WORLD RESOURCES INSTITUTE

Working Paper

AQUEDUCT COUNTRY AND RIVER BASIN RANKINGS

A WEIGHTED AGGREGATION OF SPATIALLY DISTINCT HYDROLOGICAL INDICATORS

FRANCIS GASSERT, PAUL REIG, TIANYI LUO, AND ANDREW MADDOCKS

EXECUTIVE SUMMARY

In this working paper WRI employs a weighted aggregation methodology that brings Aqueduct's granular subbasin-level information up to the country and river basin scale, generating global rankings of water-quantity-related risks for all users, as well as sector-specific rankings for agricultural, municipal, and industrial water users.

The selected indicators measure the underlying factors that drive water-quantity-related risks across countries and river basins, and are not designed to capture the effect of governance regimes, water quality, or investment in solutions. These global rankings enable comparison among countries and major river basins. Bearing in mind that there are inherent limitations in attempting to summarize entire countries' relationships with water in a single number, this information can help companies, investors, and governments assess water- quantity-related risk at country and basin scales.

CONTENTS

1. Introduction 2
2. Methodology 3
3. Results and Interpretation 5
Endnotes 7
Appendices 8

Disclaimer: *Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback and to influence ongoing debate on emerging issues. Most working papers are eventually published in another form and their content may be revised.*

Suggested Citation: Gassert, F., P. Reig, T. Luo, and A. Maddocks. 2013. "Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators." Working paper. Washington, DC: World Resources Institute, November 2013. Available online at wri.org/publication/aqueduct-country-river-basin-rankings.

The full Aqueduct Country and River Basin Ranking maps and data are available at wri.org/resources/maps/aqueduct-country-river-basin-rankings.

1. INTRODUCTION

Most water-related decisions are made across political or administrative boundaries, creating a demand for simple and robust water information to support decision-making at the administrative level. Governments devise policies to manage water resources within their borders, and can use country indicators as a statistic against which to benchmark themselves. Many financial institutions divide their portfolios by country, and thus require national-level water data to evaluate portfolio exposure to water-related risks.

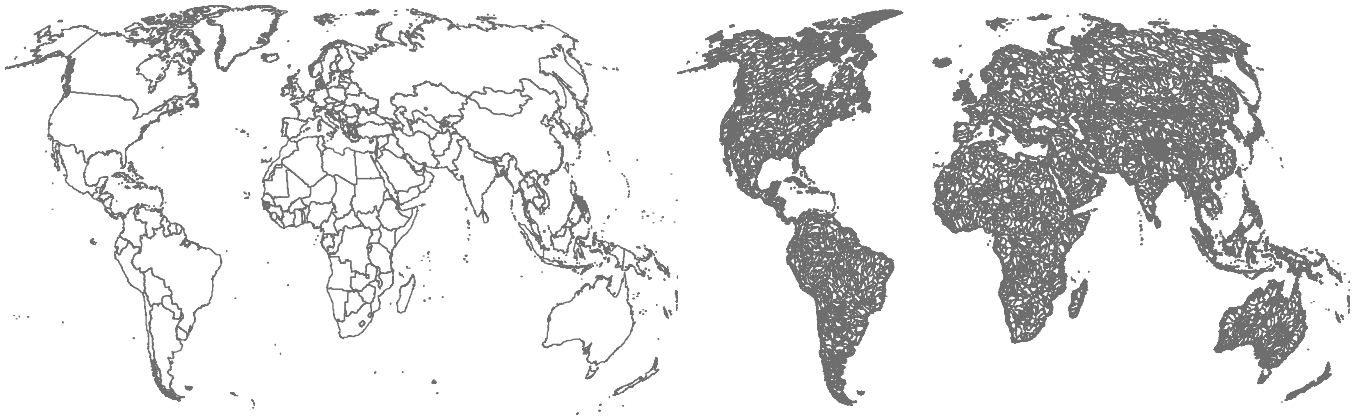
In addition, demand is growing for similar types of information at the river basin scale, particularly from companies, investors, and bilateral and multilateral financial institutions. These audiences can make use of hydrological information at the river basin scale to identify which parts of their investments, lending portfolios, and value chains are in at-risk river basins and prioritize what locations should be targeted for increased water management. Several of the emerging corporate disclosure initiatives also rely on river-basin-level data to identify areas of company value chains most at risk.

However, accurately assessing the state of water resources across administrative boundaries is a significant challenge; and simple, comparable, and robust water information to support decisionmaking at that level remains sparse. The spatial variation of water resources complicates the development of meaningful country and basin-level indicators. As opposed to other resources such as forests and agricultural lands, whose stationarity simplifies measurement and management, water cannot be accounted for by using only administrative boundaries. Even within small administrative regions, hydrological conditions may vary from lush rainforest to dry prairie.

Transboundary lakes and rivers further complicate water accounting, as special efforts must be made to avoid double counting the water supply they provide across regions. For example, the Tagus river supplies water to Spain and Portugal and thus the demand from both should be measured when evaluating the available supply within each country. Moreover, inaccessible water resources such as undeveloped Arctic rivers and rainforests should not be counted when measuring available supply. However, water in some areas, such as key economic and agricultural regions, is especially important and therefore should receive specific attention when evaluating countries and river basins.

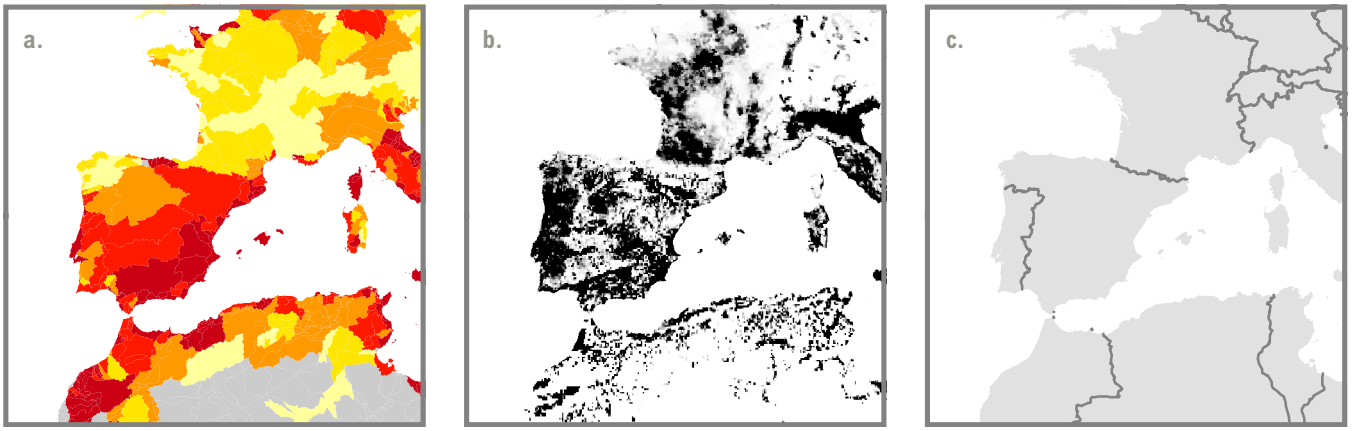
Rather than attempt to create new country and river basin-level indicators that can adjust for these complications directly, the Aqueduct Water Risk Atlas (Aqueduct)[1] first models global water-risk indicators at a relatively granular hydrological catchment scale[2] (Figure 1). In this analysis WRI then employs a weighted aggregation methodology that brings Aqueduct's catchment-level information up to the country and river basin scales. This methodology addresses each of the challenges described above by starting with indicators that were computed within basic hydrological units, and assigning spatially explicit weights to reflect the importance of the specific areas based on where water is being used. From these

Figure 1 | **Countries and Catchments**



Source: WRI Aqueduct

Figure 2 | **Examples of the Three Spatially Explicit Inputs**



a. Source indicators: baseline water stress; b. Gridded weights: total water withdrawal; c. Target regions: country boundaries.

Source: WRI Aqueduct

calculations, WRI generated estimates of the average level of exposure to five of Aqueduct's physical water quantity risk indicators for all countries and major river basins worldwide. These indicators include:

- Baseline water stress: the ratio of total annual water withdrawals to total available annual renewable supply.
- Inter-annual variability: the variation in water supply between years.
- Seasonal variability: the variation in water supply between months of the year.
- Flood occurrence: the number of floods recorded from 1985 to 2011.
- Drought severity: the average length of droughts times the dryness of the droughts from 1901 to 2008.

Baseline water stress is a particularly important indicator to understand when evaluating water-related risks. It measures the ratio of total water withdrawals (by industry, agriculture, and domestic users) to the available supply, taking into account upstream uses and depletion of water.

Two variables determine baseline water stress: water supply availability, and demand for that water. Water supply estimates are obtained from a model that considers a wide variety of variables, including temperature, precipitation, wind speed, and soil moisture absorption. The outputs of the model show where precipitation is made available to users in the form of surface and shallow groundwater. The demand for water is computed by adding the total annual withdrawals from municipal, industrial, and agricultural sources, based on a series of reported and modeled global datasets.[3]

Baseline water stress provides a robust measure of the level of competition among users and depletion of the resource. Focusing on competition and depletion makes this indicator an effective way to measure the hydrological context at the catchment scale, but does not attempt to evaluate water quality, water governance, or the level of investment in the water sector. Rather, this indicator looks at the underlying factors that drive competition and depletion of water and thus the potential dependency of that region on water management solutions.

The remainder of this paper details the methodology used for the weighted aggregations and provides basic interpretive guidelines for the resulting country and river-basin-level indicators.

2. METHODOLOGY

The general equation for weighted spatial aggregation requires three spatially explicit inputs (Figure 2):

- Source indicators;
- Gridded (pixel) weights; and
- Target regions (countries, river basins).

Table 1 | **Data Sources**

DESCRIPTION	TITLE	SOURCES
SOURCE INDICATORS		
■ Baseline water stress ■ Inter-annual variability ■ Seasonal variability ■ Flood occurrence ■ Drought severity	Aqueduct Global Maps 2.0	Gassert et al.[4]
TARGET REGIONS		
Countries	1:10m Admin 0 – Countries	Natural Earth Data[5]
100 most populous river basins*	HydroSHEDS 30s Basin Outlines	Lehner et al.[6]
	Gridded Population of the World, v3, Future Estimates 2010	CIESIN et al.[7]
100 largest (area) river basins*	HydroSHEDS 30s Basin Outlines	Lehner et al.[8]
GRIDDED WEIGHTS		
■ Total water withdrawals ■ Agricultural withdrawals ■ Domestic withdrawals ■ Industrial withdrawals	Aqueduct Global Maps 2.0	Gassert et al.[9]

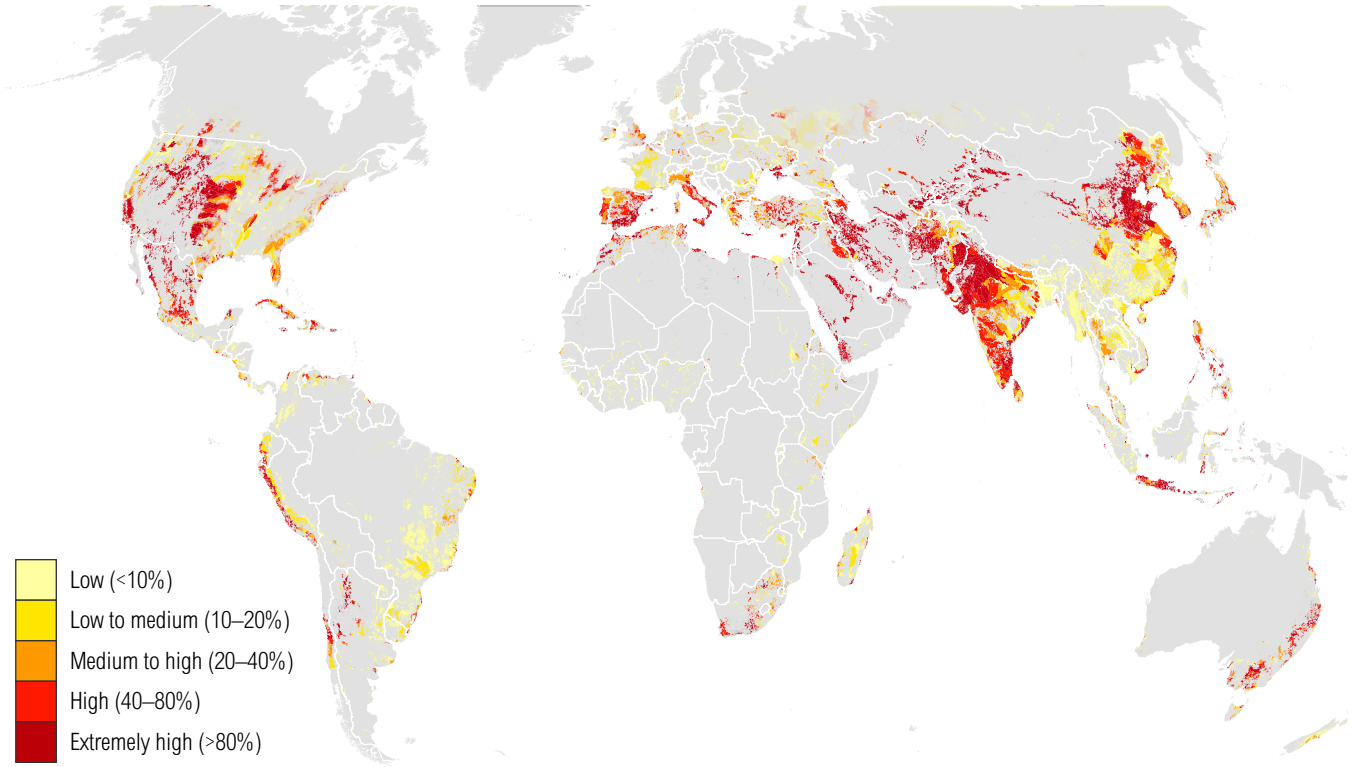
* Small (<1,000 km^2) river basins and desert basins with less than 15 km^2 mean runoff are excluded. For purposes of river basin selection, mean runoff was derived from composite runoff fields by Fekete et al.[10]

The data for this exercise were extracted from publicly available sources (Table 1). Gridded water withdrawal datasets were chosen as weights because they indicate where human demand for water is the highest and suggest that socioeconomic dependency on water resources are most critical in these areas (see Figure 2b). Gridded withdrawals were further divided into three sectors (agricultural, domestic, and industrial) to allow WRI to measure each sector's exposure to water risks. For example, the agricultural water withdrawals dataset identifies areas where agriculture is currently using water (Figure 3), and this data is used as a weight to measure the exposure of agricultural water users to specific indicators. Thus, country indicators weighted by agricultural withdrawals can be interpreted to show which countries have the most or least stressed agricultural sectors. Similarly, weighting by domestic withdrawals reflects the exposure of population, and weighting by total water withdrawals indicates the exposure of all water users to any given indicator.

For each indicator and target region, a mean indicator score for each of the four gridded weight datasets was computed. Within each administrative region, the source indicators were resampled into grids to match the cell size of the gridded weights. The weighted mean indicator value (s_r) was then computed by multiplying the gridded indicator (s_p) by the weight (w_p), summing, and dividing by the sum of the weights across the entire administrative region (r).

$$s_r = \frac{\sum_{p \in r} w_p s_p}{\sum_{p \in r} w_p}$$

Figure 3 | **Exposure to Water Stress in Areas of Agricultural Production Worldwide**



Source: WRI Aqueduct

The weighted standard deviation (σ_r) was computed as follows:

$$\sigma_r = \sqrt{\frac{\sum_{p \in r} w_p (s_p - \bar{s})^2}{\sum_{p \in r} w_p}}$$

3. RESULTS AND INTERPRETATION

The countries and basins with the highest baseline water stress indicator scores are highlighted in Tables A1-A3 in the Appendix. Results for all countries and major river basins worldwide, based on their exposure to baseline water stress, inter-annual and seasonal variability, flood occurrence, and drought severity are available for download at wri.org/aqueduct.

It is important to note that these global indicators are best suited for comparison among countries and major river basins because of the inherent limitations in trying to simplify complex phenomena into a single number. Where available, more detailed, locally sourced data should be preferred for assessing water-related risks and supporting decisionmaking processes.

Information is lost when aggregating indicators from a smaller scale. Many countries, such as the United States, and river basins, such as the Ganges-Brahmaputra, are large enough to span multiple climatic zones, and the process of averaging indicator values can disguise regions of very low or very high water-related risks.

Conversely, by focusing on the areas in which humans rely most on water, this aggregation methodology can reveal water stress that isn't otherwise immediately apparent. Brazil, Russia, and Canada, for example, are often considered immune to water risk because of their vast water resources. The reality is different, however: most of the water use in these countries is concentrated in a few regions with relatively limited supplies, while their water resources are largely remote and inaccessible. For example, over half of Brazilian cities are expected to suffer from

lack of water in the near future,[11] portions of Canada's southern Alberta province are overexploited,[12] and Russia's grain belt has suffered from several severe droughts over the past decade.

Additionally, it is worth reiterating that these indicators measure the underlying factors that drive water-quantity-related risks across countries and river basins, and are not designed to capture the effects of governance regimes, water quality, or investments in water availability solutions. The cases of Singapore and the Colorado River Basin, in the western United States, illustrate this point.

Singapore shares the highest water stress ranking (5.0) with notoriously arid countries such as the United Arab Emirates, though it is held up worldwide as an exceptional water manager. Singapore is a densely populated island nation with no freshwater lakes or aquifers; the nation's demand for water far exceeds its naturally occurring water supply, resulting in an extremely high level of baseline water stress. Only significant technology investment, international water-sharing agreements, and responsible management ensure Singapore's water supply. Advanced rainwater capture systems contribute 20 percent of Singapore's water supply, 40 percent is imported from Malaysia, grey water reuse adds 30 percent, and desalination produces the remaining 10 percent of the supply to meet the country's total demand.[13] However, these efforts are not measured as part of this exercise, making Singapore's baseline water stress score one of the highest in the world.

Similarly, the Colorado is the 14th most stressed among the world's most populated river basins, and the 6th most stressed by area, with a 4.2 risk ranking. More than 30 million Americans depend on the river, which is overdrawn by the time it reaches the Pacific Ocean; and is in the midst of a decades-long drought.[14] Those who depend on the river have responded over decades by making it one of the most managed rivers in the world, damming and legislating it intensively. Aqueduct's physical water quantity risk measurements capture the Colorado's dramatic imbalance between supply and demand, as well as the chronic drought and variability risks, but do not measure the effect of the extensive management activities.

The weighted aggregation methodology presented here provides a strong alternative to other country water indicators that ignore upstream activity and the critical geographic relationship between people and water. These global rankings enable comparison among countries and major river basins. Bearing in mind that there are inherent limitations in attempting to summarize entire countries' relationships with water in a single number, this information can help companies, investors, and governments assess water-quantity-related risk at the country and basin scales.

The full Aqueduct Country and River Basin Ranking maps and data are available at: http://wri.org/resources/maps/aqueduct-country-river-basin-rankings.

ENDNOTES

1. World Resources Institute. Aqueduct Project, 2013. Accessed on 10/24/2013, available at http://www.wri.org/our-work/project/aqueduct.
2. Aqueduct's catchments are hydrological units with a mean size of 8,800 km^2, within which all water flows to a single point. Here, catchments differ from complete river basins in that a river basin can be divided into many catchments that each represents a tributary or stream reach within the basin.
3. Gassert, F., M. Landis, M. Luck, P. Reig and T. Shiao. 2013. "Aqueduct Global Maps 2.0." Working Paper, World Resources Institute, Washington, D.C.. Available at http://www.wri.org/publication/aqueduct-metadata-global.
4. Gassert et al. 2013
5. Natural Earth Data. 10m Admin 0 - Countries. Accessed on 8/14/13, available at: http://www.naturalearthdata.com/.
6. Lehner, Bernhard, Kristine Verdin, and Andy Jarvis. "New Global Hydrography Derived from Spaceborne Elevation Data." *Eos, Transactions American Geophysical Union* 89, no. 10 (March 4, 2008): 93–94. Available at http://dx.doi.org/10.1029/2008EO100001.
7. CIESIN (Center for International Earth Science Information Network), Columbia University, FAO (United Nations Food and Agriculture Organization), and CAIT (Centro Internacional de Agricultura Tropical). "Gridded Population of the World Version 3 (GPWv3): Population Count Grid, Future Estimates," 2010. Available at http://sedac.ciesin.columbia.edu/gpw.
8. Lehner et al. 2008
9. Gassert et al. 2013
10. Fekete, B. M., C J Vörösmarty, and W Grabs. "High-Resolution Fields of Global Runoff Combining Observed River Discharge and Simulated Water Balances." *Global Biogeochemical Cycles* 16, no. 3 (2002): 10–15.
11. Andreu, V., 2013, "Água para as Cidades," Agência Nacional de Aguas, http://www2.ana.gov.br/Paginas/imprensa/artigos.aspx.
12. Pernitsky, David J., and Natalie D. Guy. "Closing the South Saskatchewan River Basin to New Water Licences: Effects on Municipal Water Supplies." *Canadian Water Resources Journal* 35, no. 1 (January 1, 2010): 79–92. doi:10.4296/cwrj3501079.
13. "Water scarcity prompts water self-sufficiency," World Wildlife Fund, accessed October 13, 2013, http://wwf.panda.org/?204587/Singapore; "The Singapore Water Story," PUB, Singapore's national water agency, accessed October 13, 2013, http://www.pub.gov.sg/water/Pages/singaporewaterstory.aspx.
14. "Colorado River," Pacific Institute, accessed October 13, 2013, http://www.pacinst.org/issues/sustainable-water-management-local-to-global/colorado-river/

APPENDIX: COUNTRY AND RIVER BASIN RANKINGS (BASELINE WATER STRESS)

Baseline water stress measures total annual water withdrawals expressed as a percentage of the total annual available blue water. Higher values indicate more competition among users.

[4–5]: Extremely high stress (>80%)

[3–4): High stress (40–80%)

[2–3): Medium-high stress (20–40%)

[1–2): Low-medium stress (10–20%)

[0–1): Low stress (<10%)

Table A1 | **Baseline Water Stress by Country or Region by Highest to Lowest Stress for All Sectors**

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
1*	Antigua and Barbuda	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Bahrain	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Barbados	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Comoros	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Cyprus	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Dominica	5.00 (0.00)	-	5.00 (0.00)	5.00 (0.00)
1*	Jamaica	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Malta	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Qatar	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Saint Lucia	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Saint Vincent and the Grenadines	5.00 (0.00)	-	5.00 (0.00)	5.00 (0.00)
1*	San Marino	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Singapore	5.00 (0.00)	-	5.00 (0.00)	5.00 (0.00)
1*	Trinidad and Tobago	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	United Arab Emirates	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)
1*	Western Sahara	5.00 (0.00)	-	5.00 (0.00)	-

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
17	Saudi Arabia	4.99 (0.18)	5.00 (0.05)	4.93 (0.56)	5.00 (0.07)
18	Kuwait	4.96 (0.17)	4.97 (0.17)	4.97 (0.17)	4.90 (0.28)
19	Oman	4.91 (0.27)	4.91 (0.28)	4.95 (0.21)	4.94 (0.23)
20	Libya	4.84 (0.64)	4.90 (0.42)	4.51 (1.31)†	4.83 (0.55)
21	Israel	4.83 (0.25)	4.81 (0.24)	4.86 (0.25)	4.79 (0.30)
22	Kyrgyzstan	4.82 (0.37)	4.82 (0.38)	4.91 (0.27)	4.89 (0.26)
23	East Timor	4.81 (0.48)	4.80 (0.48)	4.85 (0.43)	4.98 (0.16)
24	Iran	4.78 (0.58)	4.79 (0.55)	4.76 (0.72)	4.61 (0.89)
25	Yemen	4.67 (0.80)	4.69 (0.75)	4.63 (0.92)	3.92 (1.80)†
26	Palestine	4.63 (0.50)	4.69 (0.38)	4.60 (0.57)	4.65 (0.54)
27	Jordan	4.59 (0.44)	4.57 (0.49)	4.64 (0.33)	4.58 (0.42)
28	Lebanon	4.54 (0.52)	4.42 (0.52)	4.75 (0.44)	4.60 (0.50)
29	Somaliland	4.38 (0.96)	4.38 (0.96)	3.77 (2.03)†	4.47 (0.57)
30	Uzbekistan	4.32 (1.34)†	4.29 (1.36)†	4.53 (1.14)†	4.53 (1.12)†
31	Pakistan	4.31 (1.27)†	4.33 (1.26)†	4.14 (1.39)†	4.12 (1.44)†
32	Turkmenistan	4.30 (1.32)†	4.30 (1.31)†	4.13 (1.49)†	4.35 (1.38)†
33	Morocco	4.24 (1.03)†	4.28 (1.01)†	3.99 (1.12)†	4.01 (1.14)†
34	Mongolia	4.05 (1.96)†	3.23 (2.38)†	4.17 (1.85)†	4.82 (0.94)
35	Kazakhstan	4.02 (1.24)†	4.07 (1.14)†	3.79 (1.55)†	3.80 (1.58)†
36	Afghanistan	4.01 (1.25)†	4.01 (1.25)†	3.64 (1.26)†	3.89 (1.09)†
37	Lesotho	3.97 (0.17)	3.98 (0.00)	3.98 (0.05)	3.94 (0.38)
38	Syria	3.85 (1.26)†	3.86 (1.24)†	3.79 (1.33)†	3.83 (1.38)†

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
39	Spain	3.73 (1.03)†	3.71 (0.94)	3.84 (1.17)†	3.67 (1.14)†
40	India	3.58 (1.44)†	3.63 (1.41)†	3.08 (1.65)†	3.44 (1.55)†
41	South Korea	3.54 (1.29)†	3.44 (1.17)†	3.52 (1.40)†	3.85 (1.35)†
42	Tajikistan	3.53 (1.28)†	3.55 (1.30)†	3.44 (1.35)†	3.22 (1.04)†
43	Mexico	3.52 (1.49)†	3.71 (1.37)†	2.87 (1.65)†	2.86 (1.72)†
44	Australia	3.51 (1.52)†	3.50 (1.47)†	3.66 (1.67)†	3.45 (1.77)†
45	Dominican Republic	3.49 (0.89)	3.62 (0.86)	3.19 (0.89)	3.11 (0.82)
46	Iraq	3.48 (1.01)†	3.54 (0.95)	3.37 (1.22)†	3.05 (1.24)†
47	Algeria	3.44 (1.30)†	3.39 (1.27)†	3.36 (1.30)†	3.73 (1.34)†
48	Tunisia	3.44 (0.96)	3.41 (0.93)	3.56 (1.05)†	3.64 (1.05)†
49	Vatican	3.40 (0.00)	3.40 (0.00)	3.40 (0.00)	3.40 (0.00)
50	Azerbaijan	3.39 (0.89)	3.23 (0.73)	3.50 (1.14)†	3.79 (1.05)†
51	Djibouti	3.39 (2.33)†	1.99 (2.45)†	3.90 (2.07)†	4.83 (0.91)
52	Italy	3.35 (1.11)†	3.21 (1.03)†	3.57 (1.15)†	3.41 (1.15)†
53	Portugal	3.34 (0.78)	3.20 (0.70)	3.67 (0.88)	3.48 (0.83)
54	Philippines	3.33 (1.02)†	3.35 (1.00)	3.31 (1.16)†	3.24 (1.12)†
55	Andorra	3.33 (0.43)	3.44 (0.00)	3.29 (0.49)	3.21 (0.60)
56	Greece	3.27 (1.04)†	3.27 (1.05)†	3.27 (0.88)	3.26 (1.10)†
57	Indonesia	3.26 (1.81)†	3.44 (1.72)†	2.98 (1.88)†	2.64 (2.01)†
58	Chile	3.21 (1.33)†	3.00 (1.00)	3.64 (1.58)†	3.45 (1.67)†
59	Peru	3.20 (1.79)†	3.23 (1.71)†	2.75 (1.97)†	3.31 (1.98)†
60	Cuba	3.19 (0.94)	3.19 (0.94)	3.18 (0.98)	3.22 (0.90)

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
61	Belgium	3.16 (0.49)	3.08 (0.97)	3.25 (0.50)	3.16 (0.48)
62	Swaziland	3.11 (1.61)†	3.19 (1.63)†	2.19 (1.11)†	2.14 (1.27)†
63	Armenia	3.07 (0.76)	3.07 (0.76)	3.05 (0.77)	3.21 (0.67)
64	Japan	3.05 (1.09)†	2.94 (1.00)†	3.25 (1.15)†	3.23 (1.25)†
65	South Africa	3.04 (1.51)†	3.19 (1.45)†	2.69 (1.53)†	3.29 (1.59)†
66	Turkey	3.02 (0.94)	3.00 (0.91)	3.09 (0.99)	3.02 (0.98)
67	Eritrea	3.02 (1.14)†	3.05 (1.11)†	2.69 (1.28)†	3.87 (1.33)†
68	Sri Lanka	3.01 (1.12)†	3.10 (1.07)†	2.28 (1.27)†	2.65 (1.18)†
69	China	2.94 (1.85)†	3.01 (1.84)†	2.61 (1.85)†	2.94 (1.86)†
70	Ireland	2.92 (1.96)†	3.38 (1.84)†	1.82 (1.76)†	1.00 (1.47)†
71	United States of America	2.89 (1.68)†	3.49 (1.62)†	2.75 (1.67)†	2.47 (1.59)†
72	Estonia	2.75 (1.79)†	1.34 (1.16)†	3.03 (1.91)†	2.74 (1.79)†
73	Monaco	2.66 (0.00)	2.66 (0.00)	2.66 (0.00)	2.66 (0.00)
74	Macedonia	2.65 (0.60)	2.74 (0.53)	2.58 (0.64)	2.58 (0.62)
75	United Kingdom	2.63 (1.23)†	2.69 (0.89)	2.70 (1.16)†	2.54 (1.35)†
76	Argentina	2.51 (2.11)†	2.89 (1.97)†	2.16 (2.20)†	1.80 (2.09)†
77	Luxembourg	2.51 (0.09)	2.50 (0.08)	2.52 (0.11)	2.50 (0.08)
78	Nepal	2.40 (0.89)	2.40 (0.88)	2.49 (0.99)	2.55 (0.69)
79	Haiti	2.38 (0.49)	2.39 (0.51)	2.35 (0.43)	2.28 (0.28)
80	Venezuela	2.30 (1.94)†	1.83 (1.51)†	2.63 (2.10)†	2.08 (1.99)†
81	Ukraine	2.10 (1.77)†	2.55 (2.03)†	1.85 (1.46)†	1.53 (1.21)†
82	Malaysia	2.09 (1.92)†	1.93 (1.62)†	2.14 (2.00)†	2.20 (2.10)†

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
83	North Korea	2.06 (1.11)†	2.07 (1.13)†	1.86 (1.08)†	2.19 (1.01)†
84	Costa Rica	1.94 (1.61)†	1.83 (1.20)†	2.30 (2.06)†	1.67 (1.82)†
85	Germany	1.90 (1.09)†	1.62 (1.07)†	1.74 (1.12)†	1.93 (1.08)†
86	Albania	1.90 (1.02)†	1.71 (1.00)†	2.12 (1.05)†	1.97 (0.91)
87	Namibia	1.88 (2.42)†	1.63 (2.35)†	1.97 (2.44)†	3.50 (2.29)†
88	Ecuador	1.86 (1.30)†	1.90 (1.29)†	1.69 (1.35)†	1.39 (1.22)†
89	Guyana	1.78 (1.76)†	1.86 (1.77)†	0.95 (1.13)†	1.08 (1.66)†
90	France	1.75 (1.41)†	1.27 (0.81)	1.62 (1.08)†	1.89 (1.56)†
91	Netherlands	1.73 (1.31)†	1.73 (1.28)†	1.58 (1.18)†	1.75 (1.33)†
92	Thailand	1.70 (1.10)†	1.73 (1.09)†	1.40 (1.13)†	1.49 (1.17)†
93	Gabon	1.56 (2.32)†	0.17 (0.90)	1.90 (2.43)†	1.15 (2.11)†
94	Angola	1.54 (2.14)†	1.19 (1.64)†	0.56 (1.49)†	2.46 (2.40)†
95	Georgia	1.51 (0.96)	1.62 (0.91)	1.32 (1.01)†	1.46 (0.98)
96	United Republic of Tanzania	1.50 (1.26)†	1.64 (1.05)†	0.82 (1.60)†	2.61 (2.19)†
97	El Salvador	1.49 (1.57)†	1.74 (1.64)†	1.34 (1.52)†	1.22 (1.44)†
98	Moldova	1.46 (0.95)	1.39 (1.16)†	1.37 (0.86)	1.52 (0.76)
99	Botswana	1.36 (1.78)†	0.83 (1.29)†	1.76 (2.03)†	1.19 (1.55)†
100	New Zealand	1.35 (1.62)†	1.05 (1.23)†	1.98 (2.03)†	1.35 (1.88)†
101	Belize	1.35 (1.96)†	2.82 (2.34)†	3.11 (2.40)†	0.88 (1.53)†
102	Egypt	1.33 (1.55)†	1.33 (1.55)†	1.10 (1.29)†	1.56 (1.78)†
103	Poland	1.31 (0.81)	1.45 (0.75)	1.22 (0.81)	1.33 (0.82)
104	Sweden	1.30 (1.56)†	1.07 (1.29)†	1.12 (1.25)†	1.42 (1.70)†

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
105	Kosovo	1.29 (0.64)	1.21 (0.64)	1.27 (0.65)	1.31 (0.63)
106	Bulgaria	1.27 (1.44)†	1.67 (1.41)†	1.52 (1.48)†	1.11 (1.41)†
107	Madagascar	1.25 (1.32)†	1.24 (1.29)†	0.87 (1.23)†	1.73 (2.01)†
108	Russia	1.23 (1.45)†	1.58 (1.57)†	1.41 (1.53)†	1.10 (1.37)†
109	Canada	1.21 (1.31)†	2.35 (1.40)†	0.92 (1.03)†	1.16 (1.31)†
110	Lithuania	1.19 (0.35)	1.13 (0.33)	1.22 (0.38)	1.19 (0.35)
111	Czech Republic	1.13 (0.46)	1.14 (0.46)	1.08 (0.53)	1.17 (0.40)
112	Switzerland	1.06 (0.47)	1.24 (0.41)	1.03 (0.50)	1.08 (0.46)
113	Guatemala	1.01 (1.22)†	1.13 (1.24)†	0.41 (0.79)	1.17 (1.31)†
114	Nicaragua	1.01 (1.32)†	1.14 (1.33)†	0.70 (1.21)†	1.06 (1.39)†
115	Vietnam	1.01 (1.11)†	0.98 (1.08)†	1.12 (1.20)†	1.41 (1.38)†
116	Finland	0.98 (1.14)†	1.00 (0.92)	1.27 (1.27)†	0.90 (1.09)†
117	Denmark	0.95 (1.02)†	0.44 (0.76)	1.28 (1.03)†	1.01 (1.03)†
118	Brazil	0.91 (1.18)†	0.85 (1.10)†	1.08 (1.34)†	0.90 (1.19)†
119	Sudan	0.91 (1.05)†	0.93 (0.99)	0.90 (1.61)†	0.72 (1.40)†
120	Uruguay	0.86 (0.91)	0.78 (0.66)	1.12 (1.34)†	1.05 (1.31)†
121	Romania	0.84 (0.90)	0.71 (0.96)	1.00 (0.91)	0.81 (0.88)
122	Mozambique	0.82 (1.55)†	0.64 (1.25)†	0.79 (1.66)†	2.14 (2.25)†
123	Kenya	0.68 (0.64)	0.77 (0.57)	0.44 (0.71)	0.71 (0.71)
124	Bolivia	0.68 (1.01)†	0.74 (1.01)†	0.54 (0.96)	0.75 (1.04)†
125	Bangladesh	0.65 (0.76)	0.64 (0.73)	0.69 (0.92)	0.82 (1.09)†
126	Zimbabwe	0.64 (0.61)	0.61 (0.62)	0.56 (0.54)	0.88 (0.60)

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
127	Ethiopia	0.61 (0.72)	0.64 (0.70)	0.43 (0.83)	0.61 (0.67)
128	Mauritania	0.60 (1.47)†	0.48 (1.29)†	1.02 (1.89)†	3.41 (2.32)†
129	Papua New Guinea	0.60 (1.43)†	-	0.61 (1.62)†	0.58 (1.15)†
130	Belarus	0.59 (0.61)	0.67 (0.68)	0.57 (0.60)	0.58 (0.59)
131	Republic of Serbia	0.58 (0.80)	0.25 (0.60)	0.75 (0.88)	0.56 (0.79)
132	Equatorial Guinea	0.54 (1.48)†	-	0.56 (1.53)†	0.38 (1.17)†
133	Chad	0.52 (1.36)†	1.03 (1.70)†	0.12 (0.73)	0.22 (1.01)†
134	Sierra Leone	0.51 (1.22)†	0.50 (1.37)†	0.34 (0.82)	0.82 (1.11)†
135	Hungary	0.49 (0.66)	0.61 (0.62)	0.53 (0.67)	0.46 (0.66)
136	Liechtenstein	0.46 (0.00)	-	0.46 (0.00)	0.46 (0.00)
137	Somalia	0.46 (0.87)	0.44 (0.83)	1.50 (2.15)†	4.20 (1.80)†
138	Bhutan	0.45 (0.29)	0.47 (0.29)	0.41 (0.31)	0.54 (0.23)
139	Cambodia	0.44 (0.94)	0.45 (0.94)	0.38 (0.90)	0.19 (0.43)
140	Republic of the Congo	0.43 (1.40)†	0.04 (0.45)	0.13 (0.78)	1.13 (2.09)†
141	Panama	0.42 (0.70)	0.18 (0.58)	0.75 (0.74)	0.65 (0.65)
142	Gambia	0.42 (0.39)	0.01 (0.07)	0.40 (0.39)	0.68 (0.27)
143	Norway	0.40 (0.91)	0.28 (0.76)	0.68 (1.10)†	0.23 (0.72)
144	Latvia	0.35 (0.55)	0.33 (0.41)	0.37 (0.64)	0.34 (0.50)
145	Colombia	0.33 (1.14)†	0.34 (1.08)†	0.31 (1.14)†	0.32 (1.18)†
146	Austria	0.32 (0.59)	0.90 (0.70)	0.29 (0.55)	0.31 (0.58)
147	Montenegro	0.31 (0.38)	0.38 (0.37)	0.26 (0.39)	0.40 (0.35)
148	Myanmar	0.30 (0.53)	0.27 (0.47)	0.39 (0.75)	0.62 (0.76)

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
149	Nigeria	0.29 (0.67)	0.51 (0.86)	0.19 (0.50)	0.13 (0.49)
150	Liberia	0.27 (0.70)	0.00 (0.00)	0.19 (0.87)	0.65 (0.60)
151	Suriname	0.25 (0.61)	0.29 (0.65)	0.01 (0.15)	0.09 (0.38)
152	Senegal	0.21 (0.63)	0.15 (0.52)	0.61 (0.98)	0.91 (1.09)†
153	Mali	0.20 (0.61)	0.21 (0.53)	0.21 (0.76)	0.15 (0.64)
154	Slovakia	0.20 (0.41)	0.19 (0.45)	0.25 (0.42)	0.17 (0.40)
155	Guinea Bissau	0.17 (0.33)	0.03 (0.15)	0.16 (0.32)	0.70 (0.28)
156	Iceland	0.14 (0.10)	-	0.15 (0.09)	0.06 (0.09)
157	Togo	0.12 (0.35)	0.00 (0.00)	0.14 (0.37)	0.48 (0.56)
158	Niger	0.11 (0.74)	0.07 (0.60)	0.11 (0.72)	0.95 (1.96)†
159	Ghana	0.11 (0.40)	0.04 (0.24)	0.11 (0.40)	0.27 (0.59)
160	Cameroon	0.11 (0.63)	0.06 (0.52)	0.14 (0.78)	0.12 (0.39)
161	Malawi	0.11 (0.26)	0.12 (0.27)	0.05 (0.19)	0.08 (0.22)
162	Taiwan	0.10 (0.71)	0.19 (0.95)	0.11 (0.74)	0.06 (0.52)
163	Zambia	0.08 (0.17)	0.07 (0.16)	0.06 (0.15)	0.17 (0.22)
164	Honduras	0.07 (0.16)	0.06 (0.16)	0.09 (0.16)	0.06 (0.14)
165	Guinea	0.06 (0.14)	0.07 (0.16)	0.02 (0.07)	0.03 (0.10)
166	Ivory Coast	0.04 (0.37)	0.01 (0.27)	0.05 (0.38)	0.07 (0.46)
167	Slovenia	0.03 (0.07)	0.12 (0.11)	0.04 (0.08)	0.03 (0.06)
168	Bosnia and Herzegovina	0.02 (0.14)	0.01 (0.14)	0.02 (0.15)	0.01 (0.05)
169	Croatia	0.02 (0.15)	0.02 (0.16)	0.02 (0.15)	0.01 (0.12)
170	Laos	0.01 (0.05)	0.01 (0.04)	0.02 (0.11)	0.01 (0.03)

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
171	Paraguay	0.01 (0.24)	0.00 (0.02)	0.02 (0.33)	0.03 (0.41)
172	Brunei	0.01 (0.04)	0.07 (0.08)	0.01 (0.04)	0.02 (0.06)
173	Democratic Republic of the Congo	0.01 (0.05)	0.00 (0.00)	0.00 (0.02)	0.03 (0.09)
174	Uganda	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.00)
175	Burkina Faso	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
176	Benin	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
176	Burundi	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
176	Central African Republic	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
176	Rwanda	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
176	South Sudan	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)

Notes:

* Tied for highest possible score.

'-' Insufficient data. Countries and regions with insufficient data for all sectors excluded from the table.

† Standard deviation > 1.

Table A2 | **Baseline Water Stress in 100 Largest (by Area) River Basins, by Highest to Lowest Stress for All Sectors**

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
1	Yongding He	4.99 (0.13)	4.99 (0.13)	4.98 (0.16)	4.99 (0.12)
2	Harirud	4.91 (0.28)	4.92 (0.25)	4.79 (0.74)	4.95 (0.17)
3	Helmand	4.83 (0.31)	4.83 (0.31)	4.87 (0.43)	4.81 (0.42)
4	Balkhash	4.82 (0.54)	4.84 (0.44)	4.80 (0.83)	4.64 (0.97)
5	Sirdaryo	4.78 (0.53)	4.76 (0.54)	4.96 (0.19)	4.76 (0.58)
6	Indus	4.30 (1.21)†	4.31 (1.20)†	4.08 (1.36)†	4.14 (1.26)†
7	Colorado River (Pacific Ocean)	4.18 (1.28)†	3.97 (1.35)†	4.24 (1.29)†	4.48 (1.09)†
8	Lake Mar Chiquita	4.13 (1.17)†	4.08 (1.10)†	4.18 (1.22)†	4.24 (1.31)†
9	Bravo	4.12 (1.18)†	4.08 (1.19)†	4.23 (1.14)†	4.23 (1.16)†
10	Liao He	4.00 (0.72)	4.14 (0.65)	3.86 (0.65)	3.50 (0.79)
11	Huang He (Yellow River)	4.00 (1.03)†	4.07 (1.01)†	3.91 (1.10)†	3.87 (1.02)†
12	Colorado (Argentina)	3.93 (1.16)†	3.94 (1.09)†	4.13 (1.28)†	3.63 (1.64)†
13	Brazos River	3.88 (1.49)†	4.56 (1.15)†	2.76 (1.43)†	2.79 (1.26)†
14	Murray	3.73 (1.27)†	3.74 (1.27)†	3.37 (1.17)†	3.31 (1.25)†
15	Santiago	3.63 (0.95)	3.68 (0.87)	3.39 (1.21)†	3.56 (1.09)†
16	Narmada	3.56 (0.17)	3.56 (0.16)	3.56 (0.21)	3.65 (0.43)
17	Sacramento San Joaquin	3.54 (1.58)†	3.59 (1.54)†	3.11 (1.70)†	3.52 (1.65)†
18	Tigris & Euphrates	3.54 (1.15)†	3.60 (1.12)†	3.35 (1.26)†	2.98 (1.24)†
19	Ganges Brahmaputra	3.39 (1.61)†	3.43 (1.59)†	2.89 (1.79)†	3.24 (1.89)†
20	Amudaryo	3.29 (1.54)†	3.27 (1.55)†	3.58 (1.53)†	3.45 (1.37)†
21	Kura	3.26 (0.97)	3.36 (0.98)	2.96 (1.00)†	2.90 (0.75)
22	Krishna	3.08 (1.07)†	3.08 (1.07)†	3.12 (1.09)†	3.07 (1.20)†

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
23	Columbia River	2.78 (1.98)†	3.07 (2.00)†	1.74 (1.51)†	2.13 (1.73)†
24	Limpopo	2.69 (1.39)†	2.53 (1.40)†	3.00 (1.32)†	2.80 (1.39)†
25	Ural	2.62 (1.46)†	2.61 (1.47)†	2.56 (1.58)†	2.63 (1.43)†
26	Churchill River	2.52 (1.26)†	2.83 (0.72)	2.47 (1.62)†	2.52 (1.23)†
27	Douro	2.51 (0.09)	2.51 (0.09)	2.51 (0.09)	2.51 (0.10)
28	Godavari	2.51 (1.11)†	2.50 (1.11)†	2.50 (1.10)†	2.68 (1.00)
29	Mississippi River	2.44 (1.76)†	3.35 (1.61)†	1.69 (1.59)†	1.76 (1.53)†
30	Amur	2.38 (1.41)†	2.40 (1.35)†	2.38 (1.47)†	2.33 (1.50)†
31	Rio Balsas	2.35 (1.31)†	2.29 (1.30)†	2.59 (1.31)†	2.39 (1.37)†
32	Ob	2.21 (1.55)†	2.90 (1.52)†	1.78 (1.45)†	1.90 (1.44)†
33	Cunene	2.05 (2.46)†	0.00 (0.00)	0.93 (1.95)†	2.93 (2.46)†
34	St. Lawrence	2.00 (1.56)†	2.79 (1.50)†	1.56 (1.47)†	2.12 (1.55)†
35	Chao Phraya	1.97 (0.79)	1.97 (0.80)	2.00 (0.72)	2.02 (0.66)
36	Nelson River	1.94 (1.28)†	2.68 (1.11)†	1.96 (1.34)†	1.65 (1.22)†
37	Orange	1.91 (1.53)†	2.07 (1.74)†	1.70 (1.15)†	1.66 (1.29)†
38	Don	1.73 (1.14)†	1.88 (1.10)†	1.80 (1.12)†	1.56 (1.16)†
39	Oder River	1.68 (0.77)	1.73 (0.81)	1.66 (0.70)	1.68 (0.79)
40	Mahanadi River (Mahahadi)	1.66 (1.15)†	1.65 (1.15)†	1.69 (1.14)†	1.76 (1.20)†
41	Yangtze River (Chang Jiang)	1.62 (1.48)†	1.69 (1.47)†	1.57 (1.46)†	1.36 (1.52)†
42	Elbe River	1.61 (1.09)†	0.88 (1.06)†	1.58 (1.05)†	1.67 (1.09)†
43	Rhine	1.48 (0.96)	1.70 (0.78)	1.26 (0.97)	1.53 (0.96)
44	Neman	1.22 (0.08)	1.23 (0.09)	1.22 (0.09)	1.22 (0.08)

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
45	Rufiji	1.15 (0.75)	1.22 (0.71)	0.51 (0.77)	0.64 (0.69)
46	Tana	1.13 (0.04)	1.14 (0.03)	1.13 (0.08)	1.13 (0.06)
47	Volga	1.12 (1.36)†	0.97 (1.30)†	1.51 (1.62)†	0.99 (1.23)†
48	Awash Wenz	0.99 (0.23)	1.00 (0.21)	0.93 (0.32)	0.85 (0.40)
49	Loire	0.99 (0.60)	1.04 (0.51)	0.86 (0.59)	1.00 (0.63)
50	Wisla	0.98 (0.63)	1.14 (0.47)	0.97 (0.65)	0.96 (0.63)
51	Parana	0.96 (1.37)†	1.21 (1.61)†	0.79 (1.06)†	0.60 (0.90)
52	Dniepr	0.92 (0.99)	0.86 (1.26)†	0.82 (0.88)	0.98 (0.79)
53	Nile	0.86 (1.25)†	0.90 (1.24)†	0.69 (1.27)†	0.66 (1.23)†
54	Save	0.83 (0.67)	0.79 (0.66)	0.73 (0.71)	1.33 (0.54)
55	Danube	0.78 (0.98)	0.46 (0.70)	0.71 (0.91)	0.85 (1.03)†
56	Hong(Red River)	0.73 (0.58)	0.77 (0.59)	0.52 (0.50)	0.60 (0.55)
57	Lena	0.72 (1.75)†	0.59 (1.62)†	0.45 (1.44)†	0.78 (1.81)†
58	Yenisei	0.65 (1.64)†	0.57 (1.58)†	0.69 (1.69)†	0.67 (1.65)†
59	Lake Chad	0.60 (0.92)	0.71 (1.06)†	0.48 (0.59)	0.30 (0.78)
60	Okavango	0.59 (1.61)†	0.15 (0.85)	1.10 (2.06)†	0.47 (1.46)†
61	Orinoco	0.59 (1.00)†	0.81 (0.94)	0.44 (1.03)†	0.49 (0.94)
62	Alabama River & Tombigbee	0.59 (0.58)	0.51 (0.54)	0.64 (0.62)	0.58 (0.56)
63	Mackenzie River	0.58 (1.07)†	0.38 (0.79)	0.50 (0.93)	0.59 (1.08)†
64	Uruguay	0.56 (0.58)	0.62 (0.58)	0.14 (0.39)	0.14 (0.35)
65	Amazonas	0.53 (0.78)	0.71 (0.81)	0.29 (0.63)	0.35 (0.71)
66	Shebelle	0.51 (0.81)	0.52 (0.81)	0.33 (0.72)	0.46 (0.93)

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
67	Churchill (Atlantic)	0.51 (0.87)	-	0.16 (0.55)	0.53 (0.89)
68	Negro (Argentinia)	0.47 (0.83)	0.41 (0.75)	0.89 (1.44)†	0.62 (0.74)
69	Rhone	0.43 (0.55)	0.29 (0.44)	0.56 (0.58)	0.42 (0.55)
70	Salween	0.42 (0.55)	0.44 (0.56)	0.33 (0.51)	0.36 (0.53)
71	Xi Jiang	0.41 (0.46)	0.42 (0.46)	0.39 (0.45)	0.37 (0.46)
72	Fraser River	0.39 (0.68)	0.25 (0.66)	0.66 (0.71)	0.28 (0.62)
73	Mekong	0.34 (0.44)	0.34 (0.43)	0.38 (0.51)	0.37 (0.52)
74	Sao Francisco	0.25 (0.57)	0.23 (0.60)	0.28 (0.48)	0.28 (0.49)
75	Irrawaddy	0.24 (0.33)	0.24 (0.33)	0.20 (0.32)	0.33 (0.45)
76	Zambezi	0.23 (0.41)	0.19 (0.38)	0.24 (0.40)	0.42 (0.51)
77	Niger	0.16 (0.51)	0.20 (0.55)	0.08 (0.38)	0.14 (0.69)
78	Senegal	0.11 (0.41)	0.13 (0.44)	0.04 (0.24)	0.01 (0.11)
79	Lake Turkana	0.09 (0.22)	0.10 (0.15)	0.07 (0.37)	0.07 (0.25)
80	Sanaga	0.03 (0.39)	0.24 (1.08)†	0.01 (0.17)	0.00 (0.06)
81	Rio Salado (Rio De La Plata)	0.03 (0.17)	0.01 (0.11)	0.03 (0.17)	0.03 (0.20)
82	Rovuma	0.02 (0.29)	0.00 (0.00)	0.02 (0.35)	0.00 (0.00)
83	Magdalena	0.01 (0.22)	0.02 (0.27)	0.01 (0.19)	0.01 (0.18)
84	Grisalva	0.01 (0.13)	0.02 (0.15)	0.00 (0.09)	0.01 (0.14)
85	Lake Titicaca	0.00 (0.09)	0.00 (0.08)	0.01 (0.14)	0.00 (0.03)
86	Rio Parnaiba	0.00 (0.05)	0.00 (0.03)	0.00 (0.07)	0.01 (0.07)
87	Volta	0.00 (0.07)	0.00 (0.08)	0.00 (0.05)	0.00 (0.06)
88	Congo	0.00 (0.06)	0.00 (0.00)	0.00 (0.08)	0.00 (0.03)

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
89	Cuanza	0.00 (0.03)	0.00 (0.03)	0.00 (0.04)	0.00 (0.00)
90	Moose River (Trib. Hudson Bay)	0.00 (0.00)	0.00 (0.00)	0.00 (0.01)	0.00 (0.00)
91	Essequibo River	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
92	Riviere Saguenay	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
92	Albany River	0.00 (0.00)	-	0.00 (0.00)	0.00 (0.00)
92	Bandama	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
92	Grande Riviere	0.00 (0.00)	-	0.00 (0.00)	0.00 (0.00)
92	Hayes River (Trib. Hudson Bay)	0.00 (0.00)	-	0.00 (0.00)	0.00 (0.00)
92	Ogooue	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
92	Riviere Koksoak	0.00 (0.00)	-	0.00 (0.00)	0.00 (0.00)
92	Severn River (Trib. Hudson Bay)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
92	Tocantins	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)

Notes:

'-' Insufficient data.

† Standard deviation > 1.

Table A3 | **Baseline Water Stress in 100 Most Populous River Basins, by Highest to Lowest Stress for All Sectors**

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
1	Qom (Namak Lake)	5.00 (0.01)	5.00 (0.01)	5.00 (0.01)	5.00 (0.00)
2	Yongding He	4.99 (0.13)	4.99 (0.13)	4.98 (0.16)	4.99 (0.12)
3	Brantas	4.97 (0.15)	4.97 (0.14)	4.96 (0.16)	4.95 (0.18)
4	Harirud	4.91 (0.28)	4.92 (0.25)	4.79 (0.74)	4.95 (0.17)
5	Tuhai He	4.90 (0.33)	4.91 (0.32)	4.88 (0.35)	4.89 (0.34)
6	Sabarmati River	4.83 (0.27)	4.83 (0.27)	4.84 (0.24)	4.86 (0.19)
7	Helmand	4.83 (0.31)	4.83 (0.31)	4.87 (0.43)	4.81 (0.42)
8	Sirdaryo	4.78 (0.53)	4.76 (0.54)	4.96 (0.19)	4.76 (0.58)
9	Rio Maipo	4.66 (0.04)	4.66 (0.05)	4.66 (0.02)	4.66 (0.02)
10	Dead Sea (Jordan)	4.57 (0.35)	4.58 (0.34)	4.56 (0.37)	4.55 (0.40)
11	Solo (Bengawan Solo)	4.46 (0.06)	4.46 (0.06)	4.46 (0.07)	4.46 (0.08)
12	Indus	4.30 (1.21)†	4.31 (1.20)†	4.08 (1.36)†	4.14 (1.26)†
13	Daliao He	4.19 (0.37)	4.27 (0.27)	4.33 (0.17)	4.01 (0.46)
14	Colorado River (Pacific Ocean)	4.18 (1.28)†	3.97 (1.35)†	4.24 (1.29)†	4.48 (1.09)†
15	Palar River	4.15 (0.09)	4.15 (0.09)	4.15 (0.08)	4.15 (0.09)
16	Bravo	4.12 (1.18)†	4.08 (1.19)†	4.23 (1.14)†	4.23 (1.16)†
17	Liao He	4.00 (0.72)	4.14 (0.65)	3.86 (0.65)	3.50 (0.79)
18	Huang He (Yellow River)	4.00 (1.03)†	4.07 (1.01)†	3.91 (1.10)†	3.87 (1.02)†
19	Santiago	3.63 (0.95)	3.68 (0.87)	3.39 (1.21)†	3.56 (1.09)†
20	Cauvery River	3.57 (0.10)	3.57 (0.10)	3.58 (0.11)	3.58 (0.09)
21	Thames	3.57 (0.15)	3.53 (0.26)	3.57 (0.14)	3.57 (0.15)
22	Narmada	3.56 (0.17)	3.56 (0.16)	3.56 (0.21)	3.65 (0.43)

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
23	Tigris & Euphrates	3.54 (1.15)†	3.60 (1.12)†	3.35 (1.26)†	2.98 (1.24)†
24	Penner River	3.53 (0.28)	3.53 (0.28)	3.51 (0.22)	3.53 (0.29)
25	Mahi River	3.52 (0.14)	3.52 (0.13)	3.53 (0.16)	3.54 (0.20)
26	Tejo	3.51 (0.27)	3.52 (0.29)	3.48 (0.16)	3.52 (0.28)
27	Delaware River	3.46 (0.08)	3.49 (0.14)	3.45 (0.07)	3.46 (0.08)
28	Escaut (Schelde)	3.40 (0.09)	3.40 (0.17)	3.40 (0.08)	3.40 (0.08)
29	Ganges Brahmaputra	3.39 (1.61)†	3.43 (1.59)†	2.89 (1.79)†	3.24 (1.89)†
30	Amudaryo	3.29 (1.54)†	3.27 (1.55)†	3.58 (1.53)†	3.45 (1.37)†
31	Kura	3.26 (0.97)	3.36 (0.98)	2.96 (1.00)†	2.90 (0.75)
32	Huangpu Jiang	3.26 (1.19)†	3.19 (1.28)†	3.30 (1.03)†	3.37 (1.03)†
33	Tone	3.23 (0.33)	3.21 (0.31)	3.27 (0.41)	3.20 (0.29)
34	Krishna	3.08 (1.07)†	3.08 (1.07)†	3.12 (1.09)†	3.07 (1.20)†
35	Ob (Tobol)	2.83 (0.90)	3.00 (0.72)	2.81 (0.95)	2.79 (0.91)
36	Tapti River	2.81 (0.26)	2.81 (0.23)	2.84 (0.35)	2.81 (0.25)
37	Columbia River	2.78 (1.98)†	3.07 (2.00)†	1.74 (1.51)†	2.13 (1.73)†
38	Xitang He	2.70 (0.10)	2.70 (0.09)	2.71 (0.16)	2.70 (0.06)
39	Limpopo	2.69 (1.39)†	2.53 (1.40)†	3.00 (1.32)†	2.80 (1.39)†
40	Po	2.65 (0.08)	2.65 (0.07)	2.65 (0.07)	2.65 (0.10)
41	Godavari	2.51 (1.11)†	2.50 (1.11)†	2.50 (1.10)†	2.68 (1.00)
42	Han-Gang (Han River)	2.49 (1.39)†	1.82 (0.57)	2.84 (1.55)†	1.99 (0.91)
43	Mississippi River	2.44 (1.76)†	3.35 (1.61)†	1.69 (1.59)†	1.76 (1.53)†
44	Weser	2.40 (0.13)	2.38 (0.25)	2.40 (0.14)	2.41 (0.10)

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
45	Amur	2.38 (1.41)†	2.40 (1.35)†	2.38 (1.47)†	2.33 (1.50)†
46	Rio Balsas	2.35 (1.31)†	2.29 (1.30)†	2.59 (1.31)†	2.39 (1.37)†
47	Damodar River	2.26 (1.33)†	2.38 (1.35)†	1.78 (1.08)†	1.48 (0.84)
48	Fuchun Jiang	2.24 (0.41)	2.27 (0.48)	2.25 (0.43)	2.21 (0.32)
49	Meuse	2.06 (0.95)	1.27 (0.71)	1.74 (1.03)†	2.11 (0.93)
50	Taedong	2.03 (1.05)†	2.10 (1.04)†	1.70 (1.02)†	2.25 (1.13)†
51	St.Lawrence	2.00 (1.56)†	2.79 (1.50)†	1.56 (1.47)†	2.12 (1.55)†
52	Chao Phraya	1.97 (0.79)	1.97 (0.80)	2.00 (0.72)	2.02 (0.66)
53	Dniestr	1.94 (0.39)	2.03 (0.64)	1.89 (0.19)	1.90 (0.19)
54	Orange	1.91 (1.53)†	2.07 (1.74)†	1.70 (1.15)†	1.66 (1.29)†
55	Seine	1.85 (0.06)	1.85 (0.05)	1.85 (0.05)	1.85 (0.07)
56	Brahmani River (Bhahmani)	1.81 (0.38)	1.83 (0.39)	1.72 (0.32)	1.66 (0.26)
57	Don	1.73 (1.14)†	1.88 (1.10)†	1.80 (1.12)†	1.56 (1.16)†
58	Dong Jiang	1.73 (0.19)	1.72 (0.15)	1.75 (0.26)	1.73 (0.18)
59	Oder River	1.68 (0.77)	1.73 (0.81)	1.66 (0.70)	1.68 (0.79)
60	Mahanadi River (Mahahadi)	1.66 (1.15)†	1.65 (1.15)†	1.69 (1.14)†	1.76 (1.20)†
61	Yangtze River (Chang Jiang)	1.62 (1.48)†	1.69 (1.47)†	1.57 (1.46)†	1.36 (1.52)†
62	Elbe River	1.61 (1.09)†	0.88 (1.06)†	1.58 (1.05)†	1.67 (1.09)†
63	Rhine	1.48 (0.96)	1.70 (0.78)	1.26 (0.97)	1.53 (0.96)
64	Rupnarayan	1.46 (1.55)†	1.57 (1.55)†	1.01 (1.45)†	0.71 (1.31)†
65	Song Dong Nai	1.32 (1.20)†	1.40 (1.23)†	1.58 (1.27)†	1.12 (1.08)†
66	Volga	1.12 (1.36)†	0.97 (1.30)†	1.51 (1.62)†	0.99 (1.23)†

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
67	Subarnarekha River	1.09 (0.64)	1.13 (0.74)	1.01 (0.37)	1.00 (0.19)
68	Min Jiang	1.08 (0.12)	1.08 (0.12)	1.09 (0.23)	1.08 (0.08)
69	Awash Wenz	0.99 (0.23)	1.00 (0.21)	0.93 (0.32)	0.85 (0.40)
70	Loire	0.99 (0.60)	1.04 (0.51)	0.86 (0.59)	1.00 (0.63)
71	Wisla	0.98 (0.63)	1.14 (0.47)	0.97 (0.65)	0.96 (0.63)
72	Parana	0.96 (1.37)†	1.21 (1.61)†	0.79 (1.06)†	0.60 (0.90)
73	Ob	0.96 (1.16)†	0.46 (0.82)	1.01 (1.24)†	1.00 (1.15)†
74	Dniepr	0.92 (0.99)	0.86 (1.26)†	0.82 (0.88)	0.98 (0.79)
75	Nile	0.86 (1.25)†	0.90 (1.24)†	0.69 (1.27)†	0.66 (1.23)†
76	Galana	0.82 (0.08)	0.82 (0.06)	0.82 (0.11)	0.82 (0.06)
77	Danube	0.78 (0.98)	0.46 (0.70)	0.71 (0.91)	0.85 (1.03)†
78	Hong(Red River)	0.73 (0.58)	0.77 (0.59)	0.52 (0.50)	0.60 (0.55)
79	Yenisei	0.65 (1.64)†	0.57 (1.58)†	0.69 (1.69)†	0.67 (1.65)†
80	Lake Chad	0.60 (0.92)	0.71 (1.06)†	0.48 (0.59)	0.30 (0.78)
81	Orinoco	0.59 (1.00)†	0.81 (0.94)	0.44 (1.03)†	0.49 (0.94)
82	Amazonas	0.53 (0.78)	0.71 (0.81)	0.29 (0.63)	0.35 (0.71)
83	Shebelle	0.51 (0.81)	0.52 (0.81)	0.33 (0.72)	0.46 (0.93)
84	Rhone	0.43 (0.55)	0.29 (0.44)	0.56 (0.58)	0.42 (0.55)
85	Salween	0.42 (0.55)	0.44 (0.56)	0.33 (0.51)	0.36 (0.53)
86	Xi Jiang	0.41 (0.46)	0.42 (0.46)	0.39 (0.45)	0.37 (0.46)
87	Mekong	0.34 (0.44)	0.34 (0.43)	0.38 (0.51)	0.37 (0.52)
88	Sao Francisco	0.25 (0.57)	0.23 (0.60)	0.28 (0.48)	0.28 (0.49)

		SCORE (STANDARD DEVIATION)			
RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
89	Irrawaddy	0.24 (0.33)	0.24 (0.33)	0.20 (0.32)	0.33 (0.45)
90	Zambezi	0.23 (0.41)	0.19 (0.38)	0.24 (0.40)	0.42 (0.51)
91	Niger	0.16 (0.51)	0.20 (0.55)	0.08 (0.38)	0.14 (0.69)
92	Air Musi	0.13 (0.05)	0.13 (0.06)	0.13 (0.04)	0.13 (0.02)
93	Lagos	0.13 (0.55)	0.02 (0.22)	0.14 (0.58)	0.11 (0.52)
94	Senegal	0.11 (0.41)	0.13 (0.44)	0.04 (0.24)	0.01 (0.11)
95	Lake Turkana	0.09 (0.22)	0.10 (0.15)	0.07 (0.37)	0.07 (0.25)
96	Magdalena	0.01 (0.22)	0.02 (0.27)	0.01 (0.19)	0.01 (0.18)
97	Grisalva	0.01 (0.13)	0.02 (0.15)	0.00 (0.09)	0.01 (0.14)
98	Cross	0.01 (0.09)	0.00 (0.00)	0.01 (0.09)	0.01 (0.13)
99	Volta	0.00 (0.07)	0.00 (0.08)	0.00 (0.05)	0.00 (0.06)
100	Congo	0.00 (0.06)	0.00 (0.00)	0.00 (0.08)	0.00 (0.03)

Notes:

'–' Insufficient data.

† Standard deviation > 1.

ABOUT THE AUTHORS

Francis Gassert is a research analyst with the Aqueduct Project at WRI, where he manages the data collection and GIS analysis.
Contact: fgassert@wri.org

Paul Reig is an associate with the Aqueduct Project at WRI, where he leads the design and development of the Aqueduct Water Risk Atlas.
Contact: preig@wri.org

Tianyi Luo is a research assistant with the Aqueduct Project at WRI, where he works on the data collection and GIS analysis.
Contact: tluo@wri.org

Andrew Maddocks is an outreach and communications coordinator with the Aqueduct project at WRI.
Contact: amaddocks@wri.org

ACKNOWLEDGMENTS

This publication was made possible thanks to the ongoing support of the World Resources Institute Markets and Enterprise Program and the Aqueduct Alliance. The authors would like to thank the following people for providing invaluable insight and assistance: Tien Shiao, Betsy Otto, Charles Iceland, Tom Parris, David Tomberlin, Daryl Ditz, and Jonathan Proctor as well as Nick Price and Hyacinth Billings for graphic support and final editing. For their technical guidance and feedback during the development of the Aqueduct Country and River Basin Rankings, the authors would also like to thank:

- Bayan Bruss, Johns Hopkins University
- Thomas Damassa, World Resources Institute (WRI)
- Johannes Friedrich, World Resources Institute (WRI)
- Matt Luck, ISciences LLC
- Alasdair Wilson, Pricewaterhouse Coopers (PwC)

ABOUT WRI

WRI focuses on the intersection of the environment and socio-economic development. We go beyond research to put ideas into action, working globally with governments, business, and civil society to build transformative solutions that protect the earth and improve people's lives.

Solutions to Urgent Sustainability Challenges
WRI's transformative ideas protect the earth, promote development, and advance social equity because sustainability is essential to meeting human needs today, and fulfilling human aspirations tomorrow.

Practical Strategies for Change
WRI spurs progress by providing practical strategies for change and effective tools to implement them. We measure our success in the form of new policies, products, and practices that shift the ways governments work, businesses operate, and people act.

Global Action
We operate globally because today's problems know no boundaries. We are avid communicators because people everywhere are inspired by ideas, empowered by knowledge, and moved to change by greater understanding. We provide innovative paths to a sustainable planet through work that is accurate, fair, and independent.

creative commons

Copyright 2013 World Resources Institute. This work is licensed under the Creative Commons Attribution 3.0 License. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/