Chris D. Metcalfe and José Esteban Castro, "Meeting the Sustainable Development Goals for Water and Sanitation". In Metcalfe, CD, Menone M, Collins, P., Tundisi, J (Eds.), The Paraná River Basin: Protecting Ecosystem Services Through Effective Water Management. The Earthscan Series on Major River Basins of the World, Series Editor, Smakhtin, V., Routledge Publishers, 2020, pp. 161-180.

KEY MESSAGES

- Although the countries that share the Paraná River Basin, namely Brazil, Argentina and Paraguay have officially stated that they are on track to meet the targets of SGD for universal access to affordable safe drinking water and sanitation, and eliminating open defecation, the available evidence suggests that these countries will fail to achieve these targets.
- Despite reporting high levels of service coverage in urban areas, official figures must be interpreted with caution. Reported coverage levels often misrepresent the situation affecting important segments of the urban population, for example those living in shanty towns and favelas. Moreover, the quality of water delivered for human consumption in urban areas too often fails to meet minimum standards, and this is not adequately reflected in official reports. Consequently, people resort to expensive and mostly unregulated bottled water to satisfy their needs.
- The countries within the basin face significant challenges in addressing SDG 6 to provide universal access to facilities for sanitation and hygiene, particularly among the poorer segments of the population that live in rural areas or in urban slums. Afro-American and Indigenous communities are particularly affected.
- All three countries will have to make significant investments to treat domestic and industrial wastewater to meet the targets of SDG 6.3.
- Argentina and Paraguay need to develop programs to monitor water quality and report on these data to the UN-Water Integrated Monitoring Initiative for SDG 6 (IMI).
- Implementation of programs for integrated water resource management appear to be at or below the global average in the countries that share the Paraná River Basin (i.e. <50%), but there are significant barriers to increasing the participation in these types of water management programs.
- The Forum of the Countries of Latin America and the Caribbean on Sustainable Development convened under the auspices of the Economic Commission for Latin America and the Caribbean (ECLAC) may be an effective mechanism for monitoring and reviewing the implementation of the 2030 Agenda for Sustainable Development among the Member States, including reporting progress in Brazil, Argentina and Paraguay in meeting the objectives of SGD 6.

ABSTRACT

Among the 17 Sustainable Development Goals (SDGs) set under the 2030 Agenda for Sustainable Development, SDG 6 focuses on access to clean water and sanitation for all. Data are not available on the status in meeting these goals that are specific to the basin of the Paraná River, but the national data generated for the three countries that primarily share the basin (i.e. Argentina, Brazil and Paraguay) can give an indication of the capacity to meet these goals. A critical review of the data collected to date by the SDG Global Database indicates that, although Brazil, Argentina and Paraguay officially report that they are very close to meeting the SGD 6

targets for providing universal access to safe drinking water and eliminating open defecation, in reality, these countries may fail to achieve these targets. These nations, particularly Argentina and Brazil, report very high levels of service coverage in urban areas, but these data fail to reflect real coverage levels, as shanty towns and favelas are often not included or are not adequately reported. In addition, the water delivered is not always safe for human consumption, which leaves people with no other option than using water from unsafe sources or expensive bottled water. Moreover, these countries face significant challenges in addressing the target to provide universal access to facilities for sanitation and hygiene, particularly among the poorer segments of the population living in rural areas or in urban slums. The situation is particularly acute for Afro-American and Indigenous communities. In meeting the goals to improve water quality (i.e. SGD target 6.3), Brazil appears to be an active participant in programs to monitor water quality and report these data to the Global Database. However, Argentina and Paraguay need to be more active in participating in this process. All three countries are lagging behind in treating domestic and industrial wastewater before discharge into aquatic ecosystems. The level of participation in integrated water resource management programs in all three countries is equal to or less than 50%. However, because of the lack of incentives among stakeholders to participate in these programs, there are significant barriers to expanding these types of water management programs. Although at the country-level, water stress is not a significant threat, large areas of the nations within the basin are affected by medium-to-severe water stress, and a substantial share of the urban population is located in water-stressed regions, particularly in Brazil. Although the three countries appear to have the basic institutions, regulations and organizational mechanisms to meet the SGD 6 targets, they face multiple obstacles for making significant progress. In particular, a lack of commitment to tackle long-standing structural inequalities is a major problem that may prevent these countries from meeting SGD 6; a situation that has been emphasised in recent reports by the Economic Commission for Latin America and the Caribbean (ECLAC). The annual meetings of the Forum of the Countries of Latin America and the Caribbean on Sustainable Development convened under the auspices of ECLAC may provide the impetus for Brazil, Argentina and Paraguay to participate in the process of meeting the objectives of SGD 6.

LIST OF ACRONYMS

AWR: Arsenic in Water Research Group [Argentina]

CEMADEN: National Monitoring and Alerting Centre for Natural Disasters [Brazil]

ECLAC: The Economic Commission for Latin America and the Caribbean

GBD: Global Burden of Disease

GEMI: The UN-Water Organization for Integrated Monitoring of Water and Sanitation

GEMS/Water: The Global Environment Monitoring System (GEMS) for Freshwater

GEMStat: The water quality data base operated under the auspices of GEMS/Water GLAAS: The UN-Water organization for Global Analysis and Assessment of Sanitation and Drinking Water

IMI: UN-Water Integrated Monitoring Initiative for SDG 6

JMP: WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene

SGD: Sustainable Development Goals

UNSD: United Nations Statistics Division

WRI: World Resources Institute

INTRODUCTION

World leaders adopted the 2030 Agenda for Sustainable Development, which set 17 goals for improving the lives of the global population and for protecting the environment. Sustainable Development Goal 6 (i.e. SDG 6) focuses on access to affordable clean water, sanitation and hygiene for all. However, water serves as a foundation for many of the other development goals (UN Water, 2016), such as SGD 3 (Good Health and Wellbeing), SGD 11 (Sustainable Cities and Communities), SDG 13 (Combat Climate Change), SGD 14 (Life Below Water) and SGD 15 (Life on Land). As summarized in Table 1, there are eight targets within SDG 6, including Target 6.1 that aims to provide access to safe drinking water for 100% of the population in each country, and Target 6.2 that aims to provide 100% access to facilities for sanitation and hygiene. All other objectives within SGD 6 are "aspirational" targets, meaning that individual participating countries can set their own targets and report progress relative to those objectives. Targets 6.a and 6.b are organizational objectives, as opposed to other operational SGD 6 objectives for the participating countries. Table 1 summarizes the indicators that are used to measure progress towards SGD 6.

However, according to the Synthesis Report on Water and Sanitation published in July 2018 (UN Water, 2018), there will be significant challenges for many countries to achieve the targets set for SGD 6. Three years into the SGD era, this report confirms that the world at large is lagging behind in achieving the SDG 6 targets. Less than half of the UN Member States have data available on progress made towards SDG 6 targets, and there is a lack of tools available for countries to effectively track the indicators for SDG 6 (UN Water, 2018). In addition, while low- and middle-income countries may focus on advances in achieving some of the SGD objectives, such as reductions in poverty (SGD 1), improvements to health (SGD 3) and increased economic growth (SGD 8), advances in SGD 6 may not be a high national priority in the competition for limited financial resources.

Investments in infrastructure for the treatment of water and wastewater and the development of policies and practices that reduce point-source pollution are generally a low national priority relative to other investments. In a survey of 70 low-, middle- and transitional-income countries, only 19% and 9% had sufficient financial resources to meet water quality targets in urban and rural areas, respectively (GLAAS 2017). Even in countries such as the new member states of the European Union, where membership in the Union requires compliance with the Water Framework Directive to meet requirements for "*good status*" of their water resources, progress has been slow in improving water quality (Teodosiu et al., 2015). Wastewater management has historically been poorly funded because it has been considered less visible, with lower public recognition and less political support (Winpenny et al., 2016). A recent study with a focus on countries in Latin America showed that policies that attract clean and energy efficient industries have the potential to improve environmental quality while also enhancing economic growth (Sapkota and Bastola, 2017). However, many countries do not have the luxury of attracting only clean industries, and instead have a high proportion of polluting industries. The *"pollution haven*" hypothesis holds that polluting industries will re-locate from countries with more stringent environmental regulations to countries that have lax regulations and/or ineffective enforcement (Ederington et al., 2005; Tang, 2015).

Table 1: Targets for SGD 6 and indicators for measuring progress in achieving the targets.

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

6.1.1 Percentage of population using safely managed drinking water services

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

6.2.1 Percentage of population using safely managed sanitation services

6.2.2 Percentage of population with handwashing facilities with soap and water at home

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

6.3.1 Percentage of wastewater safely treated

6.3.2 Percentage of receiving water bodies with good ambient water quality

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

6.4.1 Change in water use efficiency over time

6.4.2 Level of water stress: freshwater withdrawal in percentage of available freshwater resources

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

6.5.1 Degree of integrated water resources management (IWRM) implementation (0-100)

6.5.2 Percentage of transboundary basin area with an operational arrangement for water cooperation

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

6.6.1 Percentage of change in water-related ecosystems over time

Target 6.a: *By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation- related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.*

6.a.1 Amount of water and sanitation related Official Development Assistance (ODA) that is part of a government coordinated spending plan

Target 6.b: *Support and strengthen the participation of local communities in improving water and sanitation management.*

6.b.1 Percentage of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management.

Although Latin American countries have a very diversified approach to investment priorities, environmental sustainability tends to be a low priority. In most cases, national goals tend to focus on economic growth, but in some cases extend to improving education, reducing poverty and extending access to essential public services. These latter goals whichare complementary and mutually reinforcing with SDG 6, have had a higher priority in the last two decades. This was the case, for example, in Argentina and Brazil during the period 2008-2015. Nevertheless, the lower priority for goals focused on environmental sustainability is illustrated by the lexicometric analysis conducted in 2018 by the Economic Commission for Latin America and the Caribbean

(ECLAC) on the key concepts present in national development plans (Figure 1). However, despite the focus within Latin American countries on improvements to the economy, health and education, and in reducing poverty, there is evidence that SGDs related to the environment are slowly becoming integrated into long-term national goals, at least, where these objectives converge with other national priorities. In Brazil, access to sanitation was included in a national agenda for economic activities (Rocha and Weiss, 2019). In Brazil and Argentina, advances in SGD 6 are considered integral to making progress towards the health-related SGDs (GBD 2016 SDG Collaborators, 2017). According to ECLAC (2018), among countries from Latin America and the Caribbean that were polled concerning their priorities under SGD 6, the target related to access to sanitation and hygiene (i.e. SGD 6.2) was prioritized in all cases. However, this agency reported that a high percentage of countries in the region have not defined metrics for measuring progress for SGD targets 6.6, 6.a and 6.b, while available data from many countries are unreliable or incomplete, which casts doubts on the possibility of effectively monitoring progress towards meeting the SDGs in the region (ECLAC, 2017).

Figure 1: Lexicometric analysis of key concepts present in national development plans for countries in Latin America. Source: ECLAC (2018).

In this chapter describing the prospects for meeting the SGD 6 objectives in the Paraná River Basin, it was not possible to obtain data that are specific to the basin. Therefore, the discussion will focus on national data that are available for Brazil, Argentina and Paraguay for the SGD 6 indicators summarized in Table 1, complemented with additional data from national sources and recent research. While these parameters may vary across different regions within the three countries, the data on a national level can give a general idea of the prospects within the basin for meeting the SGD 6 targets. However, we have also used sub-national data to highlight some relevant issues and support the arguments.

THE SDG PROCESS IN COUNTRIES OF THE PARANÁ RIVER BASIN

In May 2016, at the thirty-sixth session of ECLAC, held in Mexico City, the Commission's Member States established the Forum of the Countries of Latin America and the Caribbean on Sustainable Development as a regional mechanism to monitor and review the implementation of the 2030 Agenda for Sustainable Development. The Forum is convened under the auspices of ECLAC and meets annually to review progress at the national and regional level. In the two annual reports published to date by ECLAC, aggregate metadata were provided that track early progress in achieving the SDG goals (ECLAC, 2017; ECLAC, 2018). Included in these reports are descriptions

of the institutional approaches taken by the member States to coordinate national responses to the 2030 Agenda. The countries of Brazil, Argentina and Paraguay have all established high-level institutions that are charged with coordinating the national responses. Below are the names of these institutions (translated into English) and a description of their composition and mandates:

- Brazil established the *National Commission for the Sustainable Development Goals*, which reports to the Government Secretariat of the Office of the President and includes representatives from the Office of the President, the Ministry of Foreign Affairs, the Ministry of Social and Agrarian Development, the Ministry of Planning, Development and Management, and the Ministry of the Environment. Also included as technical advisors are representatives from the Geographical and Statistical Institute and the Institute of Applied Economic Research in Brazil. For the first term of the National Commission, 16 representatives from the Federal Government, state and municipal governments and civil society were selected to participate in its activities (ECLAC 2018).

- In Argentina, the coordinating role for the 2030 agenda was transferred to the *National Council for Social Policy Coordination*, which was originally established in 2002 and is attached to the Office of the President. This Council coordinates the actions of 20 ministries through 6 commissions, which include: education, science and technology, sustainable agricultural production, housing, urban development and infrastructure, work and employment, and social protection (ECLAC, 2018).

- Paraguay established a new institution, the *Inter-Agency Coordinating Committee for the Implementation, Follow-up and Monitoring of the International Commitments Accepted by the Country in the Framework of the United Nations Sustainable Development Goals.* The Committee members include the Technical Secretariat for Economic and Social Development Planning, the Ministry of Trade, the Ministry of Foreign Affairs (coordinator) and the Social Cabinet of the President. The Committee is in the process of empowering 17 national institutions to take responsibility for the Sustainable Development Goals (ECLAC, 2017).

It is worth noting that the composition of these high-level institutions is heavily weighted towards economic development, trade, large-scale agriculture, forestry and mining, education, urban and rural planning, and foreign affairs. Therefore, it is likely that the SGDs that focus on these areas of development will take precedence in the planning process, and that many of the targets for SGD 6 will be considered of lesser importance in Brazil, Argentina and Paraguay. Also, significant political changes, particularly in Brazil and Argentina, have introduced far-reaching changes that may negatively affect the countries' ability to meet the SDGs. In Argentina, during the period 2015-2019, the national government radically abandoned the target of reducing social inequality. A similar path was taken openly by the new Brazilian government, beginning in 2019.

As ECLAC's reports (2017, 2018) have clearly identified, structural inequalities have historically been a major obstacle for development in the region, and the recent reversal by the governments of the region from their commitments to reduce these inequalities may impede the achievement of the SDGs. ECLAC identified a major challenge for the member States, which is to establish and then generate data on the SDG indicators at the national level. The current level of production of the 232 SDG indicators by Brazil, Argentina and Paraguay are 31%, 28% and 20%, respectively (ECLAC, 2018). Several countries reporting to ECLAC have developed on-line platforms for SDG tracking, including Argentina (http://www.odsargentina.gob.ar/) and Brazil (http://www.agenda2030.com.br/), but Paraguay had not done so by the time of publication of the second report from this agency (ECLAC, 2018).

STATUS OF SDG 6 INDICATORS IN COUNTRIES OF THE PARANÁ RIVER BASIN

Meeting the Targets for Clean Water (SDG 6.1) and Sanitation (SDG 6.2)

The statistical information for SDG 6.1 and SDG 6.2 in Argentina, Brazil and Paraguay were collected from the SDG Global Database of the UN Statistics Division (UNSD, 2019). The origin of these data is the WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP), which along with the UN-Water Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS) and the UN-Water Organization for Integrated Monitoring of Water (GEMI) are the agencies mandated by the UN to compile country data on the SDG 6 global indicators. Together these agencies make up the UN-Water Integrated Monitoring Initiative for SDG 6 (IMI). The data compiled in Table 2 show the status of progress in achieving the goals in each country for the year in which data were collected, which in this case is 2015.

Table 2: Status of progress in achieving SDG 6.1 and 6.2 targets in Brazil, Argentina and Paraguay. Data source: UNSD (2019). The most recent date when the data were collected is shown in brackets. NA = Data not available.

Targets and indicators	Argentina	Brazil	Paraguay
Target 6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all			
Indicator 6.1.1 Proportion of population using safely managed drinking water services (%); Urban areas only.	**98.5 (2015)**	**97.5 (2015)**	**NA**
Target 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations			
Indicator 6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water			
Sub-indicator: Proportion of population practicing open defecation (%); Urban areas only.	**1.5 (2015)**	**2.0 (2015)**	**0.4 (2015)**
Sub-indicator: Proportion of population using safely managed sanitation services (%); Urban areas only.	**26.5 (2015)**	**40.4 (2015)**	**NA**
Sub-indicator: Proportion of population with basic handwashing facilities on premises (%)	**NA**	**NA**	**NA**

The official data provided to UNSD that are presented in Table 2 indicate that Argentina and Brazil would have met the target for 100% of the population to have access to "*safely managed*" drinking water (i.e. SGD 6.1). However, there are important caveats. The data presented in the table is only for urban areas, but the situation in rural areas presents a significant challenge for both countries. Also, the official data provided by the countries must be carefully scrutinized, as discussed below.

- Argentina. The data base indicates that in Argentina the level of full access to safely managed drinking water would be essentially the same for urban areas and "*all areas*" (i.e. rural and urban). However, the available evidence gives a very different picture. For example, a recent study identified 2,432 informal urban settlements across the country that house around 3 million people living in conditions of poverty, extreme poverty and vulnerability (Argentina Ombudsman, 2018). This includes 42 settlements within the capital city of Buenos Aires. The study found that only 5% of the settlements has a formal connection to a water supply network, and the majority relies on irregular connections and other alternatives (Argentina Ombudsman, 2018). It can be hardly argued that the water available for these settlements is "safely managed",

and the evidence suggests that there is scant government control over this situation and a lack of reliable information. One of the worst affected areas is the Great North Region (NGA), housing around 20% of the country's population and covering nine provinces; many within the Paraná River Basin. This region has been historically affected by poverty and lack of investment in basic infrastructure, where official levels of coverage for water supply may be as low as 75%, as in the provinces of Misiones, Chaco or Formosa, which are located in the Paraná River basin. Beyond the data on coverage officially reported, the services in the NGA tend to be severely affected by poor quality, intermittent delivery and other problems (Argentina, Ministry of Federal Planning, Public Investment, and Services, 2012), which include the threat to human health posed by the consumption of unsafe water contaminated with naturally occurring arsenic in large areas of the NGA. Arsenic of geological origin is also a major problem affecting the safety of water supplies in large areas of the country, including provinces located in the Paraná River basin, such as Santa Fe, where a significant proportion of the population receives water with arsenic levels that greatly exceed international standards of water safety (AWR, 2018). Also, Indigenous communities in Argentina are particularly affected by the lack of safe water supply. A study of 32 Indigenous communities scattered across ten provinces found that only 28% had access to a basic water supply (Argentina Ministry of Federal Planning, Public Investment, and Services, 2011). Unfortunately, the policies implemented in the last few years have not been focused on reversing the conditions of extreme poverty and inequality underpinning this situation and it is likely that in some areas the conditions may have worsened rather than improved.

- Brazil. There are no data in the JMP data base for rural populations in Brazil, but the rural population of the country, which is 30 million people according to the 2010 national census (about 16% of the total population) is the worst affected by the lack of safely managed drinking water. For example, *quilombola* communities of Afro-American descent, whose actual number is unknown but official estimates place at least at 600,000 distributed in around 2,300 rural communities scattered across several states, have scant access to safely managed drinking water. A recent study that looked at 173 *quilombola* communities reported that only 6.4% had access to "treated drinking water" (de Pádua et al., 2015). In urban areas the situation is also problematic, because even if the water supplied by the utilities were "safely managed", the evidence shows that too often the water quality is compromised by ageing and deteriorated infrastructure to the point that when it reaches the households it is no longer safe for human consumption. As pointed out by Marcos Montenegro, President of the Brazilian Association of Sanitary Engineering in Brasilia, there is a lack of credible information in the country about the quality of water distributed to the population (Montenegro, 2015). Recent developments suggest that the situation may have worsened, as the policies implemented by the national government since 2015 have weakened the public institutions in charge of planning and monitoring the delivery of essential water and sanitation services (ONDAS, 2019).
- Paraguay. This country has been praised by making rapid progress in extending coverage for water supply in recent decades. However, JMP does not have any data for the country's provision of safely managed drinking water (Table 1). A recent WHO-UNICEF joint report presented official government data for 2015, stating that 89% of the national population had access to piped water, a figure that reached 95% in urban areas but dropped to 81% in rural areas. This report also lacked information on the proportion of drinking water supplied that was "safely managed" or "free from contamination" (WHO-UNICEF, 2017). Overall, the reliability and consistency of reported official figures are a matter for concern. A recent government report estimated that in 2016 the national coverage for piped water supply was 78% but cautioned that this information

was out of date and that the real figure was likely lower. The report also stated that only 79.1% of the population receives "disinfected water" and that an unspecified but "important share of the Paraguayan population" drinks water "without any guarantee of its quality" (Paraguay Ministry of Public Works and Communications, 2018). The worst affected are marginalized urban areas and particularly rural areas, which house about 40% of the country's population, including Indigenous communities.

Among the countries within the Paraná River basin, an important aspect on reaching the SGD 6 goals for access to safe drinking water are the inequalities in access between different groups. ECLAC (2018) reported data on the gaps in drinking water coverage between the highest and lowest income households in 17 Latin American countries and these data show gaps for urban populations of approximately 7%, 3% and 1% for Paraguay, Brazil and Argentina, respectively, and for rural populations, gaps of approximately 10% and 25% in Paraguay and Brazil, respectively (no data for Argentina). Clearly, the challenges of providing access to safe drinking water are most acute among the rural poor.

In relation to the target for 100% access to facilities for sanitation and hygiene (i.e. SGD target 6.2), there are three sub-indicators for Indicator 6.2.1. According to the report, all three countries would have essentially eliminated open defecation in urban areas, although in 2017 Brazil still reported 11% open defecation in rural areas (UNSD, 2019). There will be significant challenges for the three countries to meet the targets for the sub-indicator for 100% access to sanitation services, although there are no data for this sub-indicator available in the data base to ascertain the actual situation in Paraguay. Yet, an official government report recently reported that outside the capital city of Asunción and the Central District where there is "greater coverage", in all other regions of the country the sanitation coverage is at best 10% and many places lack any sanitation facilities (Paraguay Ministry of Public Works and Communications, 2018). In addition, JMP has not recorded data for any of the three countries on the sub-indicator of the proportion of the population with handwashing facilities on the premises. ECLAC (2018) reported that the gaps in sanitation coverage between the highest income and lowest income households in rural areas in Paraguay and Brazil were approximately 65% and 27%, respectively (no data for Argentina), so as was noted in the ECLAC report on access to safe drinking water, the greatest challenge for providing access to sanitation services will be among the rural poor. However, access to sanitation services is also a challenge in urban areas among the lowest-income segment of the population. In Brazil, Argentina and Paraguay, between 19-21% of urban populations live in slums where there is poor access to sanitation services (ECLAC, 2018).

Summing up, Argentina and Brazil officially report to the JMP very high levels of coverage for safe drinking water, but a critical scrutiny of the data shows that the information is incomplete and does not reflect the realities on the ground. The situation is probably similar in Paraguay, in relation to the reliability of the available information. With lower levels of reported coverage for safe drinking water, Paraguay is likely to experience greater difficulties to achieve the universalization of safely managed drinking water by 2030. The three countries will struggle to meet the target for sanitation, and Brazil will have a particularly daunting challenge if it is to reduce the high proportion of people practicing open defecation in rural areas, where 16% of its population is located. In this regard, for all three countries that share the Paraná River Basin, the greatest challenges to meet the targets of SGD 6.1 and 6.2 will be to provide these services to the segments of the population that make up the rural poor and the urban poor. Yet, there are significant obstacles that cast serious doubt on the ability of these countries to meet the 2030 targets. In particular, the introduction since 2015 of regressive policies in the organization and delivery of essential public services in Argentina and Brazil provides

reason for concern, given that meeting the 2030 targets will require a strong State commitment to reduce structural inequalities in order to provide access to essential services to the poorest sectors of the population. Unfortunately, the evidence suggests that the policies in place in both countries are widening the inequality gap and very likely will make it impossible to meet the SDG 6 targets for water, sanitation, and hygiene. The situation in Paraguay is less clear, owing to the lack of precise information, but there are few reasons for optimism.

Having said that, a possible failure to meet the SDG 6 targets for water, sanitation and hygiene does not mean that some progress will be made, even if it slower and less extensive than expected. The data shown in Figure 2 show the increase in access to sanitation services and the decline in open defecation that occurred between 2000 and 2015 among rural and urban populations in Brazil, as reported to the JMP data base. These data show the slow but measurable progress in achieving these targets over the 15-year monitoring period, but the trends also illustrate the gap between urban and rural populations. Only the data for Brazil are provided here because Argentina and Paraguay did not report data for its rural populations and there are no data on access to sanitation services for Paraguay.

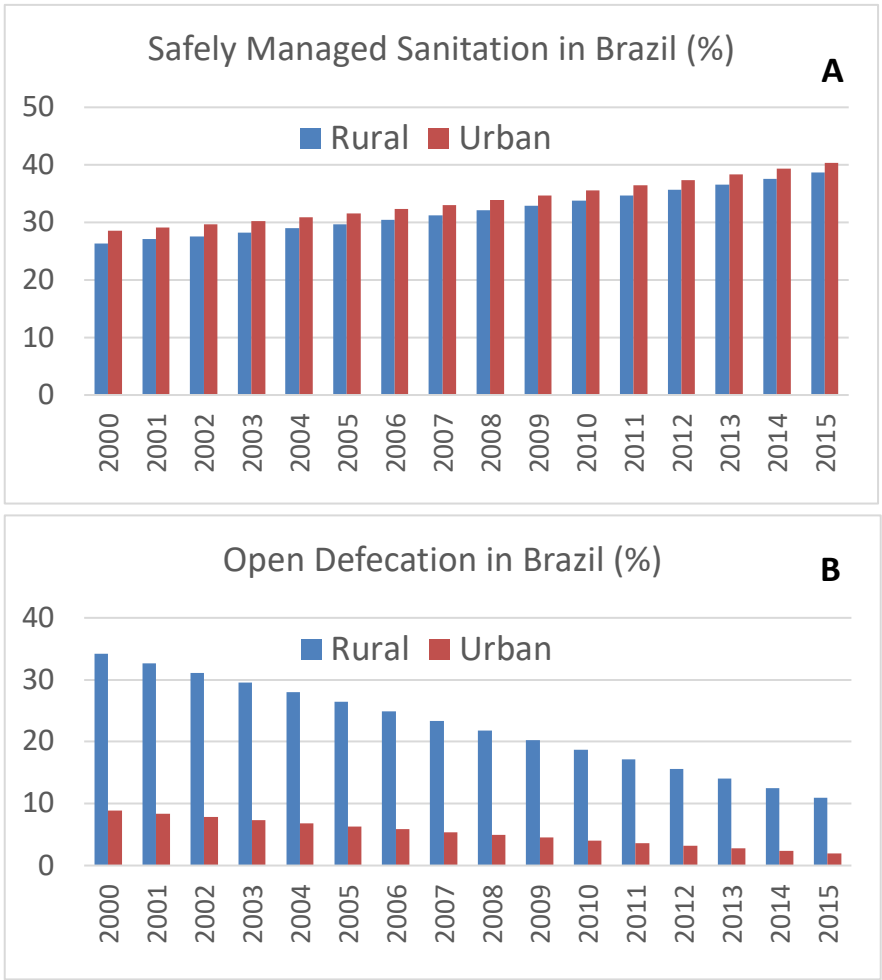

Figure 2: Temporal trends (2000-2015) in Brazil for: A) percentage of the rural and urban populations with access to safely managed sanitation services (%), and B) the percentage of the rural and urban populations practicing open defecation. Data source: UNSD (2019).

Meeting other SDG 6 Targets

Table 3 summarizes the available indicator data for SDG 6.3, 6.4, 6.5 and 6.6. It is the responsibility of the GEMI program to gather these data under the umbrella of IMI. The Executing Agency for the GEMI program is GEMS/Water, which include three operating centers, the Global Programme Co-ordination Unit, the Capacity Development Centre and the GEMStat Data Centre. SDG 6.3 addresses the critical element of water quality protection and is closely interconnected with SDG 6.1 and 6.2. To monitor progress in achieving this target, two key indicators have been identified. Countries that set national aspirations for Indicator 6.3.1 for treatment of wastewater must monitor their progress in increasing the proportion of wastewater that is "*safely treated*". Under Indicator 6.3.2, countries must define their targets for increasing the proportion of "*bodies of water with good ambient water quality*", where "*ambient"* refers to water quality in rivers, lakes and ground water, and water of "*good*" quality is judged to be sufficient to maintain ecosystem functions and not be a risk to human health. Each country can set their own water quality guidelines for assessing whether the quality of their surface waters can be described as "*good*". Eventually, global water quality standards may be developed as benchmarks for these national standards. Table 3 summarizes the current data for progress in meeting the indicators for SGD 6.3 in Brazil, Argentina and Paraguay.

Effective treatment of municipal and industrial wastewater is a key driver for improving water quality, especially in countries such as Brazil, Argentina and Paraguay, where rapid urbanization, population growth and industrialization have increased the need for treatment of wastewater. As shown in Table 3, the proportion of wastewater safely treated in Argentina and Brazil is currently below 35%. There are no data available in the UNSD data base for Paraguay, although a recent government report states that wastewater treatment is available only in the capital and a few other cities, and that it is limited to primary or at most secondary treatment (Paraguay Ministry of Public Works and Communications, 2018). Wastewater treatment in these countries is clearly below the level needed to protect the quality of aquatic resources. Table 4 shows the proportions of safely treated wastewater that exceed a level of 35% in selected other countries around the globe. If Brazil, Argentina and Paraguay are to increase the proportion of effective wastewater treatment to even the current level in Chile (72.5%) and Mexico (51%), significant investment is needed to install new systems or to upgrade existing infrastructure for the treatment of municipal wastewater.

As stated by Fernandez Cirelli and Ojeda (2008) in describing wastewater management in Argentina, "*the existence of a sewerage system does not mean automatically wastewater treatment*". In a review of the reliability of wastewater treatment systems in Brazil, the authors concluded that the traditional process of designing and operating wastewater treatment systems focuses on the technology, and too little emphasis is placed on operator training and providing the resources needed to maintain the facilities (Oliveira and Von Sperling, 2008). In Paraguay, most of the existing wastewater treatment systems are not functioning properly (Cuppens et al., 2013).

Some argue that centralized wastewater treatment systems that require an extensive sewerage network and technologically complex treatment systems are not appropriate in all situations; especially in lower- and middle-income countries. Sewage collection systems account for over 60% of the budget for wastewater management in a centralized system (Massoud et al., 2009). Decentralized or "*cluster*" systems where wastewater is collected for treatment from a small number of households may be a more appropriate and affordable treatment option in many communities (Nansubuga et al., 2016).

Table 3: Status of progress in achieving targets for SGD 6.3, 6.4, 6.5 6.6, 6.a and 6.b in Brazil, Argentina and Paraguay. Data source: UNSD (2019). The most recent date when the data were collected is shown in brackets. NA = Data not available.

Targets and indicators	Argentina	Brazil	Paraguay
Target 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally			
Indicator 6.3.1 Proportion of wastewater safely treated (%)	**22.5 (2018)**	**33.5 (2018)**	**NA**
Indicator 6.3.2 Proportion of bodies of water with good ambient water quality (%)	**NA**	**73% (2017)**	**NA**
Target 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity			
Indicator 6.4.1 Change in water-use efficiency over time (USD/m^3)	**12.1 (2010)**	**NA**	**6.9 (2010)**
Indicator 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources (%)	**10.5 (2010)**	**3.0 (2015)**	**1.8 (2010)**
Target 6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate			
Indicator 6.5.1 Degree of integrated water resources management implementation (0–100)	**38 (2017)**	**51 (2017)**	**32 (2017)**
Indicator 6.5.2 Proportion of transboundary basin area (lakes, rivers, aquifers) with operational arrangement for cooperation (%)	**NA**	**62.4 (2017)**	**50.9 (2017)**
Target 6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes			
Indicator 6.6.1 Permanent water body extent (km^2)	**27,848 (2016)**	**104,804 (2016)**	**3,407 (2016)**
Indicator 6.6.2 Change in the extent of water-related ecosystems over time (loss, % of the baseline value)	**NA**	**NA**	**NA**
Target 6.a By 2030, expand international cooperation and capacity-building support to developing countries in water and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies			
Indicator 6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan			
Sub-indicator: Total official development assistance (gross disbursement) for water supply and sanitation, by recipient countries (millions of constant 2016 USD)	**5.5 (2016)**	**105.0 (2016)**	**18.1 (2016)**
Target 6.b Support and strengthen the participation of local communities in improving water and sanitation management			
Indicator 6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management			
Sub-indicator: Countries with procedures in law or policy for participation by service users/communities in planning program in rural drinking-water supply.	**Clearly defined (2017)**	**Clearly defined (2017)**	**Clearly defined (2017)**

Sub-indicator: Countries with users/communities participating in planning programs in rural drinking-water supply, by level of participation	**Low (2017)**	**Moderate (2017)**	**Moderate (2017)**
Sub-indicator: Countries with procedures in law or policy for participation by service users/communities in planning program in water resources planning and management, by level of definition in procedures	**Clearly defined (2017)**	**Clearly defined (2017)**	**Clearly defined (2017)**
Sub-indicator: Countries with users/communities participating in planning programs in water resources planning and management, by level of participation	**Moderate (2017)**	**Moderate (2017)**	**Moderate (2017)**

Table 4: Selected countries where the proportion of safely treated wastewater (%) exceeds 35%. Data source: UNSD (2019).

Country	Safely Treated Wastewater (%)
Switzerland	99
Germany	98
USA	90
Italy	88
Canada	79.5
Australia	73
Chile	72.5
Mexico	51
China	45
Peru	39

As shown in Table 3, data on water quality are only available in the UNSD data base for Brazil, and these data indicate that 73% of water bodies in that country are classified as having good ambient water quality. The targets for water quality under SGD 6.3 are aspirational, as each country can set their own criteria for ambient water quality. However, the UN-Water guidelines recommend six "*core*" parameters as a basic data set for monitoring water quality in rivers, lakes and in groundwater (Table 5). In addition, other "*progressive monitoring*" parameters are recommended for data collection, if warranted and/or the country has the capacity to measure them.

The overall strategy of UN-Water is to encourage countries to expand their monitoring programs, increase the range of water quality parameters and adopt more sophisticated approaches for calculating water quality indexes. The level of spatial and temporal resolution of the monitoring program is also defined by the countries at a national level. The number of sampling stations and the frequency of monitoring are flexible and can be increased as the country develops capacity and resources. However, the UN- Water methodology recommends that monitoring should be at least four times per year at each station. Countries have the option of maintaining their own data base for water quality parameters and reporting their results to GEMI, or they can submit their water quality data to the GEMStat central data base. The global monitoring locations illustrated in Figure 3 indicates that Brazil is providing extensive water quality information through the GEMStat central data base. There are data from a few monitoring stations in Argentina that have been

reported to GEMI, but no water quality data have been submitted to GEMI from Paraguay (Figure 3). The available information on water quality within the Paraná River Basin is reviewed in Chapter 8 in this book, and the key message from this chapter is that anthropogenic activities (e.g. agriculture, urbanization, hydroelectric development) are impairing the quality of water in the Paraná River basin.

Table 5: The core parameters identified for water quality monitoring in rivers, lakes and groundwater (GW) using the SDG Indicator 6.3.2 methodology. The 'X' notation indicates the core parameters to be monitored within rivers, lakes and groundwater. Source: UN-Water (2017).

Core Parameter	River	Lake	GW
Dissolved oxygen	X	X	
Electrical conductivity			X
Total oxidized nitrogen	X	X	
Nitrate			X
Orthophosphate	X	X	
pH	X	X	X

The UNSD data base includes reports from several countries on their water quality. The proportions of water bodies classified as having good water quality in Germany (72%), South Africa (62.5%), the Netherlands (53%) and Sweden (49%) are all lower than the proportions reported by Brazil (i.e. 73%). Since the definition of good water quality and the scope and frequency of the water quality monitoring programs is set by each country, it is difficult to compare the SGD 6.3.2 data across countries. However, clearly Brazil has recognized the importance of developing a comprehensive water quality monitoring program in order to assess progress in meeting the targets for SGD 6.3. Argentina and Paraguay need to develop similar programs in order to fully participate in the SGD process. The qualitative data presented in Table 3 on Targets 6.a and 6.b indicate that all three countries that share the Paraná River Basin have the institutional, regulatory and organizational tools to make progress in improving water quality. As emphasized in Chapter 7 in this book on the subject of water management in the basin, what is required is the political will to make the necessary investments.

According to the data for SGD 6.4 on attempts to increase water use efficiency (Table 3), increasing the efficiency of water use is not a high priority in Brazil and Paraguay, probably because at a country level there are abundant surface water and groundwater resources. According to the data for Indicator 6.4.2 (i.e. level of water stress), as indicated by freshwater withdrawals as a proportion of available freshwater resources, water withdrawals in Argentina are currently at a level of 10.5% of available resources. However, it is probable that the highest rate of withdrawals relative to resources is in the more arid southern provinces of the country, rather than in the northern areas of Argentina within the Paraná River basin. The reported level of water stress is less than 5% in Paraguay and Brazil (Table 3). In the latest UN report on the status of the SGDs, 22 countries reported levels of water stress above 70%, which is a strong indicator of future water scarcity in these regions (United Nations, 2018). Compared to these countries, according to the data from the UN report, the nations that share the Paraná River basin would not be under a high level of threat from water scarcity. The abundant surface water and groundwater water resources in the Paraná River Basin are described in detail in Chapter 2 in this book.

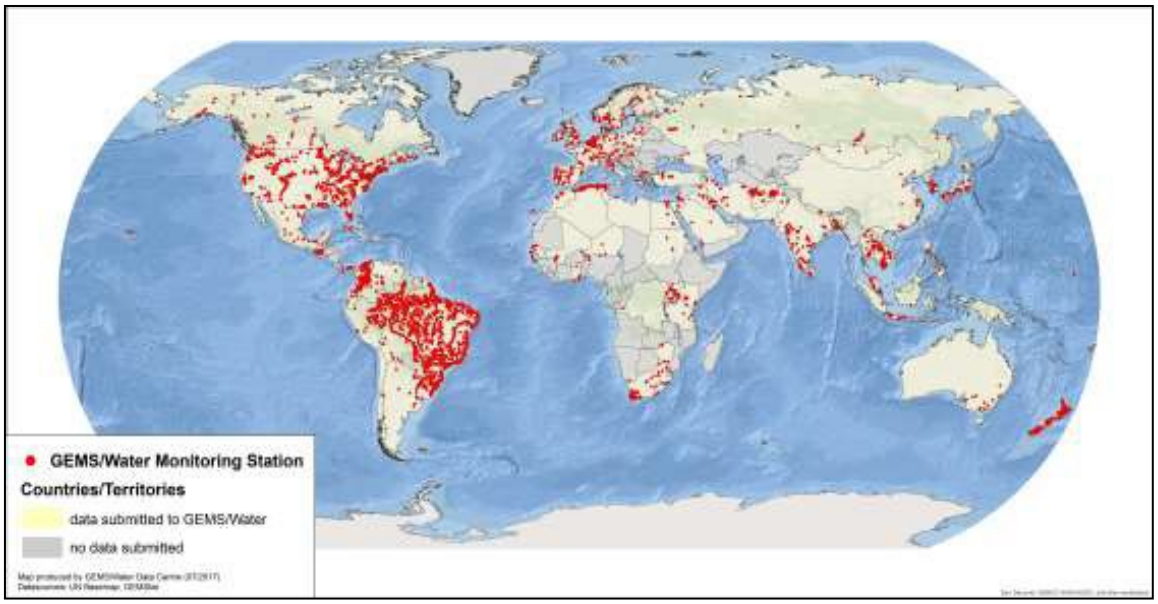

Figure 3: Global distribution of the water quality monitoring stations included in the GEMStat database of GEMS/Water (2017). The figure was provided by the International Centre for Water Resources and Global Change, Koblenz. Available upon request from GEMS/Water Data Centre: data-request@gemstat.org.

However, the national data on the levels of water stress obscure the very high inter-regional variability of available water resources, and the fact that large areas of these countries, particularly in Argentina and Brazil, are subject to water stress.

- Argentina. Two thirds of the territory of Argentina are arid or semi-arid, are subject to high inter-annual rainfall variability, and in some cases, record severe levels of water stress (Bianchi and Cravero, 2010). This is compounded by the fact that the scarce water resources in these regions are under threat from heavy pollution caused by large-scale mining and other industrial activities, while groundwaters in many areas are affected by naturally high levels of arsenic, boron and other substances that compromise the water quality for human uses (Calcagno and Mendiburo, 2000; AWR, 2018). Moreover, the impact of deforestation and global warming have been identified as the main factors behind recurrent extreme drought events recorded in the last two decades, which are expected to become a regular feature (ONDTyD, 2019).

- Brazil. Despite having the world's greatest availability of freshwater, Brazil has a very high variability in the distribution of water resources. Historically, the country's large northeastern region has been characterized by extreme aridity and regular, and even permanent drought conditions. However, owing to processes od deforestation, desertification and urbanization, the areas at risk of water stress have been expanding and now include the country's largest metropolises, Sao Paulo, Rio de Janeiro and Brasilia among others, which have been classified as being at "high" and "extreme risk" of water stress, on the same level as some Middle Eastern countries (WRI, 2019). The country has a monitoring system for droughts that provides up to date information and that is continuously expanding the regions of the country being monitored for drought occurrences (ANA, 2019; CEMADEN, 2019).

- Paraguay. Although the country is also classified as at low risk for water stress owing to its water abundance, 34% of its territory is arid. It is also characterized by regional diversity and is subject to similar pressures from deforestation, desertification and pollution of water sources. In particular, the region known as Gran Chaco, which is shared by Argentina, Bolivia, Brazil and Paraguay (20% of this region is in Paraguayan territory), is characterized by aridity and extreme aridity. This region is also home to several Indigenous communities, which have difficulty in accessing safe and sufficient water supplies. The region is under great threat from the expansion of activities that extract high volumes of water, particularly large-scale agriculture and mining, with deforestation and pollution of water sources also being a major problem (UNESCO, 2010; PAHO, 2011).

SGD 6.5 focuses on implementation of integrated water resources management at the national level, and through transboundary cooperation. Integrated water resource management has been promoted by the UN as an approach to improve global water stewardship. In the latest UN report on the status of the SGDs, 157 countries reported an average implementation of integrated water resources management of 48% and based on data from 62 countries sharing transboundary waters, the average percentage of national transboundary basins covered by an operational arrangement was only 59% (United Nations, 2018). The data summarized in Table 3 for these indicators (i.e. 6.5.1 and 6.5.2) show that the countries that share the Paraná River Basin are performing at about the average or slightly below the average among the nations that reported statistics for SGD 6.5. The current approaches to transboundary cooperation in the basin are described in Chapter 9 in this book, but most of these are bilateral agreements that focus on access to hydroelectric power and not to the protection of water resources.

There are several barriers to implementing integrated water resource management, and past applications of this approach in the real world have *"left much to be desired"* (Biswas, 2008). One of the problems is the lack of incentives among stakeholders to implement these measures. As an example, an analysis of a proposed payment for ecosystem services scheme for the Pantanal wetland in Brazil concluded that *"large-scale implementation is unlikely"* because of socioeconomic inequality between the inhabitants of the region and a lack of incentives for wealthy farmers in the uplands (Schulz et al., 2015). Therefore, new approaches may be needed to promote the protection of aquatic resources. Some argue that integrated water resource management should be abandoned for more pragmatic approaches that include financial models, such as the "*water-energy-food-climate nexus"* (Schmidt and Matthews, 2018). In addition, we cannot ignore the potential impact of climate change on water resources within the basin, which relates to SDG 13. Based on predictions from climate change models, the authors of Chapter 6 in this book concluded that the northern part of the basin will become drier, with reduced flows in the Upper Paraná.

The focus of SGD 6.6 is to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes. Chapter 5 in this book describes the water-related ecosystems within the basin, including the extensive wetland ecosystems that are threatened by agricultural development and water management schemes. The data for Indicator 6.6.1 show that the three countries that share the Paraná River Basin collectively have huge areas of permanent water bodies to protect (Table 3). However, no data were submitted to GEMI by Brazil, Argentina or Paraguay on progress to restore water-related ecosystems (i.e. Indicator 6.6.2). Moreover, the time horizon for progress on this SGD indicator is fast approaching, as 2020 is the end date for

this target. Because of the synergies between the Aichi Biodiversity Targets and the SGD target 6.6, this earlier deadline was selected to coincide with the end date of the Strategic Plan on Biodiversity (2011-2020). Both Paraguay and Argentina are parties to the Aichi agreement, but according to the on-line data base that tracks national objectives under the agreement, these countries have not set targets for protection of biodiversity under the program (Convention on Biological Diversity, 2019). However, Brazil has been active in setting targets for this process. For instance, under Article 5, Brazil has pledged to reduce by at least 50% (in comparison with the 2009 rate) the rate of loss of native habitats, and to significantly reduce degradation and fragmentation in all biomes. Whether progress will have been made towards these goals will be a subject for discussion at the UN Biodiversity Conference to be held in October 2020 in Kunming, China. However, expectations are that most of the Aichi targets set by participating nations will not be achieved by the time of the conference (Tsioumani, 2019).

CONCLUSIONS

According to the information officially reported to JMP, the nations that share the Paraná River Basin have essentially met the basic targets of SGD 6 to provide universal access to safe drinking water and to eliminate open defecation. However, on closer scrutiny of the available information, it becomes evident that there are many reasons for concern that call into question the actual level of achievement and the likelihood that these countries will meet the targets by 2030. Firstly, the coverage of "safely managed" drinking water is open to question, and the evidence suggests that it is much lower than the levels officially reported by Argentina and Brazil. Despite the lack of reliable data from Paraguay, available official information recognizes that the country is lagging behind in this area. In all three cases, the main problems are concentrated in poor urban sectors and in rural areas, and particularly affect Indigenous communities and Afro-American communities in Brazil. There are significant challenges for these countries to meet the other SGD 6 targets, such as effectively treating municipal wastewater and improving water quality.

Another challenge will be to increase access to facilities for sanitation and hygiene among the poorest segments of the population. The rapid reduction of extreme poverty achieved in Argentina and Brazil during the period 2008-2015 had raised expectations that economic growth and further poverty reduction may reduce the gap between rich and poor in accessing sanitation services, which is one of the indicators of the structural inequalities characterizing the countries of the region. However, radical political changes that have taken place since 2015 in the region have triggered a retreat from policy interventions oriented at tackling inequalities and improving living conditions through redistributive policies and strong investments in infrastructures for essential public services. Instead, the situation in both countries, and notably in Argentina, shows an enormous regression with a steep rise in poverty levels close to 40% by November 2019 and a rapidly worsening inequality gap. These conditions will certainly have an impact on the abilities of these countries to deliver on meeting the targets of SGD 6, since will require leadership and investment at federal, regional and local levels in Brazil, Argentina and Paraguay.

An additional concern, as indicated by the organizational structures of the national institutions that have been charged with acting on the 2030 Agenda in the three countries, is that making progress in SGD 6 may not be a high priority relative to other development goals, particularly those related to economic growth. Still, the countries' goals of reducing poverty, improving education and promoting health and wellbeing are compatible and mutually reinforcing with at least the basic

components of SDG 6, access to safely managed drinking water, sanitation, and hygiene. From another perspective, and very important for the monitoring process, the annual meetings of the Forum of the Countries of Latin America and the Caribbean on Sustainable Development may provide impetus for these countries to gather and share their data on progress in meeting the SGD 6 targets.

REFERENCES

ANA 2019. Drought Monitor (in Spanish). National Water Agency: Brasilia, Brazil. Retrieved from: http://monitordesecas.ana.gov.br.

Argentina Ministry of Federal Planning, Public Investment, and Services. 2012. "Development Programme for the Provinces of the Great North, Project Profile" (in Spanish). Buenos Aires, Argentina. Retrieved from: http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=36801963.

Argentina Ministry of Federal Planning, Public Investment, and Services. 2011. Project Water Infrastructure for the Great North II. Planning Framework for Indigenous Communities (in Spanish). Buenos Aires, Argentina. Retrieved from: http://www.ucpypfe.gov.ar/BirfPIHNG/MPPI-2.pdf.

Argentina Ombudsman (Defensoría del Pueblo de la Nación). 2018. Informal Settlements and Human Rights, Buenos Aires, Argentina. Retrieved from: https://www.ohchr.org/Documents/Issues/Housing/InformalSettlements/ArgentinaDefensorPueblo.pdf.

AWR 2018. Arsenic in Water, Final Report (in Spanish). Arsenic in Water Research Group. Buenos Aires, Argentina. Retrieved from: https://rsa.conicet.gov.ar/wp-content/uploads/2018/08/Informe-Arsenico-en-agua-RSA.pdf.

Bianchi, A.R., Cravero, S.A.C. 2010. Atlas Climático Digital de la República Argentina. National Institute of Agricultural Technology (INTA): Buenos Aires. Retrieved from: https://inta.gob.ar/sites/default/files/script-tmp texto_atlas_climatico_digital_de_la_argentina_110610_2.pdf.

Biswas, A.K. 2008. Integrated water resource management: Is it working? *Water Resources Development* 24:5-22.

Calcagno, A., Mendiburo, N., 2000 Report on water management in the Argentine Republic (in Spanish). Santiago de Chile: Economic Commission for Latin America and the Caribbean (ECLAC) Retrieved from: https://www.cepal.org/drni/proyectos/samtac/inar00200.pdf.

CEMADEN - National Monitoring and Alerting Centre for Natural Disasters. 2019. Monitoring drought in Brazil. Retrieved from: http://www.cemaden.gov.br/categoria/monitoramento/seca-no-brasil/.

Convention on Biological Diversity. 2019. Retrieved from: https://www.cbd.int/sp/targets/.

Cuppens, A., Smets, I., Wyseure, G. 2013. Identifying sustainable rehabilitation strategies for urban wastewater systems: A retrospective and interdisciplinary approach. Case study of Coronel Oviedo, Paraguay. Journal of Environmental Management 114:423-432.

de Pádua, V. L., Vilela, D. R. Silva, A. S. R. 2015, Participative generation of a water treatment system in a Quilombola community in Minas Gerais, Brazil, *WATERLAT-GOBACIT Working Papers*, 2(12). Retrieved from: http://waterlat.org/WPapers/WPSPIDES212.pdf.

ECLAC. 2017. Annual report on regional progress and challenges in relation to the 2030 Agenda for Sustainable Development in Latin America and the Caribbean, Economic Commission for Latin America and the Caribbean (ECLAC), Forum of the Countries of Latin America and the

Caribbean on Sustainable Development, Mexico City, Mexico, April 26-28, 2017, 111 p. Retrieved from: https://foroalc2030.cepal.org/2017/en.

ECLAC. 2018. Second annual report on regional progress and challenges in relation to the 2030 Agenda for Sustainable Development in Latin America and the Caribbean, Economic Commission for Latin America and the Caribbean (ECLAC), Forum of the Countries of Latin America and the Caribbean on Sustainable Development, Santiago, Chile, April 16-20, 2018, 167 p. Retrieved from: https://repositorio.cepal.org/handle/11362/43439?locale-attribute=en.

Ederington, J., Levinson, A., Minier, J. 2005. Footloose and pollution-free. Reviews in Economic Status 87:92-99.

Fernandez Cirelli, A., Ojeda, C. 2008. Wastewater management in Greater Buenos Aires, Argentina. *Desalination* 218:52-61.

GBD 2016 SDG Collaborators. 2017. Measuring progress and projecting attainment on the basis of past trends of the health-related Sustainable Development Goals in 188 countries: an analysis from the Global Burden of Disease Study 2016. *Global Health Metrics* 390:1423- 1459.

GLAAS. 2017. Financing universal water, sanitation and hygiene under the Sustainable Development Goals, UN-Water Global Analysis and Assessment of Sanitation and Drinking Water. Retrieved from: http://apps.who.int/iris/bitstream/10665/254999/1/9789241512190-eng.pdf?ua=1.

Massoud, M.A., Tarhini, A., Nasr, J.A. 2009. Decentralized approaches to wastewater treatment and management: Applicability in developing countries. *Journal of Environmental Management* 90:652-659.

Montenegro, M. H. 2015. Presentation by the President of the Brazilian Association of Sanitary Engineering, Federal District (ABES-DF), at Round Table 1, "Materializing the human right to water: the challenge in perspective", A Seminar for Research and Debate – DESAFIO Project, Materializing the Right to Water and Basic Sanitation Services – Day 1, Brasilia, 9 September 2015. Retrieved from: https://youtu.be/-IiNvfgsZEk?list=PLx6qphzdSP6sxHigH5SMJSfaa31tYyl8u.

Nansubuga, I., Banadda, N., Verstrate, W., Rabaey, K. 2016. A review of sustainable sanitation systems in Africa. *Reviews on Environmental Science and Biotechnology* 15:465-478.

ONDTyD. 2019. National Observatory of Land Degradation and Desertification: Buenos Aires and Mendoza, Argentina. Retrieved from: http://www.desertificacion.gob.ar.

Oliveira, S.C., Von Sperling, M. 2008. Reliability analysis of wastewater treatment plants. *Water Research* 42:1182-1194.

ONDAS (in Portuguese). National Observatory of the Rights to Water and Sanitation 2019. Brasilia, Brazil. Retrieved from: https://ondasbrasil.org.

PAHO. 2011. The Great South American Chaco. Retrieved from: http://iris.paho.org/xmlui/handle/123456789/10027?locale-attribute=pt.

Paraguay Ministry of Public Works and Communications, Directorate for Potable Water and Sanitation. 2018. National Plan of Potable Water and Sanitation. Asunción, Paraguay. Retrieved from: https://www.mopc.gov.py/pnaps/pnaps.pdf.

Rocha, D.G., Weiss, V.P.A. 2019. The convergences between the Sustainable Development Goals and national agendas: the Brazilian case. Health Promotion International 34: S1 i46-i55.

Sapkota, P., Bastola, U. 2017. Foreign direct investment, income, and environmental pollution in developing countries: Panel data analysis of Latin America. *Energy Economics* 64:206-212.

Schmidt, J.J., Matthews, N. 2018. From state to system: Financialization and the water-energy-food-climate nexus. *Geoforum* 91:151-159.

Schulz, C., Ioris, A., Martin-Ortega, J., Glenk, K. 2015. Prospects for payments for ecosystem services in the Brazilian Pantanal: A scenario analysis. Journal of Environment and Development 24:26-53.

Tang, J. 2015. Testing the pollution haven effect: Does the type of FDI matter? *Environmental Resource Economics* 60:549-578.

Teodosiu, C., Robu, B., Cojocariu, C., Barjoveanu, G. (2015) Environmental impact and risk quantification based on selected water quality indicators. Natural Hazards 75: S89-S105.

Tsioumani, E. 2019. On the road to the 2020 UN Biodiversity Conference: Imagining the post-2020 global biodiversity framework. SDG Knowledge Hub, May 30, 2019, International Institute for Sustainable Development, Winnipeg, Manitoba, Canada. Retrieved from: http://sdg.iisd.org/commentary/policy-briefs/on-the-road-to-the-2020-UN-biodiversity-conference/

United Nations. 2018. The Sustainable Development Goals Report 2018. Retrieved from: https://unstats.un.org/sdgs/files/report/2018/TheSustainableDevelopmentGoalsReport2018-EN.pdf.

UNESCO. 2010. Atlas of Arid Zones in Latin America and the Caribbean. Montevideo, Uruguay. Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000216333.

UNSD. 2019. Global SDG Indicators Database. UN Statistics Division. Retrieved from https://unstats.un.org/sdgs/indicators/database/

UN-Water. 2016. Water and sanitation interlinkages across the 2030 Agenda for Sustainable Development, UN Water Geneva, Switzerland, 47 p. Retrieved from: http://www.unwater.org/publications/water-sanitation-interlinkages-across-2030-agenda-sustainable-development/

UN-Water. 2017. Step-by-step monitoring methodology for SDG indicator 6.3.2 on ambient water quality, Chapter 4, Integrated Monitoring Guide for SDG 6, Revision January 18, 2017. Retrieved from: http://www.unwater.org/publications/step-step-methodology-monitoring-water-quality-6-3-2/

UN-Water. 2018. Sustainable Development Goal 6: Synthesis Report on Water and Sanitation, Retrieved from: http://www.unwater.org/publication_categories/sdg-6-synthesis-report-2018-on-water-and-sanitation/.

WHO-UNICEF. 2017. Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines. World Health Organization, and United Nations Children's Fund, New York, N.Y., USA. Retrieved from: https://www.unicef.org/publications/index_96611.html.

Winpenny, J., Trémolet, S., Cardone, R., Kolker, J., Kingdom, B., Mountford, L. 2016. Aid Flows to the Water Sector: Overview and Recommendations. The World Bank, Washington, D.C., USA.

WRI. 2019. Ranking shows the highest risk areas in Brazil and the world for lack of water (in Portuguese), World Resources Institute, Washington, D.C., USA. Retrieved from: https://wribrasil.org.br/pt/blog/2019/08/ranking-mostra-onde-ha-maior-risco-de-faltar-agua-no-brasil-e-no-mundo.