, and water disinfection in water systems.
5. Enhance and provide training in family and community hygiene through the development of gender-focused health education guides and manuals on hygiene habits. These resources will feature adapted content, where applicable, to align with the worldview of indigenous peoples or ethnic communities.

Objective 3: Reduction of water body pollution for a healthy environment

This objective aims to address one of the major downfalls in basic services in the region, which is the deficit in coverage and quality in wastewater treatment associated with achieving SDG 6.3, while also promoting its reuse. Similarly, it focuses on promoting comprehensive management of urban solid waste, which, due to inadequate treatment and final disposal, also causes soil and water contamination. Based on the above, the following priority actions are established (a supplemental list is included in the Annex for further reference).

Programmatic line 3.1: Increase in urban wastewater treatment

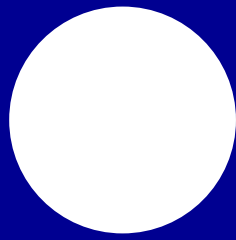
1. Support countries in reviewing and updating their discharge regulations to incorporate criteria of progressiveness and flexibility according to the dilution and dispersion capacity of the receiving body and under an integrated watershed approach.
2. Promote and finance national programs and projects that prioritize the construction, rehabilitation, or expansion of treatment plants in the most contaminated basins.
3. Support invested countries in accelerating the project cycle and improving the quality of studies and designs of wastewater treatment plants, through CAF-PPSA and third-party funds.
4. Support invested countries in promoting private sector participation in the construction and operation of wastewater treatment plants, in bidding models and schemes, coordinating among the relevant areas of CAF.
5. Develop and improve capacities in the planning, design, supervision, operation, and maintenance phases of wastewater treatment plants. This includes technological developments in treatment, public-private partnership schemes, and service sustainability, among others, using various modalities: peer-to-peer exchange, formal courses, and others.

6. Promote and apply cost-effective technologies in programs and projects, whose operating costs can be assumed by the provider, fostering innovation and the development of a combination of traditional infrastructure and NbS.

Programmatic line 3.2: Promotion of water reuse and circular economy

CAF will undertake the following actions (see Annex 1 for a complementary reference list).

1. Promote projects that utilize by-products generated by wastewater treatment and the varying use of water, consistent with the regulatory framework and the design of incentives for reuse.
2. Promote and finance programs that prioritize the construction, rehabilitation, or expansion of treatment plants with reuse modules, especially in areas of water stress or scarcity.
3. Strengthen knowledge and development of reuse, with studies and designs of wastewater treatment plants or complementary modules for reuse (CAF-PPSA and third-party funds).
4. Support interested countries in promoting private sector participation in the construction and operation of reuse modules, energy generation, and sludge treatment from treatment plants, coordinating with the corresponding areas in CAF.
5. Develop and improve operators' skills in the planning, design, supervision, operation, and maintenance phases of modules for reuse and recycling of by-products generated in wastewater treatment plants.
6. Support countries in reviewing and updating their wastewater and sludge reuse standards based on good practices and successful cases.



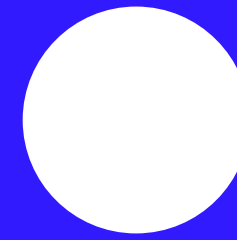
Box 7. Sludge management at the Juan Díaz WWTP, Panama

CAF has been supporting Panama's Sanitation Program since 2010, with operations currently ongoing, totaling USD 700 million. This initiative stands as the primary investment project in environmental health within the Republic of Panama. The overarching goal of the program is to revitalize sanitary and environmental conditions in the metropolitan area while mitigating pollution from untreated wastewater in urban rivers and coastal regions of the Bay of Panama. The envisioned outcome is an enhancement in public health, environmental sustainability, and overall quality of life for the residents of Panama City.

Key components of the program include the Coastal Interceptor Tunnel, spanning 100 km, the installation of 280 km of new sewer networks, and the development of the Juan Diaz Wastewater Treatment Plant, boasting a capacity of 5.5 m³/s to benefit 700 thousand inhabitants.

This treatment plant is designed around a circular economy model, ensuring environmentally sustainable operations over time. It achieves this through the implementation of technology aimed at resource optimization, reduction in energy and raw material consumption, and the utilization of waste materials.

The Thermal Hydrolysis process, implemented at the WWTP, subjects sludge to high pressure and temperature, resulting in low-viscosity sludge with a high concentration of soluble COD. This facilitates greater biogas production and reduces the volume of sludge at the end of the process, saving 3 to 5 times the energy used. Furthermore, the process sterilizes the sludge, eliminating pathogens and enhancing its suitability for use as fertilizer. Consequently, efforts are underway to explore options for maximizing the utilization of the produced sludge in the future.



Box 8. Healthy, inclusive, resilient, and sustainable cities.

Strategic objectives 1, 2, and 3 make it possible to conceive integrated interventions in the territorial scope of the basin, starting from the city as the center and engine of development. Indeed, water management can be addressed within a city, around a city, and outside a city, as follows.

- a. In cities:** access to drinking water and sanitation must be guaranteed in a safe, continuous manner, free of pathogens and suitable for human consumption, as well as access to sewerage or alternative forms that allow for the proper conduction, treatment, and disposal of the effluents generated. The existence of gray or NbS water-related infrastructure must be guaranteed for adequate stormwater drainage, which is essential to prevent flooding. It is also possible to promote NbS to increase water harvesting and infiltration, which preserves or restores the water balance in cities.
- b. Around cities:** Informal settlements in surrounding areas demand basic services of drinking water and sanitation. They coexist with sparsely populated zones suitable for certain types of water and sanitation infrastructure, both upstream and downstream of cities. Upstream, it is common to install infrastructure for water storage and regulation, achieved through either traditional methods or NBS. Additionally, infrastructure for flood prevention, using traditional methods or NBS, is often implemented. In turn, downstream areas of cities are suitable for the installation of wastewater treatment plants. These plants have the potential to reuse treated water in nearby agricultural irrigation, thus promoting the circular economy.



- c. Outside cities:** While groundwater plays a fundamental role in water supply in many cities, it is increasingly common for new water sources for cities to be located outside them, requiring the construction of transfer tunnels or pumping from one basin to another, as well as multipurpose dams located in territories distant from the cities. Therefore, watershed management has a spatial conception of the territory inside and outside cities, which allows (i) identifying, harnessing, and protecting water sources, including surface and groundwater, rainwater, treated wastewater, and seawater; (ii) identifying pollutant sources located upstream of the city or their effects on cities located downstream; and (iii) protecting the city from floods, especially when they are located in the lower part of the basins, through solutions of traditional infrastructure or NBS located in the middle or upper basin. In Lima, for example, more than 50 percent of the water comes from the Mantaro River through a transfer that crosses the mountains, and the rest comes from the basins of the Chillón, Rímac, and Lurín rivers.

Programmatic line 3.3 Improved urban solid waste management

Efforts need to be focused on closing exposed dumping grounds and ensuring proper management and final disposal of solid waste, promoting the development of sanitary landfills with biogas capture and subsequent energy generation, as well as enhancing composting systems with anaerobic digestion for energy utilization. Below is CAF's proposal (a supplemental list is included in the Annex for further reference).

1. Promote and finance national programs and projects prioritizing the construction, rehabilitation, or expansion of sanitary landfills and the closure of exposed dumping grounds, applying cost-effective technologies, fostering innovation, and technological development.
2. Strengthen service providers in planning, design, supervision, operation, and maintenance phases, as well as in commercial management, including the design of billing systems and tariff regimes in line with service costs.

3. Promote regionalization models to generate economies of scale and facilitate the operation, maintenance, and control of services.
4. Support countries in expediting the project cycle and improving the quality of sanitary landfills studies and designs through technical cooperation and third-party funds.
5. Strengthen institutional mechanisms and support the improvement of infrastructure and equipment conditions for the work of informal waste collectors and recyclers, including promoting job inclusion programs, training, fostering, and consolidating recovery cooperatives, to establish a scheme under dignified conditions.
6. Support countries interested in promoting private participation in the construction and operation of sanitary landfills through bidding models and schemes.

Objective 4: Access to irrigation for family and intensive agriculture

Programmatic line 4.1: Expansion and rehabilitation of small-scale family irrigation

This represents a focal area in which CAF has substantive expertise, especially in Bolivia. It proposes to leverage and disseminate the concept regionally to enhance access to family agriculture, resulting in increased income for vulnerable segments of the rural population and improved productivity. This serves as a cornerstone for a comprehensive rural development strategy that integrates gender perspectives and takes into account cultural diversity. The following guiding actions are considered for programs or projects to be supported by CAF (a supplemental list is included in the Annex for further reference):

1. Support and finance the expansion of family irrigation areas, particularly in rain-fed agricultural zones, agreed upon jointly with agricultural and forestry authorities, ensuring the reduction of impacts on forests and the non-encroachment on protected areas.
2. Promote family irrigation as part of comprehensive rural development strategies and its contribution to food security, seeking synergies with other national subsectors and programs, as well as its interrelation with integrated watershed management and the mitigation of risks from droughts and floods.
3. Intensify efficient irrigation systems through sprinkler or drip methods and implement deficit irrigation practices where crops are grown under mild water stress conditions, aligning with SDG 6.4 and the concept of "sustainable irrigation."

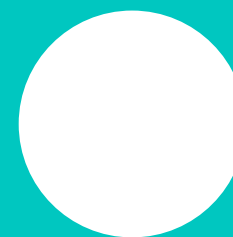
4. Support the development of inclusive financial mechanisms that improve irrigation infrastructure up to the parcel level.
5. Strengthen community irrigation organizations, both during the project implementation phase and post-project, through technical assistance in institutional organization, efficient water use, application of irrigation cycles, crop rotation and diversification, soil erosion control, agricultural drainage, soil moisture conservation, seed use, marketing practices, and establishment of family farmer associations, among others.

Programmatic line 4.2: Promotion of intensive irrigation systems

CAF has experience in driving significant irrigation projects, primarily in Peru, through support to both the public and private sectors, diversifying credit instruments, and complementing them with technical assistance. The projects financed and supported by CAF will be guided by the following principles (a supplemental list is included in the Annex for further reference):

1. Support and finance the expansion of intensive irrigation areas, particularly in rain-fed agricultural zones, agreed upon jointly with agricultural and forestry authorities, ensuring the reduction of impacts on forests and the non-encroachment on protected areas.
2. Modernize irrigation through equipment and techniques that incentivize "sustainable irrigation."
3. Promote public-private participation in agro-industrial projects, linking CAF's private sector area to such ventures.
4. Foster exchange, cooperation, and partnerships among countries in the region and other countries, as well as with leading agricultural institutions.

The typology of programs and projects to be developed through CAF's Water Strategy is presented at the end of the document (Annex 2).



Box 9. Technology-based family irrigation

In Bolivia, there are 3.3 million hectares under cultivation, of which only 11 percent have irrigation, mostly characterized by the precariousness of their structures, limited reach, dependence on precipitation/rainfall, and management by families or small community organizations. Within this framework lies the majority of peasant families inhabiting the arid and semi-arid regions of Bolivia, whose economic activity revolves around small-scale agricultural food production, serving both for family consumption and the barter of surpluses to cover other basic needs.

CAF has been supporting Bolivia's irrigation sector for over a decade. During this period, the bank has identified lessons learned, which have been incorporated into the new phases of the programs, showing a sustained evolution in scope and objectives for MI RIEGO I (traditional) and MIRIEGO II (technical) and PRESAS. The ultimate purpose of implementing these programs is to sustainably increase the income of beneficiary families, through increased agricultural production and productivity, and improve irrigation water efficiency in Bolivia. They have national scope, with a watershed and gender equity focus, strengthening the economic and socio-environmental development of rural communities.

The effective implementation of these initiatives aims to generate impact across various dimensions, with the following standing out:

- Efficient and affordable access to irrigation services for family farming, through initiatives for management and loss reduction; technification of irrigation systems; strengthening of irrigation boards (institutional frameworks, conflict management); technical assistance during project execution and also in the post-execution phase.

- Improvement in governance and sustainable management of water resources, supporting the development and implementation of local water management plans (LWMP); and the management and protection of micro-watersheds where the projects are located.
- Provision of water regulation and storage infrastructure as an adaptation measure to climate change, contributing to water security and strengthening its resilience to extreme events.
- Capacity building in dam safety, with the structuring of regulations on this subject, which is non-existent in the country and which will be the instrument enabling the design and construction of dams in accordance with international standards.
- Finally, exchange activities have been promoted so that Bolivian professionals reinforce their knowledge through support established in the memorandum of understanding between Bolivia, Spain, and CAF.

Instruments and Tools

The strategic objectives and outlined lines of action will be implemented through various instruments and tools, which are mentioned below.

Financial tools: CAF offers various instruments for both the public and private sectors, among which the following stand out:¹⁷

1. Loans: CAF's primary operational modality for financing sovereign risk operations as well as operations of clients with non-sovereign risk (policy sector loans, P4Rs, PPPs, etc.); operations presented
2. Guarantees and endorsements: Products aimed at national governments, subnational entities, public, private, or mixed companies, and financial institutions, to support credit operations granted by other sources. Partial guarantees are used to improve credit risk ratings to facilitate access to new markets or investors

by the governments of shareholder countries, subnational entities, or public or mixed economy companies (with or without sovereign guarantee), as well as by private sector companies, are eligible for financing.

and improve financing conditions. Additionally, CAF may guarantee the underwriting of fixed-income securities to attract new resources to the region and encourage private financing sources to extend the maturities of their loans.

3. Structured financing (project finance): Generally used to identify a financing modality granted under a guarantee structure, where resources (debt and equity) provided for the project are remunerated with the cash flow generated by it.
4. Credit lines: Granted to clients for a specified limit, allowing them to access financing during the term of the facility. CAF can finance operations with sovereign risk and operations of clients with non-sovereign risk. CAF can also act as a second-tier bank, providing credit lines to development financial institutions.
5. Equity investments: Operations aimed at acquiring ordinary shares, preferential shares, or stakes in the share capital, as well as subordinated debt securities, convertible debt securities, or other similar instruments, in public, private, or mixed companies, funds, or financial institutions, and special purpose financial vehicles.
6. Financial Advisory for the structuring of projects under PPP modalities.

CAF has signed agreements and formed alliances with other multilateral and bilateral banks to increase the volume of co-financing, as well as the potential to establish joint projects with climate funds.

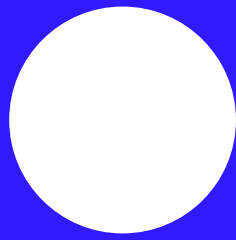
Technical cooperation: Targeted at companies, international organizations, or entities belonging to the public or private sectors of shareholder countries. Requests from public entities in various countries are prioritized through a single government agency, which coordinates requests for external resources for technical assistance programs framed within their national or regional development plans.

CAF-PPSA Water Project Preparation Facility. This is a technical cooperation framework, specifically designed to support water security in the region. The facility aims to reduce project implementation times, improve project quality, and introduce new technologies. In place since late 2018, the facility uses non-reimbursable resources mainly from CAF, although it is open to other cooperating partners and multilateral and bilateral agencies to join the initiative to increase its impact.

The program's resources are allocated to: (i) developing detailed engineering, executive projects, and final designs of water sector infrastructure projects, ensuring that studies include cutting-edge technologies as well as components for resilience to climate change and extreme water-related events; (ii) providing guidance and assistance for the drafting of the necessary documents for project or program bidding; (iii) conducting feasibility studies when the contracting modality involves integrated design and construction; (iv) financing the supervision of final studies and designs; and (v) carrying out joint financing and co-financing of projects or programs with other cooperating partners. The program establishes eligibility and prioritization criteria and complementary documents, as does the administration and management framework.

Specialized project consultancies. Aimed at providing support through the hiring of experts in complex issues. This support can be provided from the initial stages of the project, such as the contracting phase (drafting of terms of reference and tender documents). The topics will depend on the needs of each program or project.

¹⁷ For more information on financing lines, please consult: What we do (caf.com).



Box 10. Water Project Preparation Facility at CAF–PPSA

CAF created the Water Project Preparation Facility at CAF (PPSA for its acronym in Spanish) in response to the bank's analysis of excessive execution times and cost overruns in credit operations, stemming from inadequate pre-investment studies, particularly final design studies.

In December 2018, CAF approved the first phase of PPSA through a Board Resolution for USD 5 million in non-reimbursable funds. With the favorable results of this phase, the program has been progressively extended, culminating in four phases totaling USD 20 million, concluding in July 2025. By the end of 2022, 25 technical cooperations were approved, including over 30 tenderable studies for implementation, covering nine countries (Argentina, Bolivia, Brazil, Colombia, the Dominican Republic, Ecuador, Panama, Paraguay, and Trinidad and Tobago).

The investment in infrastructure resulting from the studies will amount to approximately USD 1.4 billion, in the subsectors of drinking water, sanitation, and stormwater drainage, benefiting 6.6 million people. Additionally, agricultural irrigation studies will benefit an area of 10,850 hectares of cultivated land. Based on the above, it is concluded that every dollar of pre-investment (basic and final designs) results in USD 82 in infrastructure investment.

Knowledge documents.¹⁸ CAF possesses a rich repository of publications related to water security. Additionally, the bank continues to work to support the development and dissemination of topics framed within the following guidelines:

1. Case studies and pilot projects for scaling up; particularly focusing on lesser-known and high-interest topics, such as nature-based solutions (NbS) applied in wastewater treatment, drought management, or flood control, as well as projects for groundwater recharge or increasing water availability, along with projects for wastewater reuse and utilizing by-products for energy generation or the production of fertilizer and soil conditioner.
2. Applied research studies, such as vulnerability analysis or new technologies for optimization and rehabilitation of existing systems, as well as for the management, operation, and maintenance of water and sanitation infrastructure.
3. Systematization of experiences based on evaluations during the project cycle. CAF has conducted multiple peer reviews of projects in their origination and formulation phase, midterm reviews (MTRs) of projects, as well as closure and results reports (CRRs) at the end of the organization's operations. This experience will be utilized within CAF and for the benefit of member countries.
4. Guidelines to assist member countries in conceptualization, best practices, and essential aspects of project formulation.
5. Analysis of legal and regulatory frameworks, management models, and corporate governance in service provision, as well as those related to national or transboundary water governance and specific areas of interest.

Tools for sectoral improvement and modernization.

CAF will continue to develop tools that support the improvement or modernization of services. The bank has an institutional evaluation tool for both water and sanitation service providers and project executing entities, which is regularly applied in the evaluation phase of investment projects. It has also developed a guide for the formulation of results-based contracts (RbC), aimed at high-impact

projects with third-party participation, such as reducing water losses or increasing energy efficiency.

It also has a tool for self-assessment of digital transformation, available free of charge for water and sanitation service providers, allowing them to identify the baseline and progress in the automation of their processes, aimed at the continuous improvement of their services.

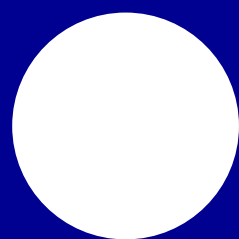
Training. Support is designed for the education and training of officials from member countries through the following modalities:

1. Specialized technical and management training, through the organization of regional or national events in selected countries, with the support of public institutions, international organizations, training entities, and others.
2. Online training in high-interest topics for the region, such as dam safety, wastewater treatment and reuse, circular economy, and nature-based solutions for water, among others.
3. Peer-to-peer training, based on the identification of a 'mentor pair' and one or more 'mentees', which includes visits from both sides for a specified period associated with the achievement of certain milestones. To date, CAF has conducted several twinning initiatives that offer an encouraging outlook for further deepening this form of training.
4. Training for the integration of the gender and diversity perspective in projects and institutional management related to water security to foster the inclusion of needs and benefits for women, Afro-descendants, and indigenous peoples.

Partnerships with global and regional organizations:

CAF actively participates in global and regional events focused on water security and will continue to do so, focusing its attention on strategic issues. CAF has chaired the Water Finance Coalition for the past two years, is a member of and has chaired the Water Finance Task Force of the World Water Council, and is also engaged in the Steering Committee and Advisory Committee of the Global Water Partnership, solidifying its position as a reputable source of knowledge and in water management in the region.

¹⁸ Publications on water security can be downloaded from CAF's website under the topic "Water and sanitation"(caf.com)



Box 11. Water Finance Coalition

During the annual Finance in Common summit of the International Development Finance Club (IDFC) in November 2020, a group of banks recognized the need to strengthen partnerships, cooperation, and knowledge-sharing to establish a water finance coalition. This coalition aims to unite multilateral banks, along with regional and national public banks, in pursuit of the common goal to increase financing for the water and sanitation sector. This support aligns with achieving the SDG6 targets and those related to water, as well as the principles outlined in the Paris Agreement on Climate Change.

Following this agreement, the first research product on the role of public banks in the water sector was compiled. In parallel, the coalition was formed, with AFD assuming the lead as chair and BANOBRAS from Mexico as co-chair. They were tasked with drafting the Joint Declaration Proposal on the Water Finance Coalition, which over 20 banks signed. To date, the coalition comprises over 60 institutions, with shared interests focused on (i) collaboration; (ii) research; and (iii) knowledge management, all aimed at fostering increased investments in the sector.

With AFD's leadership term concluded, CAF stepped into this role in the second half of 2022, with AFD and BANOBRAS serving as co-chairs. In March 2023, during the World Water Conference held in New York, the first version of the 2023–2025 Action Plan was presented, with participation from more than 12 international public banks.

Follow-up and expected results

Based on historical data from the past ten years, a possible distribution of the project portfolio is established according to the 2023–2026 USD 4 billion financing target (Figure 14).

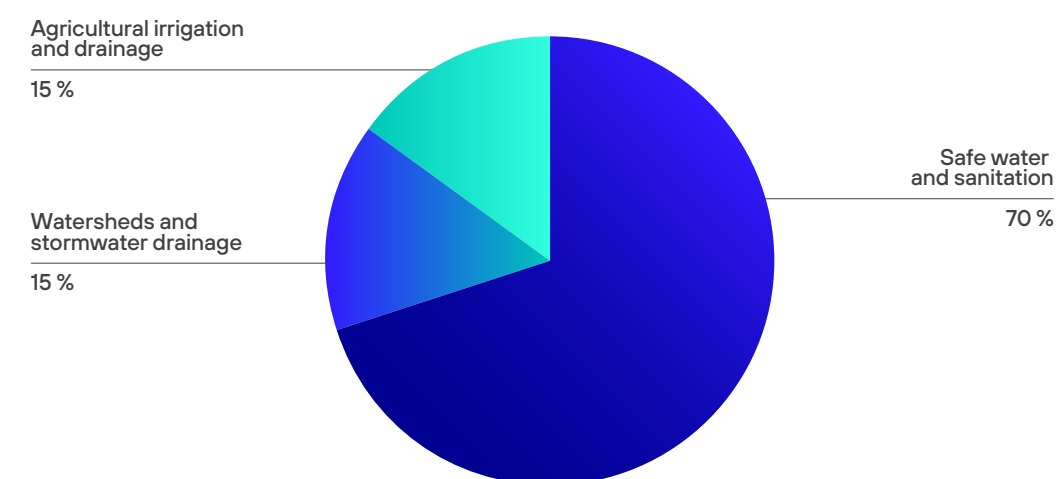
Likewise, based on the information gathered from historical approvals, achieving the investment target is expected to result in the following:

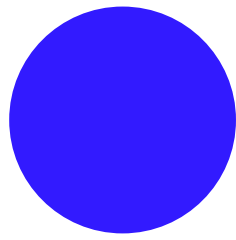
- Improved access to water and sanitation services for 10.5 million people.
- Decreased vulnerability to disaster risks from droughts or floods for 2.5 million people.
- 145,000 hectares with new or improved irrigation.

Monitoring of the progress and actions related to achieving the target will be conducted annually through tracking approvals and identifying levels of progress, potential delays, and early warning signs. The expected results are consistent with an increase in the volume and amount of operations planned by CAF in the water sector until 2026, as well as with the capacities of the water specialists team within the institution.

Figure 14. Portfolio composition of the investment target

Source: Authors





Annex 1

List of potential activities and actions to be developed by CAF classified by objective and strategic guideline.

Objective 1. IWRM for improved governance, drought management, and flood control.

Programmatic line 1.1 Contribution to IWRM policies and instruments at national and transboundary levels

Policy-based

1. Strengthen the updating of legal frameworks in water resource management to reflect the need for innovation and adaptive capacity in the face of hydro-meteorological uncertainty generated by climate change.
2. Advocate for transparent and participatory accountability in various roles: governance, regulation, service provision, to enhance understanding not only among civil entities but also among society as a whole. Only through these efforts can progress in legitimacy be achieved, an important concept to ensure that states and other non-state actors fulfill their legal obligations.

3. Ensure alignment of policies from other sectors with IWRM: environment, climate change, biodiversity, urban development, risk reduction, among others.
4. Lobby for dedicated budgeting for IWRM activities in countries, for which climate funds can play an important role in driving change, later sustained by the countries themselves.
5. Disseminate the benefits of implementing IWRM to achieve multiple sustainable development objectives, at all levels and across all sectors.
6. Identify opportunities to integrate IWRM into climate change, agriculture, risk management, urban development, and poverty reduction programs and planning processes, fostering the establishment of formal coordination mechanisms with these sectors.
7. Promote "meaningful communication" that underpins the value of implementing IWRM to achieve multiple SDGs, at all levels and across all sectors.

Institution-based

8. Provide guidance to reduce the existing fragmentation of water management institutions, which complicates resource governance and accentuates subsector silos, establishing institutional arrangements aimed at intersectoral and multilevel governance.
9. Take actions to bolster institutional and human capacity for planning, implementation, and monitoring in water management, with adequate technological support.

Management tools

10. Promote and finance the modernization and registration of hydrometeorological stations at the national level to provide real-time information as a basis for timely and reliable decision-making.
11. Enhance knowledge of water availability, with emphasis on groundwater, to "make the invisible visible," including its characteristics, level of exploitation and potential, and quality, among others.

Transboundary waters

12. Promote regional sectoral dialogue, as well as the value of cross-border cooperation between national counterparts and neighboring cross-border cities, to ensure political backing and the necessary resources to carry out studies and infrastructure works of common interest.
13. Facilitate operational cooperation agreements around international water treaties or cooperation agreements signed between countries, as well as instruments that allow parties to modify and review their water treaty regime or the conclusion of a framework agreement that allows for the flexibilization of certain clauses, such as those related to water (re)allocation or use in atypical situations.
14. Develop joint or harmonized impact assessments among countries, as well as joint monitoring and information systems (databases or GIS systems), to strengthen cooperation and minimize contradictory policies.
15. Promote knowledge management considering all forms of information, including scientific knowledge, ancestral knowledge, and local practices, as well as recognizing the diversity of local knowledge, different perceptions of risk, and political concerns.
16. Increase CAF's presence in entities specialized in transboundary water management, as well as adhere to global or regional initiatives regarding transboundary water governance.

Programmatic line 1.2 Drought and flood risk reduction

1. Strengthen and finance the equipment and modernization of real-time hydrometeorological information systems and hydraulic infrastructure monitoring for drought and flood management.
2. Incorporate risk reduction approaches into the design and implementation of preparedness, response, and recovery programs for emergencies resulting from droughts and floods.
3. Foster the development of national strategies to enhance national and local coordination and public awareness of disaster risk reduction, tapping into synergies with climate change strategies.
4. Promote the use of spatial information systems, including GIS, and technological innovations to improve tools for measurement, analysis, and dissemination of data.
5. Encourage collaboration among global and regional institutions for the application of instruments and tools for disaster risk reduction, as well as partnerships with other institutions specialized in drought management or flood control.
6. Strengthen technical capacity, consolidate knowledge and methodologies to assess disaster risk, including its components of hazards, vulnerability, and degree of exposure.
7. Join international initiatives, such as the International Drought Resilience Alliance (IDRA), to increase advocacy and cooperation regarding water-related disasters.
8. Promote financial innovation, such as Projects for Results (P4R), Environmental Impact Bonds, and Sustainability-Linked Loans.
9. Divulge information related to disaster losses and the economic, social and environmental impact, in coordination with CAF's areas of expertise.
10. Promote mechanisms for the implementation of disaster risk insurance.
11. Contribute to urban planning aimed at delineating flood zones.

Objective 2. Safe, inclusive, and efficient access to water and sanitation

Programmatic line 2.1 Increased urban access to water and sanitation under a basin and climate resilience approach

1. Strengthen normative and institutional frameworks to reduce the fragmentation of leadership, regulation, and service provision, connecting with institutions responsible for water resource management to enhance watershed management approaches.
2. Promote differentiated, public, private, or mixed schemes for improving service delivery, in line with national and sectoral policies of the countries.
3. Improve and strengthen regulatory management following best practices, as well as incorporate new regulatory instruments that promote the approach within, around, and outside cities.
4. Optimize or modernize sectoral information systems to enable monitoring of targets, coverage, and quality of services with a gender perspective, aiming for universal access to safe water and sanitation.
5. Drive and monitor technological innovations, including the utilization of non-conventional water sources such as desalination, water harvesting, and water reuse, as well as nature-based solutions (NbS) such as artificial aquifer recharge, especially in water-stressed cities.
6. Conduct research and pilot projects for the provision of safe water and sanitation in informal settlements.

Programmatic line 2.2 Bridging the access gap to rural water and sanitation

1. Strengthen intersectoral planning and coordination, both at the national and local levels, for rural development.
2. Strengthen the sustainability of rural services through associative models and the principle of subsidiarity with municipal governments.
3. Promote behavioral changes among rural populations for the use of disinfection, payment of fees or tariffs to cover operational costs, and watershed management approaches to preserve soils, both upstream and downstream of water catchment or discharge points, among others.
4. Ensure the incorporation of community development, the strengthening of the committee responsible for service provision, as well as post-project support to community organizations, as part of investment projects.
5. Support the development or consolidation of subsector information systems in rural areas, integrating gender-disaggregated information and indicators.

Objective 3. Reducing contamination of water bodies for a healthy environment

Programmatic line 3.1 Increase in urban wastewater treatment

1. Promote the inclusion of wastewater treatment plants in watershed management plans and master water and sanitation plans in a complementary manner.
2. Strengthen oversight tasks concerning wastewater discharges, promoting the reevaluation of water and the principle of "polluter pays"/the "polluter pays" maxim.
3. Include measures to improve society's perception of the importance of reducing pollution, so that individuals/people collectively assume the corresponding costs, reflected in sanitation tariffs.
4. Support countries in developing an inventory of wastewater treatment plants, including their condition and operational capacity, among other factors.
5. Provide guidance on characterizing non-domestic effluents, as well as the regulations controlling non-domestic discharges to sewerage systems.

Programmatic line 3.2 Promotion of water reuse and circular economy

1. Disseminate and implement a circular economy-oriented approach that promotes the use of treated wastewater and the recovery of by-products under the maxim: "they are not waste, they are new resources" (CAF and World Bank, 2018).
2. Attract financial resources by incorporating the Water-Energy-Food Nexus.
3. Promote the inclusion of reuse in river basin management plans and water and sanitation master plans.

Programmatic line 3.3 Improved urban solid waste management

1. Support countries in the review and updating of coherent, modern, and feasible regulatory frameworks, policies, and plans that promote the proper disposal of solid waste, as well as the use of waste as a resource.
2. Promote the inclusion of sanitary landfills in watershed management plans.
3. Promote citizen participation in waste management systems, through timely communication with reliable and transparent information, as well as measures to improve society's perception of the importance of reducing urban solid waste pollution.
4. Support countries in developing an inventory and characterization of exposed dumping grounds and sanitary landfills.

Objective 4. Access to irrigation for family and intensive agriculture.

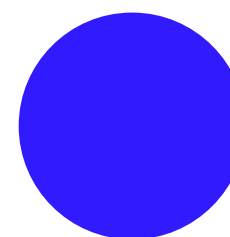
Programmatic line 4.1: Expansion and rehabilitation of family-farming irrigation

1. Advise on the formulation of policies, plans, and programs to guide agricultural development, irrigation, and watershed management, with incentives for modernization, training, and technical assistance.
2. Strengthen the capacities and institutions of agencies involved in the governance and regulation of irrigation for the formulation of public policies, planning, project cycles, and knowledge management.
3. Enhance the sustainability of family irrigation services through management models that promote collaboration.
4. Ensure that interventions in family irrigation consider watershed management, including water source protection, controlled pesticide use, and the effects of agricultural drainage.
5. Promote the use of nature-based solutions (NBS) in agriculture to reduce evaporation, increase soil infiltration, and maintain soil moisture, such as stone terraces, agroforestry techniques, and organic mulching.
6. Encourage crop cultivation methods that require less water and improve water productivity (Rosa, 2022), as well as the installation of photovoltaic panels to reduce evaporation on cropland.
7. Support the adoption of rainwater harvesting techniques for supplemental irrigation.

8. Promote training programs in modernization and integration into productive and commercial chains for small farmers, as well as exchange among irrigators involved in family farming.
9. Conduct studies and research in coordination with CAF's areas of expertise on the economic impact of irrigation in agriculture and economic development.
10. Optimize or modernize sectoral information systems for family agriculture to enable monitoring of equipped, operational irrigation areas with expansion potential, as well as differentiation between traditional and technical irrigation.

Programmatic line 4.2 Promotion of intensive irrigation systems

1. Strengthen the capacities and institutional framework of the agencies/organizations linked to the governance and regulation of intensive irrigation, for the formulation of public policies, planning, project cycles, and knowledge management.
2. Promote innovation in agribusiness through big data and digital transformation.
3. Conduct studies on the agro-industrial potential in selected countries, in coordination with CAF's sectoral knowledge area.
4. Optimize or modernize sectoral information systems for intensive agriculture, enabling the monitoring of equipped irrigation areas, operational status, expansion potential, and differentiation between traditional and technical irrigation.



Annex 2

Typology of water security programs and projects

Typology of Water Security Programs and Projects (PPI)	Examples of PPI and Technical Cooperation implemented	Country	CFA/CT
SO1. IWRM for improved governance, drought management, and flood control.			
Integrated management of national/provincial watersheds	National Hydrometeorological Network Optimization Project	Venezuela	CFA008791
	Implementation of the Integrated Management Plan for the Luján River Basin - Stages I and II Project.	Argentina	CFA 10061 CFA 11342
Integrated transboundary watershed management	Technical Cooperation: Preparing the basis for the integral implementation of the strategic action program of the La Plata Basin (GEF Funds).	Argentina, Bolivia, Brasil, Paraguay and Uruguay	CT
	Technical Cooperation: Binational Project "Adaptation to Climate Change in Vulnerable Coastal Cities and Ecosystems of the Uruguay River" - (Adaptation Fund)	Argentina and Uruguay	CT
Stormwater drainage and flood control	São Bernardo do Campo - PROINFRA	Brazil	CFA 010048 CFA 010051
	Implementation of the Integrated Management Plan for the Luján River Basin - Stages I and II Project.	Argentina	CFA 10061 CFA 11342
	Jacareí's Urban and Social Development Program - PRODUS	Brazil	CFA 011008 CFA 011016
	Araguaina Integrated Sanitation Program	Brazil	CFA 011060
	Macro-drainage and Flood Control Program for the Baquirivú-Guaçu River - Guarulhos	Brazil	CFA011320
Emergency humanitarian aid to the populations affected by the floods in the municipality of Chone.	Ecuador	CT	

Typology of Water Security Programs and Projects (PPI)	Examples of PPI and Technical Cooperation implemented	Country	CFA/CT
Drought management	São Paulo - DAEE Pedreira and Duas Pontes Dams	Brazil	CFA008680
	Alagoas - "Canal do Sertão Project" - Km 150 to Km 200 - PPSA	Brazil	CT
	Casupá Dam	Uruguay	No CFA
	Collective water solutions for socially vulnerable rural populations affected by recurrent droughts in Uruguay	Uruguay	CT
	Humanitarian aid for the population affected by drought in Paraguay	Paraguay	CT
SO2. Safe, Inclusive, and Efficient Access to Water and Sanitation			
Water catchment and/or conduction (bulk water)	Support for AySA's Service Expansion and Improvement Plan (4 phases)	Argentina	Various CFA
	Uberaba - Development and Water Resources Program	Brazil	No CFA
	Eastern Aqueduct Expansion Project, Salinity Barrier and Transfer to Santo Domingo North	Dominican Republic	CFA011663
Water Treatment Plant (new or rehabilitation)	Program for the Rehabilitation and Optimization of Major Water Purification Plants in the Bolivarian Republic of Venezuela, Phases 1 and 2	Venezuela	CFA007902 CFA008390
	Uberaba - Development and Water Resources Program	Brazil	No CFA
	Support for AySA's Service Expansion and Improvement Plan (4 phases)	Argentina	Various CFA
	Construction of a Water Treatment Plant in the Districts of La Plata, Berisso, and Ensenada	Argentina	CFA010209
	Infrastructure Rehabilitation Program for the Province of Buenos Aires	Argentina	CFA 10059
Expansion or rehabilitation of the drinking water distribution network	Construction of a Water Treatment Plant in the Districts of La Plata, Berisso and Ensenada.	Argentina	CFA 10209
	Luján River Project - Expansion of potable water service in Mercedes, West Zone	Argentina	CFA 10061
	PRODESOL Sobral Program	Brazil	CFA 10569
	New Rinconada	Peru	CFA 11724
Water demand management (sectorization, micro-metering, flow recovery, commercial management...)	Optimization of Drinking Water Supply Systems at the National Level	Venezuela	CFA 9204
	Mogi das Cruzes	Brazil	CT - PPSA
Expansion or rehabilitation of rural drinking water system (concentrated or dispersed)	Safe Water for Dispersed Communities	Argentina	
	My Water (5 phases)	Bolivia	Various CFA
Energy efficiency management in drinking water or sewage systems	AYSA Drinking Water Works Program 1 - Variable Speed Drives at AySA Pumping Station	Argentina	CFA 8083
	Study of Alternatives and Basic Project to optimize the Fortaleza Wastewater Treatment Plant and Study of Alternatives and Basic Project to optimize the Gavião Drinking Water Treatment Plant, Ceará.	Brazil	CT LAIF/KfW
Automation and digital transformation in drinking water or sanitation systems.	SANEAR Santo André Program	Brazil	CFA 11063

Typology of Water Security Programs and Projects (PPI)	Examples of PPI and Technical Cooperation implemented	Country	CFA/CT
Expansion or rehabilitation of sanitary sewer system	Panama City and Bay of Panama Sanitation Project - 2nd Module WWTP	Panama	CFA 9238 CFA 9239
	PRODESOL Sobral Program	Brazil	CFA 10569
	Maceió - Neighborhood Revitalization Program	Brazil	CFA 10634
	Ceará PROSATUR Program	Brazil	CFA 11872
	Sanitation Program for the Districts of Arraiján and La Chorrera PSACH	Panama	CFA 10454
	Burunga and Arraiján Wastewater Management headwaters	Panama	CFA 10449
On-site sanitation	National Aqueduct and Sewerage Systems Program	Panama	CFA 8686
	PROMADEC Community Development Sanitation Program (4 phases)	Ecuador	CFA 8396 and others
SO3. Reducing pollution of water bodies for a healthy environment			
Wastewater treatment plants (new or rehabilitation)	Panama City and Bay of Panama Sanitation Project - 2nd Module WWTP	Panama	CFA 9238 CFA 9239
	Wastewater management program for Burunga and Arraiján Cabecera	Panama	CFA 9854
	PRODESOL Sobral Program	Brazil	CFA 10569
	Ceará PROSATUR Program	Brazil	CFA 11872
	Mais Mogi EcoTietê Mogi das Cruzes Program	Brazil	CFA 11299 CFA 11300
	Sanitation Program for the Districts of Arraiján and La Chorrera PSACH	Panama	CFA 10454
	Infrastructure Rehabilitation Program for the Province of Buenos Aires	Argentina	CFA 10059
	Technical Cooperation: National Plan for Wastewater Treatment, Stage I	Argentina	CT
	Valencia Lake Sanitation Project	Venezuela	CFA 9225
	Wastewater reuse system	Technical Cooperation: Twinning Aguas de Portugal - AySA & Portuguese Environmental Fund - AySA	Argentina
System for the cogeneration of energy in wastewater treatment systems	Panama City and Bay of Panama Sanitation Project - 2nd Module WWTP	Panama	CFA 9238 CFA 9239
	PTAR Guangarcucho	Ecuador	CFA 11057
System for the cogeneration of energy in municipal solid waste disposal systems	Ecuador's Sectoral Mitigation Mechanism (LAIF Funds)	Ecuador	CT
Sludge stabilization and utilization system for agriculture	Programa de Infraestructura de Saneamiento del Norte Grande II - "Cleaning of the Wastewater Treatment Lagoon System of Jujuy-Province of Jujuy"	Argentina	CFA 8640
Improved urban solid waste collection services.	SANEAR Santo André Program	Brazil	CFA 11063
	PRODESOL Sobral Program	Brazil	CFA 10569
	Technical Cooperation Prefeasibility analysis of regional schemes for the provision of sanitation services in La Guajira	Colombia	CT

Typology of Water Security Programs and Projects (PPI)	Examples of PPI and Technical Cooperation implemented	Country	CFA/CT
Sanitary landfills	Sustainable Municipalities Program of the State of Pará	Brazil	CFA 10689
	PROASRED	Bolivia	CFA 8606
	PROMULPRE 2	Bolivia	CFA 11999
SO4. Access to irrigation for family and intensive agriculture			
Family irrigation	MI Riego Program (2 Phases)	Bolivia	CFA 8785 CFA 9757
	Dams Program	Bolivia	CFA 9759
Intensive irrigation	New Irrigated Areas Development Program	Argentina	CFA 8581
	Majes Sigwas Project, Stage II	Peru	CFA 7705
	Chavimochic III Stage Project	Peru	CFA 8519
	Alto Mao System Irrigation Canal Project	Dominican Republic	PPSA
	Sertão Alagoano Canal km 150 to 200	Brazil	PPSA

References

- CAF (2016). Agua Potable y Saneamiento en la Nueva Ruralidad de América Latina. Caracas, Venezuela: CAF.
- CAF (2018). Estrategia de Agua 2019–2022. Montevideo, Uruguay.
- CAF (2022). IDeAL. Energy, water, and health for a better environment. <https://scioteca.caf.com/handle/123456789/2017>
- CAF (2022). Análisis regional de los instrumentos normativos sobre vertidos, cuerpos receptores y economía circular. <https://scioteca.caf.com/handle/123456789/1984>
- CAF (2023). Estudio de brechas y cartera de inversiones en agua y resiliencia climática en la región de América latina y el Caribe hacia el 2030 y 2040. In publication.
- Citigroup (2021). Biodiversity. The Ecosystem at the Heart of Business. Citi Global Perspectives & Solutions
- Correal, M., Rihm, A. & Zambrano, M. (May 20, 2021) De desechos a recursos: gestión de residuos sólidos para el desarrollo. Volvamos a la fuente. <https://blogs.iadb.org/agua/es/desechos-a-recursos-gestion-residuos-solidos/>
- ECLAC (2022a). Social Panorama of Latin America 2021. Santiago, Chile.
- ECLAC (2022b). Social Panorama of Latin America 2022. Santiago, Chile.
- ECLAC (2023). Statistical Yearbook for Latin America and the Caribbean 2022. Santiago, Chile.
- EM-DAT (2022). The International Disaster Database. Belgium: Centre for Research on the Epidemiology of Disasters. Available at <https://www.emdat.be/>
- FAO (2014). *Agricultura familiar en América Latina y el Caribe: Recomendaciones de Política*. Santiago, Chile.
- FAO et.al. (2021). The State of Food Security and Nutrition in the World 2022. Repurposing food and agricultural policies to make healthy diets more affordable. Rome, FAO. <https://openknowledge.fao.org/items/c0239a36-7f34-4170-87f7-2fcc179ef064>
- Farber, 2015. Separated at Birth? Addressing the Twin Crises of Biodiversity and Climate Change, *Ecology Law Quarterly*, Vol. 42, pp 840-888; Regents of the University of California.
- GEF (2022) Advancing Urban Sustainability for a Green Recovery. Learning from the GEF's Sustainable Cities Program.
- GWP (Global Water Partnership) (2013). Integrated urban water management (IUWM): Toward diversification and sustainability. Policy Brief. Available at: <https://www.gwp.org/globalassets/global/toolbox/publications/policy-briefs/13-integrated-urban-water-management-iuwm.-toward-diversification-and-sustainability.pdf>

Hettiarachchi, H., Ryu, S., Caucci, S. & Silva, R (2018). Municipal Solid Waste Management in Latin America and the Caribbean: Issues and Potential Solutions from the Governance Perspective. *Recycling*, 3 (2), 19. <https://doi.org/10.3390/recycling3020019>

Hufty, M. (2001) Investigating policy processes. The Governance Analytical Framework (GAF), Research for Sustainable Development Foundations, Experiences and Perspectives.

IFPRI (2021). Assessment of the role of Irrigation for climate change. Adaptation for Africa. <https://www.ifpri.org/project/assessment-role-irrigation-climate-change-adaptation-africa>

INFRALATAM (2022). *Agua, riego y defensa contra inundaciones*.

Inter-American Development Bank (2021a). Water and Sanitation Sector Framework Document. <https://www.iadb.org/document.cfm?id=EZSHARE-1739234685-88>

Inter-American Development Bank (2021b). Strategies for the financial sustainability of waste management in Latin America and the Caribbean. Webinar: Financing for Solid Waste Management.

Inter-American Development Bank (2021a). Water and Sanitation Sector Framework Document. <https://www.iadb.org/document.cfm?id=EZSHARE-1739234685-88>

Inter-American Development Bank (2021b). Strategies for the financial sustainability of waste management in Latin America and the Caribbean. Webinar: Financing for Solid Waste Management.

International Solid Waste Association ISWA (2021). The Future of the Waste Management Sector. Trends, Opportunities and Targets for the decade 2021–2030. ISWA-2021e-Future-of-Waste-Report-10-years-SPANISH-corr.pdf

IPCC (2022a), Climate Change 2022. Mitigation of Climate Change. Working Group III. Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

IPCC (2022b). Climate Change 2022. Impacts, Adaptation and Vulnerability. Working Group II. Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

IWA (2019), IWA Principles on Water-wide Cities. Second edition. London, United Kingdom.

IWA (2022). Urban Water Management. Creating climate-resilient cities, London

IWA-INBO (2022). Handbook on Basin-Connected Cities. Why and How Urban Stakeholders can be Active Water Stewards in their Basins.

JMP (2023). Progress on household drinking water, sanitation, and hygiene 2000-2022. Geneva, Switzerland: World Health Organization (WHO) and United Nations Children's Fund (UNICEF).

OECD (2012). Water Governance in Latin America and the Caribbean. A Multi-level approach, France.

OECD-FAO (2019). Agricultural Outlook 2019–2028.

Rockefeller, SIWI & ARUP (2019) The City Water Resilience Approach (CWRA), New York.

Rosa, L. (2022). Adapting agriculture to climate change via sustainable irrigation: biophysical potentials and feedbacks. *Environmental Research Letters* 17, IOP Publishing.

Saravia, S. (2022) Panorama de los recursos hídricos en ALC y propuesta de transición hídrica sostenible. XII Edition of the International Economic Week, Santiago, Chile.

Solactive AG. (2023). Climate Change and Biodiversity Loss. Twin Crises, Joint Crises. Iceberg Data Lab, Frankfurt, Germany.

UN-Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6. Indicator 6.5.1: degree of IWRM implementation, Geneva, Switzerland.

UN-Habitat (2012). State of Latin American and Caribbean Cities 2012. Towards a new urban transition. Brazil. <https://unhabitat.org/state-of-latin-american-and-caribbean-cities-2>

UN-Habitat (2022). World Cities Report 2022. Envisaging the Future of Cities, Nairobi, Kenya.

UNDRR (2021). Special Report on Drought 2021. Global Assessment Report on Disaster Risk Reduction. Geneva, Switzerland.

UNEP (2014). Decoupling 2: Technologies, opportunities and policy options. A Report of the Working Group on Decoupling to the International Resource Panel. <https://www.resourcepanel.org/file/409/download?token=vkGx91ix>

UNEP (2018). Waste Management Outlook for Latin America and the Caribbean. United Nations Environment Programme, Office for Latin America and the Caribbean. Panama City, Panama. <https://www.unep.org/ietc/resources/publication/waste-management-outlook-latin-america-and-caribbean>

UNEP (2021a). Roadmap for the progressive closure of dumpsites in Latin America and the Caribbean. https://wedocs.unep.org/bitstream/handle/20.500.11822/34919/Roadmap_EN.pdf?sequence=7&isAllowed=y

UNEP (2021b). Progress on Integrated Water Resources Management. Global Indicator 6.5.1. Updates and Acceleration Needs.

UNEP-UNDP (2021). Smart, Sustainable and Resilient Cities: The Power of Nature-based Solutions. A Working Paper for the G20.

UNESCO (2015). Ecosystem based approach. Transboundary Water Governance and Climate Change Adaptation.

UNESCO-CODIA (2022). Transboundary water cooperation in Latin America and the Caribbean. Technical Document No 45

World Bank (2021). Bridging the Gap in Solid Waste Management. Governance Requirements for Results. <https://openknowledge.worldbank.org/bitstream/handle/10986/35703/Bridging-the-Gap-in-Solid-Waste-ManagementGovernance-Requirements-for-Results.pdf?sequence=6&isAllowed=y>

World Bank (2022). Water Matters. Resilient, Inclusive and Green Growth through Water Security in Latin America, Washington, USA.

WWAP (United Nations World Water Assessment Programme) (2016). United Nations World Water Development Report 2016: Water and Jobs. Paris: UNESCO.

WWAP (United Nations World Water Assessment Programme) (2017). United Nations World Water Development Report 2017: Wastewater, a wasted resource. Paris: UNESCO.

WWAP (United Nations World Water Assessment Programme) (2018). United Nations World Water Development Report 2018: Nature-based solutions for water management. Paris: UNESCO.

WWAP (United Nations World Water Assessment Programme) (2019). United Nations World Water Development Report 2019: Leaving no one behind. Paris: UNESCO.

WWAP (United Nations World Water Assessment Programme) (2020). United Nations World Water Development Report 2020: Water and Climate Change. Paris: UNESCO.

WWAP (United Nations World Water Assessment Programme) (2021). United Nations World Water Development Report 2021: The Value of Water. Paris: UNESCO.

WWAP (United Nations World Water Assessment Programme) (2022). United Nations World Water Development Report 2022: Groundwater: Groundwater: Making the invisible visible. Paris: UNESCO.

WWC (World Water Council, Ed.) (2018). "Water security in Latin America: The urban dimension. Empirical evidence and policy implications from 26 cities". Global Water Security. Lessons Learnt and Long-Term Implications. Singapore: Springer.

