Inter-American Development Bank

Joined by Water (JbW)

IDB's Transboundary Waters Program

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Water and Sanitation Division

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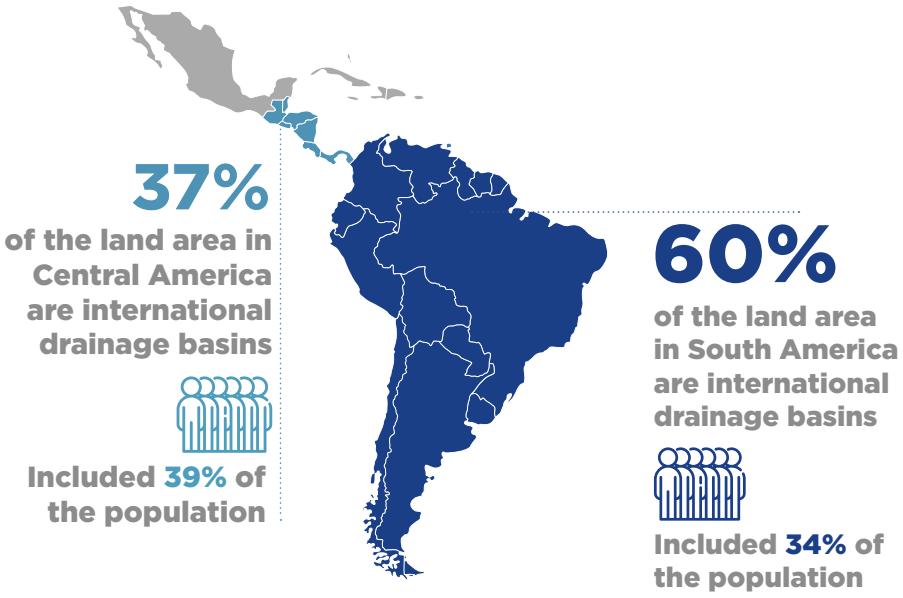
Executive Summary

Executive Summary

This concept document scopes out possible intervention approaches for the Inter-American Development Bank (IDB) to engage in transboundary freshwater projects in Latin America and the Caribbean (LAC). There are some 67 international drainage basins in LAC. In Central America, the 29 transboundary water basins account for 37% of the land area and include 39% of the population. The 38 international drainage basins in South America cover almost 60% of the continent and contain 34% of the population. The issue of effectively managing these waters is not well covered in LAC. None of the countries have ratified global conventions providing the basis of framework for transboundary water cooperation, and only 11 of the 67 basins have any operational arrangement for water cooperation. Governance at the transboundary level is, therefore, lacking in much of LAC. A consequent lack of management and financing for transboundary waters means that the region is ill-prepared to address growing environmental issues and the challenges associated with climate change impacts and to achieve the goals set under the 2030 Agenda for Sustainable Development.

The document highlights the common transboundary challenges in freshwaters, and the contribution of the new IADB transboundary water program which aims at enhancing the governance and management of transboundary waters in Latin America and the Caribbean (LAC), guaranteeing sustainability and scalability of investments. That said, as transboundary waters are not a common theme, there is very little research done specifically at the transboundary level in LAC. In this regard, much of the data and figures presented are at a national level and are extrapolated to a transboundary level.

Approaching transboundary water management in LAC requires solid alliances between countries and specialized organizations. IDB has consolidated a strong alliance with the Spanish Agency for International Development Cooperation (AECID) through the Cooperation Fund for Water and Sanitation (FCAS). This work is funded with support from the FCAS and the Latin America Investment Facility (LAIF) of the European Union managed by AECID and executed by the IDB.



Background and Regional Context

Background and Regional Context

I. Approaches to Transboundary Waters

The long way to an equitable and reasonable use

Transboundary waters are generally considered as water resources shared by two or more sovereign states and include international freshwater (rivers and lakes), international groundwater, and international Large Marine Ecosystems (LME).[1] There are several global conventions and emerging treaties which address "transboundary waters," the principal ones include:

- The United Nations Convention on the Law of the Sea (Law of the Sea Convention) (1982). [2]
- The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1992 Water Convention) (1992)[3].
- Convention on the Law of the Non-Navigational Uses of International Watercourses (1997 Watercourses Convention) (1997).[4]
- Draft Articles on Transboundary Aquifers (2008).[5]

As this IDB initiative deals with freshwater systems of Latin America and the Caribbean, the relevant conventions are the 1992 Water Convention, 1997 Watercourses Convention, and the 2008 Draft Articles on Transboundary Aquifers.

It is worthwhile to define transboundary waters for the purpose of this document to clarify the use of the term in the IDB's program. The 1997 Watercourses Convention defines a watercourse as "a system of surface waters and groundwaters constituting by their physical relationship a unitary whole and normally flowing into a common terminus". An international watercourse is a "watercourse parts of which are situated in two or more states."[6]

Under the 1992 Water Convention, transboundary waters mean "any surface or groundwaters which mark, cross or are located on boundaries between two or more States; wherever transboundary waters flow directly into the sea."[7]

Within the contexts of this background document and the Inter-American Development Bank program on transboundary waters in LAC, transboundary waters are therefore taken to mean:

1 LME are regions of ocean space of 200,000 km2 or greater that encompass coastal areas from river basins to esked populations. Sherman, K., Aquarone, M. C. and Adams, S. Eds. (2009). *Sustaining the World´s Large Marine Ecosystems*.

2 United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397 (1982), Montego Bay, 10 December 1982 (entry into force 16 November 1994).

3 Convention on the Protection and Use of Transboundary Watercourses and International Lakes. Helsinki, 17 March 1992, 1936 UNTS 269; 31 ILM 1312 (1992) (entry into force 6 October 1996). https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-5&chapter=27&clang=_en

4 Convention on the Law of the Non-Navigational Uses of International Watercourses New York, 21 May 1997 UNDoc A/Res 51/229, (36 LIM 700 (1997) (entry into force 17 August 2014). https://treaties.un-.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-12&chapter=27&clang=_en

5 ILC Draft Articles on the Law of Transboundary Aquifers (2008) (emerging treaty).

6 See Article 2, 1997 Watercourses Convention.

7 See Article 1, 1992 Water Convention. It continues to say "...these transboundary waters end at a straight line across their respective mouths between points on the low-water line of their banks." The point regarding the boundary interface with the sea is paralleled with the 1982 Convention on the Law of the Sea. See Article 9 1982 UN Convention on the Law of the Sea.

"Surface and/or subsurface waters which form a unique drainage basin and are situated in two or more States."

Transboundary waters mean any surface and/or subsurface waters which form a unique drainage basin and are situated in two or more states

In the past, countries were generally able to develop their water resources with little impact on other nation-states, as they did with many other resources such as coal, timber, etc. However, beginning in the late 19th century, the scale of water use increased, and issues concerning water and state sovereignty and associated rights of development emerged. In some cases, particularly in drier areas such as the Southwestern US and Mexico, or the Iberian Peninsula, development in one state affected the water resources in another. Competing theories emerged as to how international law should address this topic. The doctrine of territorial sovereignty is the most straightforward approach. It implies that states have the right to unbridled development or use of water resources within their territory irrespective of the repercussions to other countries.[8] The idea that upper riparian states have no responsibility to lower riparian states is generally considered as unjust and has been abandoned.[9]

Emerging to counter this was the doctrine of territorial integrity, implying that lower riparian states have the right to receive the continuous natural flow of an international watercourse undiminished in quantity and unaltered in quality. Such an approach (also known as "prior informed consent"), places a virtual veto in the hands of the lower riparian state[10] concerning the development of water resources in the upstream state and has also been rejected by the international community.[11] Emerging to balance the above two mirroring approaches is the doctrine of limited territorial sovereignty, usually articulated as the principle of equitable and reasonable utilization, and entitles each co-basin state to the equitable and reasonable use of waters flowing through its territory.[12] This doctrine is the prevailing theory of international watercourses rights.

The principle 'of equitable and reasonable utilization' (E&R)[13] is not a principle in isolation and should be applied along with the supporting rights and obligations of the international water law that include:

i. The duty to avoid causing significant harm to other riparians.[14]

8 Moermond, J. and S. Erickson (1987). "A Survey of the International Law of Rivers". *Denver Journal of International Law & Policy*. 16

9 Chenevert, D. (1992). "Applications of the Draft Articles on the Non-navigational Uses of International Watercourses on the Water Disputes Involving the Nile River and the Jordan River". E*mory International Law Review*. 6:495-203

10 Note that it is equally possible that a lower riparian state can affect upstream states. The building of the Grand Coulee Dam in 1942 in the U.S. portion of the Columbia River effectively eliminated the migration of salmon up into Canada. See Hearns, G. (2008). *The Columbia River Treaty: A Synopsis of Structure, Content, & Operation*s. Canadian Columbia River Forum (CCRF).

11 McCaffrey, S. (1996). "An Assessment of the Work of the International Law Commission". *Natural Resources Journal*. 36:297.

12 This principle has been articulated in the Helsinki Rules (1966) and refined in the 1997 Watercourses Convention.

13 Note that E&R are referenced in the 1992 Water Convention but are not elaborated there within. See ANNEX A.

14 Article 7 of the 1997 Watercourses Convention and Article 3 of the 1992 Water Convention.. "Note this is not a 'No Harm' obligation in an absolute sense, but rather the duty to take all possible and appropriate measures to 'avoid causing harm'." Where harm may have occurred, states causing the harm should seek to eliminate or mitigate the harm, and where appropriate address compensation. See ILC (2005) *Draft articles on the law of the non-navigational uses of international watercourses and commentaries thereto and resolution on transboundary confined groundwater*, in Report of the International Law Commission on the work of its forty-sixth session, 2004. p:89-135.

ii. The duty to cooperate.[15]

iii. The duty to communicate, including exchanging data[16] and notification of planned measures.[17]

iv. The duty to settle disputes in a peaceful means.[18]

II. International Evidence on Transboundary Water Cooperation

Past experience to help with future challenges

As with any form of contract or agreement, countries engage in transboundary water cooperation because they benefit from doing so. The goal of the collaboration is to develop increased value concerning water resources, as well as other "non-water" related benefits such as peace and trade, amongst others. Spain and Portugal have a long history of transboundary water cooperation which has continually evolved to provide value-added benefits. The countries share four major river basins with Spain being predominantly upstream. In 1912 the countries signed an agreement to use the border section of the Douro River for "mutual benefit and could not be appropriated for individual use."[19] Notes also set forth specifications that each country was assigned half the running flow, and a technical committee (Douro Commission) was established to oversee use. In 1927, Spain and Portugal concluded a second major treaty regarding hydropower development in the other shared basins.[20] Due to the growing interest in water as a mechanism for development, the Douro Commission was expanded in 1951 to include members from the Directorate of Industry as the post-war development boom brought more significant interest in hydroelectric generation.[21] A new agreement was developed in 1964 for the Duoro River regulating hydro production[22] and in 1968 a subsequent agreement was developed for the remaining international basins expanding the Douro Commission to become the International Rives Commission.

Environmental issues began to take precedence in the late 80. The signing of the Albufeira Convention in 1998[23] marked a shift in approach to the management of

15 Article 8 of the 1997 Watercourses Convention: "Watercourse States shall cooperate on the basis of sovereign equality, territorial integrity, mutual benefit and good faith in order to attain optimal utilization and adequate protection of an international watercourse". Article 9 of the 1992 Water Convention "Bilateral and multilateral cooperation - 1. The Riparian Parties shall on the basis of equality and reciprocity enter into bilateral or multilateral agreements or other arrangements"

16 Article 9 of the 1997 Watercourses Convention and Article 6 and 13 of the 1992 Water Convention.

17 Part III, Articles 12-19 of the 1997 Watercourses Convention and Article 13 of the 1992 Water Convention.

18 Article 33 of the 1997 Watercourses Convention. Settlement of Disputes: In the event of a dispute States will "seek a settlement of the dispute by peaceful means" through a prescribed process. Article 22 of the 1992 Water Convention.

19 Fuente González, J. M., & Santafé Martínez, J. M. (2002). *The Albufeira Agreement: The New Spanish-Portuguese Transboundary Water Agreement.* Paper presented at the From Conflict to Co-operation in International Water Resource Management: Challenges and Opportunities, Delft, Netherlands.

20 Convention between Spain and Portugal to regulate the hydro-electric development of the international section of the River Douro, 11 August 1927.

21 Exchange of notes amending article 14, paragraph 2, of the convention of 11 August 1927 done 27 September 1951.

22 Convention between Spain and Portugal for Regulating the Hydroelectric Development of the International Reaches of the Duero River and of its Tributaries, 16 July 1964.

23 Convention About the Cooperation for the Protection and Sustainable Use of the Waters of Portuguese-Spanish Hydrological Basins and Additional Protocol (Albufeira Convention). See Cooperación para la protección y el Aprovechamiento Sustentable de las Aguas de las Cuencas Hidrográficas Hispano-Portuguesas, 30 de noviembre de 1998, BOE N. 37 No 2882 febrero 2000.

the transboundary watersheds. The objective of the convention is to "manage the surface waters and groundwaters, and the aquatic and terrestrial ecosystems directly dependent upon them for the sustainable development of water resources in the shared basins."[24] The convention covers all shared rivers and, unlike the previous treaties, includes the entire basins (and tributaries) and not merely the shared frontier water sections. Moreover, the convention applies to all activities that may have impacts on the hydraulic systems that may result in any transboundary impact.

Bridge over troubled waters

Even under difficult political situations, we can find value-added water agreements across the globe. Some notable examples include:

- The Indus Water Treaty (IWT), signed in 1960, is often hailed as a successful example of a transboundary water agreement since it has enabled sustained water management between India and Pakistan despite geopolitical tensions for over 50 years (IUCN 2008). The main feature of the treaty is that the three Western Rivers (Indus, Jhelum, and Chenab) are assigned to Pakistan while the three Eastern Rivers (the Sutlej, Beas, and Ravi) are allocated to India. The two countries could accomplish an agreement, even though they didn't (and they still don't!) trust each other. One of the significant elements on this case was that the World Bank was able to broker an understanding (becoming, in fact, a party to the agreement itself) ensuring financial support for infrastructure. This would, ultimately, make more effective the use of the waters and develop improved certainty over water supply.
- The Columbia River Treaty, signed by Canada and the United States in 1961, enabled the construction of three upstream dams (in Canada) that have continued to provide irrigation and flood control benefits. It has also increased the dependability and potential for hydroelectricity production downstream (in the U.S.).[25] These benefits would not have been possible at the same cost in the absence of these projects. In exchange, the U.S. provided its upstream neighbor a one-time payment (equal to half the value of estimated future flood damage that would be prevented) and half of the power generated by power plants in the U.S. that benefited from the management of the flow of the river via these upstream dams.
- The U.S. and Mexico signed a water treaty in 1944,[26] but have had continual issues over issues of drought. Minute 319 on the Colorado River, negotiated in 2012 between the U.S. and Mexico, resolves a 70-year dispute on how the two countries approach water allocation and investment under extraordinary drought.[27] The two countries collaborated to create significant value by negotiating a series of innovative trades on several interdependent themes.

24 Article 2 of the Albufeira Convention.

25 Treaty Relating to Cooperative Development of the Water Resources of the Columbia River Basin. Opened for signature 17 January 1961, United States–Canada, 542 UNTS 244 (entered into force 16 September 1964) (Columbia River Treaty).

26 Treaty between the United States of America and Mexico relating to the utilization of the Waters of the Colorado and Tijuana Rivers and the Rio Grande, signed February 3, 1944. 59 Stat. 1219; Treaty Series 994. (1944).

27 https://www.ibwc.gov/Files/Minutes/Minute_319.pdf

For example, Mexico can now store part of its annual Colorado River water allocation in the U.S. based Colorado River reservoir (Lake Mead), while it makes necessary repairs to the water infrastructure damaged by the 2010 Easter earthquake in Mexicali. In return, the U.S. ensures higher water storage levels at Lake Mead during periods of drought, thereby lowering the costs associated with developing new piping infrastructure for the City of Las Vegas.

- Similarly, Annex II of the 1994 Israel-Jordan peace treaty[28] allots Israel 12 million cubic meters (MCM) of water in the summer and 13 million cubic meters in the winter from the Yarmouk River. In exchange, Jordan can store 20 million cubic meters of its water in Lake Tiberias (in Israel) in the winter. Furthermore, the two countries agreed to jointly develop 'existing and new water resources, increasing water availability... and minimizing wastage of water resources.' In effect, not only did they come up with creative solutions to reduce their vulnerability to water shortages, but they also recognized water as a flexible resource and committed to 'creating' more water.

Today there is a trend towards developing more holistic agreements that incorporate environmental issues as well as more traditional economic and technical issues

In every continent, save Antarctica, transboundary water agreements provide with great added value to their member countries, the Albufeira Convention shows an example of expanding value-added benefits to both countries as technology, values, and interests shift over time to include environmental issues. This should come as no surprise. A review of freshwater agreements over the last 100 years shows that there is a trend towards developing more holistic agreements that incorporate environmental issues as well as more traditional economic and technical issues. While concern for hydropower, water allocation, and irrigation continue to be necessary, the environment is the most commonly focused issue in recent years. This increased attention to the aquatic environment is reflected in the expansion of environmental interests in general. In 1970 there were a handful of agreements regarding international environmental law. Today there are over 1,000 legal instruments that are either primarily directed to global environmental issues, or contain essential provisions regarding them. As the importance of the environment continues to dominate social interests, we can expect that this proliferation of legal instruments will likely continue.

III. Diagnosis of the Transboundary Waters in Latin America and the Caribbean

Managing the richest hydrological region

Latin America is the richest hydrological region in the world and contains some of its largest rivers. However, the region faces a number of challenges: water resources are not distributed equally amongst a growing population; there are threats to water quality and quantity; much of the potential irrigation and hydropower expansion in Latin America, particularly South America, has yet to be developed, [29] and most of the river basins are shared between countries. International water cooperation is, for the most part, still developing (treaties).

28 https://peacemaker.un.org/sites/peacemaker.un.org/files/IL%20JO_941026_PeaceTreatyIsraelJordan.pdf

29 Iza, A. et al. (2014). Managing transboundary rivers in Latin America – could a global convention help? IUCN/Bridge.

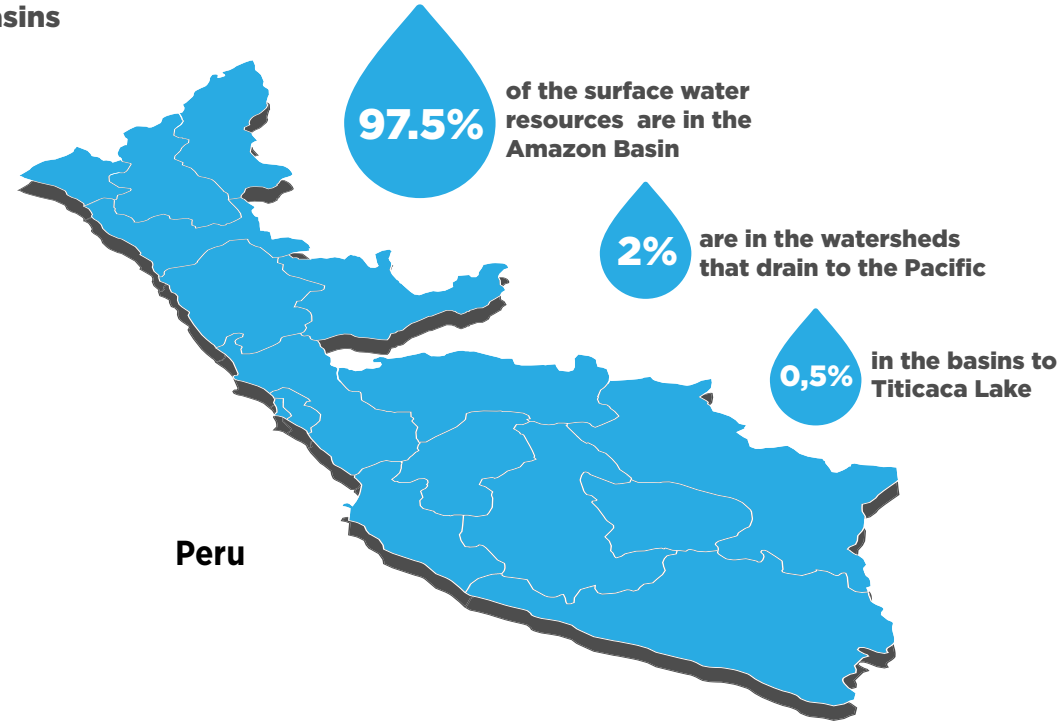
37%

of the land area in Central America are international drainage basins

60%

of the land area in South America are international drainage basins

Central America has 29 international river basins that account for 37% of the land area and contain 39% of the population.[30] In some instances, such as Belize, a basin can account for up to 65% of the land of a country. South America has 38 international water basins that cover almost 60% of the continent and where over 34% of the population resides.[31] Although water is abundant, it is not distributed equally, with 68% of the freshwater resources located in just three basins, the Amazon, La Plata, and the Orinoco, where only 25% of the population live. Indeed, the disparity is also exhibited nationally as well as regionally. In Peru, for example, 97.5 % of the total surface water resources of the country are in the Amazon Basin, 2% are in the watersheds that drain to the Pacific, and 0.5 % in the basins to Titicaca Lake. On the other hand, 65% of Peru's inhabitants live in the basins that drain to the Pacific.[32]



Same old problems...with an added difficulty

The types of problems encountered in transboundary water resources are generally the same as those encountered within national watersheds. Still, their management is complicated by international jurisdictions, and thus require additional attention. The following can be highlighted:

i. *Water Pollution:* In 2015, UNEP's Transboundary Water Assessment Program placed almost all of LAC transboundary watersheds at moderate or high risk associated with wastewater treatment. In terms of addressing increasingly prob-

30 Based on figures from UNEP's Transboundary Water Assessment Program (http://twap-rivers.org/) and population figures from the World Bank (https://data.worldbank.org). Note the figures to no include Mexico, Haiti, or the Dominican Republic. If they were included the population in international basins would be 15%.

31 Based on figures from UNEP's Transboundary Water Assessment Program (http://twap-rivers.org/) and population figures from the World Bank (https://data.worldbank.org).

32 See Tinoco, V. (2017) "Sediment Management in Dams in the Andes". Center for Latin American Studies. Available at https://clas.berkeley.edu/research/sediment-management-dams-andes

Almost all of LAC transboundary watersheds at moderate or high risk associated with wastewater treatment.

lematic issues, wastewater is at the forefront as described by a 2017 World Bank study. As a region, Latin America invests only 2.8 % of GDP into infrastructure, which just above what Africa invests and well below other areas.[33] This means only about 30% of wastewater gets treated, and the report notes the "dismal wastewater performance is a real emergency, and one that epitomizes the potential for spending better."[34]

Evidence in LAC:

- Domestic wastewater is highlighted as a primary threat in the Zarumilla basin (Ecuador and Perú). Here it is noted that "untreated wastewater discharges into rivers, streams and aquifer areas in rural and urban areas of Ecuador and Peru is a widespread problem."[35]
- In the Rio Montagua (Guatemala and Honduras), one of the main transboundary problems are surface water and groundwater pollution from domestic wastewater, agrochemicals, and solid wastes (where only 17% of municipalities have any form of treatment).[36]
- Treatment of wastewater is particularly low in the Mira (Ecuador and Colombia) and control of contamination sources is considered a priority under the Binational Basin Plan.[37] Larger basins are not immune to problems of wastewater and pollution, despite the larger volumes of water in the system.
- Each year, the Regional Strategy of integrated water resources management in the Amazon Basin notes, "thousands of tons of chemicals and waste from industrial, mining, and agricultural activities are disposed of in Amazonian rivers." [38]

33 Fay, M. et al. (2017). *Rethinking Infrastructure in Latin America and the Caribbean: Spending Better to Achieve More.* Washington DC, International Bank for Reconstruction and Development / The World Bank.

34 Ibid, on page 10.

35 UNDP. (2015). *Integrated Water Resources Management in the Puyango-Tumbes, Catamayo-Chira, and Zarumilla Transboundary Aquifer and River Basins*. Project Document (PIMS 4402).

36 UNDP. (2016). *Integrated Environmental management of the Rio Montagua Watershed.* Project Document (PIMS 5714).

37 Plan Binacional para la gestión integral de recursos hídricos de las cuencas Carchi-Guaitara y Mira-Mataje (2017).

38 ACTO. (2018). *Strategic Action Program Regional Strategy for Integrated Water Resources Management in the Amazon Basin.* Brasilia, Organização do Tratado de Cooperação Amazônica.

Table 1. Basin Stats: Summary Table with Basin Key Factors

	Countries	Water Stress	Water Quality	Climate Impact	Hydro-tension	Legal	Treaties
Amazon	*	2	5	2	4	3	6
La Plata	**	2	5	2	3	2	23
Titicaca-Poopo	Pu, Bo	2	5	2	1	3	5
Orinoco	Co, Vz, Br,Gy	2	5	2	4	5	0
Mira-Mataje	Co, Ec	2	5	1	5	5	0
Patija	Co, Ec	2	5	1	3	5	0
Catumbo	Co, Vz	2	5	1	3	5	0
Chira	Ec,Pu	4	5	4	3	3	3
Zarumilla	Ec,Pu	5	5	3	1	3	4
Tumbes	Ec,Pu	3	5	4	3	3	3
Cancoso-Lauca	Bo, Ch	3	5	5	3	5	0
Artibonite	DR, Ha	2	5	2	4	3	2
Grijalva	Mx, Be, Gm	2	4	2	4	4	1
Matagua	Gm, Ho	1	5	1	3	5	0
Camelecon	Gm, Ho	2	5	5	3	5	0
San Juan	Ni, CR	2	5	1	5	5	0
Chiriqui	CR, Pa	2	5	1	5	5	0
Sixaola	CR, Pa	2	5	1	2	3	0

*Br, Pu, Co, Bo, Ec, Vz, Gy, and Su.
** Ar, Bo, Br, Py, and Ur.

One of the emerging issues in Latin America is upstream land degradation increasing the erosion and impacts downstream infrastructure affecting hydropower production

ii. *Land Use Changes, Erosion & Sedimentation:* The impacts of land degradation, through deforestation, road building, and poor agricultural practices, amongst others, were observed beyond national borders in Latin America as early as 1992.[39] Removal of forest cover or changes to land use can increase erosion of sediments. It also reduces infiltration into groundwater, causing increased sediment loading in rivers, and increase peak flows which further exacerbates bank erosion. Altering sedimentation can change downstream environments by adding to sediment. Conversely, dams may restrict the natural movement of sediment in a system depriving area downstream of need sediment and nutrients.[40] One of the emerging issues in Latin America is upstream land degradation increasing the erosion and impacts downstream infrastructure affecting hydropower production and the longevity of reservoirs but also intake structures and navigation.

Evidence in LAC:

- In areas like the Amazon, which receives considerable input of water from the Andes, upstream land-use patterns and agriculture are resulting in siltation of downstream reservoirs and impacting hydropower generation. The issue is of such concern that in 2010 Brazil's ANA (Agência Nacional de Águas) and ANEEL (Agência Nacional de Energia Elétrica) made it mandatory to monitors
- Sediment fluxes in reservoirs.[41] Sediment transport is an increasingly important issue in a region which is increasing hydropower production as a means to generate cheap electricity and reduce carbon emissions. There are currently

39 Southgate, D. & M. Whitaker. (1992). "Promoting Resource Degradation in Latin America: Tropical Deforestation, Soil Erosion, and Coastal Ecosystem Disturbance in Ecuador". Economic Development and Cultural Change, Vol 40 No 4, July.215:225

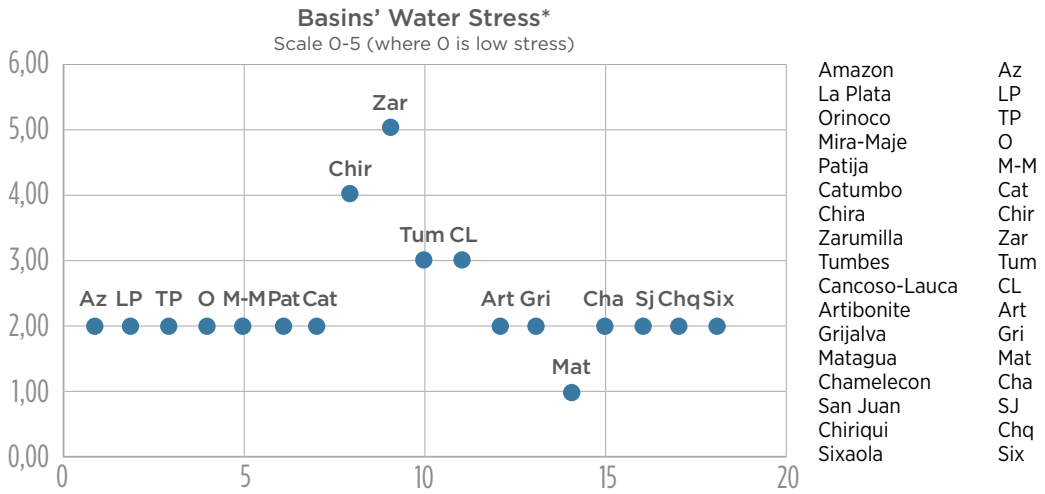
40 Sundborg, Å. and Rapp, A. (1986). "Erosion and Sedimentation by Water: Problems and Prospects." *Ambio* 15(4).

41 Poleto, C. et al. (2014). "Overview of the work in Latin America on erosion and sediment dynamics." *Journal of Soils and Sediments* 14(7): 1213-1215.

eight large dams in the Amazon basin (with hundreds of smaller dams).[42] However, there have been almost 300 plans developed for new major dam construction.[43] The situation is similar for La Plata which currently has 80 large dams, some of the hugest in the world such as Itaipu, and where Brazil is planning a further 27.[44]

- Hydropower is not the only reason for dams in the region. Indeed, a large percentage of the 700 built dams in Peru is for irrigation,[45] and many are for drinking water supply and are also affected by siltation.
- Increased siltation from agriculture in the Upper Paraguay River is not only a problem in reservoirs. It is also a significant concern in the Pantanal,[46] where there have been mass sedimentation rates over the past 35 years.[47] Siltation has been identified in ANA's new 2018 Management Plan for Upper Paraguay.[48]
- It happens the same in other plans and programs in the region where soil conservation and sediment control have been identified as problems, such as in the Mira basin,[49] or where increased sediment has resulted in increased levels of turbidity (reduced light) and a decrease in primary production.[50]

Figure 1. Basins' Water Stress



*Made up of Water Quantity (water stress associated with water use in agriculture) and Water Quality (water stress associates with pollutants from wastewater -municipal and agricutlrural sources-).

42 Winemiller et al. (2016). "Balancing Hydropower and Biodiversity in the Amazon, Congo, and Mekong". *Science* 351 (6269) 128-129, January.

43 80 in Peru, 51 in Ecuador, 150 in Brazil, 17 in Bolivia, and 1 in Colombia. See https://tfddmgmt.github.io/tfdd/map.html

44 See https://tfddmgmt.github.io/tfdd/map.html

45 See Tinoco, V. (2017). Sediment Management in Dams in the Andes. Center for Latin American Studies, University of California, Berkeley. Available at https://clas.berkeley.edu/research/sediment-management-dams-andes

46 Merten, G. and J. Minella (2013). "The expansion of Brazilian agriculture: Soil erosion scenarios." *International Soil and Water Conservation Research* 1(2): 37-48.

47 Godoya, J. M. et al. (2002). "Evaluation of the Siltation of River Taquari, Pantanal, Brazil, through 210Pb Geochronology of Floodplain Lake Sediments." *Journal of the Brazilian Chemical Society* 13(1).

48 ANA. (2018). *Plano de Recursos Hídricos de Região Hidrográfica do Paraguai.* Brasilia, Agência Nacional de Águas.

49 Plan Binacional para la gestión integral de recursos hídricos de las cuencas Carchi-Guaitara y Mira-Mataje (2017).

50 UNDP. (2015). Integrated Water Resources Management in the Puyango-Tumbes, Catamayo-Chira and Zarumilla Transboundary Aquifer and River Basins, Project Document (PIMS 4402).

Forest loss due to agriculture and pasture is the most critical threat to biodiversity in the region

iii. *Loss of Biodiversity:* Latin America is home to the world's most biodiverse habitat, the Amazon rainforest, and over 40% of the World's biodiversity is found within the South American Continent.[51] South America is also home to the largest and most biodiverse wetlands in the World, the Pantanal in the Upper Paraguay River. Forest loss due to agriculture and pasture is the most critical threat to the region. Latin America has seen rapid agricultural growth, and the trends look set to continue as countries use agrarian development as an economic driver. Agriculture, however, demands water use, particularly for irrigation, and if done inappropriately, can lead to sedimentation issues (See *Land Use Changes, Erosion & Sedimentation*) and may be susceptible to climate change (See *Climate Change and increasing hydro-climatic events*).

Evidence in LAC:

- The main areas of agricultural development affecting biodiversity are the tropical Cerrados in Brazil.[52] However, small scale agriculture expansion is also affecting natural habitats in other regions, including in the biodiversity hotspots of the Andes and Mesoamerica.[53]
- Loss and degradation of aquatic biodiversity is a severe problem in the Amazon Basin, due mainly to overexploitation, industrial expansion, and unsustainable and illegal production practices.[54] Another, reasonably large associated with biodiversity loss is related to hydropower development. Not do large reservoirs flood areas, but they alter the downstream hydrological regime, which influences habitat as we as providing migration barriers. The new Belo Monte hydropower complex in the Amazon may have set "a new record for biodiversity loss owing to the selection of a site with exceptional species endemism."[55]

Developing dams and operating storage capacity can affect the downstream ecosystem and societies by altering the natural timing of flow and cause problems associated with water quality.

iv. *Alteration to the hydraulic regime:* Developing dams and operating storage capacity, particularly for hydropower, can affect the downstream ecosystem and societies by altering the natural timing of flow, as well as problems associated with sediment disruption and water quality. Dam building, principally for hydropower, but also for irrigation, began in earnest in the Latin America in the mid 70, as shown from Brazil's cumulative storage development over the last 100 years. Alteration of the hydraulic regime through dam construction has been shown to affect even large rivers in South America. While the effects of dams can be more significant in smaller watersheds, the cumulative impacts of dam development can be felt even in large basins.

51 UNEP-WCMC (2016). *El estado de la biodiversidad en América Latina y el Caribe: una Evaluación del avance hacia las metas de Aichi para la Biodiversidad Biológica.* Cambridge, UK, UNEP.

52 Merten, G. and J. Minella (2013). "The expansion of Brazilian agriculture: Soil erosion scenarios." *International Soil and Water Conservation Research* 1(2): 37-48.

53 UNEP-WCMC (2016). *El estado de la biodiversidad en América Latina y el Caribe: una Evaluación del avance hacia las metas de Aichi para la biodiversidad Biológica.* Cambridge, UK, UNEP.

54 ACTO (2018). *Strategic Action Program Regional Strategy for Integrated Water Resources Management in the Amazon Basin*. Brasilia, Organização do Tratado de Cooperação Amazônica.

55 Winemiller et al. (2016). "Balancing hydropower and biodiversity in the Amazon, Congo, and Mekong". *Science 351* (6269) 128-129, January.

Evidence in LAC:

- The 24 large dams[56] on the Parana River have an estimated storage capacity of 275 km3 which is 57% of the 478 km3 annual flow.[57] Before many of the hydro-dams were built, the middle Parana River had an annual discharge cycle that reached its peak in March or April, with the minimum flow in September. Now, however, water management of upper dams is based on maximized power generation. Water is retained in reservoirs during falling water periods and released during low waters. Upper basin dams have increased water levels downstream and delayed the timing of floods.[58]
- The effects of dam development can be felt throughout La Plata. In the inland waters, habitat and community modifications have resulted in the transformation of predominantly river ecosystems, to lake systems altered biotic communities, including invasive exotic species that have displaced native ones.[59]
- While the Parana is the most developed of Latin American rivers, the proposed developments in the Amazon and other river systems means that there will be similar effects to those seen in the La Plata. This may include destruction or imperilment of migratory fishes; faunal range fragmentation and population isolation; extinction or imperilment of geographically restricted taxa dependent on uniquely riverine habitats; reduction in abundances of flood-dependent taxa, as well as taxa-dependent on freshwater inflows to estuarine habitats; and increases in lentic and exotic taxa.[60] This loss of biodiversity is of great importance in a region such as the Amazon with high species endemism and were 90% of fish species are only found in certain parts. The most significant factor influencing fish growth in any single year is the area of land flooded, which dams and particularly hydropower alters.
- Furthermore, poor chemical conditions, mercury leaching, oxygen depletion, and other contaminants have been observed in large dams from South America.[61] Hydraulic effects are not only felt from dams but channelization, such as the proposed *Hidrovia*, in the Pantanal will also have the effect of moving water more quickly through the system.[62]

56 FAO (2016). *Transboundary River Overview -La Plata.* FAO AQUASTAT. Rome, Italy, Food and Agricultural Organization.

57 FAO (2016). *Transboundary River Overview -La Plata.* FAO AQUASTAT. Rome, Italy, Food and Agricultural Organization.

58 Pringle, C. M. et al. (2000). "Regional Effects of Hydrologic Alterations on Riverine Macrobiota in the New World: Tropical-Temperate Comparisons." *BioScience* 50(1-2): 807-823.

59 Mugetti, A. C. et al. (2004). "Aquatic Habitat Modifications in La Plata River Basin, Patagonia and Associated Marine Areas." *Ambio* 33(1-2): 78-87.

60 Pringle, C. M. et al. (2000). "Regional Effects of Hydrologic Alterations on Riverine Macrobiota in the New World: Tropical-Temperate Comparisons." *BioScience* 50(1-2): 807-823.

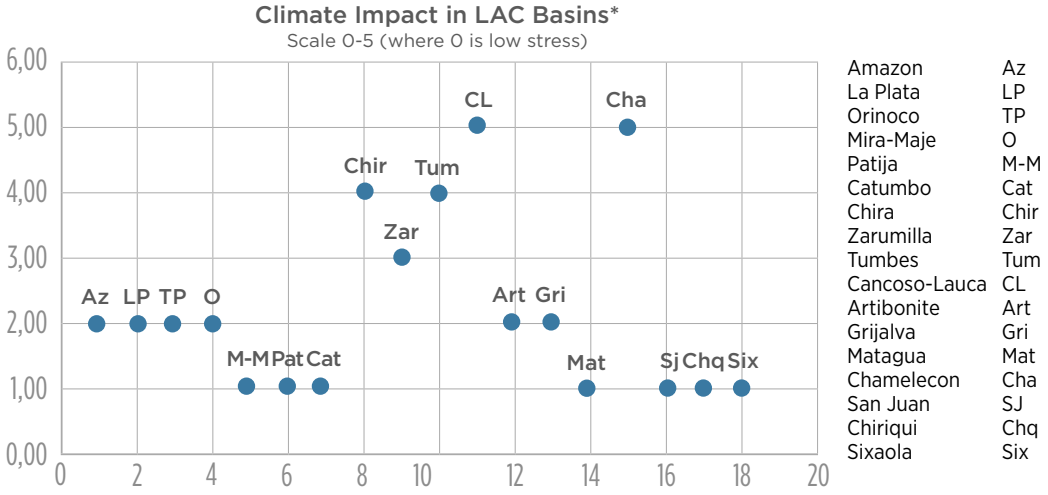
61 Pringle, C. M. et al. (2000). "Regional Effects of Hydrologic Alterations on Riverine Macrobiota in the New World: Tropical-Temperate Comparisons." *BioScience* 50(1-2): 807-823.

62 WWF (2004). *Rivers at Risk: Dams and the future of freshwater ecosystems.* Godalming, UK.

v. *Climate Change and increasing hydro-climatic events:* America temperatures have risen between 0.7°C and 1°C since the mid-1970s.[63] Precipitation has risen in the southeastern part of South America and fallen in Central America and the southern and central parts of Chile.[64] At the same time, precipitation is expected to decrease on average by 15% in Central America and increase by 8% in Argentinian coastal areas.[65] In addition to expected decreases in water availability from reduced precipitation and increased evaporation (and evapo-transpiration), glacier retreat is expected to affect water supply for over 30 million people in the Andes region.[66] To date, Bolivian glaciers have lost 50% of their ice.[67]

By 2100 it is anticipated that average temperatures across Latin America will rise by 2°C and as much as 3°C in the Amazon. Climate change impacts will be felt in all sectors, but most noticeably in the agricultural. Warming of 2°C is projected to result in reductions in yields of maize, rice, wheat, and potentially other cereal crops, particularly in Central and South America.[68]

Figure 2. Climate Impact in LAC Basins



*Calculated environmental water stress due to climate change impact by 2050.

63 Coastal Chile has experienced a decrease of 1°C. See Bárcena, A. et al. (2015). *The Economics of Climate Change in Latin America and The Caribbean Paradoxes and Challenges of Sustainable Development.* Santiago, Chile, Economic Commission for Latin America and the Caribbean.

64 Bárcena, A. et al. (2015). "The Economics of Climate Change in Latin America and The Caribbean Paradoxes and Challenges of Sustainable Development". Santiago, Chile, Economic Commission for Latin America and the Caribbean.

65 Íbid.

66 Sánchez, R. and Roberts, J. (2014). *Transboundary Water Governance. Adaptation to Climate Change,* IUCN, Gland, Switzerland. 284 p.

67 Rangecroft, S. et al. (2013). "Climate Change and Water Resources in Arid Mountains: An Example from the Bolivian Andes." *Ambio* 42(7): 852-863.

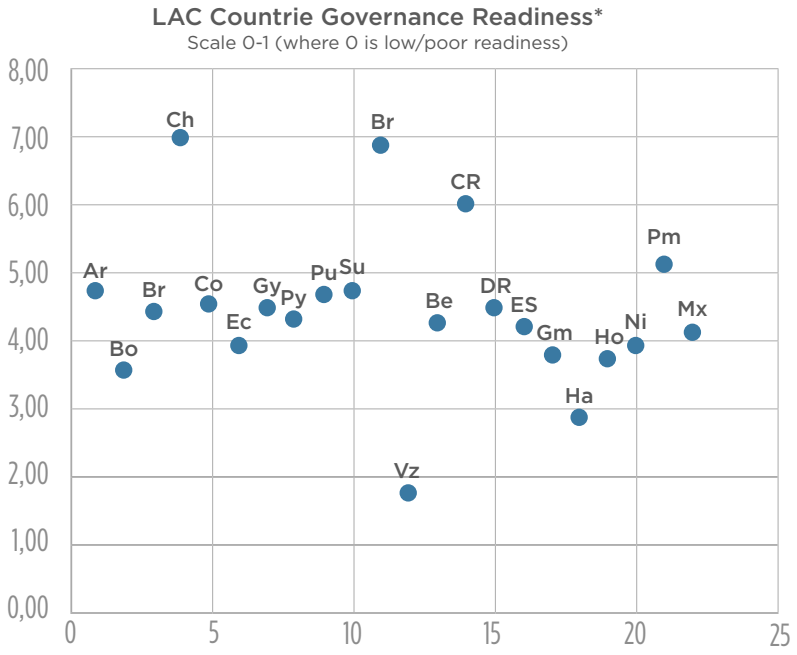
68 IPCC (2018). Sixth Assessment Report.

Climate change may have severe social repercussions resulting in migration from areas such as Central America and the Pacific zone on South America.[69] The droughts experienced in 2016-2017 in Peru, Ecuador, and Bolivia caused migration and social unrest in some areas. And it is more than likely that this will be a factor in other areas of Latin America.

The costs of extreme climate events are in the order of $100 billion per year to Latin American economies.[70] A concerted effort, management, and financing are going to be needed to address impact associated with climate change and extreme events.

vi. *Lack of Effective Governance Frameworks (Legal Structure/Institutional Architecture):* These Governance has been defined in different ways by different institutions. The Water Governance Facility (WGF), a joint SIWI and UNDP institution, defines water governance as the "political, social, economic and administrative systems in place that influence water's use and management."[71] The OECD defines water governance as the "range of political, institutional, and administrative rules, practices, and processes through which decisions are taken and implemented, and decision-makers are held accountable."[72]

Figure 3. LAC Countries Governance Readiness



*This is a measure of a country's ability to engage with large scale infrastructure from governance perspective

69 Kaenzig, R. and Piguet, E. (2013). "Migration and Climate Change in Latin America and the Caribbean". In: Piguet E., Laczko F. (eds). *People on the Move in a Changing Climate.* Global Migration Issues, vol 2. Springer, Dordrecht.

70 Vergara, W. et al. (2015). *Physical Damages Associated with Climate Change Impacts and the Need for Adaptation Actions in Latin America and the Caribbean.* Handbook of Climate Change Adaptation. L. Filho. Berlin, Heidelberg, Springer: 479-491.

71 WGF. (2013). User's Guide on Assessing Water Governance, UNDP, available at http://www.watergovernance.org/resources/users-guide-on-assessing-water-governance/

72 OECD. (2018). Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices. OECD Studies on Water, OECD Publishing, Paris. Online report available at https://read.oecd-ilibrary.org/environment/implementing-the-oecd-principles-on-water-governance_9789264292659-en#.XUdXWJNKiV4

Transboundary Water Governance Framework refers to the enabling environment and institutional architecture set up to allow the effective management of transboundary water resources

Hence Transboundary Water Governance Framework within this report refers to the enabling environment and institutional architecture set up to allow the effective management of transboundary water resources. It includes:

a. The Enabling Environment: legal structure and basis for Cooperation & Management.
   - Conventions.
   - Treaties / Agreements.
   - Memorandum of Understandings (that set up an institutional structure).

b. The Institutional Architecture for Cooperation to take place.
   - Legal establishment of Commissions.
   - Legal establishment of Basin Authorities.
   - Establishment of institutional mechanisms for cooperation at the line-ministry level (for example monthly meetings, etc.).

c. The decision-making process, stakeholder involvement, and implementation of decisions (the management). This is related to the actual activities associated with management (see next section below).

A. The Enabling Environment in LAC

There are some 45 water treaties in Latin America (Annex V). However, this impressive number should be taken with some caution:

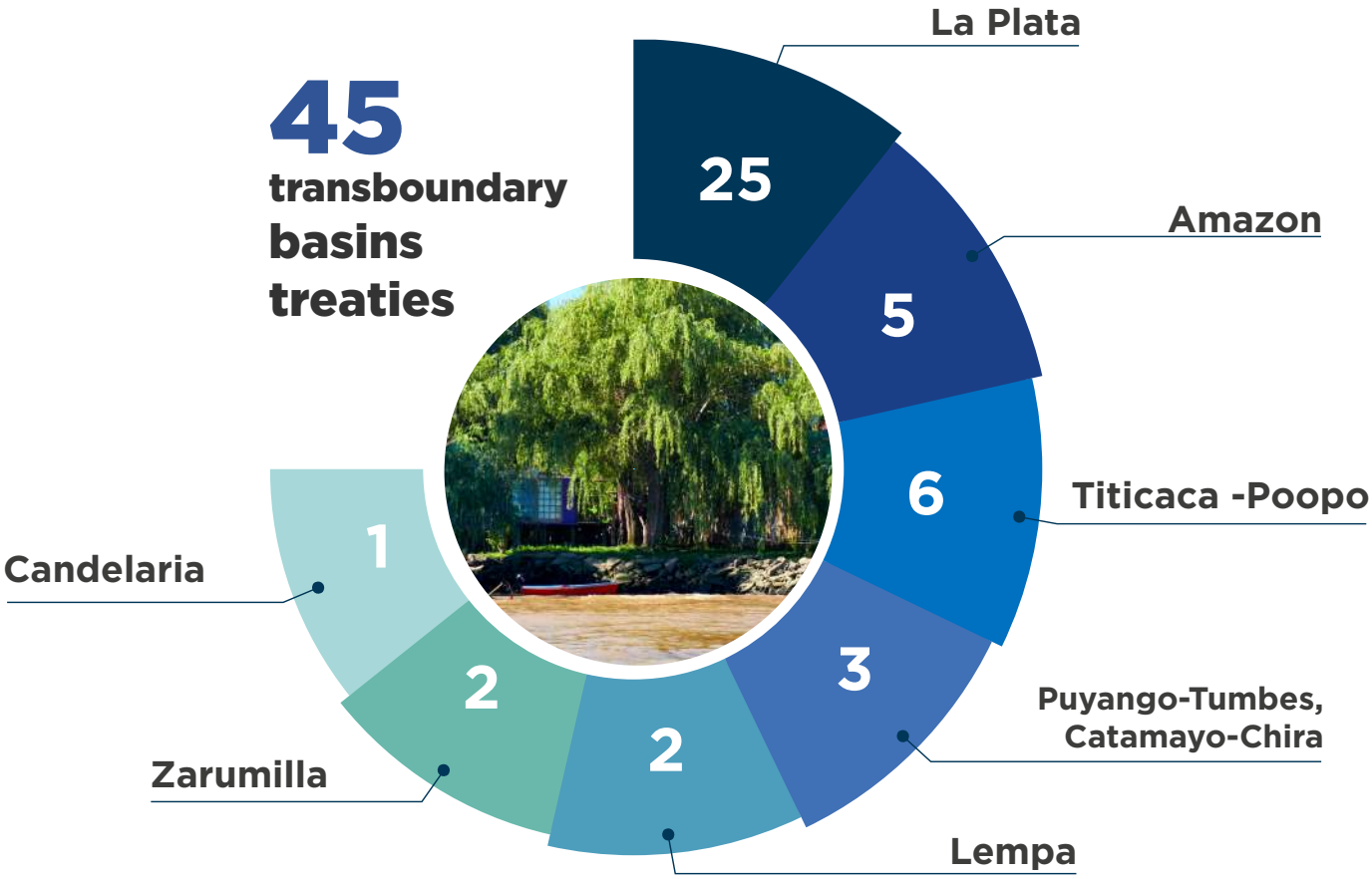
- Several of these treaties are 'add-on' protocols or clarifications of the initial agreement and, as such, constitute a part of the original treaty as opposed to an entirely new one.73 For example:
  - Supplementary boundary treaty between the Argentine Republic and the Republic of Paraguay on the river Pilcomayo and protocol annexed to the Treaty.
  - The treaties regarding the operations of the Zarumillo Canal.
- Several are for specific studies or single activities:
  - Agreement between the Argentine Republic and the Republic of Paraguay concerning a survey of the utilization of the waterpower of the Apipe Falls (lead to Yacreta Treaty).
  - Agreement concerning cooperation between Brazil and Paraguay in a study on the use of the waterpower of the Acaray and Monday Rivers.
- Several treaties are specifically for individual infrastructures, such as:
  - Tratado de Yacyretá (at Apipe Falls provided for the Yacyretá hydropower complex).
  - Treaty between the Federative Republic of Brazil and the Republic of Paraguay, concerning the hydroelectric utilization of the water resources of the Parana River owned in condominium by the two countries, from and including the Salto Grande de Sete Quedas (provided for the Itaipú hydropower complex).

73 Not all the treaties have been read to identify linkages; however, at least six are direct "add-on" treaties.

- Several are "preparatory" agreements (e.g. delineating boundaries before a more complex treaty on water resources is developed):
  - Exchange of Notes constituting an Agreement on the delimitation of the frontier along the thalweg on the Uruguay River in the area of the Basic Garabi Development Project.

Moreover, the agreements and treaties are not spread out over the region. In fact, they are in only eight of Latin America's 67 transboundary basins, and focused on the La Plata, Amazon, and Titicaca-Poopo basins, which account for 37 of the 45 treaties/agreements (Table 1).

Figure 4. List of treaties and agreements by basin in LAC



There has been a certain reluctance amongst LAC states to develop legally binding instruments or to ratify the global conventions

B. The Institutional Architecture for Cooperation in LAC

Several basins have established commissions (either basin-wide or topic-specific) to oversee management. La Plata basin has some 14 transboundary commissions, the Bilateral Commission between Panama and Costa Rica has been established to address all transboundary issues, including the Sixoala basin.[74] There is a commission in the Trifinio region of the upper part of the Lempa basin,[75] and commissions have been active in both the Titicaca-Poopo and Zarumilla basins. Moreover, there is a movement to develop treaties addressing environmental concerns and protection, whereas many of the older settlements addressed infrastructure. Of note is one of the more recent agreements between Brazil, Bolivia, and Paraguay on the sustainable management of the Pantanal.[76]

Despite this, however, there has been a certain reluctance amongst LAC states to develop legally binding instruments or to ratify the global conventions.[77] No Latin American country[78] has ratified the 1997 UN Watercourses Convention or the 1992 UNECE Water Convention. Interestingly, both Paraguay and Venezuela signed the 1997 UN Watercourses Convention, but neither went on to ratify it.[79]

There are clear needs for higher transboundary governance of water resources. In light of the number of functioning commissions and legal institutional mechanisms in the region, international water governance in Latin America can be said to be in its early stages.

vii. *Lack of Effective Management at the Transboundary Level:*

In this report, the management of transboundary waters includes the activities associated with implementing IWRM (Integrated Water Resources Management),[80] such as information gathering, analysis, planning, decision-making, undertaking development, and utilizing of transboundary waters at a technical level, amongst others. It requires a governance framework (see the section above) to function effectively.

A scoping of bilateral management plans and activities in Latin America shows that while there are some basins, such as the La Plata, which have a strong history of cooperation through agreements and commissions, the majority of

74 Binacional Commission between Panama and Costa Rica.

75 Comisión Trinacional del Plan Trifinio (CTPT) (http://www.plantrifinio.int/quienes-somos/plan-trifinio).

76 Declaration on the Sustainable Management of Pantanal, signed 22 March 2018.

77 Iza, A. et al. (2014). *Managing transboundary rivers in Latin America – could a global convention help?* IUCN/Bridge.

78 French Guiana ratified the 1992 UNECE Transboundary Water Convention when it was ratified by France (30 June 1998).

79 Venezuela signed the 1997 UN WC 22 September 1997; Paraguay signed 25 August 1998.

80 Integrated Water Resources Management (IWRM) is a process which promotes the coordinated development and management of water, land and related resources to maximize economic and social welfare equitably without compromising the sustainability of vital ecosystems and the environment. https://www.gwp.org/en/GWP-CEE/about/why/what-is-iwrm/

transboundary water basins do not appear to have any form of plan or management action at the transboundary level.

The majority of transboundary water basins in LAC do not appear to have any form of plan or management action at the transboundary level

The following is a list of management initiatives found:

Existing Basin Plans

- The La Plata basin has numerous plans, many dealing with infrastructure, which have been developed and implemented through its various commissions. However, there has been no over-arching plan for the basin, and no specific management plans have been assessed in the development of this report.
- 2018 Water Resource Plan for the Upper Paraguay River, [81] developed by Agência Nacional de Águas. This is a national-level plan relating to the management of the Upper Paraguay River. However, it also acknowledges the system in transboundary. It is an update of the 2005 Implementation of Integrated River Basin Management Practices in the Pantanal and Upper Paraguay River Basin,[82] also developed by ANA Brazil, as a national-level plan with one of its action items being "developing partnerships with Paraguay and Bolivia".
- 2018 Strategic Action Program for the Amazon: Regional Strategy for Integrated Water Resources Management in the Amazon Basin. Developed by ACTO in collaboration with UNEP and national ministries responsible for the environment. This is a transboundary framework plan.
- 2017 Binational Plan for the Management of the Carchi-Guaitara and Mira-Mataje Basins.[83] The plan was developed by the environment ministries in Ecuador and Colombia. It is a framework for management, outlining projects that need to be developed, or are being undertaken at national levels. It describes a way forward to cooperation between the two countries.
- 1997 Plan Trifinio.[84] Developed with governmental environmental agencies of Guatemala, El Salvador, and Honduras, as well as international partners, including the private sector coffee companies. It was established under the Central American System of Integration (SICA)[85] promoting greater economic integration. SICA also has a Regional Committee on water resources. One of its roles is the improvement of transboundary water management.[86]
- Lake Titicaca-Poopo (Peru and Bolivia) has an existing Global Management Plan which is currently updating its Basin Master Plan in partnership with the UNDP.[87]

81 ANA. (2018). Plano de Recursos Hídricos de Região Hidrográfica do Paraguai. Brasilia, Agência Nacional de Águas.

82 ANA/GEF/UNEP/OAS. (2005). Implementation of Integrated River Basin Management Practices in the Pantanal and Upper Paraguay River Basin, Agência Nacional de Águas, Brasilia, May 2005.

83 Plan binacional para la gestión integral de recursos hídricos de las cuencas Carchi-Guaitara y Mira-Mataje (2017) available at https://www.iucn.org/sites/dev/files/content/documents/pbgirh-27abr2017.pdf

84 http://www.plantrifinio.int/quienes-somos/plan-trifinio

85 https://www.sica.int/, initiated from the Protocolo a la Carta de la Organización de Estados Centroamericanos in 1951, has became SICO in 1993 and operates as a regional mechanism for integration in various sectors. Based in El Salvador.

86 "Mejorar el manejo de la demanda integral de agua y de los recursos transfronterizos". https://www.sica.int/consulta/entidad.aspx?IdEnt=32&Idm=1

87 UNDP. (2016). Integrated Water Resources Management in the Titicaca-Desaguadero-Poopo-Salar de Coipasa (TDPS) System/Gestión Integrada de los Recursos Hídricos en el Sistema Titicaca Desaguadero Poopo Salar de Coipasa (PIMS 438).

- Putumayo (Peru, Colombia, Ecuador, and Brazil). In 1993 Peru and Colombia developed a management plan for the Putumayo basin.[88] The Plan contains a diagnostic of the basin, seven proposed studies, and projects that cover areas of economic development, forest use, fishing, health, and agriculture. They developed an updated plan in 1998 and created a binational commission in 2013. Since 2017, there have been several meetings to develop a "road map" for integrated water resource management.[89] The UNECE is probably assisting this process. In terms of the larger basin, there is a possibility that all four countries are in the process of developing a GEF proposal with the World Bank as an implementing agency.[90]

Basin Plans under development

- In the Sixaola Basin (Costa Rica-Panama). There is no management plan, but there is an active binational commission[91] which is helping to address transboundary water issues. In particular, improving education with the assistance of the IUCN, and promoting cleaning of municipal waste. A key document is the "Mapping of contamination Sources in the Sixaola Basin."[92]
- Puyango-Tumbes, Catamayo-Chira, and Zarumilla (Ecuador and Peru). There has been cooperation, particularly concerning the Zarumilla Canal. A specific transboundary water management plan is being developed by national line ministries in partnership with the UNDP.[93]
- Rio Montagua (Guatemala and Honduras). There is limited substantive coordination; however, a plan is being developed by line ministries in partnership with the UNDP.[94]

Not surprisingly, the evaluation of management action at the transboundary level mirrors the assessment of legal mechanisms, as often the later provides an enabling environment for the former to function. It should be noted that it is not always necessary to have a legal structure in place to have practical actions taken at the international level. Treaty development can often be a long process and take decades. The Columbia River Treaty between the U.S. and Canada, two neighbors without much contention, took almost 20 years to negotiate. The Convention on the Protection of the Danube took ten, and so did The Mekong River Treaty and the Mahakali Treaty (between India and Neal).[95]

88 Plan Colombo-Peruano para el Desarrollo Integral de la Cuenca del Rio Putumayo - Diagnóstico Regional Integrado, available at https://www.oas.org/dsd/publications/Unit/oea62s/oea62s.pdf

89 https://www.unece.org/fileadmin/DAM/env/documents/2018/WAT/02Feb_06-07_BenefitsWS_Geneva/4.3._Peru%CC%81_Pomareda.pdf

90 More work is needed to determine the extent of this process.

91 http://www.cuencariosixaola.bocasdeltoro.org/

92 ANAM-MINAET-BID/GEF. (2012). *Identificación y mapeo de fuentes de contaminación en la cuenca binacional Sixaola.* 4.4 final product of IDB-GEF project. http://www.cuencariosixaola.bocasdeltoro.org/pdfs/fuentes%20contaminacion%202012.pdf

93 UNDP. (2015). *Integrated Water Resources Management in the Puyango-Tumbes, Catamayo-Chira, and Zarumilla Transboundary Aquifer and River Basins.* Project Document (PIMS 4402).

94 UNDP. (2016). *Integrated Environmental management of the Rio Montagua Watershed.* Project Document (PIMS 5714).

95 Hearns, G. (2010). *Analysis of Process Mechanisms Promoting Cooperation in Transboundary Waters.* Faculty of Graduate Studies, Resource Management, and Environmental Studies. Vancouver, University of British Columbia. Ph.D.: 301.

Joint management and actions can and should be promoted at functional levels despite not having an overarching legal framework to formally mandate it

Consequently, joint management and actions can and should be promoted at functional levels despite not having an overarching legal framework to formally mandate it. This can come through MOUs (Memorandum of Understanding)[96] between line ministries, or the development of management plans themselves. Transboundary actions in this way help inform what kind of governance structure may be required.[97]

Problems´ Root Causes

Some of the key root causes associated with the problems are:

i. *Municipal and industrial wastewater*:

» It alters water chemistry and water quality.

Water quality is an issue with extensive untreated municipal and industrial wastewater being released into the systems. This matter is particularly relevant in the higher population-dense areas, such as the lower La Plata and basins in Central America.

ii. D*eforestation – Land Use Changes:*

» Increases run-off and exacerbates flooding.

» Increases sedimentation altering eco-systems and river habitat.

» Reduces water retention, increases heat absorption, and exacerbates droughts.

Deforestation is a driving force in many basins. Removal of forest cover results in high erosion and increased peak runoff causes flooding and sediment loading in various parts of the downstream system. This can affect habitat, undermine the efficiency of infrastructure and impair navigation. These effects are felt throughout the region, including the Amazon and upper La Plata, amongst others; but they are particularly pronounced in the Central American area where climate impacts and storm events are anticipated to be more pronounced.

iii. *Agricultural Practices – Land Use Changes:*

» Removes forest cover (see Deforestation).

» Introduces pollutants (pesticides) increasing chemical toxicity.

» Introduces pollutants (nitrates and fertilizers) altering water chemistry, reducing oxygen.

In areas of high agriculture, such as the Motagua basin between Guatemala and Honduras, agrichemicals also present a major transboundary problem along with

96 MOUs are generally used to document a relationship of goodwill between the parties to the MOU. They are not legally binding.

97 Hearns, G. and R. Paisley (2013). "Lawyers Write Treaties, Engineers Build Dikes, Gods of Weather Ignore Both: Making Transboundary Waters Agreements Relevant, Flexible, and Resilient in a Time of Global Climate Change." *Golden Gate University Environmental Law Journal* 6(2): 36.

nutrient loading that is a transboundary concern. These effects are felt in other transboundary basins with intense levels of agriculture, and generally a considered a problem in Central America.

iv. *Dams (either for hydropower, storage or irrigation) and infrastructure (navigation):*

- » Alters the hydraulic regime impacting downstream ecosystems.
- » Stops sedimentation which affects downstream ecosystems.
- » Alters downstream water chemistry.

These effects are felt throughout the region but are of greater importance in some of the more dammed basins such as the Parana river of the La Plata Basin. Developing navigational infrastructure, as in the Pantanal (Paraguay river), also has effects of channelization and degradation of wetland ecosystems.

v. *Overuse-water scarcity – Land-use / Irrigation:*

- » Reduces water availability in critical times.

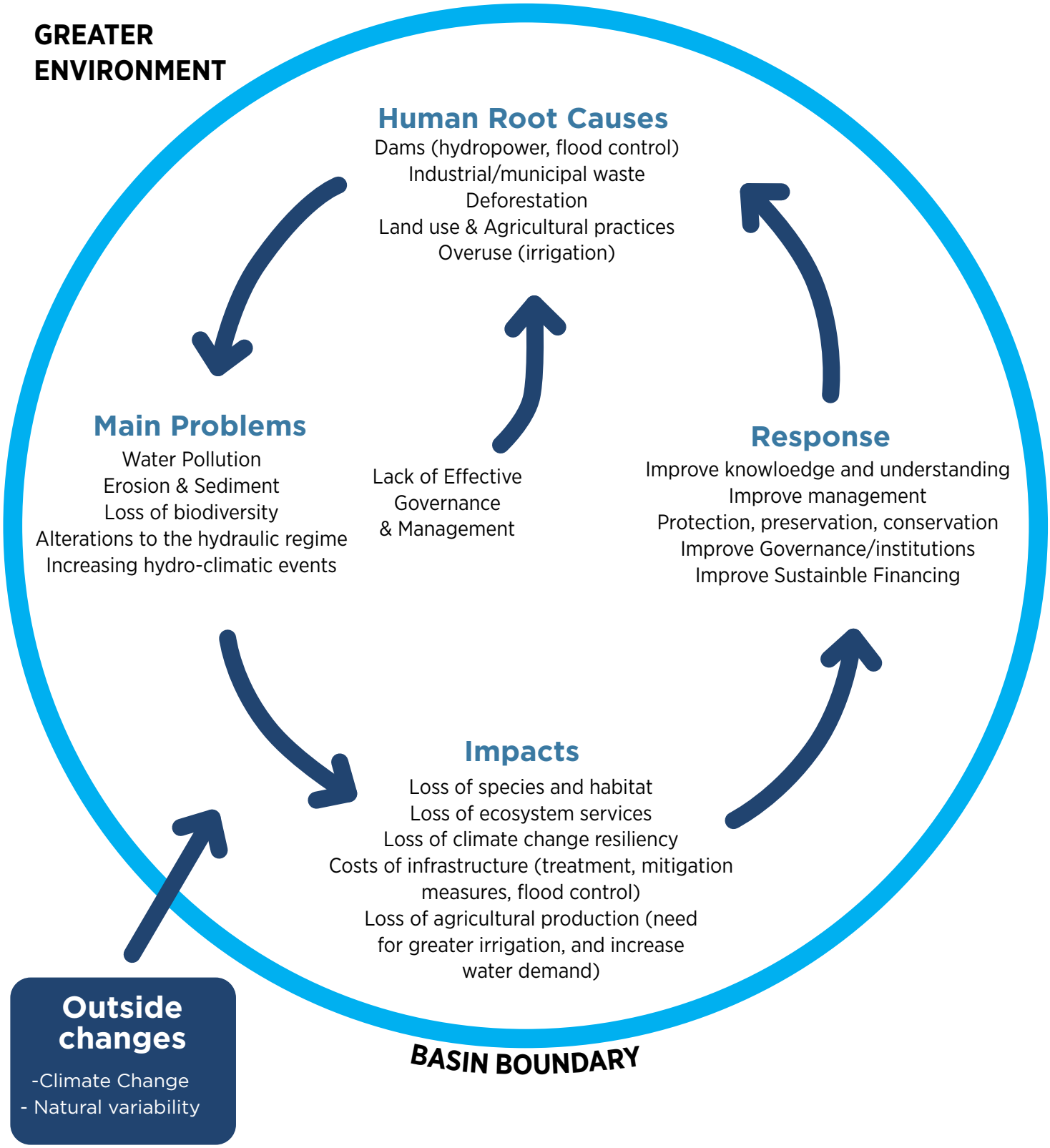
In terms of transboundary problems, water scarcity is not an issue at a basin level in most of LAC, with the exceptions of smaller basins on the Pacific coast of South America, such as the Zarumilla-Chira-Tumbes basins between Ecuador and Peru.

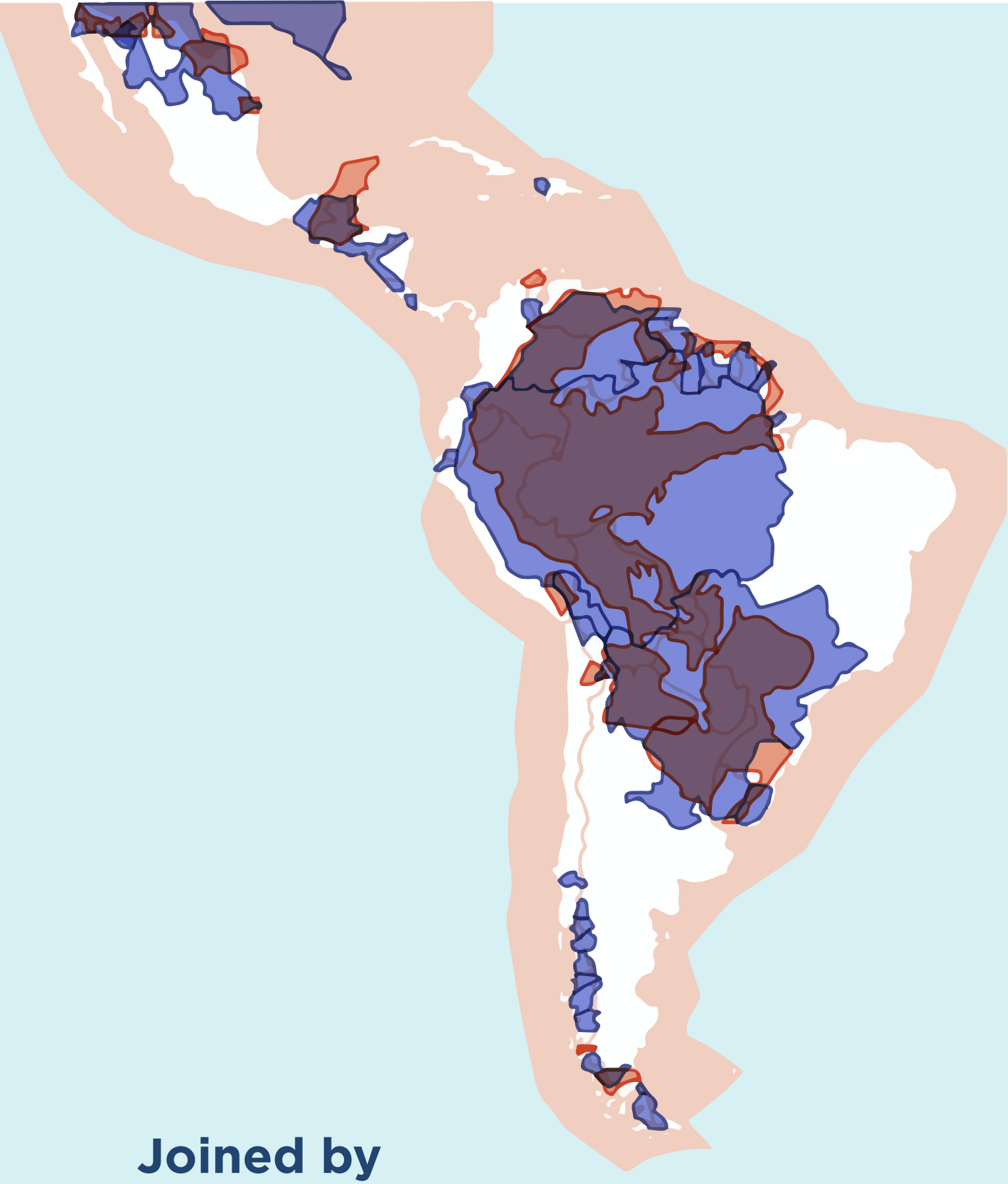
The greater the illness, the bigger the pill

Figure 1 outlines the main drivers of human-induced causes and their link to significant problems identified in transboundary waters in Latin America. The issues, exacerbated by climate change effects outside the boundaries of the basin, resulting in impacts on both, the environment and society. One of the social consequences will be the need for greater infrastructure to address water management problems. As noted in the Problem Section, agriculture is likely going to be the hardest hit sector from climate impacts. Increased temperature is going to place pressure on agriculture through disease, pests, and most importantly, increased water needs. Areas which are currently not water-stressed may well become so.

The impact will demand responses, such as improved management, increased protection of critical areas, improved governance and institutions, and as just noted, improved sustainable financing. Underpinning this will be developed knowledge and understanding of the systems, both environmental and social.

Figure 5. Linkages between Causes, Problems, Impacts, and Responses





Joined by Water Program (JbW)

Joined by Water (JbW) – the IDB Transboundary Waters Program

Sharing water, sharing challenges

The key identified challenges are:

i. Ineffective integrated water resources management, including information gathering, planning, and infrastructure (green and grey);

ii. Inefficient governance, institutional and legal regime to enable transboundary management;

iii. Increasing environmental pressures and climate change impacts in ecosystems;

iv. Lack of financing mechanisms for sustainable development.

Sharing water, sharing benefits: references from other regions of the world

i. Transboundary water cooperation can act as an essential driver for improved international relations and conflict resolution or avoidance. A case in point has been the enhanced relations between Afghanistan and its Central Asian neighbors (in particular, Tajikistan) in addressing flood risk management and hydro-meteorological data exchange that has been supported by the World Bank.

ii. Joint planning and consultative decision making enhances social participation and strengthens democracy. This has been shown in the Dniester Basin between the Ukraine and Moldova. Here the promotion of transboundary cooperation has increased local community and civil society involvement at both national and international levels.

iii. More employment and income opportunities for the population living in transboundary water zones, including the creation of integrated economic zones and market opportunities. In the Danube basin, the integration of environmental, economic and social issues at commission levels have provided a forum for private sector input, such as the navigational and transportation sectors, tourism sector, and power sector.

iv. Improved access to social services provision. As a consequence of ameliorated development in transboundary waters, numerous basins have improved early warning systems for flooding, which has saved countless lives. It has been the case of the Amu Darya and Pyanj rivers of Central Asia.

v. Exchange of scientific knowledge, data, and information sharing. Those basins where transboundary issues have been addressed invariably have some degree of information exchange. Basins where this has advanced greatly has been the Nile, Sava and Mekong basins.

vi. Increased ecological integrity and reduced risks of climate change events. Transboundary cooperation has worked to address environmental issues in many basins, such as wetlands in the case of Colorado River Delta, or the Tonlé Sap in the Mekong.

vii. Joint investments in transnational communication and energy networks. The

Columbia River between Canada and the U.S. is one of the key examples of integrated benefit-sharing. Here, new infrastructure was built upstream to improve power generation and flood control downstream and has resulted in the development of energy networks. The La Plata basin has several examples of transboundary water development stimulating energy transmission and networks, including Yacyretá and Itaipu, amongst others.

Why is the IDB developing this new Program?

The IDB is the leading international development bank with a specific focus on LAC. With the mission of "**Mejorar Vidas**", the IDB has been providing financial and technical support to the water and sanitation sector of the region through the Water and Sanitation Division (WSA) for over 60 years. This commitment translates today into an active portfolio of more than US$ 9 billion that finances emerging programs and projects. As such, it can facilitate dialogue and capacity development at senior political levels, which is required for transboundary water cooperation.

US$9 billions

has the IDB active portfolio to finance emerging programs on water and sanitaiton

Moreover, as a financing institution, the IDB will contribute to the development of feasible and appropriate investment planning as part of Basin development to ensure "bankable" projects are identified and properly assessed. The IDB has also experience in working with innovative financing techniques, which are a potential niche for its transboundary program, for example (see Annex III for detailed information):

- Hydro-IDB.
- GCAM-LAC.
- Wastewater-to-Resource (WW2R).
- Remote sensing.
- Water footprint and virtual water.
- Circular Economy (CE).
- Blue Economy (BE).
- Analysis of data and information technologies.

The program is advanced through the Water and Sanitation (WSA) division of the IDB but has links to Agriculture and Rural Development, Energy, and Regional Integration. Moreover, the program complements and aligns with IDB's Water Security in LAC. The issues and problems addressed in the Water Security Program are going to impact water resources not only at the national level but also at the international scale. Some examples are: increased water use by 55% by 2050;[98] changes in precipitation and extreme events will increase;[99] increased demand, particularly from agriculture; and increased population.

98 OECD. (2014). *Climate Change, Water and Agriculture: Towards Resilient Systems, OECD Studies on Water*. OECD Publishing.

99 Vergara, W. et al. (2015). *Physical Damages Associated with Climate Change Impacts and the Need for Adaptation Actions in Latin America and the Caribbean. Handbook of Climate Change Adaptation.* L. Filho. Berlin, Heidelberg, Springer: 479-491.

The two complementary programs will help the region in advancing IDB member countries' ability to achieve SDGs, in particular:

- **SDG 2** (achieve food security): it will be directly addressed through better management of transboundary water resources in areas where agriculture is affected by either shortage for irrigation, or pollution from agricultural runoff, amongst others.

- **SDG 6** (sustainable management of water & sanitation): it will be directly addressed through advancing SDG 6.5 ("By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.").

- **SDG 13** (climate action): addressed through cooperation on water regulation for flood risk management and drought; hydro-power to displace thermal production, preservation of wetlands and carbon sinks, and development of green infrastructure.

- **SDG 15** (protecting ecosystems-halting biodiversity loss): is directly addressed through international cooperation in the conservation and protection of sensitive and environmentally biodiverse areas such as wetlands.

Objectives of the Program

The goal of the Program is to support the IDB member countries in achieving their goals around SDG 2, 6, 13 and 15.

The objective of the program is to enhance governance and management of transboundary waters in Latin America and the Caribbean (LAC), guaranteeing sustainability and scalability of investments. This will maximize economic, environmental and social welfare of the countries sharing a body of water in a balanced manner.

The Program will support member countries with technical and financial assistance in designing and implementing joint projects that address existing problems, or avoid potential future issues, in transboundary waters within LAC. More specifically, this program will focus on:

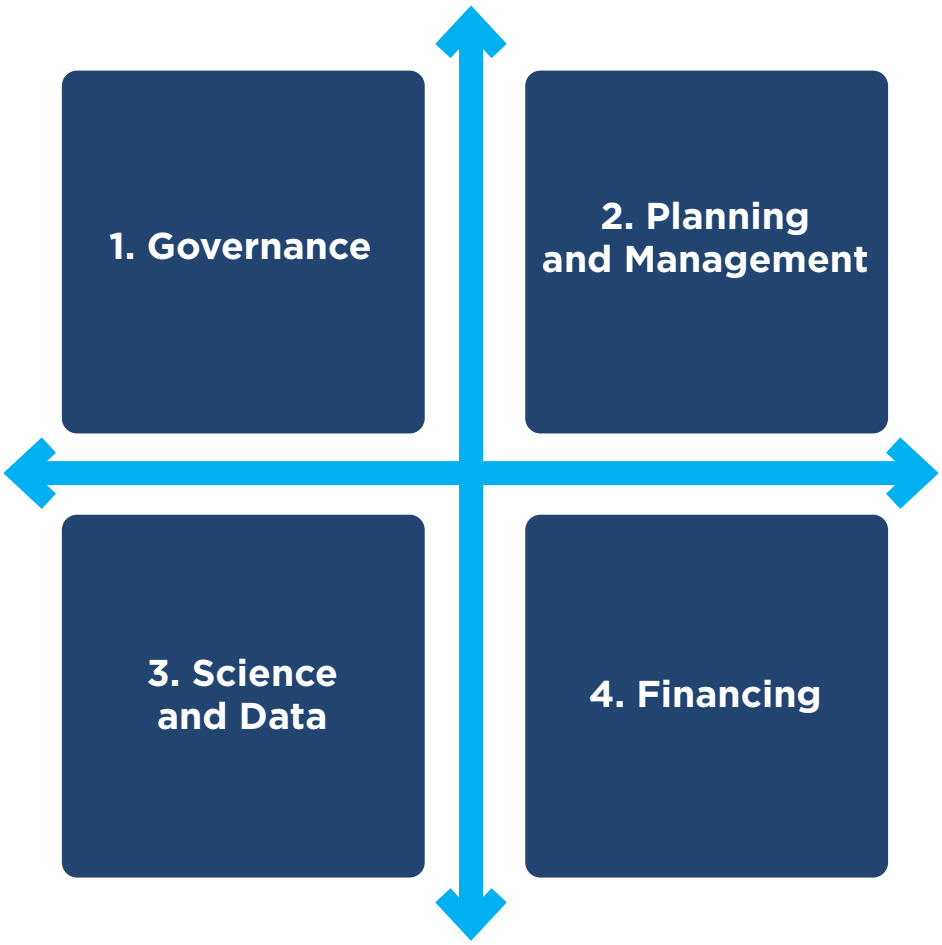
- Enhancing governance.
- Building awareness and technical capacity among stakeholders and decision-makers.
- Developing basin planning at the management and investment level.
- Mobilizing funding for projects implementation.

Vision
To be the foremost institution promoting and facilitating governance of integrated water resources management of transboundary waters in LAC addressing the challenges of climate change and increased use.

Mission
To build resilience in the management of transboundary waters in LAC and the capacity to adapt to the uncertainty associated with climate change and changing uses in five key international basins in LAC by 2023.

Thematic Areas: Governance, People, Science and Financing
The Bank will leverage its expertise, particularly in political level dialogue, innovative financing, and technical knowledge to promote the governance, management and sustainable financing of transboundary waters in LAC, addressing the challenges of climate change.

Figure 6. Joined by Water (JbW)Program - Thematic Areas



I. Legal and Institutional Frameworks

Facilitate intergovernmental and stakeholders dialogue at technical and political levels to encourage cooperative governance structures for the equitable and reasonable use of shared water resources.

Lines of Action:

1. Legal and policy frameworks

Under this component it will be conducted a detailed legal analysis of the prioritized transboundary basins of the program aimed at coordinating legislation and policies, as well as monitoring and control mechanisms to facilitate the implementation of actions.

Operational Activities:

Facilitate comparative analyses of legislation, regulations and policies to identify legal gaps and define common instruments for effectively managing transboundary watersheds.

Facilitation and hosting of dialogues.

Provision of technical assistance, information and funding to support dialogue processes and the development of cooperation arrangements

2.Institutional Mechanisms

Catalyze and strengthen institutional mechanisms for transboundary water governance. It aims at providing a platforms for dialogue, information-sharing, and coordinated decision-making on shared water management.

Operational Activities:

- Conduct feasibility assessments for the establishment or strengthening of institutional structures (comparative analyses, needs assessment, organizational structure, human resources, operations, long-term financial sustainability, etc)
- Design or assess changes/improvements to institutional architecture for effective and efficient transboundary water resources management
- Implementation of institutional strengthening plans and programs

Measurement would include number of dialogue meetings held; development of policies, MOUs, agreements, protocols; political indications or statements towards cooperation (from media, amongst others); establishment of governance mechanisms such as commissions, basin authorities, or linkages between management line ministries such as a joint-technical working group with mandate, amongst others.

II. Knowledge Development

Under this theme, activities will enhance the understanding and knowledge of ecological-socio-economic systems. Identifying mutual interests, information gaps, and problem identification is key to transboundary cooperation. This requires studies, exchanging information, analysis, decision-making, and planning. Solutions will be developed to address water management and climate impacts.

Lines of Actions:

1. Data and information gathering will develop an understanding of the system, allow knowledge gaps to be identified, and begin the process of identifying priority actions.

Operational Activities:

a. Needs assessment, national cross-sectoral studies (socio-economic, hydrological, bio-physical, environmental aspects, human capacity; amongst others), gap analysis,

b. Development of civil science apps for community-based data gathering.

c. Involvement of academia for data gathering and analysis.

2. Data exchange and analysis will allow for a truly transboundary perspective to be achieved and thus focus on major transboundary basin issues.

Operational Activities:

a. Undertake a transboundary water diagnostic analysis, using hydrological modelling tools such as HydroBID and NEXUS

b. Development of data exchange mechanisms,

c. Prioritize and agree to cause effect mechanisms.

3. Direct capacity development and training for specific aspects of transboundary water management will target decision-makers and those involved in management planning and implementation. This can include different levels of government staff (senior level government for political issues and awareness building, mid-level and technical staff of relevant line ministries involved in planning and management), municipal governments, and specific organizations (international and national).

Operational Activities:

a. Workshops; webinars; basin conferences, including participation to global intergovernmental meetings and workshops on transboundary water cooperation

b. Manuals and publications;

c. Multi-media learning tools (MOOCs, video series, web learning, educational phone apps);

d. Study tours;

e. Project twinning (linking similar projects so that management staff can learn from each other's experiences);

f. Academic certification (utilizing existing academic on-line courses).

4. Awareness building will target those people within the basin (or country) that should be informed about transboundary issues and activities to ensure support as well as input depending on the target group concerned. Consideration should include communities that will be affected by transboundary cooperative activities, the general public, and parliamentarians (particularly if treaties or agreements are being advanced) to garner input and support for programs.

Operational Activities:

a. Awareness building and stakeholder strategy development to determine key messaging and targeting audiences;

b. Targeted engagement, for example with parliamentarians, education of journalists;

c. Broad engagement and involvement of public in "celebrating River Days" or equivalent events); information packages, amongst others.

III. Planning and Sustainable Management

Planning will strengthen regional coordination and guide policy and institutional reforms to implement priority actions at the national and regional level. Planning could include socio-economic and environmental objectives for both land and water; infrastructure; protected area management actions; and targets for water allocation objectives.

Lines of Actions:

1. Planning will allow for a genuinely transboundary perspective to be achieved and thus focus on major basin issues.

Operational Activities:

a. Develop a participatory planning process that could include the development of a Master Plan/Programs identifying clear priorities.

b. Design cross-sectoral Master Plans/Programs, including conservation; protected areas; sustainable infrastructure – transport, energy, water supply and sanitation, drainage systems; and food security and production systems; etc.

Measurements would include number and range of studies and reports; information gathering systems (monitoring stations & program, mobile apps); effectiveness of knowledge exchange mechanism (web-based, GIS, remote sensing, etc.) measured through access, data exchanged, number and detail of planning documents; amongst others.

2. Stakeholder engagement and Social participation

Promotion of stakeholder engagement and participation in transboundary water governance mainly basin committees and others that include representation from sub-national and local governments, civil society organizations, private sector, grassroots organizations and others that are influenced or affected.

Operational Activities:

a. Conduct stakeholder assessments

b. Promote and implement local governance mechanisms

Measurements for capacity building outputs can be linked to products or events (such as the number of manuals, or number of workshops held); number of people trained; number of learning hours; number of courses or topics covered; number of people visiting web-sites of using multi-media tools; number of sessions held with journalists, parliamentarians, or senior level politicians; number of awareness building products developed (posters, web-pages, brochures, amongst others); number of people attending events; amongst others.

IV. Sustainable Financing

Develop innovative financing methods that enhance the value of public sector spending by involving the private sector and builds on ecosystem services through exploring novel approaches such as green infrastructure. It will allow to apply different methods to optimize water use in basins and sharing benefits accordingly.

Lines of Action:

1. Consolidating Bank knowledge to develop innovative sustainable financing mechanisms to promote transboundary water projects.

Operational Activities:

a. Design financial strategies

b. Collaboration with IDB Invest and the IDB Capital Lab for smaller scale investments

c. Project Preparation Facilities (PPF) mainly for infrastructure projects oriented to public and private bankable projects

d. Funding mechanisms such as water funds, multi-donor funding alliances and other blended finance mechanisms

e. Green credit lines; green bonds; others

Measurements would include number and detail of investment plans; number of sustainable financing mechanisms examined; number and extent (equivalent $ value) of funding mechanisms identified or developed; number and extent (equivalent $ value) of green and grey projects implemented,

Figure 4. Result Chain of the Transboundary Waters Program

Challenges

i. Ineffective integrated water resources management, including information gathering, planning, and infrastructure (green and grey)

iii. Inefficient governance, institutional and legal regime to enable transboundary management

iii.Increasing environmental pressures and climate change impacts in ecosystems

iv. Lack of financing mechanisms for sustainable development

IDB Strategy

The objective of the program is to enhance governance and management of transboundary waters in Latin America and the Caribbean (LAC), guaranteeing sustainability and scalability of investments. This will maximize economic, environmental and social welfare of the countries sharing a body of water in a balanced manner.

Thematic Areas

1: Legal and Institutional Frameworks (Governance)

2: Sustainable Planning and Management

3: Knowledge Development (Science and Data)

4: Sustainable Financing

Outcomes

- National commitments at the political or management level to manage transboundary water issues

- Basin level institutions/ mechanisms established or strengthened to coordinate effectively

- Countries engaged in Regional Transboundary Platform Dialogues

- Population potentially benefited as water users from the transboundary system in the area of influence by the project

- Partnerships established to mobilize and work together in transboundary system

- Innovative financing for sustainable development mechanisms created/ established

Intermediate Outcome

- Maximize economic, environmental and social welfare in an equitable manner

- Strength International relations

- Improve access to and quality of services

- Create evidence and scientific knowledge on transboundary waters

Impact

Enhanced cooperation and effective management of transboundary water resources in achieving SDGs 2, 6, and 13

IDB Updated Institutional Strategy: i) Social Exclusion & Inequality; ii) Productivity and Innovation and iii) Economic Integration

Applicable to the RC of the Program

Applicable to subsequent actions beyond the RC of the Program

BOX 1: IDB TRANSBOUNDARY PROJECTS UNDER DEVELOPMENT

Pilcomayo River Basin (shared By Argentina, Bolivia and Paraguay

In December 2018, the Banck approved the US$1.5M technical cooperation (TC), 'Water resources management of the Pilcomayo river basin.' The objective of this TC is to update the Pilcomayo River Basin Master Plan by conducting a comprehensive diagnosis that results in hydrological planning of the basin. The plan will identify necessary actions and investments to improve the qualify of life of its population, guaranteeing the integration of local agents during the project, conducting knowledge transfer workshops and developing a communication and socialization plan for the Master Plan.

The Pantanal (shared by Bolivia, Brazil and Paraguay)

It is increasingly becoming an economic engine in South America, whose ecosystem benefits have been valued in around $112 billion per year; but it is facing great environmental pressures. The program will help implement the 2018 World Water Forum declaration by Brazil, Paraguay and Bolivia to conserve and promote integrated sustainable development of the Pantanal in a coordinated manner.

Trifinio Plan-Water Security (shared by El Salvador, Guatemala and Honduras)

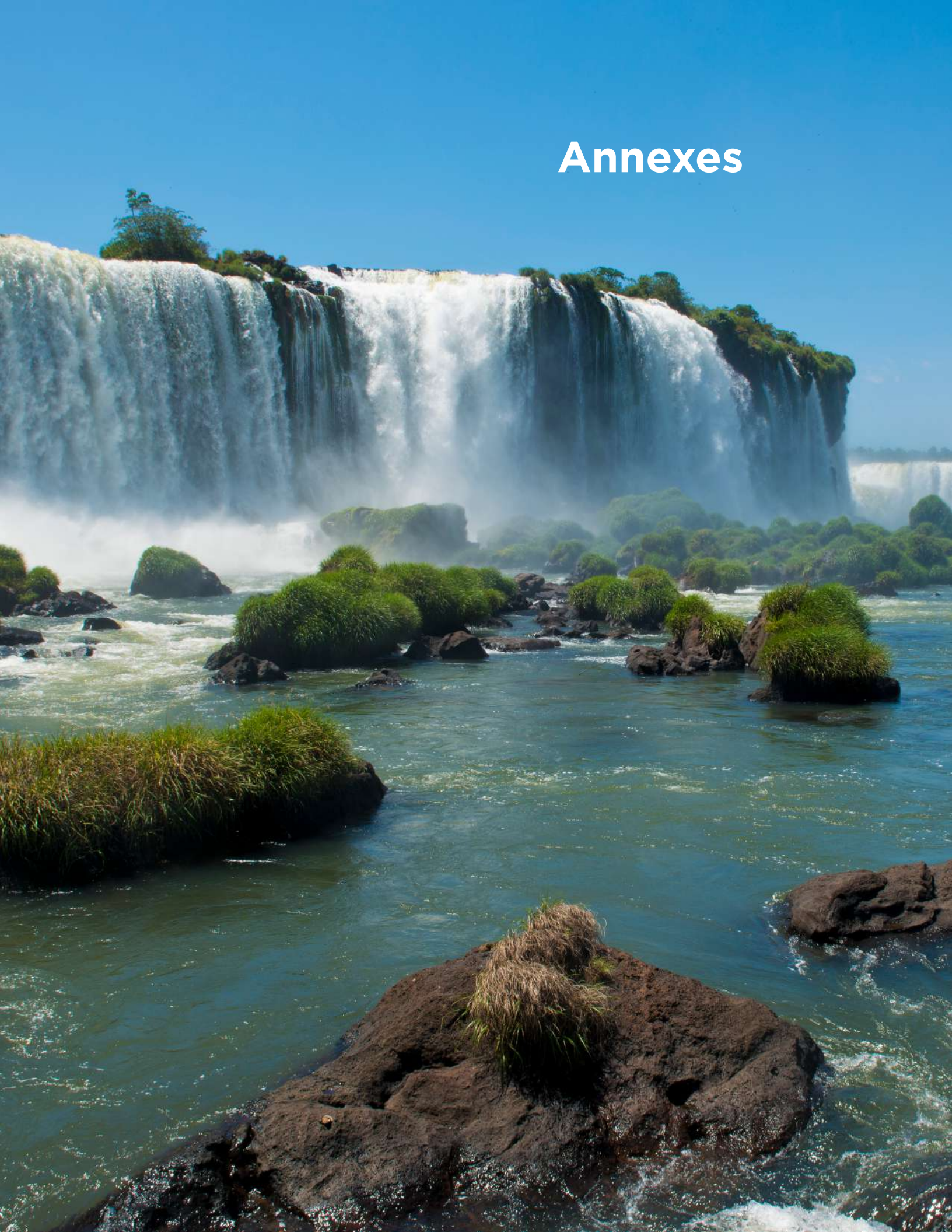
The Trifinio Comissión has requested support from the Bank to develop a project focusing on innovative financing mechanisms. The possibility of creating the fisrt transboundary water fund is studied. This is an excellent opportunity to link into private sector financing and IDB involvement.

Amazon Aquifer Assessment and Management

In recent years, the extend of the aquifer systems under the Amazon Basin is being mapped out, both with the aid of satellite imagery as well as extensive proper monitoring and is likely one of the most extensive sustems in tne world. According to IGRAC, it covers 3.6 million Km^2 and is contained in Bolivia, Brazil, Colombia, Ecuador, Peru, and Venezuela. There is currently no international manahement of the aquifer sustem or even significant exchange of data regarding the system. UNEP has received a GEF grant to advance implementation of the Strategic-Axction Program for the Amazon Basin and is developing a concept note to the GEF regarding the Amazon aquifer System.

The IDB will work closely with UNEP to develop a concept note for the GEF regarding the "Enabling Transboundary Cooperation and Integrated Management for the Greater Amazonian Aquifer.

Annexes



ANNEXES

Annex I. Situational Analysis - Methodology

In defining investment activities for the IDB, the key basins were looked at in term of high-level critical factors that could help determine geographical and thematic areas for engagement. These factors should be assessed alongside the Bank's program priorities to better identify possible actions.

Factor/ Parameter	Sub-Indicators	Country / Basin	DataBase -Comments
Environmental	Water Quantity	B	Transboundary Waters Assessment Programme (TWAP)[100]
	Water Quality	B	TWAP
	Climate Vulnerability	C	GAIN[101]
	Climate impact	B	TWAP / UNDP/
Governance / political	Institutional Risk	B	TWAP
	Governance readiness	C	GAIN (Political Stability; non-violence; the rule of law, regulatory quality)
	Measure of past performance	C	MDG database[102]
Legal	Existence of treaty	B	OSU
	Action Plan for joint-development	B	IW:LEARN / UNDP / GEF / National agencies
Socio-Economic	Social development	C	HDI (UNDP)
	Economic readiness	C	World Bank Doing Business (DB) Index
	Social readiness	C	GAIN (Social inequity; ICT; Education; innovation)
Investment needs	Categorizing investment levels and possible actions	B	Transboundary Action planning where they exist – or do not exist will help determine the investment level - TDA and SAP (IW LEARN) Interviews with key experts: UNDP - Andrew Hudson / GEF – Chris Severin / UNEP – Isabelle Van der Beck / UNESCO-Quito /
	Projected hydro-power	C	Calculated from GAIN + World Bank

100 http://twap-rivers.org
101 https://gain.nd.edu
102 UNDP 2015 Final report on Millennium Development Goals.

Environmental: the environmental factor looks developed from crucial parameters related to water at a basin level and country level in terms of anticipated climate change impact to hydrology, and projected stresses in terms of water use. (TWAP 0-5, low is good) i) quantity/stress (rolled up from current and projected use – municipal and agricultural), ii) quality (rolled up from municipal + industrial, and agricultural pollution), iii) Climate impact; and at a country level on vulnerability to climate change (GAIN – scale 0-1, low is good).

The importance of the environmental factor will be critical when looking at investment opportunities in the basin (i.e. flood control, hydropower, storage for agriculture).

Captures the main elements of environmental concerns:

- **Water Stress** – (Basin level: scale 0-5, where 0 is low stress): Is made up of **Water Quantity** (Basin level indicator), which is the water stress associated with water use in the agricultural, and Water Quality (Basin level indicator), the water stress associated with pollutants from wastewater (municipal and agricultural sources).
- **Climate Vulnerability** – (Country-level indicator: scale 0-1, where 0 is low vulnerability): This is derived at the country level from ND-GAIN[103], which measures the projected change in annual runoff as presented by the World Resource Institute from their aqueduct database, in terms of the projected change; the percent change in annual runoff from the baseline projection (1980-2009) to the future projection (2040-2069) using RCP4.5 emission scenario;[104] change in groundwater re-charge (from 1971-2000 to 2050 using RCP4.5 emission scenario); freshwater withdrawal rate;[105] and the proportion of the total renewable water resources originated outside the country.[106]
- **Climate change impacts** – (Basin level indicator: scale is 0-5, where 0 is low impact): Calculated environmental water stress due to climate change Impact by 2050. Directly taken from TWAP at the basin level.[107]

Governance: This is a "measure" of an ability to respond to changes or problems in the basin. This report defines it as: "the array of political, social, and economic decision-making mechanisms through which water is managed within and between nations."[108] The Bank may be cautious in engaging in structural investments in basins with a low governance rating, for example. It may, on the other hand, seek investments in these countries to enhance governance.

103 Notre Dame Global Adaptation Iniciative summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience.

104 Aqueduct database World Resources Institute. https://www.wri.org/our-work/project/aqueduct

105 Freshwater withdrawal as percentage of total actual renewable water resources. AQUASTAT database FAO. http://www.fao.org/aquastat/en/.

106 Water dependency ratio, AQUASTAT database FAO. http://www.fao.org/aquastat/en/.

107 http://twap-rivers.org/indicators/

108 Hearns & Paisley (2015) Governance indicators for Transboundary Water, WWF Indicator initiative.

The governance indicator captures the name issues associated with the ability to conduct joint development within the basin from a government's point of view. It is made up of the following sub-indicators:

- **Institutional Risk** – (Basin level: scale is 0-5, where 0 is low tension): This is based on an assessment of i) institutional vulnerability/capacity and ii) water stress related to changes in the hydrological regime (environmental, human, etc.).
- **Governance readiness** – (Country level: scale 0-1, where 0 is low/poor readiness): This is a measure of a country's ability to engage with large scale infrastructure from a governance perspective. The sub-indicator is made up of a composite of World Governance Indicators (WGI).[109]
- **Achievement of MDG[110] in the water sector** – (country level): Possible indicator to look at "improvement" in achieving water sector goals at a country level.

Legal: This is a measure of the static situation associated with whether or not the basin has legal mechanisms that apply and are functioning (basin level: scale 0 -5, where 0 is low stress and functioning, and 5 means none existence of legal mechanisms). It is measured by combined assessment of i) international treaties, which deals with joint development or other factors beyond "an agreement to cooperate"; and ii) development of transboundary strategic action programs or basin plans.

Socio-Economic: (Country level: Scale 0-1, where 0 is poor readiness).[111] This is an overall assessment of the level of social and economic capacity within the basin to sustain and enhance IADB engagement and investments. It is a measure of how likely IDB intervention will be adopted by society, as opposed to the government. Societies that have reliable education systems, up to and through the tertiary level, a fair rule of law, and adequate information and communication technologies are more interesting for investments. Measured by:

- **Human Development Index (HDI) (Country level:** scale 0-1, where 0 is very poor). HDI is the United Nations Development Programme measure of achievement in the basic dimensions of human development. It considers the basic measurements of economic aspects, through assessment of GDP; health dimension, through assessment of years of life expectancy; and knowledge dimension, through evaluation of years of education expected.112
- **Social Readiness (SR)** (Country level: scale 0-1, where 0 is very poor). This is derived from the Global Adaptation Index and is a measure of social conditions that help society to make efficient and equitable use of investment and yield more benefit from the venture. It incorporates social inequality (the countries' poorest quintile's share in national income or consumption); information communication technology (ICT) (mobile phone subscribers, percentage with access to the In-

109 https://info.worldbank.org/governance/wgi/#home
110 Millenium Development Goals.
111
112 http://hdr.undp.org/en/humandev - integration of standard of living (GDP), Health (life expectancy) and knowledge (expected years of schooling).

ternet, etc.); education (a measure of enrolment in tertiary education), and innovation (number of patent applications).

- **Economic Capacity** (Country level: scale 0-1, where 0 is very poor). The Economic Capacity seeks to capture the business condition that attracts adaptation investment, a description with access to the general investment climate is a good proxy for the economic component of readiness. It uses the World Bank Doing Business (DB) indicators to evaluate countries' investment climate by measuring procedures, time, and cost of performing business activities through business life cycles.[113]

Investment Needs: This is a coarse level assessment of the possible investment needs/opportunities and categorizes them based on:

1. **Low:** Planning and data: Basin planning (need for basin plans); basic information (need for hydromet stations, monitoring infrastructure); early warning system for flooding; - i.e. investments of US$10 millions or under US$30 millions level. For example, if there are no TDA (Transboundary Diagnostic Analysis)[114] or SAP (Strategic Action Program), or are still at the initial stage of development in basin cooperation.
2. **Medium**: Moderate infrastructure; flood control, irrigation channel, bank stabilization, micro-hydro - infrastructure of US$30-US$80 millions (per project, not basin). If there are specific projects identified, such as during a TDA phase, but no major infrastructure sites identified.
3. **High:** Large infrastructure, hydro dams, large flood control, etc. US$80 millions plus (per project, not basin). If there are SAP or cooperative basin agreements and initiatives which outline significant infrastructure needs, such as, treatment plants, dams, etc.

It is measured through:

- The level of cooperative development identified in transboundary plans.
  - i. If there is not TDA or SAP, or other documents, then the level of investment is considered low as transboundary projects have not been identified. The investment comes in the form of planning and capacity development as would be the case with new GEF basins.
  - ii. If there are TDA or ongoing projects that may have identified possible needs, planning or related to data acquisition, and small-scale investments.

113 http://www.doingbusiness.org/

114 A Transboundary Diagnostic Analysis (TDA) is a scientific and technical assessment, through which the water-related environmental issues and problems of a region are identified and quantified, their causes analyzed and their impacts, both environmental and economic, assessed. The analysis involves an identification of causes and impacts at national, regional, and global levels and the socio-economic, political and institutional context within which they occur. The identification of the causes would specify sources, locations, and sectors. See http://diktas.iwlearn.org/yslme/about-us/transboundary-diagnostic-analysis-tda

iii. If there are SAP or equivalent documents that identify large (>US$80 millions) infrastructure projects.

- **Hydropower need**s (change in generating capacity 2005-2050). This is derived from the GAIN database and is based on assessing the impacts to hydropower generation due to climate change and the projected needs from energy planning for the country. It indicates the possible risk to hydropower over time. Calculated by the percentage change in hydropower generation capacity using a standard global emission scenario of A1B. However, all the values are between 0.43 and 0.45 relative change. A more indicative indicator may be hydropower dependency in 2015 and hydropower potential. Installed is taken from the World Bank Data source[115] (https://data.worldbank.org/indicator/eg.elc.hyro.zs).

The following criteria will be applied to project development under this program:

1. The projects will adhere to IDB policies and support national interests in the client countries.
2. Projects will preserve IDB neutrality & integrity. As such, the project will:
   i. Avoid existing conflict areas.
   ii. Attempt to provide equal benefits for countries.
3. The project will be able to have rapid execution. As such, seek projects will either have:
   i. Existing initiatives associated with them.
   ii. A clear expression of political interest.
4. The projects will have the most significant impacts on environmental and social stress reduction. As such, the project will focus on:
   i. Climate change impacts.
   ii. Immediate priorities.
5. The projects will build on the existing experience and comparative advantage of IDB:
   i. Promoting political level dialogue
   ii. Innovative financing (particularly concerning funding of green infrastructure – build on Water Fund)
   iii. Complement the "Water Security" program.

115 https://data.worldbank.org/indicator/eg.elc.hyro.zs

Annex II. IDB Transboundary Water Projects under development

The IDB is analyzing the following projects:

Pilcomayo River Basin (In execution)

The Pilcomayo river basin comprises an extended area shared by Argentina, Bolivia, and Paraguay. It is part of the great Del Plata basin, covering approximately 290,000 square kilometers. The Pilcomayo is a mountain river, with headwaters in Bolivia at 5,500 m high descending to 250 m in the surroundings of the locality of Misión La Paz in Argentina. After leaving the Andes, at the Bolivian city of Villa Montes, the river enters the Chaco plain following a south-east direction and converting in a plain river.

The Pilcomayo basin (Argentina, Bolivia, and Paraguay) has a Master Plan and an Integrated Water Resource Project (2000-2008) which was financed by a Technical Cooperation from de EU. The plan was developed as a guiding framework for short, medium, and long-term planning to solve the main water issues of the three countries from a social, environmental and economic perspective. It aims to reinforce the transboundary integration with a horizon in 2025. The plan focuses on water quality, erosion, sediment transportation, aquatic life, flood risk management and development and integration of indigenous population. Also, an environmental and socio-economic baseline study was carried out in 2006, identifying the main problems of the basin based on an integrated diagnosis.

The main problems identified in the study (Halcrow & Serman, 2006), were:

- Geologic risk affecting populations, infrastructure, and natural resources due to intense erosion and sedimentation processes.
- River retreat and divagation.
- Environmental degradation due to mining and hydrocarbon exploitation (upper basin).
- Environmental degradation due to water and sediments.
- Water scarcity and limitation of water resource use.
- Environmental degradation due to deforestation, salinization and desertification.
- Degradation of fishery resources.
- Biodiversity and habitat loss.
- Climate change impact in population, infrastructure, economic activities (extreme events).
- Uneven wealth distribution within the basin.
- Social dislocation and cultural tradition loss.

- Life quality deterioration.
- Inefficient and unprofitable economic activities.
- Deficient public policies.
- Low involvement of the population in determining and executing actions.
- Poor or inexistent communication and services infrastructure.

In December 2018, the Bank approved the US$1.5M technical cooperation (TC), financed by the AquaFund[116] and Latin America Investment Facility (LAIF) of the European Union managed by AECID and executed by the IDB 'Water resources management of the Pilcomayo river basin.' The objective of this TC is to update the Pilcomayo River Basin Master Plan by conducting a comprehensive diagnosis that results in hydrological planning of the basin. The plan will identify necessary actions and investments to improve the quality of life of its population, guaranteeing the integration of local agents during the project, conducting knowledge transfer workshops and developing a communication and socialization plan for the Master Plan.

Pantanal (Ongoing)

The Pantanal is among the highest biodiverse places on Earth and the world's largest tropical wetland covering 170,000 square kilometers between Bolivia, Brazil, and Paraguay. It is increasingly becoming an economic engine in South America, whose ecosystem benefits have been valued in around $112 billion per year. Despite its economic significance, it faces a series of environmental pressures that include rapid changes in land use; alteration of water flows; contamination from industrial, mining, and agricultural pollution; and poor sanitation treatment that threatens to destabilize the numerous ecosystem services that sustain the region's economic and social development.

Help implement the 2018 World Water Forum declaration by Brazil, Paraguay, and Bolivia to conserve and promote integrated sustainable development of the Pantanal in a coordinated manner (*non-conflict and demonstrated political will*).

- Expand and build on Brazil's new 2018 Upper Paraguay River Basin Management Plan to identify and implement transboundary elements (*rapid and high impact*).
- Considering the different levels of progress in information, data, and capacity of each country, the approach to implementation will be according to the specific needs and times required by each of them. In this sense, while Brazil will be in the implementation phase, Paraguay and Bolivia will catch up with studies to generate data and information for decision making.
- Promote a joint strategy to address anticipated impacts of development and

116 The AquaFund is a multidonor fund financed by the IDB's own resources, the Government of Austria, the Spanish Agency for International Development Cooperation AECID, the PepsiCo Foundation and the Swiss Cooperation through its Development Agency and SDC Cooperation and the Secretariat of State for SECO Economic Affairs.

land-use decisions, mainly related to infrastructure practices related to roads, railways, dams, ports, and waterways, agriculture, and ranching. The plan will identify the contributions of the intact wetland and associated ecosystems for economic, human, and biodiversity benefits such as flood control, habitat protection, drinking water, and agriculture; and set shared priorities for actions to improve water management and coordinated economic development.

- Catalyze and strengthen institutional mechanisms for transboundary water governance of the Pantanal. This will provide a platform for dialogue, information-sharing, and coordinated decision-making on shared water management and governance challenges.
- Promote sustainable financing planning for conservation and development (including water funds, green infrastructure financing, public and private bankable projects, green credit and others) (*Innovative*)
- Promote strategic partnerships bringing some stakeholders and actors to jointly address the numerous challenges. Include GEF, GCF, and other bilateral and multilateral funding options.

Trifinio Plan-Water Security (ongoing).

The GEF has approved a 4.8M project for the Trifinio Region. The project 'Fostering Water Security in the Trifinio Region: a TDA/SAP approach,' aims at reducing stress on the transboundary water resources of the Trinational Trifinio region. It does so by developing a Strategic Action Plan and enabling the joint management of water and land resources while building community-based ecosystem resilience to climate variability and change.

The Trifinio Commission has requested support from the Bank to develop a project focusing on innovative financing mechanisms. Potential engagement could be delivered through the component III of the GEF project, 'Demonstrating the feasibility and cost of innovative IWRM solutions (pilot projects).' The possibility of creating the first transboundary water fund is studied. This is an excellent opportunity to link into private sector financing and IDB involvement.

Building on the current advances in economic development planning in the Gulf of Fonseca, the Bank will seek to emphasize the importance of watershed management/protection as critical sources of pollution and sedimentation that impact the coastal zone through the development of the GEF/GCF project.

Amazon Aquifer – Assessment and Management (concept stage)

In recent years, the extent of the aquifer systems under the Amazon Basin is being mapped out, both with the aid of satellite imagery as well as extensive proper monitoring[117] and is likely one of the most extensive systems in the world.[118] According

117 Pfeffer, J. et al. (2014). "Low-water maps of the groundwater table in the central Amazon by satellite altimetry." *Geophysical Research Letters* 41(6): 1981-1987.

118 Ferreira do Rosárioa, F. et al. (2016). "Hydrogeology of the Western Amazon Aquifer System (WAAS)." Journal of South American Earth Sciences 27(December): 11.

to IGRAC, it covers 3.6 million km2 and is contained in Bolivia, Brazil, Colombia, Ecuador, Peru, and Venezuela.[119] There is currently no international management of the aquifer system or even significant exchange of data regarding the system. UNEP has received a GEF grant to advance implementation of the Strategic Action Program for the Amazon Basin and is developing a concept note to the GEF regarding the Amazon aquifer system.

The IDB will work closely with UNEP to develop a concept note for the GEF regarding the "Enabling Transboundary Cooperation and Integrated Management of the Greater Amazonian Aquifer System (GAAS)."

119 See IGRAC at https://apps.geodan.nl/igrac/ggis-viewer/viewer/transboundary/public/default

Annex III. Capacities and analytical resources

The IDB will use its comparative advantage of being the first international development bank with a specific focus on LAC. As such, it can facilitate dialogue and capacity development at senior political levels, which is required for transboundary water cooperation. Moreover, as a financing institution, the IDB will contribute to development of feasible and appropriate investment planning, as part of Basin development, to ensure "bankable" projects are identified and adequately assessed. The IDB also has experience in working with innovative financing techniques, which are a potential niche for its transboundary program, for example:

- **Hydro-IDB** is a Bank developed analytical tool to help model and simulate water use in multiple sectors, including the agricultural sector. In support of the "Water Security" Program, IDB is developing a new module for the calculation of irrigation water allocation. Hydro-IDB can be used for high-level modelling of transboundary basins and complemented as needed with other modelling tools (e.g. WEAP), water quality and non-point source models (e.g. SWAT) and crop models (e.g. DSSAT). The tool will be used in the Program to simulate water use under different development scenarios.
- **GCAM-LAC:** The "Global Change Assessment Model" (LAC) for the LAC region consists of an integrated multi-sector modelling platform. It was developed as part of the Water-Energy-Food Nexus Program in the Bank. GCAM-LAC contains modules to assess the supply and demand of water and land for crops, impacts of climate change, policy interventions in the water, agriculture and energy sectors (including biofuels) and economic analysis of infrastructure investments. A regional irrigation analysis was already carried out as part of the ESW program in 2016, and several case studies are being carried out that address issues of integrated management of water resources, particularly with respect to infrastructure investment requirements. This analytical tool will be used in this initiative to assess the use of water by different sectors within a basin level to assist in management-level decision-making and planning.
- **Wastewater-to-Resource (WW2R):** As part of the IDB's Nexus initiative, the main objective of WW2R is to promote a paradigm shift to water and wastewater quality through the recovery of resources. WW2R seeks to increase the economic benefits of treatment systems and provides additional benefits that can be taken advantage of by communities (energy, nutrients, biosolids). In particular, the promotion of prioritizing and designing investments in the context of a circular economy where wastewater is considered an asset and a resource instead of a liability. The agricultural sector is one of the main sources of water pollution and, at the same time, one of the primary users of water for irrigation. Therefore, the WW2R has great potential to be used as part of the Transboundary Program, particularly in basins suffering from poor agricultural practices and wastewater discharge.
- **Remote sensing:** Remote sensing technology has great application in transboundary water management where often hydro-meteorological data is lacking, partic-

ularly in frontier areas near borders, as well in assessing irrigation demand that depends on spatial and temporal data on temperature, soil moisture, precipitation, evapotranspiration, and crop dynamics. The Bank already engaged in a series of technical cooperation projects that address some of these variables. This program will build upon the existing expertise and advance discussions with key stakeholder such as NASA, ESA, GEOCLAM, amongst others.

- **Water footprint and virtual water:** WSD has led the Bank's first product for the analysis of water footprint and virtual water in LAC based on the use of Input-Output models through an internal study entitled "The Green, Blue and Grey Water Footprint of Bioenergy production in Brazil: A Nexus perspective." The Division will continue this line of research through a regional analysis for all LAC economies focussing on the production and trade within the agricultural sector, as the most significant water consumer. The concept has not yet been applied in other international drainage basins to any extent but is highly applicable to analysis at the transboundary level, particularly as a means of discussing fair uses of water.
- **Circular Economy (CE):** The circular economy approach is being promoted by the GEF 7 as a means of making water use more efficient and addressing scarcity issues in the coming decades.[120] The Bank is already adopting and implementing CE principles in projects like WW2R. This program will provide the opportunity to pilot the application of CE principles to water at a basin scale.
- **Blue Economy (BE):** "Strengthening national Blue Economy opportunities to reduce threats to marine and coastal waters" is one of the key objectives of the GEF-7 International Waters Program.[121] While the "BE" emphasizes coastal zone areas, there is a role for freshwater systems in terms of land-based sources of marine pollution (LBSMP). Also, the approach to examining the coastal systems from an economic analysis could be applied to basin system through a Fresh-Blue Economy. This Program will potentially pilot this approach in one or more of its transboundary water projects.
- **Analysis of data and information technologies:** The analysis of data, on water, crops, land, and climate, can be integrated through telecommunications networks to improve understanding of hydrological systems, environmental needs, forecast for floods, and improve efficiency and the economy of irrigation, amongst others. The Bank has already acquired experience in this field and will build upon this in the Program

120 GEF (2018) GEF-7 Replenishment Programming Directives, Global Environment Facility, Washington DC.
121 Ibid, p. 55.

Annex IV. Transboundary Freshwater Resources in LAC

List of Rivers and Aquifers in South America

Basin	Countries	Relative Size / importance[122]
Agua dulce (aquifer)		
Amacuro (river)	Ven-Guya	Very small.
Amazon aquifer (aquifer)		
Amazon River (river)	Bra-Col-Ecu-Per-Ven-Gya-Sur-Guyane-Bol	Very significant, many sub-basins, 32 M pop, many dams, etc.
Argentina (lake)	Arg-Chil	
Aviles (river)		
Aysen (river)		
Baia Grande (lake)		
Baker (river)		
Barima (river)	Ven-Guya	Very small.
Boa vista-Serra de tucano-North savanna (aquifer)		
Buenos Aires (lake)	Arg-Urug	
Cancoso/Lauca (river)	Bol-Chil-Peru	Small, small pop, HIGH water stress.
Carmen silva/Chico (river)		
Catatumbo (river)	Col-Ven	Low water stress, 1.8 m pop.
Chira (river)	Col-Ecu	0.6 M pop, high water stress.
Chuy (river)		
Cochrane (lake)		
Coesewijne (aquifer)		
Comau (river)		
Corantijn/Courantyne (river)		
Costeiro (aquifer)		
Cullen (river)		
El condor-Canadon del Condor (aquifer)		
Essequibo (river)	Sur-Ven-Guya	Significant for Surinam, low risk of water stress.
Fagnano (lake)		
Gaiba (lake)		
Gallegos/Chico (river)		
General vintter (lake)		

122 Will need to include references where possible.

Basin	Countries	Relative Size / importance[122]
popGrupo roraima (aquifer)		
Guarani (aquifer)		
Jurado (river)		
La guajira (aquifer)		
La Plata (river)	Arg-Bra-Bol-Par-Uru	Very significant, 88M pop, low water stress, hydro development, high risk to water quality.
Lagoon Mirim (river)	Bra-Uru	Med, 0.7M pop.
Lake Fagnano (river)		
Lake Titicaca-Poopo system (river)	Bol-Peru-Chi	Med-size, 2.4 M, low water stress.
Literaneo-Chuy (aquifer)		
Mandiora (lake)		
Maroni (river)	Sur-Guyana-Bra	Low water stress , small population.
Mataje (river)		
Mira (river)	Col-Ecu	Small , small pop.
Oiapoque/Oyupock (river)	Sur-Guyane-Bra	Small pop.
Orinoco (river)	Ven-Bra-Col-Guyana	Large area significant, 12Mpop.
Palena (river)		
Pantanal (aquifer)		Significant.
Parana river (river)	Bra-Bol	Significant, sub-basin La Plata.
Pascua (river)		
Patia (river)	Col-Ecu	Small, small pop.
Puelo (river)		
Punenos (aquifer)		
Puyango-Tumbes-Chira-Catamayo (aquifer)		
Rio grande south america (river)		
Rio sao francisco river basin (river)		
San martin lake (lake)		
San martin river (river)		
Seno union/Serrano (river)		
Titicaca aquifer (aquifer)		
Titicaca lake (lake)		
Tumbes (river)	Col-Ecu	Moderate water stress, 0.1 M pop, small.

Basin	Countries	Relative Size / importance[122]
Valdivia (river)		
Yelcho (river)		
Yrenda-Toba-Tarijeno (aquifer)		
Zanderij (aquifer)		
Zapaleri (river)		
Zarumil	Col-Ecu	Small, but sig risk of water stress, 0.6 M pop.

List of transboundary fresh water Central America and Caribbean

Basin	Countries	Relative Size / importance[123]
Artibonite (river)	Haiti-Dominican Rep	Significant, 0.24 M.
Belize (river)	Mex-Bel	
Boca del cerro-San pedro (aquifer)		
Bolson del hueco-Valle de juarez (aquifer)		
Candelaria (river)		
Chamelecon (river)		
Changuinola (river)		
Chicomuselo-Selequa/Cuilco (aquifer)		
Chiriqui (river)		
Choluteca (river)	Hon-Guat	HIGH risk , low pop.
Coatan achute (river)		
Coco/Segovia (river)	Hon-Nic	Significant, Runs length of border, 0.8 M.
Colorado (river)		
Conejos medanos-Bolson de la mesilla (aquifer)		
Conventillos (river)		
Corredores/Colorado (river)		
Cuenca baja del rio bravo / grande (aquifer)		
Cuenca baja del rio colorado (aquifer)		
Edwards-Trinity-El burro (aquifer)		
El naranjo (river)		
Goascoran (river)		
Grijalva (river)	Guat-Mex-Bel	Sig for the region, 8 M, low water stress.
Hondo (river)		
Jurado (river)		
Lempa (river)		
Marquez de comillas-Chixoy/Xaclbal (aquifer)		
Mesoamerica aquifers (aquifer)		
Moho (river)		
Motagua (aquifer)		

123 Will need to include references where possible.

Basin	Countries	Relative Size / importance[123]
Artibonite (river)	Haiti-Dominican Rep	Significant, 0.24 M.
Motaqua (river)		
Negro (river)	Hon-Nic	Significant for the countries. 0.4M pop.
Nogales (aquifer)		
Ocosingo-Usumacinta-Pocom-Ixcan (aquifer)		
Paz (river)		
Peninsula de yucatan-Candelaria-Hondo (aquifer)		
Rio Grande north America (river)		
San juan (river)	Nic-CR	Significant, 3.4 M,
San pedro (aquifer)		
Sarstun (river)		
Sixaola (river)		
Sonoyta-Papagos (aquifer)		
Suchiate (river)		
Tacana river (river)		
Temash (river)		
Tijuana (river)		
Yaqui (river)		

Annex V. List of existing legislation and links

The following table has been modified from the Treaties Database at OSU[124] (http://gis.nacse.org/tfdd/treaties)

	Name	Signatories	Issue Area	Basin	Date	
1	Protocol between Uruguay and Argentina dealing with the questions of the jurisdiction of the River Plate, signed at Montevideo.	Argentina, Uruguay	Navigation	La Plata	1910-01-05	Full Details
2	Supplementary boundary treaty between the Argentine Republic and the Republic of Paraguay on the river Pilcomayo and protocol annexed to the treaty.	Argentina, Paraguay	Water quantity	La Plata	1945-06-01	Full Details
3	Agreement concerning the utilization of the rapids of the Uruguay River in the Salto Grande area.	Argentina, Uruguay	Hydro-power/ Hydro-electricity	La Plata	1946-12-30	Full Details
4	Agreement concerning cooperation between Brazil and Paraguay in a study on the utilization of the water power of the Acaray and Monday Rivers.	Brazil, Paraguay	Hydro-power/ Hydro-electricity	La Plata	1956-01-20	Full Details
5	Agreement between the Argentine Republic and the Republic of Paraguay concerning a study of the utilization of the water power of the Apipe Falls.	Argentina, Paraguay	Hydro-power/ Hydro-electricity	La Plata	1958-01-23	Full Details
6	Treaty between the Argentine Republic and the Eastern Republic of Uruguay on the boundary constituted by the Uruguay River.	Argentina, Uruguay	Water quality	La Plata	1961-04-07	Full Details
7	Treaty of the River Plata Basin.	Argentina, Bolivia, Brazil, Paraguay, Uruguay	Economic	La Plata	1969-04-23	Full Details
8	Convenio para el estudio del aprovechamiento de los recursos del Río Paraná.	Argentina, Paraguay		La Plata	1971-06-18	Full Details
9	Treaty between the Federative Republic of Brazil and the Republic of Paraguay concerning the hydroelectric utilization of the water resources of the Parana River owned in condominium by the two countries, from and including the Salto Grande de Sete Quedas.	Brazil, Paraguay	Hydro-power/ Hydro-electricity	La Plata	1973-04-26	Full Details
10	Tratado de Yacyretá.	Argentina, Paraguay	Hydro	La Plata	1973-12-03	Full Details
11	Statute of the river Uruguay, signed at Salto.	Argentina, Uruguay	Navigation/ joint management	La Plata	1975-02-26	Full Details
12	Agreement on Paraná River projects.	Argentina, Brazil, Paraguay	Water quantity/flood control	La Plata	1979-10-19	Full Details

124 Oregon State University.

	Name	Signatories	Issue Area	Basin	Date	
13	Treaty between the government of the Argentine Republic and the government of the Federal Republic of Brazil for the development of the water resources contained in the border reaches of the Uruguay river and its effluent, the Pepiri-Guazu river.	Argentina, Brazil	Hydro-power/ Hydro-electricity	La Plata	1980-05-17	Full Details
14	Decree No. 88.441 promulgating the agreement for water resources exploitation within the Uruguay river and its effluent the Pepiri-Guacu river, between the government of the Federal Republic of Brazil and the government of the Argentine Republic.	Argentina, Brazil	Infrastructure/ development	La Plata	1983-06-29	Full Details
15	Exchange of Notes constituting an Agreement on delimitation of the frontier along the thalweg on the Uruguay River in the area of the Basic Garabi Development Project.	Argentina, Brazil		La Plata	1983-10-20	Full Details
16	Cooperation Agreement between the Republic of Argentina and the Oriental Republic of Uruguay to prevent and fight against pollution incidents of the aquatic environment produced by hydrocarbons and other noxious substances.	Argentina, Uruguay		La Plata	1987-09-16	Full Details
17	Agreement of cooperation between the government of the Eastern Republic of Uruguay and the Federal Republic of Brazil for the use of natural resources and the development of the basin of the Cuareim river.	Brazil, Uruguay	Economic	La Plata	1991-03-11	Full Details
18	Complementary agreement to the basic scientific and technical cooperation agreement between the government of the Eastern Republic of Uruguay and the Federal Republic of Brazil on cooperation in the area of water resources.	Brazil, Uruguay	Technical cooperation/ assistance	La Plata	1991-03-11	Full Details
19	Agreement through exchange of notes constituting the Statute of the Bi-National Commission for the Pilcomayo Lower Basin between the Republic of Argentina and the Republic of Paraguay.	Argentina, Paraguay		La Plata	1994-08-05	Full Details
20	Acuerdo entre el Gobierno de la República del Paraguay y el Gobierno de la República Federativa del Brasil para la conservación de la fauna acuática en los cursos de los ríos limítrofes.	Brazil, Paraguay		La Plata	1994-09-01	Full Details
21	Agreement constituting the trilateral commission for the development of the Pilcomayo river basin.	Argentina, Bolivia, Paraguay	Joint management	La Plata	1995-02-09	Full Details
22	Agreement for the multiple uses of the resources of the upper basin of the Bermejo river and the Grande de Tarija river.	Argentina, Bolivia, Paraguay	Joint management	La Plata	1995-06-09	Full Details

	Name	Signatories	Issue Area	Basin	Date	
23	Complementary settlement to the agreement of cooperation between the government of the Eastern Republic of Uruguay and the government of the Federal Republic of Brazil for the use of natural resources and the development of the Cuareim river basin.	Brazil, Uruguay	Water quantity	La Plata	1997-05-06	Full Details
24	Acuerdo por notas reversales sobre la creación de una franja de seguridad de mil metros aguas abajo y aguas arriba del eje de la presa en toda su extensión, de la Central Hidroeléctrica de Yacyretá.	Argentina, Paraguay		La Plata	2000-11-07	Full Details
25	Declaration on the Sustainable Management of Pantanal	Brasil, Bolivia Paraguay	Wetland conservation	La Plata	2018-03-22	
26	Declaration and exchange of Notes concerning the termination of the process of demarcation of the Peruvian-Ecuadorean frontier	Ecuador, Peru	Water quantity	Amazon	1944-05-22	Full Details
27	Treaty for Amazonian cooperation	Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, Venezuela	Economic	Amazon	1978-07-03	Full Details
28	Agreement concerning the Cachuela Esperanza hydroelectric plant, supplementary to the agreement on economic and technical co-operation between the government of the Federative Republic of Brazil and the government of the Republic of Bolivia	Bolivia, Brazil	Hydro-power/ Hydro-electricity	Amazon	1984-02-08	Full Details
29	Exchange of notes constituting an agreement for the construction of a hydroelectric plant in Cachuela Esperanza, supplementary to the agreement on economic and technical cooperation	Bolivia, Brazil	Hydro-power/ Hydro-electricity	Amazon	1988-08-02	Full Details
30	Agreement on Economic and technical co-operation between the Government of the Republic of Brazil and the Government of the Republic of Bolivia	Bolivia, Brazil		Amazon		Full Details
31	Agreement between the United Mexican States and the Republic of Guatemala on the protection and improvement of the environment in the border area	Guatemala, Mexico	Water quality	Candelaria	1987-04-10	Full Details

	Name	Signatories	Issue Area	Basin	Date	
32	Agreement for the development of the binational Puyango-Tumbes and Catamayo-Chira basins by Peru and Ecuador (with provisional rules of procedure of the Mixed Peruvian-Ecuadorian Commission for the Puyango-Tumbes and Catamayo-Chira basins).	Ecuador, Peru		Chira	1971-09-27	Full Details
33	Exchange of letters constituting an agreement approving the rules of procedure of the Mixed Peruvian-Ecuadorian Commission for the Puyango-Tumbes and Catamayo-Chira basins, as provided for in article 16 of the abovementioned Agreement.	Ecuador, Peru		Chira	1972-06-10	Full Details
34	Exchange of letters constituting an agreement amending the rules of procedure of the mixed commission for the Puyango-Tumbes and Catamayo-Chira Basins established in accordance with the agreement of 27 September 1971	Ecuador, Peru		Chira	1975-02-26	Full Details
35	Agreement on the criteria for the rehabilitation or reconstruction of the headworks and ancillary works of the Zarumilla Canal	Ecuador, Peru	Water quality/Joint management/ navigation	Zarumilla	1905-06-20	Full Details
36	Reglamento para la Administracion del Canal de Zarumilla y la utilizacion de sus aguas	Ecuador, Peru	Not available/ not coded	Zarumilla	1998-10-26	Full Details
37	Treaty for the delimitation of the boundary between Guatemala and El Salvador	El Salvador, Guatemala	Water quantity	Lempa	1938-04-09	Full Details
38	Treaty between the Republics of El Salvador, Guatemala and Honduras for the execution of the Trifinio Plan	El Salvador, Guatemala, Honduras	Joint management	Lempa	1998-05-25	Full Details
39	Treaty between Chile and Peru for the settlement of the dispute regarding Tacna and Arica	Chile, Peru	Irrigation	Lake Titicaca-Poopo	1929-06-03	Full Details
40	Preliminary convention between Bolivia and Peru for the exploitation of fisheries in Lake Titicaca	Bolivia, Peru	Fishing	Lake Titicaca-Poopo	1935-07-17	Full Details
41	Exchange of notes between Peru and Bolivia establishing a joint commission for study of the Puno-Guaqui railway line and joint use of the waters of Lake Titicaca	Bolivia, Peru	Technical cooperation/ assistance	Lake Titicaca-Poopo	1955-04-20	Full Details
42	Preliminary convention between Peru and Bolivia concerning a study of the joint utilization of the waters of Lake Titicaca	Bolivia, Peru	Technical cooperation/ assistance	Lake Titicaca-Poopo	1955-07-30	Full Details
43	Agreement between Bolivia and Peru concerning a preliminary economic study of the joint utilization of the waters of Lake Titicaca.	Bolivia, Peru	Hydro-power/ Hydro-electricity	Lake Titicaca-Poopo	1957-02-19	Full Details
44	Notas reversales related to the creation of the Autonomous Binational Authority of the basin of the Lake Titicaca, Desaguadero river, Lake Poopó, Coipasa Salt Pan system	Bolivia, Peru	Joint management	Lake Titicaca-Poopo	1993-06-21	Full Details

	Name	Signatories	Issue Area	Basin	Date	
45	Award of the President of the United States on the validity of the treaty of limits of 15 April 1858 between Costa Rica and Nicaragua	Costa Rica, Nicaragua	Navigation	San Juan	1888-03-22	Full Details